Te Kaunihera-ā-Rohe o Ngāmotu
New Plymouth District Council

2021-2031 Water Supply Asset Management Plan

2021-2031: He Rautaki Whakahaere Rawa mō Te Wai Whakarato

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General Volume

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1. Executive Summary

This Water Supply Asset Management Plan (AMP) outlines how New Plymouth District Council (NPDC or the Council) manages assets associated with the Council's water supply asset portfolio, and will contribute to the community outcomes and priorities identified in the 2021-2031 Long Term Plan (LTP). This AMP covers the period from 1 July 2021 to 30 June 2031.

The LTP identifies 'fixing our plumbing' as a priority for the coming ten years. Unacceptable risks from ageing infrastructure failing due to historic underinvestment have been identified. The Council has agreed to increase expenditure on replacing ageing water infrastructure, and to debt fund the replacement of some long life assets.

New Plymouth residents use up to 60 per cent more water on average than other comparable parts of the country. Conserving water will improve the environment, but also reduce future infrastructure in new water takes. The Council will introduce moderate water conservation measures, including water meters. The water conservation plan, including water meters, incorporates the principles of He Puna Wai, the Council's iwi and hapū working party on water issues. Charging for water on a volumetric basis will start in 2024/25. This is expected to reduce our water consumption by around one quarter, reducing our pressure on rivers for drinking water and delaying infrastructure spend to take more water.

While much of this Water Supply AMP focuses upon the next 10 years in alignment with the LTP, asset management planning tends to consider much longer time frames. The majority of the Council's assets have lifecycles far greater than 10 years.

Water supply activities involve operating, maintaining and developing water collection, water treatment and water distribution facilities. NPDC provides approximately 33.2 million litres of water per day to just under 30,000 households and businesses in defined urban and rural areas. Water supply assets include four Water Treatment Plants (WTP) at New Plymouth (NPWTP), Inglewood, Oakura, and Okato, six pumping stations at Tikorangi, Mangorei Road, Oakura, and Okato, the reticulation network, headworks/intakes, and storage facilities.

The water assets operate as four separate water supply schemes in the district, including New Plymouth, Oakura, Okato and Inglewood, which are fed from both surface and ground water sources.

The key objectives for the Three Waters Service in regard to water supply assets are detailed below:

A. To provide a safe, healthy and efficient service at an affordable cost.

B. To minimise the impact of high-density human populations on the environment.

C. To ensure infrastructure can meet both current and future demand within defined Levels of Service.

D. To comply with the Drinking-water Standards for New Zealand 2005 (Revised 2018) (DWSNZ).

E. To protect public health and the environment.

F. To provide an acceptable level of resilience in emergency situations.

Key issues for the Three Waters Service in regard to water supply assets have been identified through undertaking a problem statement gap analysis. The key issues are detailed below:

1. Incomplete inspection/condition rating data and programme.
2. Lack of asset inventory data and standards and guidelines.
3. System design does not meet current and future demand.
4. Lack of a robust renewal programme for telemetry and communications technology.
5. Lack of engagement with iwi on infrastructure design, build and operation.
6. Not understanding the threats of natural hazards to infrastructure and not building in resilience.
7. Not meeting all consent or legal compliance.
8. Lack of maintenance scheduling.
9. Insufficient operational procedures.
10. Lack of understanding of the system capacity and performance.
11. Historical lack of renewals.

The following Levels of Service that identify key measures and targets for water supply services have been defined:

- We provide water that is safe to drink – in 2019/20 there was a target of full compliance with Parts 4 and 5 of the Drinking-water Standards (bacteria compliance criteria and protozoal compliance criteria respectively). Compliance was achieved with these standards.
- Manage demand to minimise the impact of water supply activities on the environment – in 2019/20 the target for the average consumption of drinking water per day per resident was 300 litres per day. This target was achieved. The target for the number of abatement notices, infringement notices, enforcement orders, and convictions received was zero. This target was also achieved.
- We maintain the reticulated water network in good condition - in 2019/20 the percentage target of real water loss from the networked reticulation system was 25% or less. The actual loss was 16.3%.
- We respond to faults and unplanned interruptions to the water supply network in a timely manner -
  - The median response time to urgent callouts (from the time that we receive notification to the time that service personnel reach the site) – in 2019/20 there was a target of one hour or less. This target was achieved during that period as the median response time was 0.52 hours or less.
  - The median resolution time for urgent callouts (from the time we receive notification, to the time that service personnel confirm resolution of the fault or interruption) - in 2019/20 there was a target of four hours or less for mains greater than 250 diameter, and eight hours or less for mains less than 250 diameter. This target was achieved during that period, being a medium resolution time of 1.82 hours for mains greater than 250 diameter and there

were no urgent callouts for mains less than or equal to 250 diameter.

- The median response time to non-urgent callouts (from the time we receive notification to the time that service personnel reach the site) – in 2019/20 there was a target of 42 hours or less. During that period the response time was 19.3 hours for Priority 2 items (e.g. leaks) and 43.74 hours for all service requests (e.g. new connections). For the 2020/21 period these targets have been changed to a combined target of 70 hours or less due to an Audit New Zealand request that the median of all callouts other than urgent callouts, i.e. Priority 2, 3, and 4 jobs, be used.

- The median resolution time for non-urgent callouts (from the time we receive notification to the time that service personnel confirm resolution of the fault or interruption) – in 2019/20 there was a target of 66 hours or less. During that period the median resolution time was 76.7 hours. For the 2020/21 period this target has been changed to a target of 116 hours or less due to an Audit New Zealand request that the median of all callouts other than urgent callouts, i.e. Priority 2, 3, and 4 jobs, be used.

• Customers are satisfied with our water supply service – in 2019/20 there was a target of 10 or less for the total number of complaints (per 1,000 connections) received about drinking water clarity, taste, or odour; drinking water pressure or flow; continuity of supply; and our response to any of these issues. The combined number of complaints in that period was 7.87.

Managing and maintaining the Three Waters Service, and water supply assets is resource intensive.

To sustain current Levels of Service, the existing built asset base will require baseline Operational expenditure (Opex) of approximately $97.5 million and approximately $105.3 million Capital expenditure (Capex) for renewals and Level of Service projects over the next 10 years.

The biggest driver of increased demand for all Council services and use of Council assets is population growth. The Growth Projects require Capex of approximately $20.1 million over the next 10 years. As at 30 June 2019, the certified fair value of water supply assets was approximately $181.9 million.

A number of issues associated with asset management have been identified throughout this AMP. The improvement actions required over the 10 year period (2021-2031) have been collated in this AMP. A number of improvement actions relate to all the AMPs and are therefore included in the **Strategic Asset Management Plan.**

2. Introduction

This Water Supply AMP General Volume outlines how NPDC manages assets associated with water supply. It also demonstrates how the Three Waters Service will contribute to the community outcomes and priorities identified in the 2021-2031 LTP.

This AMP has been developed in accordance with the requirements of the Local Government Act 2002 (LGA). It covers the forecast activities and expenditure for a 30 year planning period, with an emphasis on the 10 year period from 1 July 2021 to 30 June 2031. The AMP assumes that water assets have an indefinite life and the focus is therefore on determining the strategies required for maintaining, rehabilitating and renewing components over the next 30 years. It is intended that this AMP be reviewed every year with a major update every three years prior to the LTP review process.

Under the Health Act 1956 and the Health (Drinking Water) Amendment Act 2007, NPDC has a duty to improve, promote and protect public health within the district. This is done first and foremost by providing safe drinking water. Water supply must comply with the current version of the DWSNZ and a reliable supply of water must be provided in emergency situations.

Water supply activities involve operating, maintaining and developing water collection, water treatment and water distribution facilities. This includes groundwater bores/headworks, WTPs, storage facilities, pump stations and underground pipe networks. NPDC provides approximately 33.2 million litres of water per day to just under 30,000 households and businesses in defined urban and rural areas.

A range of Council staff are involved in preparing and delivering the Water Supply AMP and providing support services for asset management. How these responsibilities are allocated, managed and delivered are shown in **Figure 1** in the **Strategic Asset Management Plan**. The framework and key elements of the overall AMP are shown in **Table 1** in the **Strategic Asset Management Plan.**

2.1 Asset Descriptions

The water reticulation system is designed to meet the day to day requirements of residential, commercial and industrial customers and firefighting requirements in urban areas. The components of the reticulation network assets include headworks/intakes, WTPs, reservoirs, pump stations, trunk mains, distribution mains, hydrants, pressure reducing valves, backflow preventers, valves, manifold assembly and toby and/or meters or restrictors at the customer point of supply.

The water assets operate as four separate water supply schemes in the district, including New Plymouth, Oakura, Okato and Inglewood, which are fed from both surface and ground water sources. The four water supply schemes are shown in **Figures 1, 2, 3 and 4**.

Figure 1: New Plymouth water supply scheme

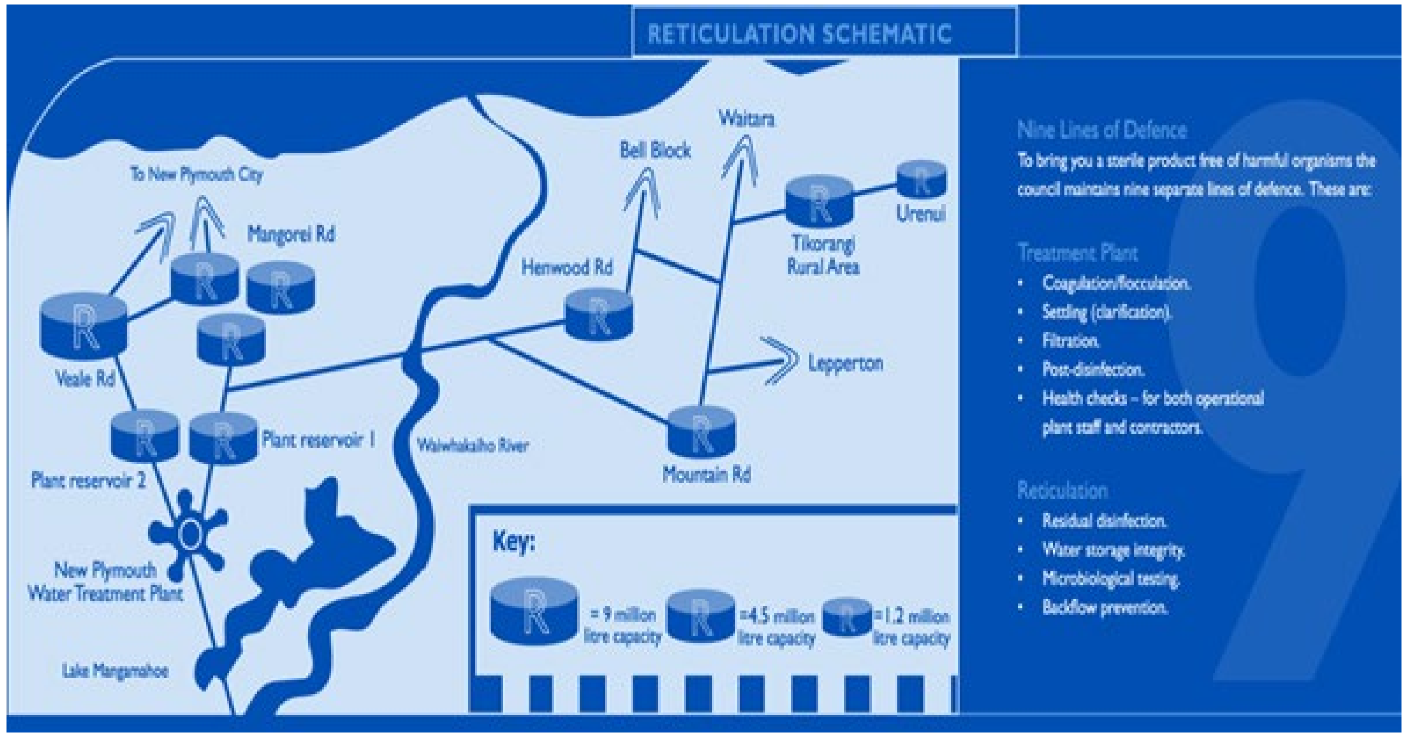


Figure 2: Inglewood water supply scheme

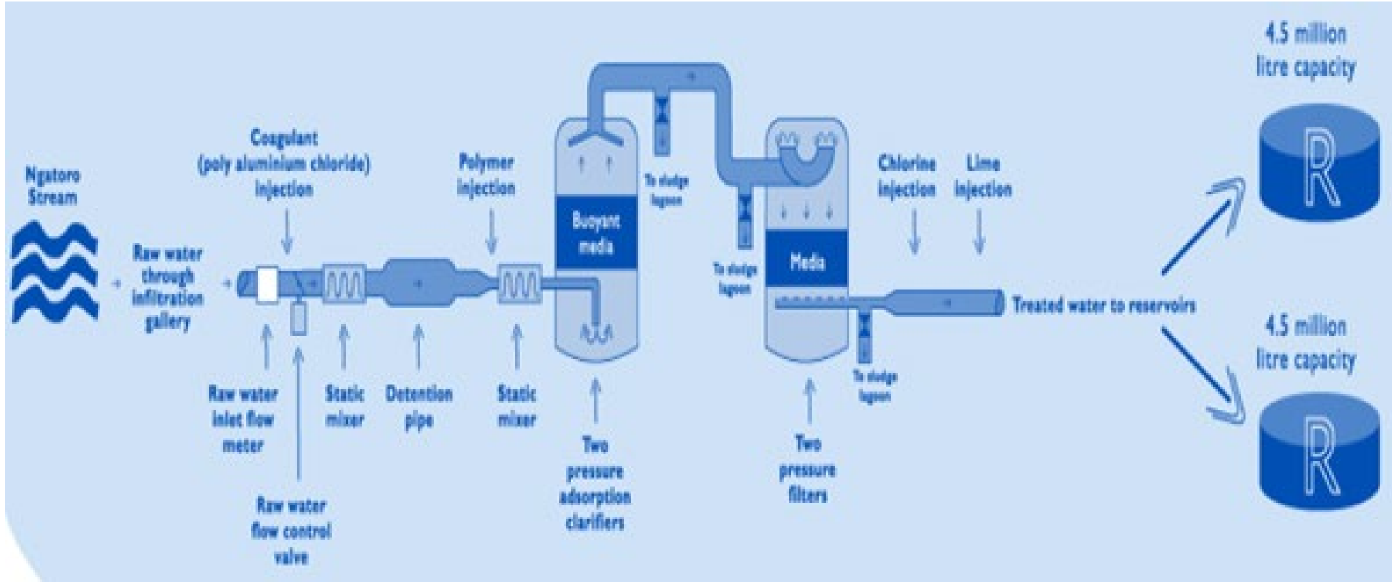


Figure 3: Oakura water supply scheme (June 2021) Note: The Oakura WTP plant is currently undergoing a upgrade due to completion in late 2021

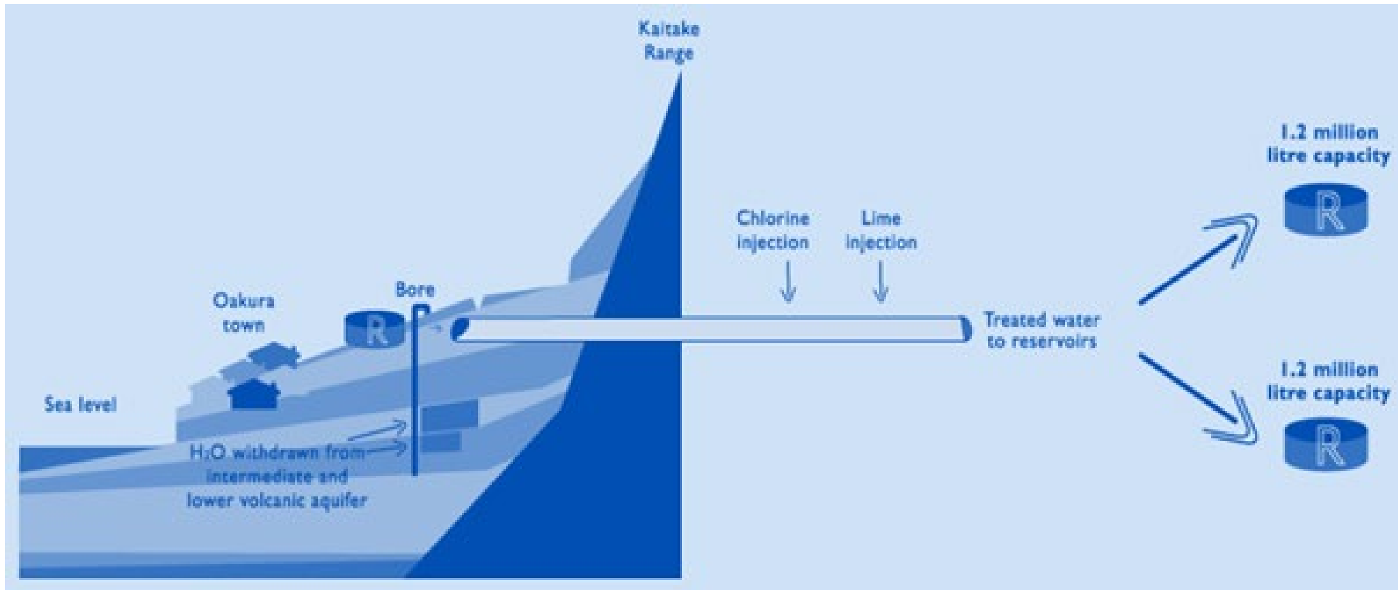
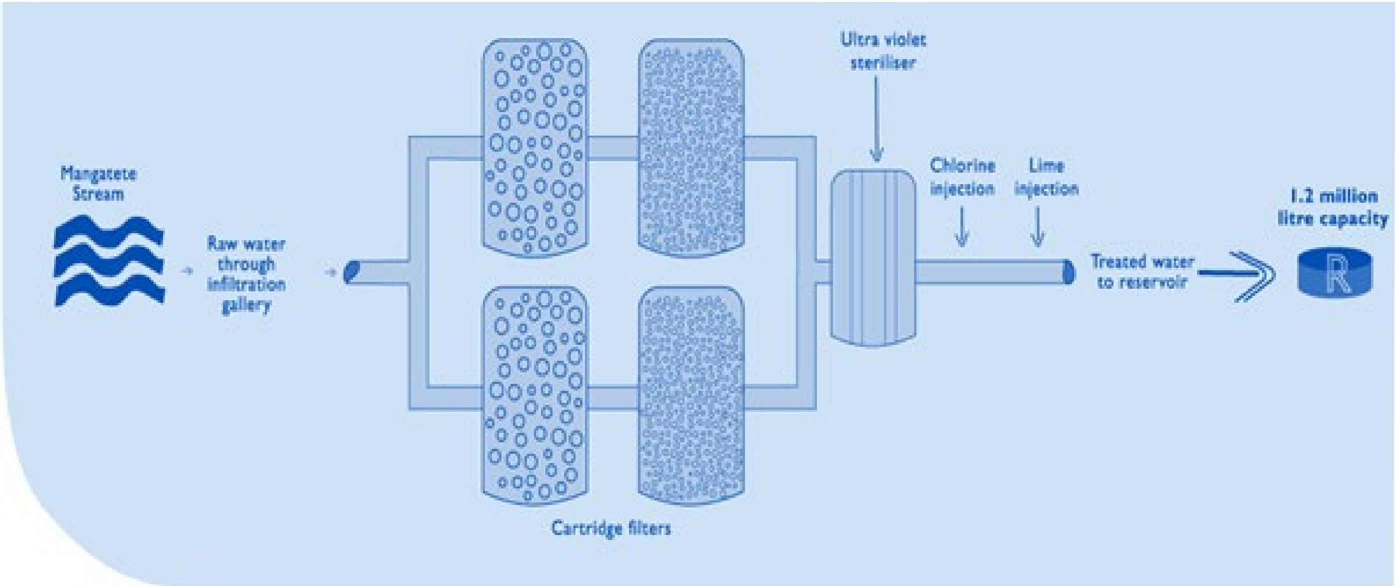


Figure 4: Okato water supply scheme (2018) Note: the Okato WTP was upgraded in 2019 to include duty standby UV.



An overview of all water supply assets included in the water supply schemes is provided in **Table 1**. Further details about each asset category can be found in the **Water Supply AMP: Volumes 1-5**.

Table 1: Asset summary

Asset Category	Description	Quantity	AMP Volume
Headworks and intakes	New Plymouth	3	Volume 1
	Inglewood	2	
	Okato	1	
	Oakura	2	
	Waitara Industrial Supply	1	
WTPs	New Plymouth Inglewood Oakura Okato	4	Volume 2
Pumping stations	Tikorangi/Faull Road pump to Urenui Mangorei Road Cowling Road Veale Road Oakura pump station (Wairau and Surrey Road) Okato from reservoir to rural	6	Volume 3

Asset Category	Description	Quantity	AMP Volume
Reticulation network	Trunk mains	143.873km	Volume 4
	Distribution and rider mains	642.22km	
	Pipe bridges (including hanging under the bridges)	64	
	Valves	8,025	
	Manholes	40	
	Chambers	43	
	Hydrants	3,849	
	Service connections	27,274	
	Backflow preventers	1517	
	Meters	7791	
Storage	NPWTP #1 NPWTP #2 Mangorei #1 Mangorei #2 Mangorei #3 Veale Road Henwood Road #1 Henwood Road #2 Mountain Road #2	21	Volume 5

Asset Category	Description	Quantity	AMP Volume
Storage	Faull Road Urenui (twin cell) Urenui Domain Inglewood #1 Inglewood #2 Oakura WTP #1 Oakura WTP #2 Okato WTP (twin cell) Mountain Rd (Waitara Industrial Supply) Johnson Rd (Waitara Industrial Supply)	21	Volume 5

2.2 Asset Information and Data

The Three Waters Service store and manage information and data for water supply assets in various systems, including the following:

- Enterprise Asset Management (EAM) system (part of TechnologyOne) for document management, financial management, customer information and requests, asset inventory, asset history, work order management and maintenance scheduling
- ARCGIS for spatial records with general Geographic Information System (GIS) viewer MILES
- RedEye for all drawings including working drawings
- SharePoint for the Drawing Management System (RedEye), asset data and Improvement Plan items

- CS-VUE - The Council's consent compliance management system is a web-based software solution specifically for compliance with RMA requirements. Resource consents are stored in CS-VUE and the system identifies and retrieves consent conditions and provides quality assurance.

- Water Outlook for gathering and managing the Supervisory Control and Data Acquisition (SCADA) system and processing data

- Water Online for reporting compliance data to the Ministry of Health

- Infoworks for pipe network modelling

Table 5 in **Section 5: Asset Management System** of the **Strategic Asset Management Plan** outlines the asset data accuracy/confidence grades. In previous AMPs, asset data accuracy/confidence for asset descriptions was determined by the Three Waters Team's knowledge and experience. Asset data accuracy/confidence grades have not been provided in this AMP as a more robust data quality system is needed to determine the grades more accurately. There is an improvement action for data accuracy/confidence grades in **Section 10: Asset Management Improvement Programme** of the **Strategic Asset Management Plan**.

3. Strategic Framework

NPDC's strategic framework for the district is detailed in **Section 4: Strategic Framework** of the **Strategic Asset Management Plan**. This section of the AMP outlines the alignment of the Council's Asset Management Drivers and Objectives with Water Supply Objectives, key issues for water supply, and the relevant statutory and regulatory requirements.

3.1 Strategic Alignment

AMPs are a key component of the strategic planning and management of the Council. The following four Asset Management Drivers have been identified to guide the Asset Management Team and to prioritise investment in asset infrastructure over the 10 year period of the AMP:

1.Taking care of what we have
   – We need to ensure that we invest in maintaining, renewing or replacing our existing asset infrastructure to preserve and extend their useful life.

2. Resilience and responding to climate change
   – As we build new assets and renew our existing infrastructure we must ensure that we build in resilience to issues from natural hazards including, volcanic and seismic activity, sea level rise, coastal erosion, flooding events and droughts along with the consideration of the predictions of climate change.

3. Planning for growth
   – Our district will continue to grow and it is important that we manage that growth and provide the infrastructure in the appropriate areas to support new housing and employment areas.

4. Meeting the needs of our community and reducing our impact on the environment
   – As our community grows and changes we need to ensure that our infrastructure responds to those changing needs and that we also respond to increasing standards to support public health and environmental protection.

These four drivers of decision making have been translated into specific Asset Management Objectives as details in **Table 2.**

Table 2: Asset Management Drivers and Objectives

Taking care of what we have

Taking care of infrastructure assets means:

- We understand that asset data and evidence based decision making are critical to optimising costs and maximising the value our services bring to our customers
- We protect and enhance public health by providing quality services
- We own and operate infrastructure that is safe for our staff, suppliers and customers

Resilience and responding to climate change

Resilience of assets means:

- Our infrastructure protects and enhances our built environment and creates amenity value
- We provide reliable services and infrastructure that is resilient to natural hazards and adapts to climate change
- We provide system redundancy and emergency back up systems to our critical infrastructure

Planning for growth

Planning and providing for growth means:

- We work in partnership with Tangata Whenua when we plan for our infrastructure
- Our infrastructure is an enabler for economic activity and future growth
- We educate our community so they can make informed choices about how they use our services and manage demand on our infrastructure and services

Meeting the needs of our community and reducing our impact on the environment

Meeting the needs of our community and reducing our impact on the environment means:

- We manage the consumption of energy and associated greenhouse gas emissions to mitigate our impact on climate change.
- We protect and restore the health of our natural environment.
- We manage the use of resources in a sustainable way, minimising waste and seek out opportunities to use wastes as a resource to be reused or recycled

Details for the key Water Supply Objectives and the alignment of these to the Asset Management Drivers and Objectives are provided in **Table 3**

Table 3: Alignment of Asset Management Drivers and Objectives, and Water Supply Objectives

	Asset Management Drivers			
Wastewater Objectives	1. Taking care of what we have	2. Resilience and responding to climate change	3. Planning for growth	4. Meeting the needs of our community and reducing our impact on the environment
A. Provide a safe, healthy and efficient service at a relatively low cost.				
B. To minimise the impact of high density human populations on the environment.				
C. To ensure infrastructure can meet both current and future demand within defined Levels of Service.				
D. To protect public health and the environment.				
E. To provide an acceptable level of resilience in emergency situations.				

Wastewater Objectives	Asset Management Drivers			
	1. Taking care of what we have	2. Resilience and responding to climate change	3. Planning for growth	4. Meeting the needs of our community and reducing our impact on the environment
F. To provide an acceptable level of resilience in emergency situations.				

3.2 Key Issues for Water Supply

There are four key issues that are relevant to the planning and management of our water supply over the next 30 years, which were identified in the LTP. These are further explored in the gap analysis summarised in **Table 4**.

The four key issues from the LTP are:

1. The condition of the water supply network.
   • Addressing the condition of the existing network is a priority through improved data collection on the condition of the network and increased funding for renewals. (Estimated at $33m of renewal work from several years of underfunding)
2. Capacity of the network.
   • The current rate of water usage is close to capacity in much of the network. Water conservation initiatives, in particular universal water metering and volumetric charging, will enable investment in new water sources to be deferred while catering for growth.
3. Continuity of water supply in the event of a natural disaster.
   • Protection of the network from weather events, seismic and volcanic activity is a priority to ensure public health is safeguarded in these circumstances. The Council plans to improve existing assets to withstand seismic activity and natural disasters, manage the risk of damage to the network from existing hazards and, where possible, provide duplicate assets as an alternative supply.
4. The National Policy Statement for Freshwater Management.
   • This has a potential major impact on NPDC. Much of our water supply relies on the ability to take water from our rivers and changes to the standards of freshwater management could impact on our ability to take what we need. Water conservation initiatives will be an important factor in managing this impact.

A problem statement gap analysis has been undertaken for water supply assets. **Table 4** outlines the problems, key issues, and the plan of actions associated with each problem.

Table 4: Problem statement gap analysis

Item No.	Title	Problem Statement	Key Issues	Planned Action
1.	Incomplete inspection/ condition rating data and programme	The Council has not operated a comprehensive inspection and condition rating programme resulting in incomplete data and to limited knowledge of the actual condition and deterioration rate of assets, there is a likelihood of asset failures	• Incomplete plan and resourcing for the inspection and condition rating of: - Plant and equipment (P&E) - Pipe bridges and river crossings - Above ground/underground pipes - Unlined tunnels - WTP buildings	• Condition inspection program for reticulation assets • Additional Opex for P&E inspectors • Condition assessment methodology research project • Opex for pipe bridge structural inspections • Opex for buildings inspections
2.	Lack of asset inventory data and standards and guidelines	The Council has not understood the value of asset data and has not developed formal metadata standards to ensure the right data is recorded to support asset management decision making which has resulted in Incomplete and inaccurate assets inventories which has in turn caused operational challenges including maintaining an inadequate spares inventory, increased risk of asset failure and an inability to accurately plan for future works	• No metadata standard – not planned for required data • No metadata standards – poor quality data in inventory • Unrecorded assets are not maintained • Undervalued asset inventory which impacts on renewals planning • Undervalues asset valuation results in under insurance • Assets not in the inventory cannot have maintenance schedules created so will not get maintained and serviced • Lack of Operations and Maintenance manuals for some P&E	• Write and adopt asset metadata standards • Introduce additional resource for asset inspections and use to complete as-built surveys and inventory validation • Create or update operation manuals and functional descriptions • Asset data quality analysis scripting
3.	System design does not meet current and future demand	Poor system design, legacy performance issues and a lack of future development considerations, particularly for older facilities have resulted in poor asset performance, higher operational cost, increased health and safety risks, a lack of capacity to accommodate future development, lack of contingency plans, increased risk of environmental harm and non-compliant with the Council's own bylaw	• NPWTP and source issues: - High operational cost for sludge settling ponds - Single source supply leading to poor resilience - Exposed clarifiers cause mediocre efficiency in the process - Launder supports are not fit for purpose - Significant water quality issues when the lake was drawn down and diversion tunnel stopped - NPWTP intake falling mains are operating at inadequate capacity, and the new falling main is likely to be affected by the Lake Mangamahoe saddle dam - Intake screens do not meet national best practice for fish entrainment - Significant dam safety issues with the Main and Saddle dams - Parts of the NPWTP are earthquake prone	• General: - Water Master Planning - Water Supply Resilience Assessment - Water Conservation Programme (including Pressure reduction) - Universal water metering - Reservoir upgrades - Fire Fighting Level of Service

Item No.	Title	Problem Statement	Key Issues	Planned Action
3. Cont.	System design does not meet current and future demand	Poor system design, legacy performance issues and a lack of future development considerations, particularly for older facilities have resulted in poor asset performance, higher operational cost, increased health and safety risks, a lack of capacity to accommodate future development, lack of contingency plans, increased risk of environmental harm and non-compliant with the Council's own bylaw	- Growth is expected to exceed abstraction capacity within next 20 years - Capacity issues between clearwell and reservoirs 1 and 2. • Inglewood WTP issues: - Difficult to de-sludge the sludge tank - No generator and redundancy plan for filter and clarifier train for emergency maintenance - No ability to run to waste when restarting the plant after a high turbidity event - Limited source supply leading to poor resilience • Oakura WTP issues: - Toilet facilities have not been connected • Okato WTP issues: - Infiltration gallery is at high risk of loss in a storm, particularly at the upstream end of the gallery • Reticulation General Issues: - No defined firefighting Level of Service - Parts of system lack basic firefighting capacity and hydrant numbers. - Significant risk of backflow in the network - No plans as to how to accommodate the growth proposed in the district plan. - Limited network resilience - No potable water is provided to Dudley road user group - Excessive pressure in some areas - Private fire sprinkler systems are designed based on spot pressure whereas pressure fluctuates with seasons and reduces with growth - Excessive size of mains leading to water age issues in some areas	• NP WTP - NPWTP Improvement Plan - Lake Mangamahoe dam safety upgrades - Lake Mangamahoe fish screen upgrades - Future of Waitara industrial supply • Inglewood WTP: - Upgrades to Inglewood backwash tank - Integrated sludge management (NP WTP Improvement Plan) • Oakura WTP sewer • Mangorei Weir removal project • Dudley Road water supply upgrades • Future of the Waitara industrial supply

Item No.	Title	Problem Statement	Key Issues	Planned Action
3. Cont.	System design does not meet current and future demand	Poor system design, legacy performance issues and a lack of future development considerations, particularly for older facilities have resulted in poor asset performance, higher operational cost, increased health and safety risks, a lack of capacity to accommodate future development, lack of contingency plans, increased risk of environmental harm and non-compliant with the Council's own bylaw	• No power backup for pump stations • Discoloured water at Inglewood • No backflow prevention installed on some reservoirs • Some self-supplied community facilities are without safe drinking water (e.g. schools). • No disposal plan for redundant assets (Mangorei weir and Waitara industrial supply)	
4.	Lack of a robust renewal programme for telemetry and communications technology	Parts of the telemetry and communications networks used to control the automation of the system have become aged and outdated. Without modernisation they will continue to cause inaccurate data recording, delayed notification of emergency events and non-compliance with standards.	• Lack of software licenses • Out of date Piping and Instrumentation Diagrams (P&IDs) and functional descriptions • Communications single points of failure/lack of redundancy • Out of date radio equipment • Out of date pump station instrumentation including level monitors and alarms • Narrow bandwidth connections between SCADA sites • Lack of spares inventory • Lack of remote programming access to essential sites • Data inaccuracies in recorded data • Lack of essential power equipment • Inadequate firewalls • Reticulation instrumentation relies on cellular networks • Program Logic Control (PLC) codes do not comply with NPDC standards • No space at WTPs for PLC room, historian, remote access servers, etc.	• Extra Opex to purchase more software licences • PLC replacement program • Create or update functional descriptions and P&IDs • NP WTP Improvement
5.	Lack of engagement with iwi on infrastructure design, build and operation	Much of the system was designed and built with little or no cultural consideration and pre-dates Te Mana O Te Wai and, as a result, parts of the system and the way it is designed to operate are considered culturally offensive	• Lack of Iwi input into decision making • Potential over abstraction from sources leading to negative environmental and cultural impacts • Inefficient use of water	• He Puna Wai • Three Waters Hui • Water Conservation Plan • Water Master Planning • Future of the Waitara industrial supply • Mangorei Weir removal project • New Plymouth New Source Options Assessment • Water Supply Resilience Project

Item No.	Title	Problem Statement	Key Issues	Planned Action
6.	Not understanding the threats of natural hazards to infrastructure and not building in resilience	When infrastructure has developed, there has been a lack of consideration for natural hazards and poorly defined resilience performance expectations which have resulted in vulnerable infrastructure being constructed in natural hazard zones and a vulnerable system that is linear in nature and has a high number of single-points-of-failure.	• No resilience framework, overarching Levels of Service or understanding of key vulnerabilities of the networks. • Unknown earthquake rating of some buildings and reservoirs • River crossings relative to flood levels • General effects of coastal erosion and sea-level rise on coastal assets, in particular trunk mains • NPWTP administration building and clearwell is earthquake prone • Inglewood fault lines • Impacts of volcanic ash fall unknown • Above ground assets are at risk of land movement • Potential water quality issues during droughts	• Creation of a resilience framework • Water Master Planning • NP WTP Improvement Plan • Fire Level of Service • Earthquake assessments of all buildings • Water Supply Resilience Assessment • Develop resilience Levels of Service (including drought) • Pipe bridge upgrades • Waitara pipe bridge renewal
7.	Not meeting all consent or legal compliance	The Council does not comply with some of its legislative requirements which has resulted in increased health and safety risks, damage to the environment and potential enforcement action.	• NP raw water intakes are non-compliant for fish exclusion • Some chemical storage areas do not comply with Hazardous Substances and New Organisms Act 1996 (HSNO Act) requirements • Compliance with Inglewood discharge consent is patchy due to design of system • Resource consent cannot be granted to allow maintenance of moss on pipe bridges • A thorough review of compliance with legislation and resource consents has not been completed leading to potential of unknown non-compliances	• Water Master Planning • Lake Mangamahoe fish screen upgrade • NP WTP Improvement Plan • Inglewood backwash tank upgrades • Review of compliance with legislation and resource consents
8.	Lack of maintenance scheduling	There has been an insufficient investment of resources to develop a comprehensive programme of preventative maintenance schedules which have resulted in many items of P&E receiving no routine servicing which has in turn increased the cost of reactive emergency repairs, voided equipment warranties, shortened the operating lives of assets, increased the cost of the renewals programme, reduced system performance and increased health, safety and environmental risks	• Only about 50% of P&E assets have maintenance schedules in the system • Maintenance budget is insufficient • Major lime build-up in clearwater tank and reservoirs • Accumulated iron, manganese and lime in reservoirs at Inglewood WTP • Unknown bore condition at Oakura WTP	• Maintenance scheduling Opex project to create missing schedules and compile maintenance manuals • Additional fitter resource • Create or update operating manuals • Undertake bore condition assessment • Clean reservoirs
9.	Insufficient operational procedures	There has been an insufficient investment of resources to develop comprehensive operational procedures which have resulted in increased operational cost, shortened the operating lives of assets, increased the cost of the renewals programme, reduced system performance and increased health, safety and environmental risks	• Decommissioned or redundant equipment has not been removed • Most operation manuals and functional descriptions are incomplete or do not exist • Issues with asset capitalisation	• Create or update operating manuals • Asset capitalisation project

Item No.	Title	Problem Statement	Key Issues	Planned Action
10.	Lack of understanding of the system capacity and performance	The district's population is growing; however, there is insufficient evidence based understanding of the system's capacity and performance and an overreliance on the observational knowledge of field staff to inform future development decisions which has resulted in poor system performance, increased environmental risks, poorly informed investment decisions and barriers to land development	• Population growth assumptions are not enough to undertake growth modelling • LiDAR of the district is incomplete and will become out of date in 2025 leading to poor outcomes when creating hydraulic models • Some trunk mains are operating at or close to capacity • Capacity issues between clearwater tank and plant reservoirs • No firefighting capacity level of service • Excessive water usage is occurring in the district • No clear plan on if reticulated water will be provided to Egmont village	• Water Master Planning • Fire Level of Service • NP WTP Improvement Plan • LiDAR Project • New water source options assessment • Water Conservation Plan • Universal water metering
11.	Historical lack of Renewals	Due to fiscal constraints the level of investment to replace assets was significantly reduced, which has resulted in an overall deterioration in the condition of the network, increased risk of asset/system failure, increased reactive maintenance costs and increased risk of environmental damage	• Carrying a large backlog of deferred reticulation renewals • Renewals funding is insufficient for both reticulation and P&E so backlog will continue to accrue • Condition of Inglewood contingency water intake main is poor • Gravielectric sludge cones mechanism in the clarifiers require upgrading • Tube settlers require renewal at NPWTP • Infiltration gallery requires renewal at Inglewood WTP • Pipe bridge over Waitara River requires urgent renewal • Some historic renewals did not decommission the renewed asset • NPWTP staff welfare facilities require renewal	• P&E renewals • NP WTP Improvement Plan • Accelerated renewal program • Resource consent renewals • Waitara pipe bridge renewal

3.3 Statutory and Regulatory Requirements

The statutory and regulatory documents that are relevant for water supply assets are detailed in **Table 5.**

Table 5: Relevant legislation and other documents

Document	Relevance to the Water Supply AMP
Legislation	
LGA 2002 and Amendments	This Act sets the statutory requirements for local governments and includes the mandatory preparation and adoption of a 30 year Infrastructure Strategy that underpins each LTP.
Health (Drinking Water) Amendment Act 2007	This aims to protect public health by improving the quality of drinking-water provided to communities
Resource Management Act 1991 and Amendments (RMA)	This is the primary legislation dealing with the management of natural and physical resources. It provides a national framework to manage land, air, water and soil resources, the coast, subdivision and the control of pollution, contaminants and hazardous substances.
Fire and Emergency New Zealand Act 2017 and Amendments	This Act provides the framework under which Fire and Emergency New Zealand operate.
Civil Defence Emergency Management Act 2002 and Amendments	The Act requires that an emergency management plan is maintained and reviewed annually and that it is accepted as suitable by independent review.
Health and Safety at Work Act 2015 and Amendments	The objective of this Act is to promote the prevention of harm to all people at work, and others in, or in the vicinity of, places of work
Building Act 2004 and Amendments	In New Zealand, the building of houses and other buildings is controlled by this Act. It applies to the construction of new buildings as well as the alteration and demolition of existing buildings.

Document	Relevance to the Water Supply AMP
Legislation	
HSNO Act 1996 and Amendments	The use of hazardous substances at any water supply sites needs to comply with the HSNO Act.
Climate Change Response Act 2002 and Amendments	This Act created a legal framework for New Zealand to ratify the Kyoto Protocol and to meet obligations under the United Nations Framework Convention on Climate Change.
Public Works Act 1981 and Amendments	This Act acknowledges that works often cannot be carried out without affecting private landowners. It provides the Crown with legislative powers to compulsorily acquire land for public works so that public works proposals are not unreasonably delayed.
Other Documents	
Health and Safety at Work (Hazardous Substances) Regulations 2017	This is the regulation of hazardous substances that affect human health and safety in the workplace sit under the Health and Safety at Work Act. Of relevance is the handling of hazardous substances to treat drinking water.
Water Supply Services Management System and Contracts	The service levels, strategies, and information requirements described in the AMP are incorporated within contract specifications, Key Performance Indicator and reporting documentation.
DWSNZ (Revised 2018)	The availability of safe drinking-water for all New Zealanders, irrespective of where they live, is a fundamental requirement for public health. The DWSNZ provide requirements for drinking-water safety.
New Zealand Standard (NZS) 4404:2010 – Land development and subdivision infrastructure	This Standard provides criteria for design and construction of land development and subdivision infrastructure.
Land development and subdivision infrastructure standard (local amendment Version 3)	This Standard was jointly prepared by NPDC, South Taranaki District Council (STDC) and Stratford District Council (SDC) and is based on NZS 4404:2010.
Water and Sanitary Assessment (2009)	This document provides an assessment of water services as required by the LGA.

Table 5: Relevant legislation and other documents

Document	Relevance to the Water Supply AMP
Other Documents	
Infrastructure Asset Grading Guidelines 1999	This is a guide used when carrying out condition assessments to determining the grading of assets life and condition.
Water, Wastewater and Stormwater Services Bylaw (2008, amended and readopted in 2014)	Part 9 of this Bylaw covers specific requirements for water supply additional to the general requirements in the Bylaw.
Operative New Plymouth District Plan (2005) and Proposed District Plan (2019)	The District Plan includes objectives, policies and rules that manage the adverse effects of activities on the environment with a focus on land use and subdivision activities.
National Policy Statement for Freshwater Management (NPS-FW) (2020)	The NPS-FW provides local authorities with direction on how to manage freshwater under the RMA.
Resource Management (National Environmental Standards for Freshwater) Regulations 2020 (Freshwater NES)	The Freshwater NES regulates activities that pose risks to the health of freshwater and freshwater ecosystems.
Regional Fresh Water Plan (2001)	The Regional Fresh Water Plan promotes sustainable management of the region's freshwater resources by applying rules and conditions to various activities. The Plan is currently under review.
Guidelines for Earthworks (2006)	The aim of these guidelines is to provide guidance to consulting engineers and contractors working within the Taranaki region, on practical measures to help them meet the conditions of the earthwork activities rules contained in the Regional Fresh Water Plan.
Water Master Plan (ECM#: 7136169)	The Master Plan is intended to identify the key issues and deliverables required to ensure a future proofed sustainable, resilient and cost-effective water supply system for the community.
Three Waters and Resource Recovery Pandemic Plan (ECM#: 983033)	This Pandemic Plan specifies the actions to be taken by the Three Waters Team and Resource Recovery Team in response to the threat of or in the event of an actual pandemic or epidemic.

4. Levels of Service

The Levels of Service for water supply are driven by the Council's overall service objectives in the LTP, customer expectations, and legislative and technical requirements. The Opex and Capex investment programmes included in this AMP are based on effective asset management practices that delivers on these objectives, expectations and requirements.

4.1 Customer Levels of Service

The Customer Levels of Service included in the LTP, together with target levels and a snapshot of past performance are shown in **Table 6**.

Table 6: Water Supply Customer Levels of Service

Asset Manage-ment Driver	Water Supply Objective	What you can expect	How we measure performance	Actual 2019/2020	Target 2021/2022	Target 2022/2023	Target 2023/2024	Target 2030/2031	Comments
1	A, D & E	We provide water that is safe to drink	Our level of compliance with Part 4 of the Drinking-water Standards (bacteria compliance criteria)	Full compliance	Full compliance	Full compliance	Full compliance	Full compliance	
1	A, D & E		Our level if compliance with Part 5 of the Drinking-Water Standards (protozoal compliance criteria)	Full compliance	Full compliance	Full compliance	Full compliance	Full compliance	
1, 3 & 4	B, C & F	Manage demand to minimise the impact of water supply activities on the environment.	The average consumption of drinking water per day per resident within New Plymouth district.	284 litres per day	300 litres per day	300 litres per day	300 litres per day	300 litres per day	25% reduction in the gross per capita consumption expected in the next 10 years as part of the Water Conservation Programme.
1, 3 & 4	B, C & F		The number of abatement notices received.	0	0	0	0	0	
1, 3 & 4	B, C & F		The number of infringement notices received.	0	0	0	0	0	
1, 3 & 4	B, C & F		The number of enforcement orders received.	0	0	0	0	0	
1, 3 & 4	B, C & F		The number of convictions received.	0	0	0	0	0	
2 & 4	C & F	We maintain the reticulated water network in good condition	The percentage of real water loss from our networked reticulation system.[1]	16.3%	20% or less	20% or less	20% or less	20% or less	Benchloss calculation has been indicating better than 20% since unbilled meter readings have been collected. Water Conservation Programme and Universal Water Metering will support on the reduction and benchloss calculations.

1 Water loss calculation: The percentage of water loss is calculated by dividing the annual volume of water loss by the total amount of treated water supplied for the year (obtained from water meter records from the WTP). To calculate the annual volume of water loss, the minimum night flow (the average flow between 2am and 4am for the lowest 20 days of the year divided by the number of connections) is determined and the legitimate night usage per property (assumed to be six litres per property per hour) is subtracted. The difference is the estimated volume of water loss per property.

To determine the annual volume of water loss, the estimated volume of water loss per property is multiplied by the number of connections, and that figure is then multiplied by 365.

Asset Manage-ment Driver	Water Supply Objective	What you can expect	How we measure performance	Actual 2019/2020	Target 2021/2022	Target 2022/2023	Target 2023/2024	Target 2030/2031	Comments
1, 2 & 3	C & F	We respond to faults and unplanned interruptions to the water supply network in a timely manner	The median response time to urgent callouts (from the time that we receive notification to the time that service personnel reach the site)	0.52 Hrs	1 Hr or less	1 Hr or less	1 Hr or less	1 Hr or less	
1, 2 & 3	C & F		The median resolution time for urgent callouts (from the time we receive notification, to the time that service personnel confirm resolution of the fault or interruption)	1.82 Hrs for < DN250 Pipe	4 Hrs or less for < DN250 Pipe	4 Hrs or less for < DN250 Pipe	4 Hrs or less for < DN250 Pipe	4 Hrs or less for < DN250 Pipe	
1, 2 & 3	C & F			No urgent callout for ≥ DN250 Pipe	8 Hrs or less for ≥ DN250 Pipe	8 Hrs or less for ≥ DN250 Pipe	8 Hrs or less for ≥ DN250 Pipe	8 Hrs or less for ≥ DN250 Pipe	
1, 2 & 3	C & F		The median response time to non-urgent callouts (from the time we receive notification to the time that service personnel reach the site)	49.55 Hrs	70 Hrs or less	70 Hrs or less	70 Hrs or less	70 Hrs or less	Change due to Audit New Zealand request that the median of all callouts other than urgent callouts, i.e. P2, P3 and P4 jobs, be used.
1, 2 & 3	C & F								
1, 2 & 3	C & F		The median resolution time for non-urgent callouts (from the time we receive notification to the time that service personnel confirm resolution of the fault or interruption)	89.65 Hrs	116 Hrs or less	116 Hrs or less	116 Hrs or less	116 Hrs or less	Change due to Audit New Zealand request that the median of all callouts other than urgent callouts, i.e. P2, P3 and P4 jobs, be used.

Asset Manage-ment Driver	Water Supply Objective	What you can expect	How we measure performance	Actual 2019/2020	Target 2021/2022	Target 2022/2023	Target 2023/2024	Target 2030/2031	Comments
1 & 4	A, B & D	Customers are satisfied with our water supply service. The total number of complaints (per 1,000 connections)	Drinking water clarity, taste, or odour	Combined of 13.01	Combined of 16 or less	Combined of 16 or less	Combined of 16 or less	Combined of 16 or less	
1 & 4	A, B & D		Drinking water pressure or flow						
1 & 4	A, B & D		Continuity of supply						
1 & 4	A, B & D		Our response to any of these issues						

4.2 Technical Levels of Service

To meet legislative requirements, the following Technical Levels of Service are applied:

- **The New Zealand Fire Service Water Supplies Code of Practice SNZ PAS 4509:2008** governs the minimum required flows and pressures for firefighting. In accordance with this standards, NPDC's targeted Level of Service for residential areas is currently fire water classification FW2. This target has been established collaboratively with the Fire and Emergency New Zealand. We are now working to establish target levels of service for our non-residential areas to ensure practical and suitable Levels of Service are provided.

- **The maximum desirable working pressure for water supply is 900 kPa.** This is being progressively achieved as pressure zone and demand management procedures are implemented. Some zones at higher elevations (typically on the outskirts of New Plymouth city) will have pressure sustaining valves to ensure minimum pressures stay above the minimum Level of Service (300 kPa for urban properties and 200 kPa for rural properties) wherever possible.
- Requirements and conditions of resource consents from Taranaki Regional Council (TRC) and NPDC

- **DWSNZ** - This aims to protect public health by improving the quality of drinking-water provided to communities

- **NPDC Water, Wastewater and Stormwater Services Bylaw** – As noted in **Table 5** this Bylaw covers specific requirements for water supply as well as general requirements for the Three Waters Service

Table 7 identifies the achievements for each water supply scheme in 2019 in regard to the Technical Levels of Service.

Table 7: Achievements for each water supply scheme in 2019

Criteria		Category	Threshold for Failure (Target)	New Plymouth Actual 2019	Inglewood Actual 2019	Oakura Actual 2019	Okato Actual 2019
Level of services	Pressure	Low Pressure – Rural (including restricted)	< 20m	99.4% achieved. 144 out of 25584 customers failed the level of service criteria, and these customers are located at high elevations and near reservoir sites. These areas are: • Rural customers on Carrington Road • Two urban customers in Brooklands and several urban customers in Highlands Park at the entrance to the zone • Rural customers near Henwood Road reservoir and urban customers towards the southern zone boundary in Bell Block Several rural customers along the Eastern Feeder Line on Manutahi and Mountain Road near the Mountain Road Reservoir	96% achieved. 7 out of 1625 customers are susceptible to low pressures (below 10m) are located near the Inglewood reservoirs.	Achieved. Areas of low pressures (blow 10m) are located near the Oakura reservoir and suction side of the booster pump station. No customers connected to this of the network. The network provides adequate pressure to every customer in the network.	Achieved. Areas of low pressures (blow 10m) are located near the Okato reservoir. The modelling indicates that no immediate improvements are required to the network to rectify maximum/minimum pressures.
		Low Pressure - Urban	< 25m				
		High Pressure – All Customer Types	> 100m		Achieved. The network experiences pressure up to 97m, which is below the threshold criteria for maximum pressures.	Achieved. The network experiences pressures slightly above 100m head (101m) at the end of Surrey Hill Road, however no customers connected to this part of the network. The pump control set point could be slightly reduced.	Achieved. The network experiences pressure up to 94m, which is below the threshold criteria for maximum pressures.
System performance	Pipe Headloss	High Headloss	> 5 m/km	High headloss is observed/predicted in many zones throughout the network as follows: • Along Barrett Road and Karamea Road in Barrett zone • At the entrance to the zone in Glen Avon on Queens Road, Atiawa Street and Smart Road • Several undersized pipes on Wills Road, Devon Road and Mountain Road in Bell Block There are also several pipes in Veale, Brooklands, Lower Highlands Park, Fitzroy Residential, Glen Avon, Waitara, Tikorangi, Urenui, and the Eastern Feeder where high headloss is observed	High headloss in Inglewood West is limited to a small area of the network, including pipes on Rata Street, Ngahere Street. In Inglewood East, the proposed upgrades are shown to significantly improve headloss within the zone. The headloss predicted along the pipe supplying flow to the Inglewood Laundry, and filling point (Brown Street) exceeds 5m/km; however, the delivery pressure remains above 50m.	The minimum LOS to all customers provided, however there are two locations experienced high headloss. One location is along the trunk main from the Oakura Reservoirs and South Road and another location is the discharge main exhibit in Oakura Boosted, which has extremely high headloss. Immediate upgrades of the network are not required but upgrading the existing Asbestos Cement (AC) pipe sections along the trunk main when they are due for renewal is recommended.	High headloss in Okato is limited to a small area of the network, including pipes on Carthew Street, Curtis Street, Oxford Road and Old South Road. Given that there is no level of service issues in Okato, upgrading the pipework is not required immediately.
	High Velocity	High Velocity	> 1.5 m/s	The maximum velocity does not exceed 0.5 m/s in the most network. There are a limited number of pipes where the maximum velocity exceeds 2m/s. Most notably in the Veal zone.	Following the upgrades to the network, velocities are generally predicted to remain below 1m/s during peak demand periods. Velocities are predicted to be below 2m/s along Brown Street and certain sections of the trunk main.	Achieved. The model predicts that velocities do not exceed the threshold limit of 1.5m/s throughout the network during peak demand conditions.	The velocities are predicted to be below 1m/s. The modelling indicates that no immediate improvements are required to the network to rectify high velocities in the pipework.

Criteria		Category	Threshold for Failure (Target)	New Plymouth Actual 2019	Inglewood Actual 2019	Oakura Actual 2019	Okato Actual 2019
System performance	Reservoir Storage	Reservoir Storage	< 24 hrs storage, average day demand (total reservoir volume)	Most reservoirs in the New Plymouth network are able to meet the 24 hour average day demand and 8 hour average day peak week demand requirements. The storage capacity in Henwood Road Reservoir (supplying to Bell Block), Mountain Road Reservoir (supplying to Waitara) and Veale Road Reservoir (supplying flow to Veale, CBD and Hurdon) is below the 24 hour average day demand. The capacity of these reservoirs could be marginally increased without adversely impacting turnover times.	Achieved. Available reservoir storage is 7ML, and Total Demand (24 hrs) is 1.77ML. Storage as % of Total Demand is 39.6%.	Achieved. Available reservoir storage is 2.11ML, and Total Demand (24 hrs) is 0.71ML. Storage as % of Total Demand is 29.8%.	Achieved. Available reservoir storage is 1.03ML, and Total Demand (24 hrs) is 0.45ML. Storage as % of Total Demand is 23.0%.
			< 8 hrs average day peak week demand (50% reservoir volume)		Achieved. Available reservoir storage is 7ML, and Total Demand (8 hrs) is 0.77ML. Storage as % of Total Demand (50% reservoir volume) is 45.6%.	Achieved. Available reservoir storage is 2.11ML, and Total Demand (8 hrs) is 0.36ML. Storage as % of Total Demand (50% reservoir volume) is 29.5%.	Achieved. Available reservoir storage is 1.03ML, and Total Demand (8 hrs) is 0.23ML. Storage as % of Total Demand (50% reservoir volume) is 22.7%.
	Reservoir Turnover Time	Maximum Residual Time	Average day low & peak demand week > 72 hrs	The turnover times for Tikorangi Reservoir and Urenui Reservoirs exceed the threshold period of 72 hrs. The turnover time in Urenui Reservoir is above the 72 hrs threshold for both the low demand and peak demand week suggesting that the reservoir is oversized.	Not achieved. Average day low demand week is 113.43 hrs and average day peak demand week is 74.37 hrs. The turnover period corresponding to the Inglewood reservoirs exceeds the threshold period of 72 hrs for both the low demand and peak demand weeks. However, NPDC currently does not have any issues with low residual chlorine with this supply due to long residence times. To better understand this issue, additional flow meters to be installed, as part of the Inglewood trunk main upgrade, to understand if this is exacerbated by preferential flow issues with these reservoirs.	89.57 hrs, not achieved. However, there is a sharp reduction in the turnover period during peak demand by more than 50%, thus illustrating the variation in network demand over the course of the year. As the population (and demand) increases, the turnover time in these reservoirs is expected to reduce to acceptable levels on a consistent basis. On average day peak demand week 46.7 hrs, achieved.	Not achieved. The average day low demand week is 82.31, the turnover period corresponding to the Okato reservoir exceeds the threshold period of 72 hrs. However, there is a sharp reduction in the turnover period during peak demand by more than 50%, thus illustrating the variation in network demand over the course of the year. As the population (and demand) increases, the turnover time in these reservoirs is expected to reduce to acceptable levels consistently. On average day peak demand week 36.08 hrs, achieved.

4.3 Level of Service Projects

To ensure the Three Waters Service meets community expectations, a number of projects have been identified to improve and maintain Levels of Service over the 10 year period of the AMP. The Three Waters Service also has a number of general initiatives, plans, and projects planned over the period of the AMP.

The Level of Service Projects are listed in **Table 8**. The alignment of each project to the Asset Management Drivers and key issues for water supply (see **Section 3: Strategic Framework**) is also identified.

Table 8: Level of Service Projects

Project Budget Code	Project Description	Asset Management Driver	Key Issue
WA1025	Water reticulation minor augmentation programme	3 & 4	3
WA1040	Mountain Rd & Henwood Rd Reservoirs	2 & 3	10
WA2004	NP WTP Intake Fish Screen	1 & 4	7
WA2009	NPWTP EQ Strengthening & Welfare Modifications	2 & 4	6 & 12
WA2026	New Water Source	1 & 3	3
WA2203	Water Customer Equipment Renewals	1	1
WA2206	Installation of Backflow Preventers	1 & 4	3
WA3009	Water Resilience - Reservoirs Inlets-Outlets	1 & 4	3, 6 & 8
WA3011	Inglewood Contingency Intake Fish Exclusion	1 & 4	3 & 11
WA3014	Inglewood WTP Sludge Management	1, 3 & 4	3
WA3016	Water Conservation Program	1 & 4	5 & 10
WA3018	Patterson Road Water Main	3	10

Key: Strategic Projects (see **Section 4: Strategic Framework of the Strategic Asset Management Plan**)

Details for key Level of Service Projects are provided below:

WA2206: Installation of Backflow Preventers. In order to protect the Council's water supply network against contamination, it is a requirement of the Council's Water Supply Bylaw that backflow preventers be installed at extraordinary water supply properties. However, many of these properties do not have backflow preventers and these devices now need to be installed.

There are also a number of residential connections at higher risk due to their location in the network (i.e. properties that will be the first to experience negative pressures in the event of a mains break or fire flow etc.). These are in the process of being identified as part of the network modelling component of the Water Master Plan. Consideration needs to be given as to whether additional backflow prevention measures should be installed on these properties.

WA3016: Water conservation program.

Residents are not currently using water efficiently. This is evidenced by high residential per capita consumption of 292L/p/d compared with a national average of 275L/p/d and international best practice of 130L/p/d. This is leading to the following problems:

- **Damage to the environment:** In a 1:100 year drought the Waikawaiho River, Ngatoro Stream, and Mangatete Stream are drawn down to around 55% of the Mean Annual Low Flow (MALF). National guidance is that abstraction from rivers should cease at 90% of MALF (as a rule of thumb). This indicates that the current abstraction rates are likely to be having a negative environmental impact.

- **Difficulty obtaining consents:** NPDC's abstraction consents for the New Plymouth and Inglewood water supplies expire in June 2021. Due to growth, a second source of water will be needed between 2040 and 2045. As part of justification for these consents it needs to be demonstrated that water is being taken efficiently. At this point, the Council cannot to do this. In addition, it is reasonable to assume that continuing to abstract down to 55% of the MALF is not a viable option in the long term. As such, ways to reduce take from these streams need to be found.

- **Inefficient use of ratepayer's money:** At least $50m of Capex plus associated Opex will be required to meet water demand over the next 20 years if consumption continues at its current rate. Much of this can be deferred or eliminated by reducing consumption thus reducing rates. Financial modelling indicates that a 20% reduction in water consumption would achieve a $25m saving (Capex and Opex) over 30 years. On top of this there are expected to be savings with operating the WTPs (as less water used means less water to treat) and with upgrading of distribution mains to allow for densification which are not included in the above analysis.

The Capex forecast for the Level of Service Projects over the 10 year period of the AMP is shown in **Table 18** in **Section 8: Financial Summary**.

5. Future Demand

Asset management planning relies on forecasts and the identification of other factors (e.g. growth and age of the population) to understand the demand on water supply assets. As detailed in **Section 3: The New Plymouth District and the Taranaki Region** of the **Strategic Asset Management Plan**, the Council's latest growth projections were developed in April 2020 and cover the period 2018 to 2051. The growth projections indicate that the district will grow by almost 25% by 2051 (from a population of 86,504 in 2021 to 104,129 in 2051). The age profile within the district is also changing and it is anticipated that there will be an increase in the number of people aged 65 and over, from 19% (16,651) of the total population in 2021, to approximately 27% (28,256) in 2051. The growth projections indicate that there will be an increasing demand for housing and infrastructure in the district.

Over the life of the LTP, the annual rate of new dwellings is anticipated to be around 355 new dwellings per year during the first five years and 383 new dwellings per year during the last five years of the AMP period (2021-2031). There will also need to be a further 6,600 houses accommodated by 2051. These will require additional three waters connections and upgrades.

The New Plymouth Water Master Plan completed in 2016 (ECM#: 7136169) includes a 30 year work program for the New Plymouth water trunk main and reservoir system based on medium population growth projections. The approach for preparing the work program is summarised as follows:

- Use the existing network model with current demand. Establish future growth in the area by using the medium growth demand forecast and Council Blueprint.
- Develop and formulate additional demand and add these demands to the network and assess the impact of these additional demands on the network infrastructure
- On identifying the network deficiencies, formulate solutions to remove these deficiencies, check the impact of these solutions with universal metering
- Discuss the resilience of the network and impact on resilience with the solutions developed

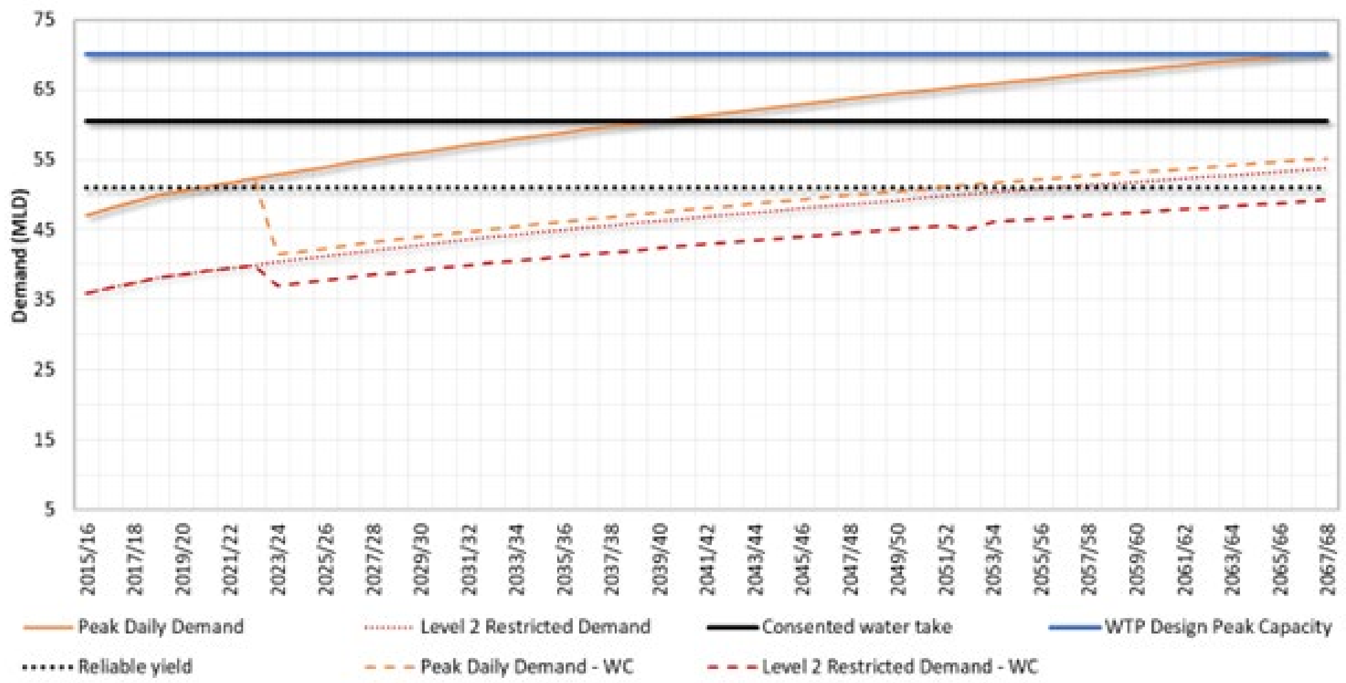
The program considers universal water metering and its impact on network resilience as a water conservation measure. It also considers tools such as pressure reduction, leakage and losses reduction, rainwater tanks and pricing policies.

These measures should reduce water consumption per person per day. However, in the long term, population growth will continue to increase the peak demand placed on the water supply system. The anticipated population growth and the impact of this additional demand to the existing network infrastructure is significant and will require capital and operational investment in a number of capital improvement projects.

Modelling tools are assets in their own right and require renewal on a regular basis. Many of the Three Waters Service's current water supply hydraulic models need updating to facilitate more reliable planning for growth, renewals, system management and operations. A plan is required to ensure models remain up to date in the future. This is an improvement action and is recorded in **Section 9: Improvement Plan.**

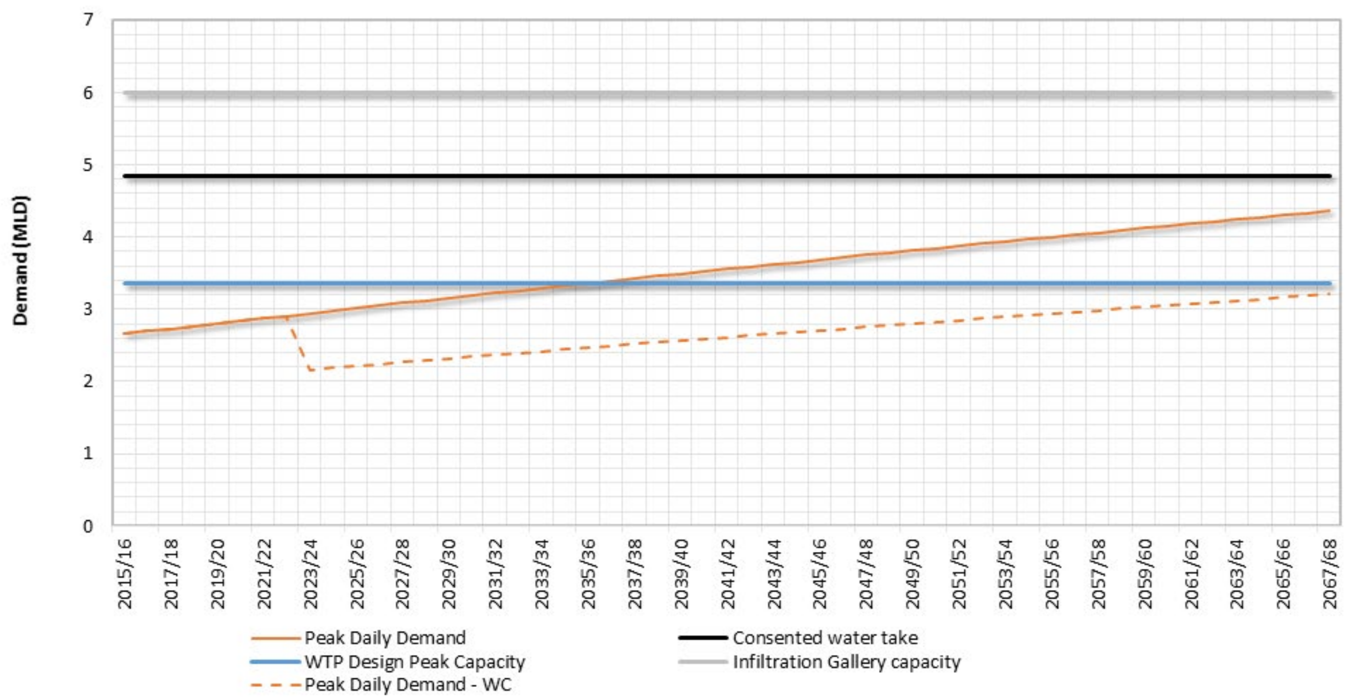
The graph in **Figure 5** shows the demand forecast for the New Plymouth water supply scheme based on the Council's growth scenario with and without water conservation (WC).

Figure 5: New Plymouth water supply scheme demand forecast



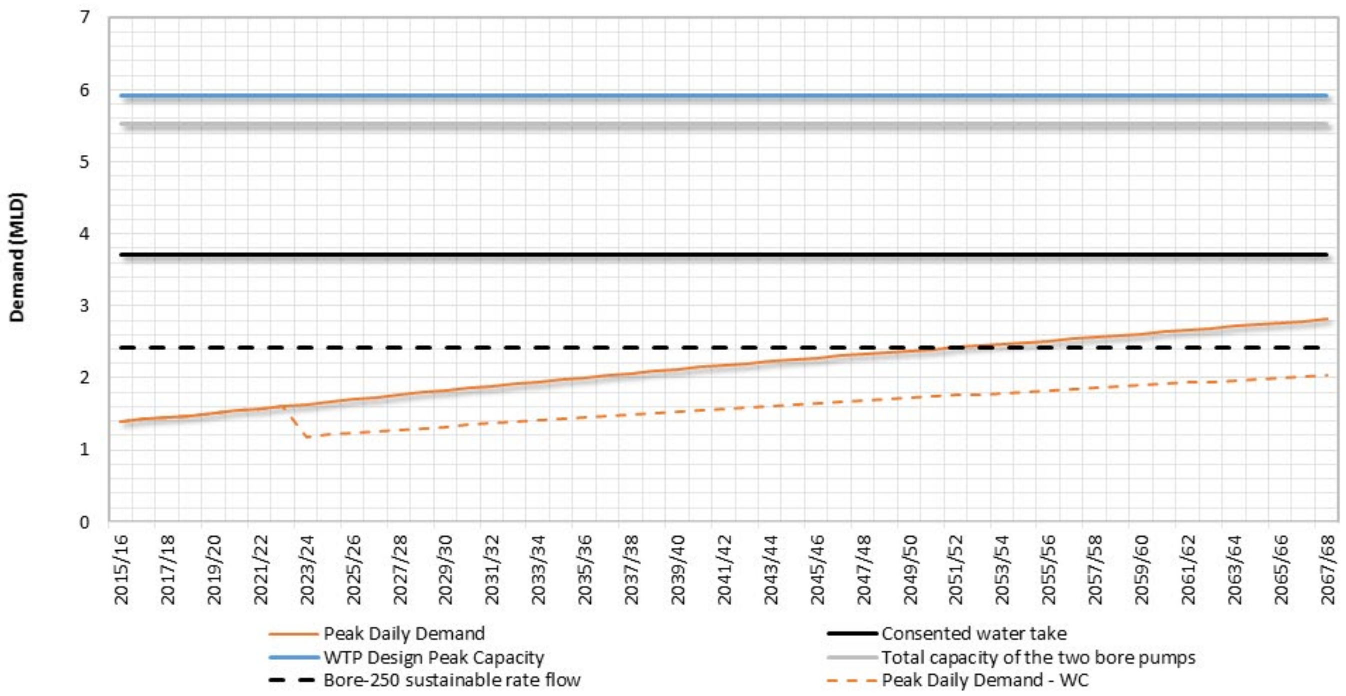
The graph in **Figure 6** shows the demand forecast for the Inglewood water supply scheme based on the Council's growth scenario with and without water conservation (WC).

Figure 6: Inglewood water supply scheme demand forecast



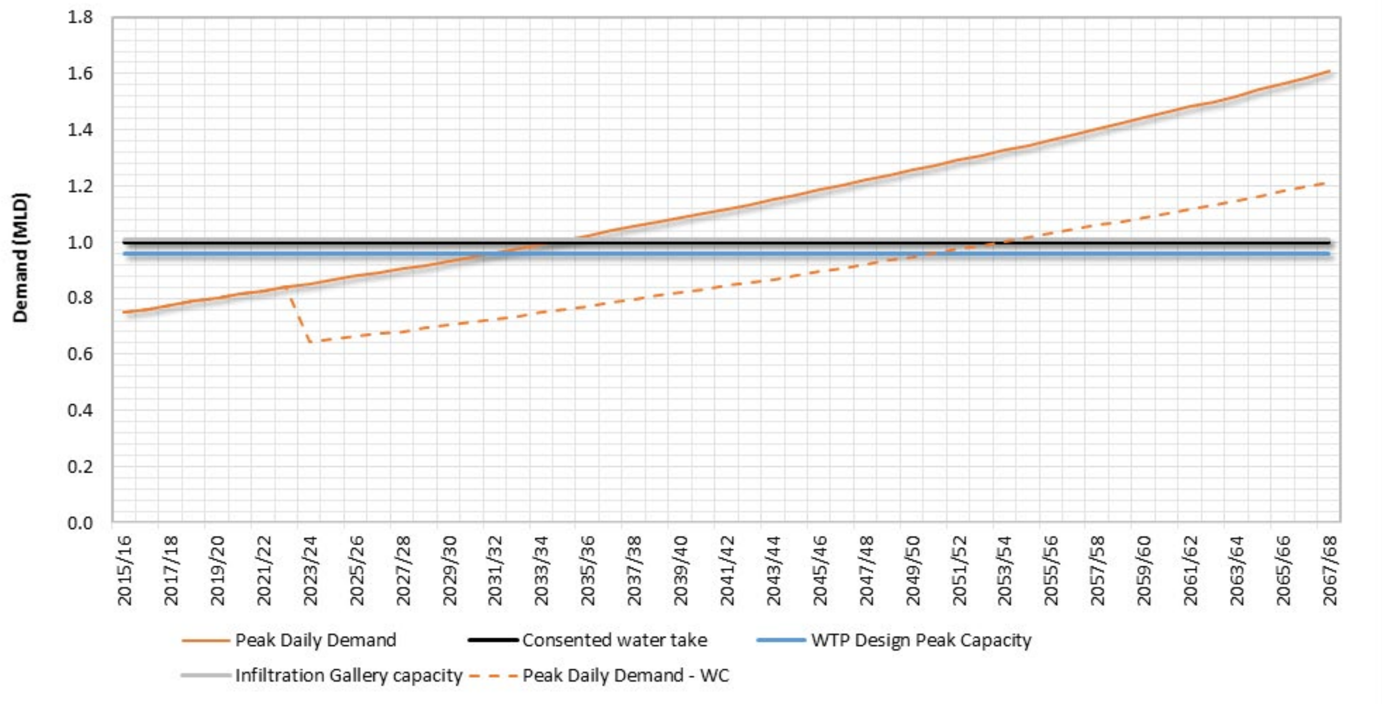
The graph in **Figure 7** shows the demand forecast for the Oakura water supply scheme based on the Council's growth scenario with and without water conservation (WC).

Figure 7: Oakura water supply scheme demand forecast



The graph in **Figure 8** shows the demand forecast for the Okato water supply scheme based on the Council's growth scenario with and without water conservation (WC).

Figure 8: Okato water supply scheme demand forecast



5.1 Growth Projects

The Growth Projects related to water supply assets are listed in **Table 9.** The alignment of each project to the Asset Management Drivers and key issues for water supply (see **Section 3: Strategic Framework**) is also identified.

Table 9: Growth Projects

Project Budget Code	Project Description	Asset Management Driver	Key Issue
WA1040	Mountain Rd & Henwood Rd Reservoirs	2 & 3	10
WA2006	Water Services for Subdivision Services	3 & 4	3 & 10
WA2017	Duplicate WTP Outlet and Central Feeder (WMP)	3	10
WA2019	Universal Water Metering (WMP)	1 & 3	10
WA2026	New Water Source	1 & 3	3
WA3016	Water Conservation Program	1 & 4	5 & 10
WA3018	Patterson Road Water Main	3	10

Key: Strategic Projects (see **Section 4: Strategic Framework of the Strategic Asset Management Plan**)

Information for the Growth Projects is provided below:

WA1040: Mountain Rd and Henwood Rd Reservoirs

The Three Waters Team have identified some existing problems with the Water Supply network. Water conservation measures are currently applied during peak demand, for example, changing the operational set points of service reservoirs manually to optimise the supply capacity of the trunk main system. Modelling confirms that under current operations, there are problems with filling the key reservoirs along the eastern trunk feeder because of head losses in the mains to the Henwood and Mountain Road reservoirs. This has potential to impact approximately 3,000 customers, including rest homes and commercial users, with a cascading impact on customers in Tikorangi and Urenui.

WA2006: Water Services for Subdivision Services

Minor augmentation of the Council's water network is often required in order to accommodate small subdivisions connecting to the network.

WA2017: Duplicate WTP Outlet and Centre Feeder (WMP)

The eastern feeder is operating near capacity and is expected to reach capacity shortly due to growth. However, there are a number of other initiatives that could affect the need for and/or timing of this project. These include:

- The adoption and effectiveness of the Water Conservation Plan
- The construction of a second source of water (should it proceed)

As such this project is a place holder for Capex spend until the Water Master Plan is progressed further.

WA3018: Patterson Road Water Main

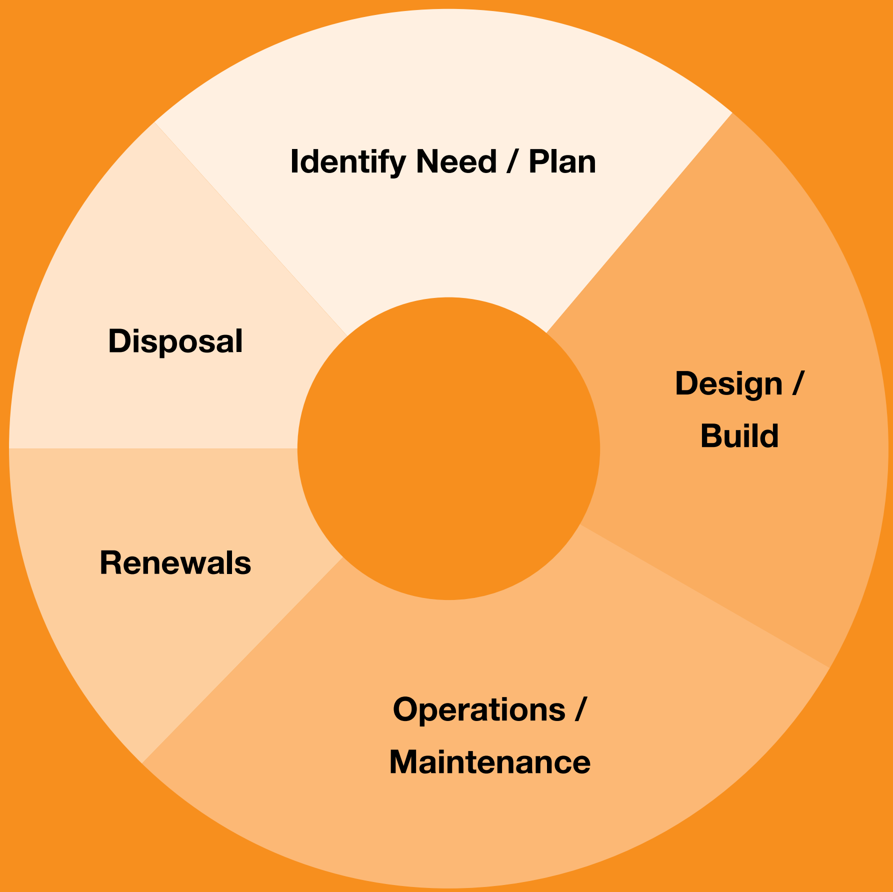
There is a private plan change being proposed by a group of land owners around the Patterson Road area. If this area is rezoned then the Council will need to develop core infrastructure (new sewage pump station, water supply from Veale Road and upgrade and extension of Patterson Road).

The Capex forecast for the Growth Projects over the 10 year period of the AMP is provided in **Table 19** in **Section 8: Financial Summary**.

6. Lifecycle

The lifecycle of an asset has five main stages as shown in **Figure 6** and detailed in **Section 7: Asset Lifecycle** of the **Strategic Asset Management Plan**.

Figure 9: Asset lifecycle



General information about the lifecycle management of water supply assets is to follow. Detailed lifecycle management is covered in each of the **Water Supply AMP: Volumes 1-5**.

6.1 Identify Need and Plan

The Three Waters Team determines the need for new water supply assets by using the Council's Portfolio, Programme and Project Management (P3M) framework.

6.1.1 Asset Condition

Table 6 in **Section 7: Asset Lifecycle** of the **Strategic Asset Management Plan** outlines the condition grades for assets. In previous AMPs, asset condition was determined by the Three Waters Team's knowledge and experience. Condition grades for assets have been provided in this AMP; however, a robust data quality system is needed to determine the grades more reliably. There is an improvement action for asset condition data in **Section 10: Asset Management Improvement Programme** of the **Strategic Asset Management Plan.**

Table 10 outlines available condition assessment methods for water pipes and examples of each technology.

Table 10: Current available technologies for water pipelines

Condition Assessment Methods	Description	Examples
Pressure testing	Confirms the limits of pipelines in terms of maximum pressure, leaks, joint and fitting integrity	Isolate the pipe and raise the pressure to the required level and hold for a specific time
Visual inspection	Assesses the internal or external surface condition of the pipe by a visual inspection	Visual inspection by the trained field technician
Pitting depth measurement	Measures wall thickness loss of the pipeline	Pit depth gauge
Direct current voltage gradient (DCVG) survey	Assesses coating condition of buried steel structure	DCVG survey
Electromagnetic inspection	Inspects ferromagnetic pipes condition (external or internal) using electromagnetic technology	• Magnetic flux leakage (MFL) • Remote field eddy current • Broadband electromagnetic • Pulsed eddy current • Ground penetrating radar survey • Pipe Diver
Pressure wave inspection	Utilises pressure waves to determine the location and extent of defects in the pipe	P-Cat™
Acoustic inspection	Utilises sound waves to determine the location and extent of defects in the pipe	• Acoustic emission leak detection • Smart Ball • Leak finder ST • Sahara • ePulse (Echologics)
Piezoelectric wave inspection	Utilises a piezoelectric actuator to generate small amplitude pressure signals to measure pipe wall deterioration and faulty flow isolation valves	University of Canterbury Piezoelectric wave generation system for condition assessment
Ultrasonic Testing (UT)	Pipe external or internal screening tool for corrosion/erosion at discrete locations	• Ultrasonic wall thickness check • UT in-line inspection survey • Long-range UT
Closed-Circuit Television (CCTV) or video camera inspection including laser or sonar profiling	Uses laser technology to create a pipe interior wall profile	Laser and sonar profiling system (3D scan)
Infrared pipeline testing	Detects and locates subsurface pipeline leaks	Infrared thermographic
Operational results analysis	Analysis of operational interventions to predict the condition of the pipes e.g. leaks	Operational data monitoring and analysis
Pipeline sampling	Take pipe samples for condition assessment	• Asbestos Cement (AC) pipe sample CT scan/ analysis • CSL pipe sample analysis

Explanations for some of the examples detailed in **Table 10** are provided below:

- **MFL –** is a magnetic method of non-destructive testing that is used to detect corrosion and pitting in steel structures. The principle is that a powerful magnet is used to magnetise the steel. At areas with missing metal, the magnetic field leaks from the steel and MFL tool detects the leakage.

- **Remote field eddy current –** is a method of non-destructive testing using low-frequency alternating current to identify defects in steel pipes and tubes

- **Broadband electromagnetic –** works by inducing eddy currents to flow in close proximity to the transmitter in a ferrous pipe. The eddy currents migrate with time, allowing a complete profile of the ferrous pipe to be obtained.

- **Pulsed eddy current –** an electromagnetic method is used to determine the wall thickness of the metal component. A probe induces eddy currents in a component, and the probe measures wall thickness by tracking the amount of time it takes the eddy currents to decay. The thicker the wall, the longer it takes for the eddy currents to decay to zero.

- **Acoustic emission testing –** is a non-destructive testing method that is based on waves produced by a sudden redistribution of stress in a material

- **UT –** is a family of non-destructive testing techniques based on the propagation of ultrasonic waves in the object or material tested

- **Infrared thermographic –** is a form of non-destructive testing that measures temperature variances of a component as heat flow though

6.1.2 Remaining Useful Life

Asset condition is a key parameter in determining the Remaining Useful Life (RUL) of an asset and can be used to predict how long it will be before an asset needs to repaired, renewed or replaced. Asset condition is also an indicator of how well an asset is able to perform its function.

The RUL of assets have been recorded in the **Water Supply AMP: Volumes 1-5**. Condition ratings for underground assets where inspection programmes are not currently in place are predominantly inferred from the assets age, and known failure profiles. Where visual inspection is possible professional judgement and experience is relied upon to determine the condition rating. . There is an improvement action in **Section 10: Asset Management Improvement Programme** of the **Strategic Asset Management Plan** to add reliability to the condition rating processes.

Table 11: Water Supply combined asset remaining life years

Asset Type	2019				
	Critical Combined Years	Important Combined Years	Moderate Combined Years	Non- Critical Combined Years	To Be Determined Combined Years
Water P&E	47,284	145,007	333,849	138,294	3,620,224

6.1.3 Critical Assets

There is currently no definition for critical assets; however, critical water supply assets have been identified in the **Water Supply AMP: Volumes 1-5,** where possible. This information is based on the Three Waters Team's knowledge and experience.

The criticality scores for water supply reticulation mains are assessed using the process and scoring system detailed in the Water, Wastewater and Stormwater Mains Criticality and Renewals Prioritisation Process (ECM#: 988741). These scores are converted into criticality ratings and recorded in the EAM asset inventory to assist the Three Waters Team with asset maintenance and renewal planning.

The Three Waters Team recently commenced a programme to assess and record criticality ratings for P&E assets in the EAM asset inventory. This process is only partially complete. As previously noted, there is an improvement action for asset data to record criticality ratings more accurately in **Section 10: Asset Management Improvement Programme** of the **Strategic Asset Management Plan**.

6.1.3.1 Critical Spares

Critical spare parts are the parts within critical equipment that, should they fail, will badly reduce or stop production, or harm the organisation, or a person, or the community.

Refer to **Section 2: Lifecycle** in the **Water Supply AMP: Volumes 1-5** for information about critical spares for water supply assets.

6.2 Design and Build

The design and build of water supply assets is managed by the Council's Projects Team. The Projects Team typically works closely with designers, the Council's engineers and consultant engineers, to lead the project through the necessary stages, depending upon the risk to Council, complexity of the project, financial implications and integration in the wider network.

Development works are planned in response to identified service gaps, growth and demand issues, risk issues and economic considerations.

6.3 Operations and Maintenance

The operation and maintenance of water supply assets is undertaken by several different teams within the Council. Further details are below:

- The WTP Operations Team maintains the everyday running of the plant. They also schedule in routine maintenance on the various plant with specialist suppliers and contractors.

- The Network and Customer Team work with the maintenance contractor to operate the water supply system. This team also works closely with the Mechanical Maintenance Team on water values and pumps, the Control Systems Team on the operation of Pump Stations and the Asset Data Team to ensure that any changes to the network are recorded.

There are a number of issues in regard to the operation and maintenance of water supply assets. These are listed below:

- There is currently no Maintenance Management Plan detailing how water supply assets are identified, recorded, measured, analysed, and optimised/improved in terms of maintenance activity and performance. This has resulted in high levels of reactive maintenance and the associated higher levels of risk and cost.

- There are large discrepancies between the asset inventory of P&E assets and the physical assets that exist on site. This has resulted in undervaluation of P&E assets and in unrecorded assets having no defined scheduled maintenance.

- Many mechanical P&E do not have any scheduled maintenance activities assigned to them. This has resulted in high levels of reactive maintenance and the associated higher levels of risk and cost. It has also resulted in poor reliability.

- Most maintenance tasks are recorded and scheduled using EAM. However, instrumentation and electrical (I&E) maintenance is not scheduled in EAM, which makes it difficult to monitor and measure performance.
- A significant number of P&E assets are not tagged with P&ID reference numbers. This is not consistent with good engineering practice and makes it difficult to identify equipment on-site.
- Many P&IDs and layout drawings for P&E are inaccurate, incomplete, or out of date. This causes delays and additional costs during project planning and creates potential safety issues when operating equipment.

Improvement actions have been identified for these issues in **Section 9: Improvement Plan**.

6.3.1 Opex Projects

Opex funding related to Capex projects and general operating expenditure is allocated for water supply assets (see **Tables 20 and 21** in **Section 8: Financial Summary**).

Table 12 shows the Opex Projects that are related to the Capex Projects, which are planned during the 10 year period of the AMP. These projects have seed funding allocated for the initial planning stage and/or when the project is completed.

The alignment of each project to the Asset Management Drivers and key issues for water supply (see **Section 3: Strategic Framework**) is also identified.

Table 12: Opex Projects related to Capex Projects

Project Budget Code	Project Description	Asset Management Driver	Key Issue
WA1013	Oakura Reservoir Seismic Strengthening	1, 2 & 4	6
WA1020	Water Master Plan Programme Development	1	3, 5, 6, 7, 10 & 11
WA2009	NPWTP EQ Strengthening & Welfare Modifications	1, 2 & 4	6 & 12
WA2017	Duplicate WTP Outlet and Central Feeder (WMP)	1 & 3	10
WA2019	Universal Water Metering (WMP)	1 & 3	10
WA2026	New Water Source	1 & 3	3
WA2206	Installation of Backflow Preventers	1 & 4	3
WA3007	Waitara Pipe Bridge Deterioration	1, 3 & 4	1 & 6
WA3008	Water Resilience - Flow Metering	1 & 4	4 & 6
WA3009	Water Resilience - Reservoirs Inlets-Outlets	1 & 4	3, 6 & 8
WA3010	Water Resilience - Reticulation Zones	1 & 4	4 & 6
WA3011	Inglewood Contingency Intake Fish Exclusion	1 & 4	3 & 11
WA3014	Inglewood WTP Sludge Management	1, 3 & 4	3
WA3015	Long Term Solution For Disposal Of NPWTP Solids Residuals	1, 3 & 4	3

Key: Strategic Projects (see **Section 4: Strategic Framework of the Strategic Asset Management Plan**)

Project Budget Code	Project Description	Asset Management Driver	Key Issue
WA3016	Water Conservation Program	1 & 4	5 & 10
WA3017	Draft Water Resilience - Pump Station Upgrades	2 & 4	1
WA3018	Patterson Road Water Main	3	10

Key: Strategic Projects (see **Section 4: Strategic Framework of the Strategic Asset Management Plan**)

The expenditure forecast for Opex Projects which are related to Capex Projects over the 10 year period of the AMP is provided in **Table 20** in **Section 8: Financial Summary.**

There are a number of Opex Projects for water supply assets that are not related to a specific Capex Project as detailed in **Table 13.**

Table 13: Opex Projects (not related to Capex Projects)

Project Budget Code	Project Description	Asset Management Driver	Key Issue
WA3502	Mangorei Weir Removal	1 & 4	3 & 7
	Mangamahoe Dam Safety Upgrades	1,2,4	6
	Water Asset Condition Inspections	1,2,4	1
	Water Resilience - Pipe Bridge Protection - No.2 Pipe Bridge	1,2,4	6
	Future of the Waitara Industrial Water Supply	1,4	3
	Riparian Planting Programme	2,4	7
	NPWTP Backflow Risks-Removing Redundant Equipment	1,4	1
	Pipe Bridges Resilience survey	1,2	1,2,6

The expenditure forecast for these Opex Projects over the 10 year period of the AMP is provided in **Table 21** in **Section 8: Financial Summary**.

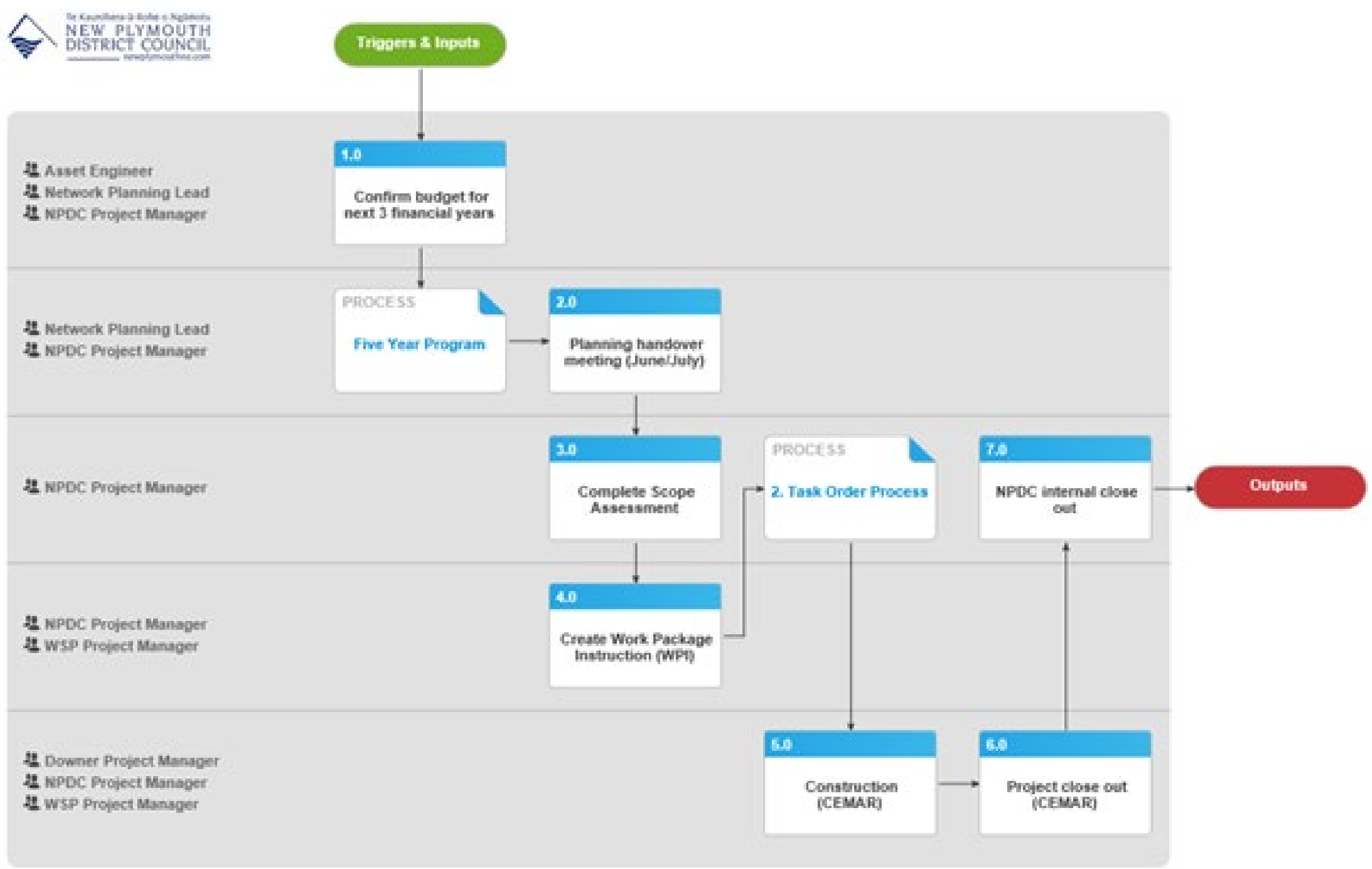
6.4 Renewals

The Council's Asset Management and Network Planning Team determine a schedule of renewals on a three-yearly basis. The reticulation renewals projects are delivered by the Projects Team. With respect to P&E renewals the Projects Team delivers larger projects, while the renewal of small-scale mechanical equipment is undertaken by the Maintenance Team.

Asset renewals are determined using condition assessment inspections and the use of Monte Carlo analysis for planning the improvements. The Monte Carlo analysis provides confidence intervals for funding decisions. This method has been used to determine spend on renewals for the water supply, wastewater and stormwater reticulation systems.

Figure 7 shows the process for the renewal of water supply assets.

Figure 10: Renewals of water supply assets



6.4.1 Renewals Projects

Details for Renewals Projects are provided in **Table 14**. The alignment of each project to the Asset Management Drivers and key issues for water supply (see **Section 3: Strategic Framework**) is also identified.

Table 14: Renewals Projects

Project Budget Code	Project Description	Asset Management Driver	Key Issue
WA1081	Resource Consent Renewals Water	1 & 4	11
WA1085	Water Electrical Renewals I&E	1	4
WA2002	Emergency Water P&E Renewals	1 & 4	3 & 10
WA2019	Universal Water Metering (WMP)	1 & 3	10
WA2022	Emergency Water Reticulation Renewals	1 & 4	3 & 10
WA2025	Water Building Renewals	1 & 2	1
WA2203	Water Customer Equipment Renewals	1	1
WA3002	Water Reticulation Renewals (Medium)	1	1 & 11
WA3003	Water P&E Renewals WTP - Programmed (Medium)	1	1 & 11
WA3007	Waitara Pipe Bridge Deterioration	1, 3 & 4	1 & 6

Information for key Renewals Projects is provided below:

WA1081: Resource Consent Renewals Water

This project involves the renewal of resource consents that are due to expire in 2021. This includes consent for the modification and maintenance of an existing earth retention structure (dam) on the Kakapo Stream.

WA3007: Waitara Pipe Bridge Deterioration

A recent inspection of the drinking water trunk main bridge crossing in Waitara observed that the surface of the 345mm diameter asbestos main was soft with a texture of wet cardboard.

The poor condition of this pipe bridge presents three notable risks:

- The trunk main where it crosses the Waitara River is one of the Council's water supply network "single points of failure". Loss of this section of pipe would result in the loss of service for all properties east of the Waitara River up to Urenui.
- At the moment moss is covering the pipe and is keeping it in a wet state; however, in the dryer summer months there is a high probability that the surface of the pipe will dry out, become friable and release airborne asbestos fibres. It could become a significant health hazard to the public.
- Treated water contains chlorine, which could contaminate the waterways (river) threatening the environment

The Capex forecast for Renewals Projects over the 10 year period of the AMP is provided in **Table 22** in **Section 8: Financial Summary**.

6.5 Disposals

On large scale disposal projects, the planning is undertaken by the Asset Management and Network Planning Team and the Projects Team delivering the project for the Council. Smaller scale disposal projects are undertaken by the maintenance contractor.

7. Risk Management

7.1 Risk Assessment

Risk assessments are conducted, recorded, managed, escalated and monitored in accordance with NPDC's Corporate Risk Management Framework: Policy and Process (ECM#: 1479536). A summary of how the policy and process operate and a list of the current key risks relevant to assets is included in **Section 8: Risk Management** of the **Strategic Asset Management Plan**. The list includes risks that are applicable across all asset categories and those particular to the Three Waters Service.

Table 15 lists the water supply projects and shows the level of risk and prioritisation for each project. Information for the risk levels is provided in **Section 8: Risk Management** of the **Strategic Asset Management Plan**. Priority 1 projects are scheduled to take place within the first three years of this AMP and Priority 2 projects are scheduled to take place within the first six years of this AMP.

Table 15: Risk level and prioritisation for wastewater projects

Project Budget Code	Project Description	Priority	Risk Level
Level of Service Projects			
WA1025	Water reticulation minor augmentation programme	1	High
WA2004	NP WTP Intake Fish Screen	1	Extreme
WA2009	NPWTP EQ Strengthening & Welfare Modifications	1	High
WA2026	New Water Source	2	High
WA2206	Installation of Backflow Preventers	1	High
WA3009	Water Resilience - Reservoirs Inlets-Outlets	2	Low
WA3011	Inglewood Contingency Intake Fish Exclusion	2	High
WA3012	Mangorei Weir Fish Pass	1	High
WA3014	Inglewood WTP Sludge Management	2	Medium
WA3016	Water Conservation Program	1	High
Growth Projects			
WA1040	Mountain Rd & Henwood Rd Reservoirs	1	Unknown
WA2006	Water Services for Subdivisions in Un-Service A	1	High
WA2017	Duplicate WTP Outlet and Central Feeder (WMP)	2	High
WA2019	Universal Water Metering	1	High
WA3018	Patterson Road Water Main	2	Unknown

Project Budget Code	Project Description	Priority	Risk Level
Renewals Projects			
WA1081	Resource Consent Renewals Water	1	High
WA1085	Water Electrical Renewals I&E	Unknown	Unknown
WA2002	Emergency Water P&E Renewals	Unknown	Unknown
WA2022	Emergency Water Reticulation Renewals	Unknown	Unknown
WA2025	Water Building Renewals	Unknown	Unknown
WA2203	Water Customer Equipment Renewals	Unknown	Unknown
WA3002	Water Reticulation Renewals (Medium)	Unknown	Unknown
WA3003	Water P&E Renewals WTP - Programmed (Medium)	Unknown	Unknown
WA3007	Waitara Pipe Bridge Deterioration	1	High

Key: Strategic Projects (see **Section 4: Strategic Framework** of the **Strategic Asset Management Plan**)

7.2 Infrastructure Resilience Approach

Information regarding NPDC's infrastructure resilience approach is provided in **Section 8: Risk Management** of the **Strategic Asset Management Plan**. Additional information for water supply is provided below.

7.2.1 Natural Hazards and Climate Change

Following on from ex-cyclone Gita, which damaged a trunk main crossing a pipe-bridge in February 2018, and the Havelock North Water Inquiry; the importance of the Council's water network has been highlighted. This has resulted in the Council considering the resilience of water assets based on cost versus risk assessments. The Council now plans to invest more on the general resilience of the drinking water supply system to enhance security and integrity and increase performance against the Levels of Service. The items that have identified for investment over the period of the AMP include the following:

- More inspections and preventative maintenance of critical assets
- More backup spare parts for critical equipment such as spare pipes, valves and pumps
- Increasing the number of backflow preventers on high risk commercial/industrial properties
- Enhancing scenario-based planning and mitigation for weather events
- Investigation of options to improve the resilience of WTPs
- Upgrading critical pipe bridges
- Upgrading water pump stations to include backup power supplies and warning alarm systems
- Designing backup options for parts of the water supply network supplied by a single pipe

The region is particularly susceptible to volcanic activity. Massey University research identifies that seismic activity is likely in the next 50 years with approximately 50% probability of Mt Taranaki erupting in that period. A volcanic event could cause major disruption through lahars and ash fall in the district, which would impact on water supply assets.

7.3 Compliance with Legislation and Resource Consent Conditions

The relevant planning documents for water supply assets are listed in Table 5 in Section 3: Strategic Framework. The Three Waters Service holds a number of extant resource consents, with conditions that need to be actively monitored and complied with.

Consent conditions are currently being monitored through CS-VUE and resource consents are renewed when required, as detailed in this AMP. Further, new resource consent applications are also obtained for water supply assets when required.

7.4 Pandemics

The relevant planning documents for water supply assets are listed in Table 5 in Section 3: Strategic Framework. The Three Waters Service holds a number of extant resource consents, with conditions that need to be actively monitored and complied with.

Consent conditions are currently being monitored through CS-VUE and resource consents are renewed when required, as detailed in this AMP. Further, new resource consent applications are also obtained for water supply assets when required.

8. Financial Summary

This section provides a summary of the relevant financial information for the Water Supply AMP. All financial forecasts show inflation adjusted dollar values.

8.1 Funding Strategy

Water supply assets are funded through a Uniform Annual Charge, by water meter charges and by restricted flow tariffs. Capital improvements are funded by loans, while the renewal and replacement of assets is funded from renewal reserves. The replacement value of assets is **$181.9 million** (including land and buildings).

8.2 Valuation Forecasts

The last three yearly statutory valuation of fixed assets was conducted in 2019. Details can be found in the New Plymouth District Council 2019 Valuation of Plant and Equipment for Three Waters, Solid Waste and Treatment Plants report (ECM#8050452). The assets included are all the equipment for water supply. The valuation also includes onsite pipelines as they are typically not constructed in a manner where NZS 4404 would be applicable.

None of the pipe bridge structures installed and owned by the Three Waters Service for the sole purpose of supporting water reticulation and trunk mains have been created as individual assets on the

asset inventory. Therefore, they have not yet been valued. This is an improvement action and is recorded in **Section 9: Improvement Plan**. Where pipes are either supported on structures/bridges installed/owned/maintained by others or are self-supporting spans, the value of these assets has been included in the valuation.

The valuation of water supply assets based on the criticality of assets and is summarised in **Table 16**.

Table 16: Water supply asset valuation

Asset Type	2019					
	Critical $	Important $	Moderate $	Non- Critical $	To Be Determined $	Grand Total $
Water Plant & Equipment	15,006,101	36,697,131	40,999,487	8,877,831	80,341,242	181,921,792

8.3 Expenditure Forecast Summary for Opex and Capex

A summary for the general Opex and Capex total expenditure during the LTP period (2021 to 2031) is provided in **Table 17**. The total forecast for water supply assets is $223.2m. Of this, the total general Opex is $97.8m excluding depreciation and total Capex is $125.4m.

Table 17: Water Supply expenditure forecast summary for Opex and Capex

Water Supply Expenditure Forecast ($)											
Activity	**21/22**	**22/23**	**23/24**	**24/25**	**25/26**	**26/27**	**27/28**	**28/29**	**29/30**	**30/31**	**LTP Total**
General Operating	673,409	690,595	715,207	739,388	764,707	790,962	817,965	846,487	876,188	907,002	**7,821,911**
Direct Cost	3,832,870	4,048,205	4,333,706	5,799,153	5,907,908	6,081,590	4,692,843	4,733,542	4,867,559	4,991,485	**49,288,862**
Internal Charges	3,676,320	3,728,010	3,851,118	3,974,625	4,154,966	4,067,342	4,171,354	4,301,479	4,439,022	4,370,794	**40,735,030**
Total Opex	**8,182,598**	**8,466,811**	**8,900,032**	**10,513,166**	**10,827,581**	**10,939,894**	**9,682,162**	**9,881,508**	**10,182,770**	**10,269,281**	**97,845,803**
Level of Service	1,499,326	1,195,3111	3,771,974	4,125,790	1,985,529	3,461,802	3,576,890	1,834,433	1,883,947	1,619,220	**24,954,222**
Growth	5,412,396	4,851,889	1,700,812	615,806	417,949	2,597,231	3,108,023	449,104	461,226	474,413	**20,088,849**
Renewals	7,231,732	8,445,378	7,543,157	10,045,084	7,333,002	7,498,925	7,738,802	7,849,848	8,130,760	8,464,335	**80,281,023**
Total Capex	**14,143,454**	**14,492,578**	**13,015,943**	**14,786,680**	**9,736,480**	**13,557,958**	**14,423,715**	**10,133,385**	**10,475,933**	**10,557,968**	**125,324,094**

8.4 Level of Service Projects Capex Forecast Summary

Table 18: Level of Service Projects expenditure forecast

The Capex forecast for Level of Service Projects is shown in **Table 18**.

Water Supply Capex Forecast ($) – Levels of Service														
Activity	**21/ 22**	**22/ 23**	**23/ 24**	**24/ 25**	**25/ 26**	**26/ 27**	**27/ 28**	**28/ 29**	**29/ 30**	**30/ 31**	**LTP Total**	**% LOS**	**% GRW**	**% RNL**
WA1025 Water reticulation minor augmentation programme	100,600	103,010	106,000	108,650	111,370	114,150	117,000	120,040	123,280	126,610	**1,130,710**	100	0	0
WA1040 Mountain Rd & Henwood Rd Reservoirs	784,680	0	0	0	0	0	0	0	0	0	**784,680**	52		0
WA2004 NP WTP Intake Fish Screen	0	309,030	2,862,000	0	0	0	0	0	0	0	**3,171,030**	100	0	0
WA2009 NPWTP EQ Strengthening & Welfare Modifications	0	0	0	0	0	1,712,250	1,755,000	0	0	0	**3,467,250**	100	0	0
WA2026 New Water Source	0	0	0	1,002,229	1,027,320	1,052,963	1,083,388	1,103,052	1,132,825	1,163,424	**7,565,202**	86	14	0
WA2203 Water Customer Equipment Renewals	35,210	36,054	37,100	38,028	38,980	39,953	40,950	42,014	43,148	44,314	**395,749**	5	0	95
WA2206 Installation of Backflow Preventers	503,386	515,445	528,374	543,667	557,277	0	0	0	0	0	**2,648,149**	100	0	0
WA3009 Water Resilience - Reservoirs Inlets-Outlets	0	0	0	0	0	285,649	293,902	299,237	307,314	0	**1,186,101**	100	0	0
WA3011 Inglewood Contingency Intake Fish Exclusion	0	0	0	1,086,500	0	0	0	0	0	0	**1,086,500**	100	0	0
WA3014 Inglewood WTP Sludge Management	0	0	0	478,060	0	0	0	0	0	0	**478,060**		0	0
WA3016 Water Conservation Program	75,450	231,773	238,500	868,657	250,583	256,838	263,250	270,090	277,380	284,873	**3,017,392**	75	25	0
WA3018 Patterson Road Water Main	0	0	0	0	0	0	23,400	0	0	0	**23,400**	5	95	0
Total	1,499,326	1,195,311	3,771,974	4,125,790	1,985,529	3,461,802	3,576,890	1,834,433	1,883,947	1,619,220	**24,954,222**			

Key: Strategic Projects (see **Section 4: Strategic Framework of the Strategic Asset Management Plan**)

8.5 Growth Projects Capex Forecast Summary

The Capex forecast for Growth Projects is shown in **Table 19**.

Table 19: Growth Projects expenditure forecast

Water Supply Capex Forecast ($) - Growth														
Activity	21/22 ($)	22/23 ($)	23/24 ($)	24/25 ($)	25/26 ($)	26/27 ($)	27/28 ($)	28/29 ($)	29/30 ($)	30/31 ($)	LTP Total	% LOS	% GRW	% RNL
WA1040 Mountain Rd & Henwood Rd Reservoirs	724,320	0	0	0	0	0	0	0	0	0	724,320	52.1	47.9	0
WA2006 Water Services for Subdivisions In Un-Service A	151,016	154,633	158,512	163,100	167,183	171,356	176,308	179,508	184,353	190,061	1,696,029	0	100	0
WA2017 Duplicate WTP Outlet and Central Feeder (WMP)	0	0	0	0	0	2,168,850	2,223,000	0	0	0	4,391,850	0	100	0
WA2019 Universal Water Metering (WMP)	4,511,910	4,619,999	1,462,800	0	0	0	0	0	0	0	10,594,709	0	69	31
WA2026 New Water Source	0	0	0	163,154	167,238	171,413	176,365	179,567	184,413	189,395	1,231,545	86	14	0
WA3016 Water Conservation Program	25,150	77257.5	79,500	289,552	83,528	85,613	87,750	90,030	92,460	94,958	1,005,797	75	25	0
WA3018 Patterson Road Water Main	0	0	0	0	0	0	444,600	0	0	0	444,600	5	95	0
Total	5,412,396	4,851,889	1,700,812	615,806	417,949	2,597,231	3,108,023	449,104	461,226	474,413	20,088,850			

Key: Strategic Projects (see **Section 4: Strategic Framework of the Strategic Asset Management Plan**)

8.6 Opex Projects Related to Capex Projects Expenditure Forecast Summary

The overall 10 year forecast for Opex Projects that are related to Capex Projects is shown in **Table 20.**

Table 20: Opex Projects related to Capex Projects expenditure forecast

Water Supply Opex Forecast ($)												
Activity	21/22	22/23 ($)	23/24 ($)	24/25 ($)	25/26 ($)	26/27 ($)	27/28 ($)	28/29 ($)	29/30 ($)	30/31 ($)	LTP Total	Driver
WA1013 Oakura Reservoir Seismic Strengthening - Activity 1005	0	0	0	0	0	0	0	0	0	125,860	**125,860**	LOS
WA1020 Water Master Plan Programme Development - Activity 1001	500,383	512,393	525,234	540,414	553,924	567,785	584,226	594,820	610,870	629,783	**5,619,832**	STG
WA2009 NPWTP EQ Strengthening & Welfare Modifications	0	0	0	216,000	221,400	0	0	0	0	0	**437,400**	LOS
WA2017 Duplicate WTP Outlet and Central Feeder (WMP)	0	0	0	189,000	193,725	0	0	0	0	0	**382,725**	GRW
WA2019 Universal Water Metering (WMP)	100,000	0	0	172,800	177,120	181,552	186,096	190,928	196,080	201,376	**1,405,952**	STG
WA2026 New Water Source	100,000	102,400	105,370	0	0	0	0	0	0	0	**307,770**	STG
WA2206 Installation of Backflow Preventers	0	0	0	0	0	42,584	43,817	44,611	45,815	47,234	**224,061**	LOS
WA3007 Waitara Pipe Bridge Deterioration	0	0	316,110	0	0	0	0	0	0	0	**316,110**	RNL
WA3008 Water Resilience - Flow Metering	0	0	0	0	0	0	0	0	0	188,790	**188,790**	LOS
WA3009 Water Resilience - Reservoirs Inlets-Outlets	0	0	0	27,000	27,675	0	0	0	0	0	**54,675**	LOS
WA3010 Water Resilience - Reticulation Zones	0	0	0	0	0	0	0	0	0	62,930	**62,930**	LOS

Water Supply Opex Forecast ($)												
Activity	21/22	22/23 ($)	23/24 ($)	24/25 ($)	25/26 ($)	26/27 ($)	27/28 ($)	28/29 ($)	29/30 ($)	30/31 ($)	LTP Total	Driver
WA3011 Inglewood Contingency Intake Fish Exclusion	0	102,400	0	0	0	0	0	0	0	0	**102,400**	LOS
WA3014 Inglewood WTP Sludge Management	0	0	52,685	0	0	0	0	0	0	0	**52,685**	LOS
WA3015 Long Term Solution For Disposal Of NPWTP Solids Residuals	0	0	0	0	0	0	0	0	0	302,064	**302,064**	LOS
WA3016 Water Conservation Program	0	204,800	252,888	302,400	309,960	317,716	325,668	334,124	343,140	352,408	**2,743,104**	STG
WA3017 Draft Water Resilience - Pump Station Upgrades	0	0	0	0	0	0	0	0	0	62,930	**62,930**	LOS
WA3018 Patterson Road Water Main	0	0	0	0	0	45,388	0	0	0	0	**45,388**	GRW
Total	700,383	921,993	1,252,287	1,447,614	1,483,804	1,155,025	1,139,807	1,164,483	1,195,906	1,973,374	12,534,677	

Key: Strategic Projects (see **Section 4: Strategic Framework** of the **Strategic Asset Management Plan**)

8.7 Opex Projects Expenditure Forecast Summary

The overall 10 year forecast for Opex Projects that are not related to any Capex Projects is shown in **Table 21**.

Table 21: Opex Projects NOT related to Capex Projects expenditure forecast

Opex Forecast ($)											
Activity	21/22	22/23 ($)	23/24 ($)	24/25 ($)	25/26 ($)	26/27 ($)	27/28 ($)	28/29 ($)	29/30 ($)	30/31 ($)	LTP Total
WA3502 Mangorei Weir Removal	0	51,5050	0	0	0	0	0	0	0	0	**51,505**
Mangamahoe Dam Safety Upgrades	0	0	0	1,333,333	1,333,333	1,333,333	0	0	0	0	**3,999,999**
Water Asset Condition Inspections	0	100,000	233,447	132,936	133,447	133,447	133,447	133,958	132,936	132,936	**1,266,554**
Water Resilience - Pipe Bridge Protection - No.2 Pipe Bridge	21,000	0	0	0	0	0	0	0	0	0	**21,000**
Future of the Waitara Industrial Water Supply	0	0	100,000	100,000	0	0	0	0	0	0	**200,000**
Riparian Planting Programme	0	0	0	75,000	70,000	70,000	70,000	0	0	0	**285,000**
NPWTP Backflow Risks-Removing Redundant Equipment	20,000	100,000	0	0	0	0	0	0	0	0	**120,000**
Pipe Bridges Resilience Survey	0	0	0	0	70,000	28,500	28,500	28,500	28,500	28,500	**212,500**
Total	**41,0000**	**251,500**	**333,447**	**1,641,269**	**1,606,780**	**1,565,280**	**231,947**	**162,458**	**161,436**	**161,436**	**6,105,053**

8.8 Renewals Project Expenditure Forecast Summary

The Capex forecast for Renewals Projects is shown in **Table 22.**

Table 22: Renewals Projects expenditure forecast

Water Supply Capex Forecast ($) - Growth															
Activity	21/22 ($)	22/23 ($)	23/24 ($)	24/25 ($)	25/26 ($)	26/27 ($)	27/28 ($)	28/29 ($)	29/30 ($)	30/31 ($)	LTP Total	% LOS	% GRW	% RNL
WA1081 Resource Consent Renewals Water	0	0	0	5,433	16,706	22,830	5,850	0	67,804	12,661	131,283	0	0	100
WA1085 Water Electrical Renewals I&E	402,400	412,040	424,000	271,625	278,425	285,375	292,500	300,100	308,200	316,525	3,291,190	0	0	100
WA2002 Emergency Water P&E Renewals	60,360	61,806	126,761	130,430	133,695	137,033	140,454	144,103	147,993	151,990	1,234,625	0	0	100
WA2019 Universal Water Metering (WMP)	2,027,090	2,075,652	657,200	0	0	0	0	0	0	0	4,759,942	0	69	31
WA2022 Emergency Water Reticulation Renewals	150,900	154,515	318,000	325,950	334,110	342,450	351,000	360,120	369,840	379,830	3,086,715	0	0	100
WA2025 Water Building Renewals	90,540	0	3,180	11,952	44,548	22,830	93,600	12,004	13,561	184,851	477,065	0	0	100
WA2203 Water Customer Equipment Renewals	668,990	685,017	704,900	722,523	740,611	759,098	778,050	798,266	819,812	841,957	7,519,222	5	0	95
WA3002 Water Reticulation Renewals (Medium)	2,926,052	4,026,249	4,143,116	4,401,908	4,512,108	4,624,738	4,740,205	4,863,369	4,994,636	5,129,550	44,361,931	0	0	100
WA3003 Water P&E Renewals WTP - Programmed (Medium)	905,400	1,030,100	1,166,000	1,241,714	1,272,800	1,304,571	1,337,143	1,371,886	1,408,914	1,446,971	12,485,500	0	0	100
WA3007 Waitara Pipe Bridge Deterioration	0	0	0	2,933,550	0	0	0	0	0	0	2,933,550	0	0	100
Total	7,231,732	8,445,378	7,543,157	10,045,084	7,333,002	7,498,925	7,738,802	7,849,848	8,130,760	8,464,335	80,281,022			

Key: Strategic Projects (see **Section 4: Strategic Framework of the Strategic Asset Management Plan**)

9. Improvement Plan

This section provides information about water supply asset maturity and an Improvement Plan for this service. The general Asset Management Maturity Improvement Plan undertaken using the International Infrastructure Management Manual 2015 (IIMM) maturity guidelines is included in **Section 10: Asset Management Improvement Programme** of the **Strategic Asset Management Plan.**

9.1 Asset Management Maturity

An internal assessment of Water Supply asset management maturity was conducted in December 2020 using the IIMM maturity guidelines. The assessment covers 16 key areas of the specification and each area attracted a score between 0 and 4.

The maturity scores in most areas were assessed as being in the 0 – 1 range indicating that some improvement is required. The medium term plan i.e. during 2020 and 2023 period is to increase maturity scores into the 2 – 3 range. The scores assessed for each of the 16 components and the aims to improve the scores to take the Water Supply asset management practices from current ratings to Basic, Core, Intermediate and Advanced levels is shown in **Table 23.**

Table 23: Asset management maturity ratings score

Element	Aware	Basic	Core	Intermediate	Advanced
	0	1	2	3	4
Asset Management Policy Development	■ 2020	■ 2020	■ 2020	■ 2023	
Levels of Service and Performance Management	■ 2020	■ 2020	■ 2020	■ 2020	■ 2023
Demand Forecasting	■ 2020	■ 2020	■ 2020	■ 2023	
Asset Register Data	■ 2020	■ 2020	■ 2020	■ 2023	
Asset Condition	■ 2020	■ 2023	■ 2023		
Decision Making	■ 2020	■ 2020	■ 2020	■ 2023	
Risk Management	■ 2020	■ 2020	■ 2023		
Operational Planning	■ 2020	■ 2020	■ 2023		
Capital Works Planning	■ 2020	■ 2020	■ 2023	■ 2023	■ 2023
Financial and Funding Strategies	■ 2020	■ 2020	■ 2023		
Asset Management Teams	■ 2020	■ 2020	■ 2023	■ 2023	
AMPs	■ 2020	■ 2020	■ 2023	■ 2023	

Key: ■ 2020 (orange) Maturity rating status at 2020
■ 2023 (grey) Proposed improvements to 2023

Element	Aware	Basic	Core	Intermediate	Advanced
	0	1	2	3	4
Management Systems					
Information Systems					
Service Delivery Mechanisms					
Improvement Planning					

Key: Maturity rating status at 2020

Proposed improvements to 2023

The AMPs produced to date have therefore been developed during a period of basic asset maturity competence. There is an expectation that the next AMP developed for the next 10 year plan (2024-2034 LTP) will be at a more advanced maturity level.

9.2 Improvement Plan

General improvements identified for water supply assets and specific areas of improvement identified for different asset categories are listed in **Table 24.**

Table 24: Water Supply AMP improvements summary

No.	Title	Description	Status	BAU or SharePoint
General Improvements				
1	Modelling management plan	Produce Modelling Management Plan and up to date validated water supply models.	In progress	
2	Maintenance management plan	Produce and implement Maintenance Management Plan.	In progress	
3	Plant equipment survey	Survey all P&E and match inventory to on-site status.	In progress	
4	Service notifications and check sheets	Produce full set of scheduled maintenance and check sheets for mechanical P&E and record/ implement schedule in EAM.	In progress	
5	I&E maintenance records	Record and manage I&E scheduled maintenance tasks in EAM.	In progress	
6	Assets identification tags	Check and install tagging to all P&E.	In progress	
7	RedEye	Following survey in item 2, update P&IDs and layout drawings.	In progress	

No.	Title	Description	Status	BAU or SharePoint
Headworks and Intakes				
8	Critical spares list	Assess critical spares and procure any required components.	In progress	
9	Critical asset management plan	Produce focused management plan for those assets identified as critical.	In progress	
Water Treatment Plants				
10	Critical spares list	Assess critical spares and procure any required components.	In progress	
11	Critical asset management plan	Assess asset condition and record results in EAM.	In progress	
Pump Stations				
12	Critical spares list	Assess critical spares and procure any required components.	In progress	
13	Critical asset management plan	Produce focused management plan for those assets identified as critical.	In progress	
Reticulation Network				
14	Asset inventory	Include pipe bridges/values on asset inventory i.e. for 14 structures constructed to specifically support pipes and owned/maintained by the Three Waters team.	In progress	
15	Level of Service study	Conduct a study to identify any improvements required to meet firefighting capacity Level of Service.	In progress	

No.	Title	Description	Status	BAU or SharePoint
Reticulation Network				
16	Zone meters data collection	Improve data collection and analysis from zone meters to assist understanding of leakage rates and potential improvements.	In progress	
17	Level of Service study	Conduct a study to identify any improvements required to meet pressure delivery level of service.	In progress	
18	Asset data quality plan	Conduct analysis of existing asset data to identify and correct any obvious errors or omissions. This will form part of the Asset Data Quality Plan to be developed with the OSS team.	In progress	
Storage				
19	Critical spares list	Assess critical spares and procure any required components.	In progress	
20	Critical asset management plan	Produce focused management plan for those assets identified as critical.	In progress	

Glossary

AC	Asbestos Cement
AMP	Asset Management Plan
ANZCO	ANZCO Foods Limited
Capex	Capital Expenditure
CCTV	Closed-Circuit Television
CI	Cast Iron
CLDI	Concrete Lined Ductile Iron
CLS	Concrete Lined Steel
DCVG	Direct current voltage gradient
DI	Ductile Iron
DWSNZ	Drinking-water Standards for New Zealand 2005 (Revised 2018)
EAM	Enterprise Asset Management
HSNO Act	Hazardous Substances and New Organisms Act 1996
I&E	Instrumentation and Electrical
IIMM	International Infrastructure Management Manual
LGA	Local Government Act
L/hour	Litres per hour
L/day	Litres per day
LTP	Long Term Plan
MALF	Mean Annual Low Flow
MANN	Mannesmann Steel
MFL	Magnetic flux leakage
NPS-FW	National Policy Statement for Freshwater Management
NPWTP	New Plymouth Water Treatment Plant
NZS	New Zealand Standards
Opex	Operational Expenditure
PAC	Powdered Activated Carbon
PACl	Polyaluminum Chloride
P&E	Plant and equipment
PLC	Program Logic Control

POLY-H	Polyethylene high density
POLY-L	Polyethylene low density
POLY-M	Polyethylene medium density
P&ID	Piping and Instrumentation Diagram
PVC	Polyvinyl Chloride
PVCI	TBC
RMA	Resource Management Act 1991
RUL	TBC
SCADA	Supervisory Control and Data Acquisition system
SDC	Stratford District Council
ST-CL	Cast Iron Steel Tube
ST-GTS	Galvanised Steel Tube
ST-SWS	Stain/Steel Spiral Welded Seam
STDC	South Taranaki District Council
TRC	Taranaki Regional Council
UPVC	Un-plasticised PVC
OPVC	Oriented Polyvinal Chloride
MPVC	Microcellular Polyvinal Chloride
UT	TBC
UV	Ultra Violet disinfection treatment
WTP	Water Treatment Plant

2021-2031 Water Supply Asset Management Plan

2021-2031: He Rautaki Whakahaere Rawa mō Te Wai Whakarato

Volume 1 - Headworks And Intakes

Pukapuka Tuatahi - Ngā Taupuni Wai / Ngā Ngote Wai

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1. Introduction

This volume provides descriptions for the headworks and intakes asset category of the Water Supply AMP. Headworks and intakes provide regular and uninterrupted intake of raw water from the natural environment to the WTPs, which in turn supply water to the reservoirs, trunk mains, and reticulation system. The components of this asset category include the raw water sources, intake structures, headworks, and falling mains. This volume also contains details for the asset lifecycle management of these assets.

Raw water sources and headworks are often the limiting factors in a water supply system. Irrespective of improvements and capacity increases to assets such as WTPs downstream, if the headworks cannot pass matching sufficient flow, the available water supply will be constrained over a given period.

Limiting factors may be:

- Regulatory (e.g. the consent abstraction limit)
- Environmental (e.g. low flows in river sources or depletion of an aquifer, source water pollution)
- Physical (e.g. hydraulic capacity of the intake structure, the falling mains or head losses within the system)

1.1 Asset Descriptions

1.1.1 General

Raw water is extracted at five locations in the district through nine headwork and intake installations. These are detailed in **Table 1.**

Table 1: Locations of raw water extraction

Intake Locations			
Item	**Location**	**Type**	**System**
1	Lake Mangamahoe, Junction Road	Take and Use Surface Water	New Plymouth
2	Lake Mangamahoe, Junction Road	Take and Use Surface Water	New Plymouth
3	Lake Mangamahoe, Junction Road	Take and Use Surface Water	New Plymouth
4	Dudley Road	Take and Use Surface Water	Inglewood
5	Dudley Road	Take and Use Surface Water	Inglewood
6	Okato Intake, Saunders Road	Take and Use Surface Water	Okato
7	Upper Wairau Road	Take and Use Surface Water	Oakura
8	Wairau Road	Take and Use Ground Water x2	Oakura
9	Waiongana Stream, Mountain Road (3km south of Lepperton)	Take and Use Surface Water	Waitara Industrial Supply

The headworks and intakes installations include 11.6km of falling mains, which convey raw water to the WTPs.

1.1.2 Consents to Take Water

Current TRC consents to take raw water from natural sources are summarised in **Table 2.**

Table 2: Existing consents to take water

Taranaki Regional Council Consents to Take Water Locations					
Consent	**SubType**	**Location**	**Town**	**Expiry**	**Purpose**
0026-3	Take and Use Surface Water	Okato intake, Saunders Road	Okato	1/06/2037	To take up to 1000 cubic metres/day [13.8 litres/ second] of water from the Mangatete Stream in the Kaihihi Catchment for municipal supply purposes
0126-5	Take and Use Surface Water	Waiongana Stream, Mountain Road	Lepperton	1/06/2031	To take and use water from the Waiongana Stream to supply water for industry in Waitara
1278-4	Take and Use Surface Water	Upper Wairau Road	Oakura	1/06/2031	To take and use water from the Wairau Stream for Oakura water supply purposes
2055-3	Take and Use Surface Water	Lake Mangamahoe, Junction Road	New Plymouth	1/06/2021	To take up to 60,480 cubic metres per day at a maximum rate of 740 litres/second of water from Lake Mangamahoe in the Waiwhakaiho Catchment for municipal water supply purposes
3934-3	Take and Use Surface Water	Dudley Road	Inglewood	1/06/2021	To take water as a contingency supply and for farm supply purposes from an intake weir in the Ngatoro Stream.
4510-2	Take and Use Surface Water	Dudley Road	Inglewood	1/06/2021	To take and use water from the Ngatoro Stream a tributary of the Manganui River in the Waitara Catchment for Inglewood urban water supply purposes
6114-1	Take and Use Groundwater	Wairau Road	Oakura	1/06/2020	To take and use groundwater from two bores for Oakura water supply purposes

Consent renewals have been lodged to TRC between March 2020 and March 2021 for the Oakura, Inglewood and New Plymouth water takes.

1.1.3 New Plymouth Headworks and Intakes

Lake Mangamahoe is an artificial lake with 25m high dam that was built in 1931. The lake is fed from three sources; Mangamahoe Stream, an unnamed stream, and the Waiwhakaiho River via a diversion tunnel. The Mangamahoe Stream is the natural inlet to the lake. The tunnel provides the majority of the water to the lake.

Lake Mangamahoe is also a part of the Mangorei Hydroelectric Power Scheme, which includes the dam, lake, diversion tunnel and the Mangorei Hydroelectric Power Station, all of which are owned by Trustpower. The power station releases flow back into the river approximately 6km downstream of the river diversion tunnel.

Trustpower and NPDC share maintenance responsibility for the lake in an agreement that gives NPDC priority over the water for the purpose of municipal supply. Trustpower maintains dual penstocks, which run from the northern end of the lake to the Mangorei Hydroelectric Power Station. NPDC has an offtake (375mm nominal bore) on the west penstock as an emergency water supply source. Trustpower also operates the river diversion weir and tunnel, which includes the weir, residual flow mechanism, fish pass, diversion tunnel, tunnel intake gates, and instrumentation for monitoring control.

Trustpower keeps an automatic and continuous record of the residual flow downstream of the abstraction weir (constructed in 1992) and maintains the residual river flow downstream of the intake weir. The operation and adjustment of the intake gates to control the flow into the tunnel is automated. The system uses a Programmable Logic Controller and algorithms to control and adjust the intake gate openings in relation to changing weir levels and compliance with consent regulations.

The three intake works do not meet current best practice to prevent fish entrainment. TRC require works to be completed to remedy this and ensure compliance with consent conditions.

Asset Capacity/Performance

The capacity of the tunnel is 7m3/s to 10 m3/s.

The headworks provide operational flexibility in that within Lake Mangamahoe we can utilise or switch between three different intakes using an automated valve arrangement installed during Project Manaaki Wai. Two separate pipelines form the falling mains from the lake intakes to the NPWTP. These two pipelines converge at the NPWTP and feed into the plant via a 900mm diameter pipe, capable of conveying the full plant capacity of 70 million litres per day flow to the main flash mixer. Alternately, the flow can be directed via an old inlet pipe to the flash mixer. However, this method restricts flow capacity.

The single diversion tunnel that supplies the majority of flow to Lake Mangamahoe from the Waiwhakaiho River has no redundancy. While this single tunnel is capable of delivering the consented abstraction amount of 864 million litres per day into the lake (Trustpower consent limit), its singularity represents

a significant risk within the NPWTP headworks. The tunnel is owned by the hydro power utility operator (Trustpower) but there is an operating agreement between Trustpower and NPDC with regard to water supply, ongoing maintenance and capital improvement costs.

Trustpower re-lined the tunnel in 2004, with NPDC contributing 50% of capital costs. Trustpower have indicated that upgrades are required to the dam and that NPDC may be required to contribute towards the cost of the work.

Intakes also include pipe work, valves, I&E cabinets, the pre-treatment process, and level transmitters.

1.1.4 Inglewood Headworks and Intakes

The primary intake at Inglewood is an infiltration gallery within the bed of the Ngatoro Stream. All infiltration galleries are susceptible to stream bed movement, aggrading, or binding up of the stone matrix.

Redundancy is provided in the form of an old contingency intake located at the edge of the Egmont National Park. It is able to convey raw water via a concrete pipeline (falling main) down Dudley Road to the Inglewood WTP. This intake is now routinely used to back flush the infiltration gallery and to supply water to the plant during periods when the infiltration gallery is inoperable because of poor water quality in the lower river.

The contingency intake also serves as a rural raw (untreated) water supply to local properties bordering Dudley Road. In 2008, the contingency intake farm supply draw point was modified to ensure a reliable supply to the Dudley Water Users Group (farm supply) during periods when the Inglewood WTP draws from the contingency line.

Asset Capacity/Performance

The Inglewood intake is capable of delivering the current consented abstraction volume of 4.8 million litres per day via a 1km long falling main to the Inglewood WTP on Dudley Road.

Concerns about reduction in the gallery observed in 2008/2009 have been addressed by introducing routine back flushing of the gallery river bed media, using the contingency intake to relieve the progressive fouling experienced over previous years of operation (when back flushing was not done). Full flow testing of the gallery and the plant in 2009/2010 showed that the gallery capacity has recovered, and is being maintained by routine back flushing. As a result of further review of the gallery flow capacity in 2014/2015, the height of the infiltration gallery well head was raised to increase the effectiveness of gallery back flushing.

The gallery is regularly monitored and the gallery bed is flushed or rehabilitated as changes are observed, typically once per year. The Inglewood infiltration gallery does not sufficiently filter highly turbid, raw water laden with natural organics after heavy rain and floods (freshes) within the Ngatoro catchment. Optimisation of the treatment process since 2004 means the plant can now handle most storm events without needing to be turned off.

1.1.5 Okato Headworks and Intakes

Okato relies on an infiltration gallery drawing water from the Mangatete Stream. In early 2004, the in-bank gallery was damaged by floods but was successfully repaired. In April 2008, the viability of the gallery was again threatened by floods. Regular river bed and bank work is now undertaken to shield the infiltration gallery from flood damage and to help protect the property and road bridge that the main pipe from the gallery is attached to.

Asset Capacity/Performance

The Mangatete Stream has demonstrated low flows to the point where abstraction consents require the Three Waters Team to implement water restrictions at an increasing frequency. In June 2011, the Three Waters Team submitted an application to TRC to review the MALF for the Mangatete Stream and the associated consent conditions. TRC granted a variation amending the low flow levels for the Mangatete Stream, and associated in stream flows at which water restrictions

have to be implemented. The Three Waters Team investigated alternative groundwater bore sources to augment and preferably replace the existing surface source at Okato. This investigation did not result in the identification of a suitable bore. Whilst groundwater was found, it was only just sufficient in quantity to meet demand. Herbicides were detected in the water which, although well below the limits that would threaten health it was considered potentially unacceptable for residents.

The infiltration gallery has consistently demonstrated a maximum continuous flow capability of 0.98 million litres per day.

The infiltration gallery in the Mangatete Stream has suffered significant boulder damage. The Three Waters Team has repaired this to ensure water flows down the fish pass during low river conditions.

1.1.6 Oakura Headworks and Intakes

Asset Capacity/Performance

The Oakura No. 1 bore water supply was commissioned in 2004. Extracting groundwater from a bore at 130m to 185m below ground level, its single bore pump at 127.5m below ground level is capable of delivering 2.88 million litres per day to the Oakura WTP.

A second bore was commissioned in 2008 drawing water from the same aquifer as bore No. 1. The second bore is capable of an additional 1.92 million litres per day. The combined consented abstraction limit for both bores is 3.72 million litres per day.

Both bores are granted “secure groundwater” status under the DWSNZ. Based on inspection data, both production bores and their associated observation bores required further work to secure them from access and contamination by stock. This work was undertaken in 2020 when the second bore was replaced by a new bore. It has a sustainable yield of 25 L/s.

In case of failure of the bores or bore pumps, the existing surface water intake (on the Wairau Stream and on the periphery of the Kaitake Ranges) has been retained as a contingency measure. This intake is isolated from the treated water supply until it is required and its operable status in now uncertain due to not being regularly maintained. The need for this facility is currently under review.

1.1.7 Waitara Raw Water Headworks and Intakes

The existing headworks, falling mains and open reservoirs for the Waitara untreated (raw water industrial) supply, take Waiongana River water from a weir and intake approximately 3km south of Lepperton. Water is conveyed to the ANZCO site in Waitara via a 500mm diameter trunk main and a 60,000,000 litre capacity open reservoir on Mountain Road and a 20,000,000 litre capacity reservoir off Raleigh Street, Waitara.

Asset Capacity/Performance

In November 2006, the abstraction consent was renewed for a further five years and in 2011 it was renewed for a further 20 years. This consent had a reduced abstraction limit of 6 million litres per day and stringent no-take provisions to preserve minimum river levels. Since commissioning the alternate refrigeration plant, no water has been used by the Waitara cool stores now owned by ANZCO. The trunk mains and steel pipe-work are in a poor condition and now have numerous leaks. By agreement between ANZCO and NPDC, this system is currently mothballed but the Three Waters Team are obliged to maintain this system under an agreement with ANZCO. If ANZCO was to require water supplies in the future the current system would need to be significantly upgraded. The Three Waters Team is investigating alternatives with ANZCO with the ultimate aim of either transferring ownership or decommissioning this system in the next 10 years.

2. Lifecycle

2.1 Identify Need and Plan

There are no major acquisition plans for new headworks and intakes planned over the next 10 years. However, land has been acquired adjacent to the Oakura observation bore to meet stock exclusion requirements under the DWSNZ.

The existing intake fish screen at the NPWTP does not meet industry standards and required renewal by June 2024 to prevent fish entering the raw water tank and to avoid any prosecution actions (Project: **WA2004**). The fish screens for the Inglewood contingency intake may also require an upgrade (Project: **WA3011**).

2.1.1 Asset Condition

Headworks and intakes assets are generally considered to be in Good Condition (Grade 2) with a few known exceptions that have either already been addressed or will need to be addressed in either renewals plans, reactive maintenance or future use plans.

No formal asset conditions are recorded for headworks and intakes in the asset inventory.

2.1.2 Asset Remaining Lives

The life expectancy of headworks and intakes assets is variable as it is based on the type of construction material and usage. Concrete structures have a life expectancy of 100 years; valves and other miscellaneous assets have a life expectancy similar to those described in other volumes of this AMP.

The life expectancy data for headworks and intakes assets has been recorded in EAM.

2.1.3 Critical Assets

Criticality ratings for headworks and intakes assets have not yet been conducted; therefore, there is currently no data recorded in EAM.

Following asset criticality assessments, the Three Waters Team will develop a focused management plan to ensure the integrity and resilience of critical assets. This is a data integrity issue and is recorded as an improvement action in the **Water Supply AMP: General Volume - Section 9 (Improvement Plan).**

2.1.4 Critical Spares

An assessment of the critical spares required has not yet been conducted for headworks and intakes assets. This is a data integrity issue and is recorded as an improvement action in the **Water Supply AMP: General Volume - Section 9 (Improvement Plan).**

2.2 Design and Build

See **Section 6: Lifecycle** of the W**ater Supply AMP: General Volume** for general information about the design and build of water supply assets.

2.3 Operations and Maintenance

2.3.1 Operations

Routine operational activities include the following:

- Valve operation for source selection and flow control, and for functional checks
- Regular scouring of the mains to the WTPs
- Regular inspection and cleaning of permanent screens and filter socks
- Regular inspection, maintenance, and functional testing of stepper screens on the New Plymouth headworks
- Regular inspection, maintenance, and functional testing of telemetry and control equipment
- Inspection of all valves, locks, hinges, and security covers for correct operation
- Checking of the integrity of weirs, fish passes, well head structures, valve pits, stream bed armoring and filtration media, and river banks for erosion, undermining, corrosion, flood damage or fouling, general silting, etc.
- Removal of sand and silt build-up in intake structures
- Maintaining all vehicle access tracks
- Ensuring all accessways and ladders are clear and safe to use
- Checking for indications of source water contamination from upstream discharges
- Regular flow tests on the Inglewood WTP and Okato WTP to determine maximum intake flow capability
- Continuous measuring of abstraction flows for all plants and sources using electronic Mag Flow meters. Flows are recorded continuously through the SCADA system at each site.
- Annual infiltration gallery remedial work to maintain river bed profile
- Infiltration remedial work, including back flushing, to clear blockages on an as required basis – primarily at Inglewood

- Monitoring of consents compliance, including regular TRC inspections, abstraction Mag Flow meter five yearly validation to validate our flow measurement (from 1 July 2011), and provision of daily source water abstraction data to TRC
- Routine sampling and analysis of source water for the DWSNZ water characterisation
- Sludge management at Lake Mangamahoe

Work is managed through daily and weekly check sheets.

Specific additional Opex has been allocated for the following:

- The Oakura operability of the contingency surface water supply system at Upper Wairau Road has not been tested since 2002, following the second bore being established at Wairau Road. The continued requirement for surface water contingency assets needs investigation, including whether the Three Waters Team need to test or decommission/dispose of these assets.
- Okato infiltration gallery maintenance work is restricted to the period 1 November to 30 April. Resource consent is required for maintenance work to be carried out all year round. As the bores will not replace the surface water intake, the available options to improve the integrity of the intake need to be reviewed.
- The Inglewood contingency intake supplies some properties and operates as a backwash for the main intake. The options to make modifications at this location need to be reviewed.

2.3.2 Maintenance

In terms of headworks and intakes assets, weekly visits and cleaning is required; however, the screens at the NPWTP are automated to enable remote operation and switching between intakes.

An ongoing risk assessment is required for each of the water source catchments to identify changes in source water risks. This involves:

- Regular visual assessment by walking and overflying each source river catchment

- Five yearly source water re-characterisation and catchment surveys in line with the DWSNZ requirements
- Liaison with TRC in regard to changes to activities along source rivers

Assessments to date include an extensive sanitary survey of the NPWTP source water catchment to comply with the DWSNZ assessment criteria. In 2008, the Three Waters Team conducted less rigorous surveys of the Okato WTP, Inglewood WTP and NPWTP as part of the source risk categorisation process. In 2016/2017 the Three Waters Team conducted detailed assessments at Okato and Inglewood. In 2017/2018 a protozoa sampling program was undertaken at NPWTP to comply with the DWSNZ.

The general 10 year Opex forecast for water supply assets is included in **Table 17** in **Section 8: Financial Summary** of the **Water Supply AMP: General Volume**.

2.4 Renewals

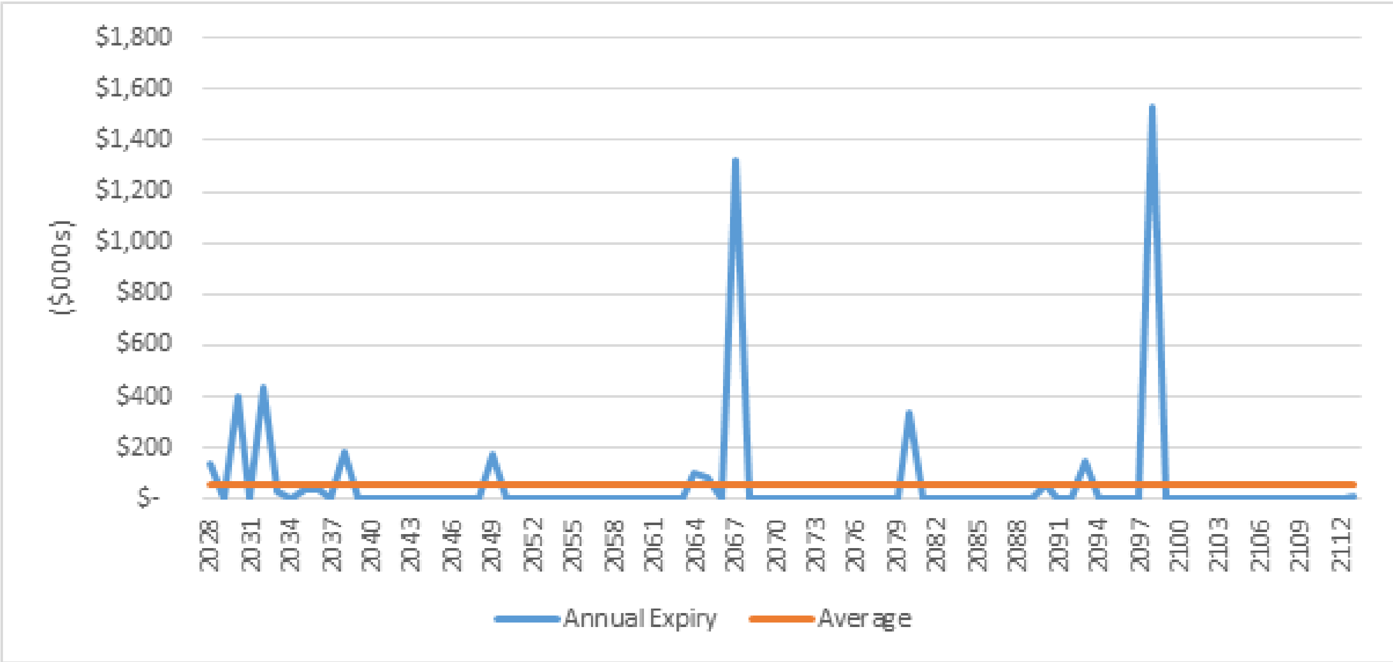
As headworks and intakes assets continue to age, investment in renewals will be required to maintain current reliability levels. Prior to confirming expenditure on Renewals Projects, the Three Waters Team will undertake condition and criticality assessments and review the RUL of the assets to ensure optimum value from the assets is being achieved.

No specific Renewals Projects for headworks and intake assets are planned over the 10 year period of the AMP. However, the general provisions for P&E renewals are included in **Table 22** in **Section 8: Financial Summary** of the **Water Supply AMP: General Volume**, which is sufficient to cover any planned or unplanned renewals that may occur.

The accounting expiries for headworks and intakes assets (i.e. the dates at which the assets reach their book life expectancy) for the years beyond 2027/2028 are shown in **Figure 1**. There are two major items:

- Renewal of the NPWTP main inlet line No.1 at $1.3m in 2067
- Renewal of the NPWTP main inlet line No.2 at $1.4m in 2098

Figure 1: Accounting expiries for headworks and intakes assets post 2027/2028



2.5 Disposals

NPDC is planning to dispose of the Low Head dam on the Mangorei stream (see WA3500) and the Mangorei weir (WA3502). In addition, options are being considered with ANZCO to decommission the Waitara Industrial Supply scheme that includes the Waiongana Weir and intake structure.

2021-2031 Water Supply Asset Management Plan

2021-2031: He Rautaki Whakahaere Rawa mō Te Wai Whakarato

Volume 2 - Water Treatment Plants

Pukapuka Tuarua - Ngā Taupuni Whakatika

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List of Figures

1. Introduction

This volume provides descriptions for the assets covered by the WTP asset category of the Water Supply AMP. It also contains details for the asset lifecycle management of these assets.

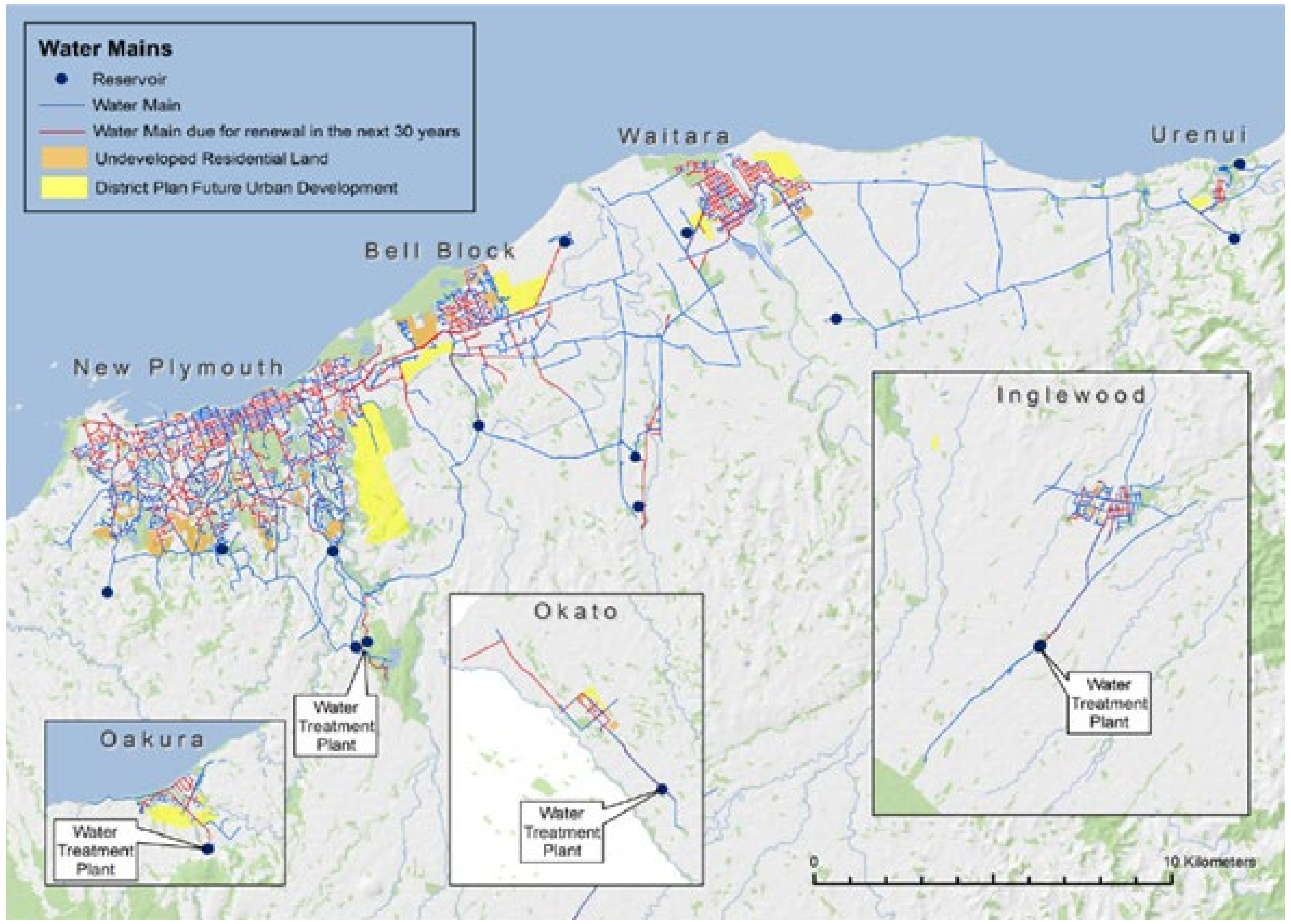
There are four WTPs located in the district, including the NPWTP, Inglewood WTP, Oakura WTP, and Okato WTP. The purpose of these WTPs is to treat the raw water received from headworks and intakes to meet the DWSNZ and other standards (e.g. NPDC Water, Wastewater and Stormwater Services Bylaw), prior to supplying it to the reticulation network.

1.1 Asset Descriptions

1.1.1 General

The locations for the four WTPs in the district are shown in **Figure 1.** The NPWTP serves New Plymouth city, Bell Block, Waitara, and Urenui. Inglewood, Oakura, and Okato WTPs are separate areas as shown on the map.

Figure 1: Location of Water Treatment Plants



The facilities and processes of each WTP are specifically designed to cater for the characteristics of its raw water supply and the population it serves. The components of the treatment process included at each WTP is summarised in **Table 1.**

Table 1: Treatment process component summary

	Water Treatment Plant Facilities and Process			
	NPWTP	Inglewood WTP	Okato WTP	Oakura WTP
Administration	Y	Y		
Chemical dosing	Y	Y	Y	Y
Chemical preparation	Y			
Flocculation - poly-mix	Y			
Clarification	Y	Y		
Filtration	Y	Y	Y	Y
Gallery intake		Y	Y	
Contengency intake	Y	Y		
Intake				Y
Raw water preparation	Y			
Reservoir	Y	Y	Y	Y
Services & utilities	Y	Y	Y	Y
Sewage pumping	Y			
Sludge handling	Y	Y		
Telemetry	Y	Y	Y	Y

1.1.2 New Plymouth Water Treatment Plant

Key information for the NPWTP is below:

Source of water
Lake Mangamahoe/Waiwhakaiho River.

Design capacity
70,000,000 L/day (2,917,000 L/hour).

Treatment
- Screening at inlet (stepper screens)
- Taste and odour removal (powdered activated carbon)
- Raw water conditioning (lime and/or CO2 addition)
- Mixing (mechanical and static mixers)
- Coagulation (polyaluminium chloride (PACl))
- Floculation (polyelectrolyte)
- Clarification (hopper bottom clarifiers fitted with plate separators).
- Filtration (rapid gravity filters)
- Manganese removal ('green sand' filter media)
- Sterilisation (chlorine gas)
- pH correction and corrosivity contral (CO2 and lime)

Clarifiers
16 Portals – hopper bottom clarifiers fitted with plate settling tubes and gravelectric cones.

Filters
Eight rapid gravity sand filters filled with 600mm of anthracite coal over 400mm silicon sand media. A wedge wire collection and backwash system is bolted to the floor of the filters. Each filter is fitted with launders to aid filter cleaning at the time of back washes, and has filter to waste capacity.

Operation
The water for the NPWTP is diverted from the Waiwhakaiho River via a tunnel that leads to Lake Mangamahoe. During the summer, a combination of intakes is used, but water is normally drawn more heaviliy from an intake (called the river intake) near the tunnel outlet. The water passes through the pipe which runs under the lake to a stepper screen chamber and then to the NPWTP.

When the river intake is not in use, water is drawn from both of the lake intakes on the north-western side of Lake Mangamahoe. This water is also piped to the stepper screening chamber and then on to the NPWTP. The stepper screens trap large debris such as twigs and other organic matter, and stop them from flowing into the plant. They also prevent wildlife such as ducks and eels from inadvertently entering the water supply pipes.

The stepper screens are checked regularly to prevent blockages and to help maintain good, even flow. Plant operators use automated valves to control which intake is used.

The raw water is piped to the plant where depending on raw water conditions, it may be dosed with carbon dioxide or lime to control the pH to 6.7.

Powdered Activated Carbon (PAC) is also added to remove organic taste and odour causing compounds. A mixing tank ensures enough reaction for lime and PAC.

Following the carbon dioxide and/or lime addition a small amount of PACl is added. This enables the tiny particles in the water which cause colouration, and other suspended particles, to clump together. This process, called coagulation, makes particles easier to remove. Adding lime also ensure sufficient alkalinity is available if the natural water contains an insufficient level for the coagulation process to work well.

Polyelectrolyte is then added to bind together the clumps of particles resulting from the coagulation process. This binding of coagulated particles into larger particles is called flocculation.

The water is fed into the bottom of the clarifiers and rises slowly, allowing the heavier particle clumps to settle out into a sludge (floc) blanket. The floc blanket binds micro-organisms such as giardia and other protozoa for removal with the sludge, or into filterable floc particles. Plate settling tubes greatly increase the capacity of the clarifiers.

The clear water flows out the top of the clarifiers via the decant troughs, while the sludge is drained off to the sludge lagoons in front of the plant.

On average it takes the water 4.5 hours to pass through the clarifiers. As the water leaves the tanks, hydrated lime (calcium hydroxide) is added to raise the pH of the water to 7.7 and chlorine is added in order to create the right conditions in the filters for manganese removal.

From the clarifiers, the water travels in channels to the rapid sand filters where it passes downwards through layers of anthracite coal and sand which remove any remaining particles. This process usually takes about 35 minutes. The filters are taken out of service for back washing, either on a scheduled timetable or when conditions such as head loss or turbidity mean the filters require it. Backwashing the filter removes the particles trapped in the coal and sand layers. The resulting dirty water is drained to the sludge lagoons, where the particulates settle out.

From the filter outlets, the treated water goes into a large ‘clear water’ tank directly beneath the plant. As a final disinfection process to ensure there are no remaining micro-organisms present in the water, chlorine gas is added to the water before it enters the ‘clear water’ tank. This also provides a residual disinfetant which safeguards against accidental contamination in the reticulation system. CO2 and lime are added to give a final pH level of 7.8 to 8.0 and to condition the water and minimise its corrosivity. The DWSNZ requires 30 minutes contact time for chlorine disinfection. The ‘clear water’ tank and two on site reservoirs are required to achieve this time.

Clarifier sludge, backwash and filter waste from the filter system are directed to one of the two sludge lagoons. The supernatant from the ponds is then returned to the raw water supply to undergo full treatment.

Water quality is monitored constantly throughout the various stages of the treatment process to ensure that it meets strict standards for public health.

Critical online monitoring equipment includes:

- pH meters

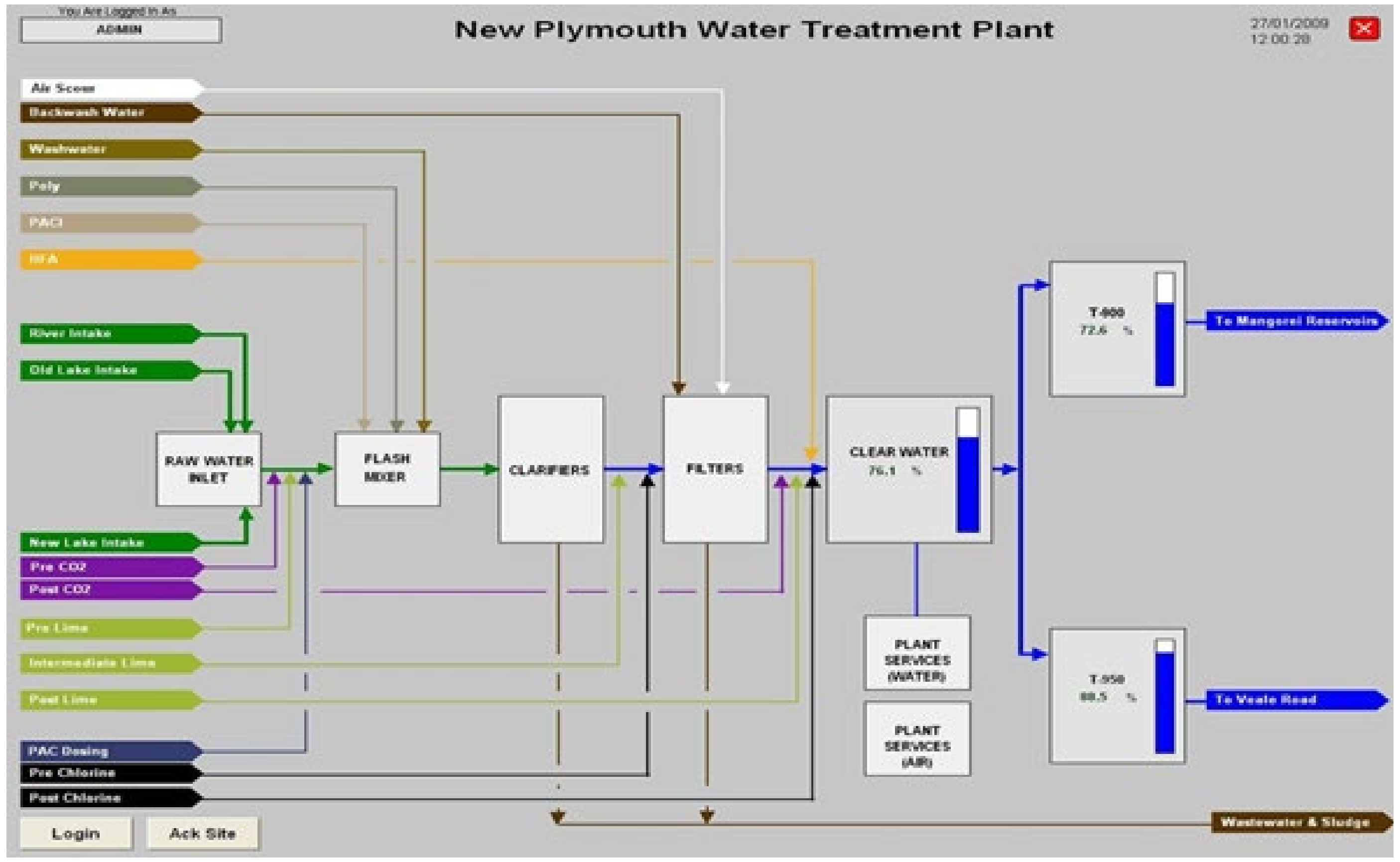
- Turbidity meters
- Chlorine monitors
- Streaming current monitors
- SCAN multifrequency UV spectral analyser

Supplementing the online monitoring is regular water testing by the water treatment technicians and contract laboratories that are IANZ accredited and recognised by the Ministry of Health.

NPDC’s IANZ accredited laboratory operates under strict requirements to maintain process and quality management systems. The Council’s water treatment technicians receive specialist training to gain NZQA Drinking Water Diploma/Certificate qualifications from external authorities. Ongoing training is also undertaken to ensure staff are operating the NPWTP in line with best practice based on national and international standards and guidelines.

The treatment process at the NPWTP is shown in **Figure 2**.

Figure 2: New Plymouth Water Treatment Plant process diagram



Asset Capacity/Performance

The plant capacity at the NPWTP is detailed in **Table 2.**

Table 2: New Plymouth Water Treatment Plant capacity

Water Treatment Plant Facilities and Process				
Water Treatment Plant	Design Peak Capacity (million litres/ day)	Average Daily Winter Consumption (million litres/ day)	Average Daily Summer Consumption (million litres/day)	Commentary
New Plymouth	70	30	40	Peak recorded flows in summer to date have been 47 million litres per day. Forecast future peak demand for the next ten years is 60 million litres per day. Even though the plant has been design for 70 MLD, there are some constraining capacities that need to be addressed to achieve this capacity. A NP WTP Improvement Plan is under development to address capacity issues, among others. The current New Plymouth consent abstraction limit is 60.4 million litres per day, for which the term has expired in 2021. Consent renewal has been lodged in March 2021.

1.1.3 Inglewood Water Treatment Plant

Key information for the Inglewood WTP is below:

Source of water
Ngatoro Stream.

Present capacity
140,000 L/hr (normal current flow 100,000 L/hr).

Treatment

- Filtration at inlet (infiltration gallery) – currently does not meet the Bank Filtration requirement of the DWSNZ
- Coagulation (PACl)
- Mixing (static mixers)
- Flocculation (polyelectrolyte)
- Contact flocculation (pressure adsorption clarifiers)
- Filtration (pressure filters)
- Sterilisation (chlorine)
- pH correction (lime)

Clarifiers
Two pressure adsorption clarifiers, media – granular MDPE (Medium Density Polyethylene), rise rate at 100,000 L/hr.

Filters
Two pressure filters, media – dual media (silicon sponge and sand), filter rate at 100,000 L/hr.

Operation
The water for the Inglewood WTP is extracted from the Ngatoro Stream via an infiltration gallery. The infiltration gallery consists of two slotted pipes buried under the stream bed. The stream bed and filter material placed on top of the pipes act to filter gross solids from the raw water before it enters the plant. The two gallery pipe legs feed a pipeline that supplies the WTP.

At the entrance of the plant a small amount of a PACl is added. This enables the tiny particles in the water to clump together in a process called coagulation, which makes them easier to remove. A static mixer and large diameter detention pipe allow turbulence and time for this reaction to take place. Polyelectrolyte is also added to bind the clumps of particles.

The water flows upwards through two pressure adsorption clarifiers. Buoyant granular media in the clarifier further helps the clumping of solids in a process called contact flocculation, and traps the majority of these solids on the surface of the media. A regular wash sequence flushes the trapped solids from the media to waste.

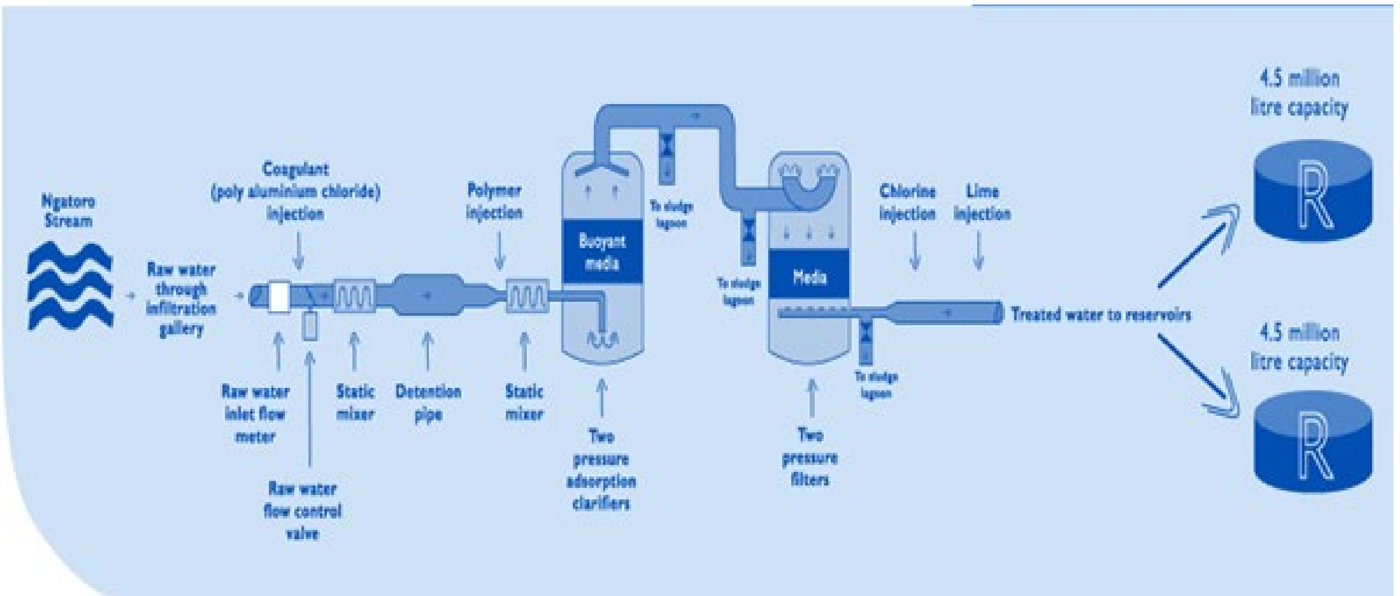
The clean water flows out of the top of the clarifiers into two pressure filters and passes down through silica sponge and sand filtration media where any remaining particles are removed. The filters are also backwashed regularly to remove particles trapped in the media.

From the filter outlets, the treated water flows to the reservoirs. On the way, chlorine gas and hydrated lime (calcium hydroxide) are injected. Chlorine is added as a disinfectant to ensure there are no micro-organisms present in the water. This also provides a residual disinfection safeguard against accidental

contamination in the reticulation system. Lime is added to raise the pH of the water to 7.8 - 8.0, making the acidity/alkalinity level healthy for consumers and non-corrosive to household plumbing. The DWSNZ requires 30 minutes contact time for chlorine disinfection. The two reservoirs are required to achieve this time.

The treatment process at the Inglewood WTP is shown in **Figure 3.**

Figure 3: Inglewood Water Treatment Plant process diagram



Asset Capacity /Performance

The water infrastructure at the Inglewood WTP supply area is sufficient to meet current and future demands. Egmont Village currently does not have a reticulated water supply. One option would be to consider supplying Egmont Village from the Inglewood WTP and network but the capacity at the plant may need to be increased to achieve this and cater for predicted growth. Submissions have been made in each Annual Plan to extend the water reticulation to Egmont Village. Due to cost, lack of any known negative health impacts and lack of unanimous agreement this has not been approved by the Council.

The plant capacity at the Inglewood WTP is shown in **Table 3.**

Table 3: Inglewood Water Treatment Plant capacity

Water Treatment Facilities and Process				
Water Treatment Plant	Design Peak Capacity (million litres/ day)	Average Daily Winter Consumption (million litres/ day)	Average Daily Summer Consumption (million litres/day)	Commentary
Inglewood	3.36	1.8	2.5	There is adequate plant and reservoir capacity for at least another 10 years.

1.1.4 Oakura Water Treatment Plant

Key information for the Oakura WTP is below:

Source of water
Groundwater: Aquifer (via two bores granted secure bore status).
Surface water: Wairau Stream.

Present capacity
2,800,000 L/day (normal use 720,000 L/day)

Treatment
- Secure bores
- Chlorination to provide residual disinfection in reticulation system
- pH control and corrosion minimisation (lime)

Operation
The groundwater is pumped from a deep volcanic avalanche flow strata originating from the Pouakai Range. It is then piped to the WTP where sodium hypochlorite disinfectant and lime slurry for pH correction and corrosion minimisation are added before it is sent to reservoirs for storage. The age of the groundwater has changed over recent years from >300 years in 2005, 75 years in 2011 and 175 years in 2017.

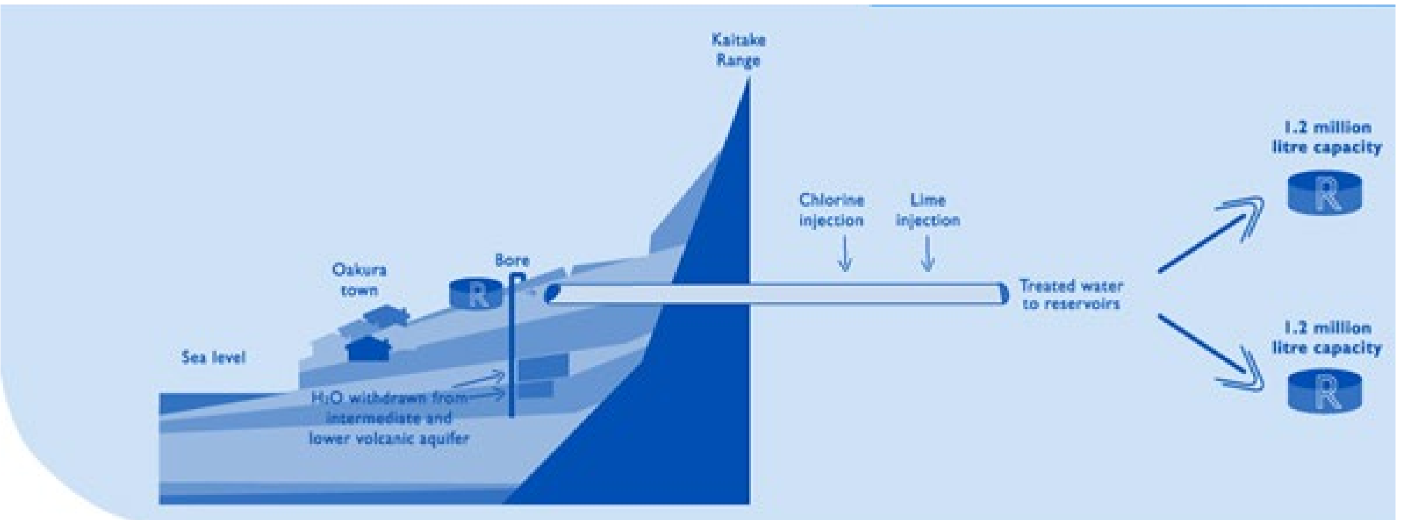
Disinfection is necessary to protect against contamination occurring in the reticulation, e.g. in the case of back flow. Production from the bores and dose rates are set automatically to maintain quality standards. The water is pumped to two 1.2 million litre capacity reservoirs.

To ensure security of supply, a second bore has been commissioned. Having two bores provides backup to cover maintenance or pump failure, and can double the production when run in 'dual mode'. Each bore alone can supply the average daily demand. However, it is preferable that each bore takes an equal proportion of the demand to minimise any possible adverse effects on the aquifers. Any over-pumping could permanently damage the aquifers and the equipment. The Three Waters Team operate one bore in preference and have found that each bore influences the other but the team has not yet been able to prove that both bores are supplied from the same aquifer.

An existing surface water source is maintained as a contingency in case both bores are unavailable. The surface water treated system is via an 'automatic valve-less gravity' sand filtration and gas chlorination. This system is still connected but no maintenance has been conducted since 2002 and would now require upgrade work if it was required for use in the future.

The treatment process at the Oakura WTP is shown in **Figure 4.**

Figure 4: Oakura Water Treatment Plant process diagram



Asset Capacity/Performance

The plant capacity at the Oakura WTP is shown in Table 4.

Table 4: Oakura Water Treatment Plant capacity

Water Treatment Plant Facilities and Process				
Water Treatment Plant	Design Peak Capacity (million litres/ day)	Average Daily Winter Consumption (million litres/ day)	Average Daily Summer Consumption (million litres/day)	Commentary
Oakura	2.8	0.53	0.85	There is currently adequate capacity in Oakura The WTP is being upgraded to install cartridge filtration and UV disinfection and increase treatment capacity to 3,500m3/day.

1.1.5 Okato Water Treatment Plant

Key information for the Okato WTP is below:

Source of water
Mangatete Stream.

Present capacity
40,000 L/hr.

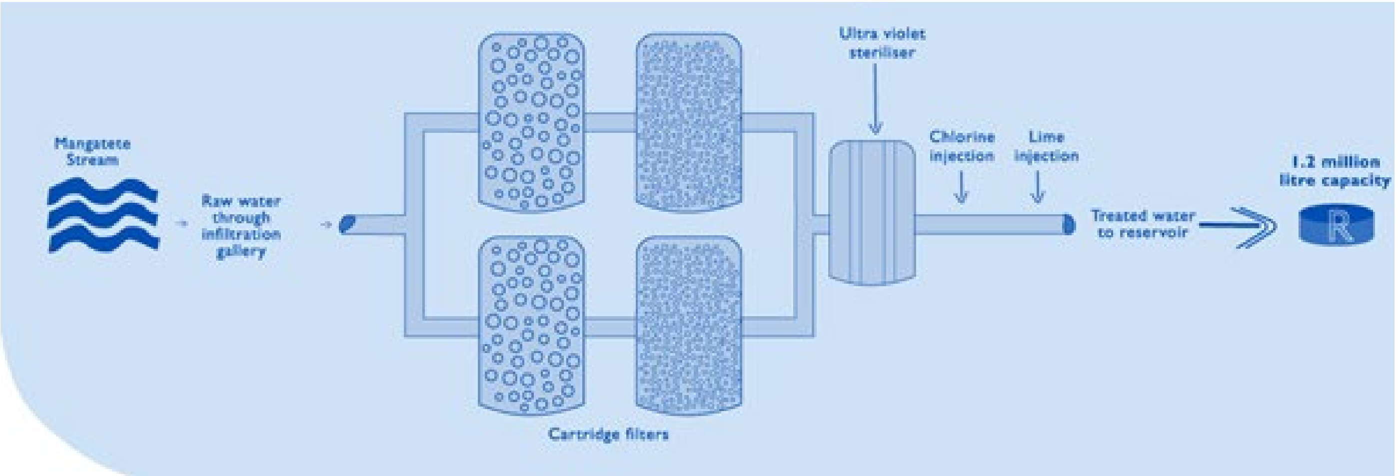
Treatment
- Filtration at inlet (in bank infiltration gallery) currently does not meet the Bank Filtration requirement of the DWSNZ
- Cartridge filtration (1 micron nominal pre and 1 micron absolute post)
- Ultraviolet disinfection
- Sterilisation (chlorination)
- pH correction (lime)

Operation
Water from the Mangatete Stream is drawn through an infiltration gallery under the riverbank and flows by gravity to the Okato WTP where the following multi-barrier process occurs:
- Two-stage microfiltration – two banks of cartridge filters operate in parallel to remove fine particles and protozoa (e.g. giardia). Each bank has two different filter sizes. The first filter at 1 micron nominal acts to protect the second at 1 micron absolute from blocking too quickly.
- Ultra-violet sterilisation unit – acts as an additional barrier against protozoa contamination
- Lime addition for pH adjustment – to reduce the corrosive potential of the water to plumbing
- Chlorine addition for disinfection – to ensure there are no microorganisms present in the water distributed to the reservoir

The water is then transferred to the 1.2 million litre capacity reservoir (twin cell).

The treatment process at the Okato WTP is shown in **Figure 5.**

Figure 5: Okato Water Treatment Plant process diagram



Asset Capacity/Performance

The Okato WTP has a design capacity of 1.2 million litres per day limited by the UV unit which has a certified capacity of 40 m³/h. Average daily consumption demands for water in the Okato water supply area are approximately 0.8 million litres per day in winter and 0.5 million litres per day in summer.

There have been a number of incidences where restrictions have been imposed in this area, due to low water levels in the Mangetete Stream.

The issues associated with the water source limitations at Okato are described in the **Water Supply AMP: Volume 1 – Headworks and Intakes**. The plant capacity at the Okato WTP is detailed in **Table 5**

Table 5: Okato Water Treatment Plant capacity

Water Treatment Plant Facilities and Process				
Water Treatment Plant	Design Peak Capacity (million litres/ day)	Average Daily Winter Consumption (million litres/ day)	Average Daily Summer Consumption (million litres/day)	Commentary
Okato	1.2	0.4	0.5	As noted above, there have been a number of incidences where water restrictions have been imposed in this area due to low water levels in the Mangetete Stream. The capacity at the WTP is limited by the UV unit which has a certified capacity of 40 m³/h

2. Lifecycle

2.1 Identify Need and Plan

There are no acquisitions of WTPs planned over the next 10 years.

2.1.1 Asset Condition

No formal asset conditions are recorded for WTPs in the asset inventory. Despite this, the WTP assets are generally considered to be in Good Condition (Grade 2) with a few known exceptions that have already been addressed or will be addressed in either renewals plans or through reactive maintenance.

2.1.2 Asset Remaining Lives

The life expectancy of WTP assets is variable as it based on construction materials and usage. Concrete structures have a life expectancy of 100 years, valves and other miscellaneous assets have a life expectancy similar to those described in the **Water Supply AMP: Volume 4 – Reticulation Network.**

The life expectancy data for WTP assets has been recorded in EAM.

2.1.3 Critical Assets

Criticality ratings for WTP assets have not yet been conducted; therefore, there is currently no data recorded in EAM.

Certain WTP assets are recognised as critical for monitoring and controlling water quality, including:

- pH meters
- Turbidity meters
- Chlorine monitors
- Streaming current monitors

Following asset criticality assessments, the Three Waters Team will develop a focused management plan to ensure the integrity and resilience of critical assets. This is a data integrity issue and is recorded as an improvement action in the **Water Supply AMP: General Volume - Section 9 (Improvement Plan).**

2.1.4 Critical Spares

An assessment of the critical spares required for the WTPs has not yet been conducted for WTP. This is an asset data integrity issue and is recorded as an improvement action in the **Water Supply AMP: General Volume - Section 9 (Improvement Plan).**

2.2 Design and Build

See **Section 6: Lifecycle** of the **Water Supply AMP: General Volume** for general information about the design and build of WTP assets.

2.3 Operations and Maintenance

2.3.1 Operations

Opex is the greatest component of water treatment costs, incorporating all energy, chemical and staff costs. All costs per plant are separately budgeted and accounted for to enable cross-supply comparison and external benchmarking against comparable supplies. As the largest plant and supply area, the NPWTP has a greater economy of scale than the other WTPs. Its water production costs are half those of the smallest plant at Okato.

Routine Operational Activities

Routine operations at WTPs include:

- Operational control and monitoring of reservoir water levels, flows in trunk mains and pump station operation within the distribution network
- Checking the treatment chemical inventory, flow and dose rates at the WTP
- Daily flushing and operation of valves, pumps, and dose lines and validating and maintaining the analyser
- Sampling and laboratory analysis of water quality for process optimisation and compliance
- Monitoring plant processes and logging recorded results
- Mixing of chemical solutions for dosing (e.g. coagulant, lime, polyelectrolytes)
- Equipment maintenance and maintenance checks
- Cleaning of facilities

Additional duties include:

- Undertaking and coordinating reactive and planned maintenance
- Checking (including cleaning) of intake structures (typically daily or on receipt of heavy rainfall warning)
- Issuing and administrating permits to work (required for works on all operational sites)
- Calibrating and troubleshooting of analysers (weekly)
- Answering customer enquiries and hosting interest visits (e.g. schools, technical groups)

Outside of manned hours, the duty operator is able to monitor and control the WTPs via a laptop with remote access to the SCADA system.

In addition to the above, every two years the NPWTP lagoon needs to have sludge removed, at an estimated cost of $250k - $350k.

2.3.2 Maintenance

Instrumentation and Electrical Maintenance

Planned and reactive maintenance for electrical equipment and instrumentation at the WTPs is managed by the Water Treatment Plant Coordinator who is supported in-house by water treatment operators and the NPDC Electrical and Systems Team. In the case of a fault, the duty operator contacts the electrical contractor directly and if necessary escalates the fault to the Electrical and Systems Team, who maintain an inventory of all required instrumentation and the preventative and predictive electrical maintenance required at the WTPs.

Mechanical Maintenance

Planned and reactive mechanical maintenance at all WTPs and facilities is managed by the Water Treatment Plant Coordinator, supported by the Mechanical Maintenance Coordinator and (in-house) by the water treatment technicians. The mechanical maintenance contractor and various specialist suppliers/providers provide external support. Plant technicians undertake front line reactive maintenance and some smaller planned works. Typically, the duty technician will contact the mechanical contractor as a first responder. They may call upon the Projects Team and other specialist service providers to facilitate works beyond reactive maintenance e.g. major repairs, upgrades and major works in general. All preventative and predictive mechanical maintenance activities are recorded and managed in EAM.

Building and Grounds Maintenance

Building facilities and ground maintenance work is managed by the Property Team. The Three Waters Team also contract approved suppliers to provide building maintenance services. This includes 10-yearly painting of buildings. Most grounds keeping is done by the Parks and Open Spaces Team or by approved contractors in line with a grounds keeping agreement. Any grounds work outside of the agreement is undertaken by approved contractors as required.

Major Maintenance

Major repairs are undertaken on a case by case basis – subject to prior approval and within approved budgets. Major maintenance items required include:

- NPWTP PACl storage tanks 1 and 2 need internal fiberglass relining to remain serviceable
- NPWTP cleaning clarifiers: lamella plates (settling tubes). There are eight of these plates with a life expectancy of 10 years. Starting in 2018, the Three Waters Team plan to replace one per year.
- NPWTP sludge lagoon requires regular emptying. Investigation needed for long term solution to sludge disposal (investigation could include other WTPs).
- NPWTP clarifiers require annual camera inspection
- NPWTP clear water tank requires annual cleaning
- All WTPs filters median needs inspection/ replacement
- Inglewood WTP requires inspection/replacement of clarifiers and filters
- Inglewood WTP sludge tank requires regular emptying and has very poor access arrangements

The general 10 year Opex forecast for water supply assets is included in **Table 17** in **Section 8: Financial Summary** of the **Water Supply AMP: General Volume.**

2.4 Renewals

As the WTP assets continue to age, investment in renewals is required to maintain current levels of reliability. The Three Waters Team has planned for general and emergency renewals of P&E and general building components, based on historical performance. These values are approximate to the currently recorded accounting expiries in EAM. Prior to confirming expenditure on Renewals Projects, we will undertake condition and criticality assessments and review the RUL of the assets to ensure optimum value from the assets is achieved.

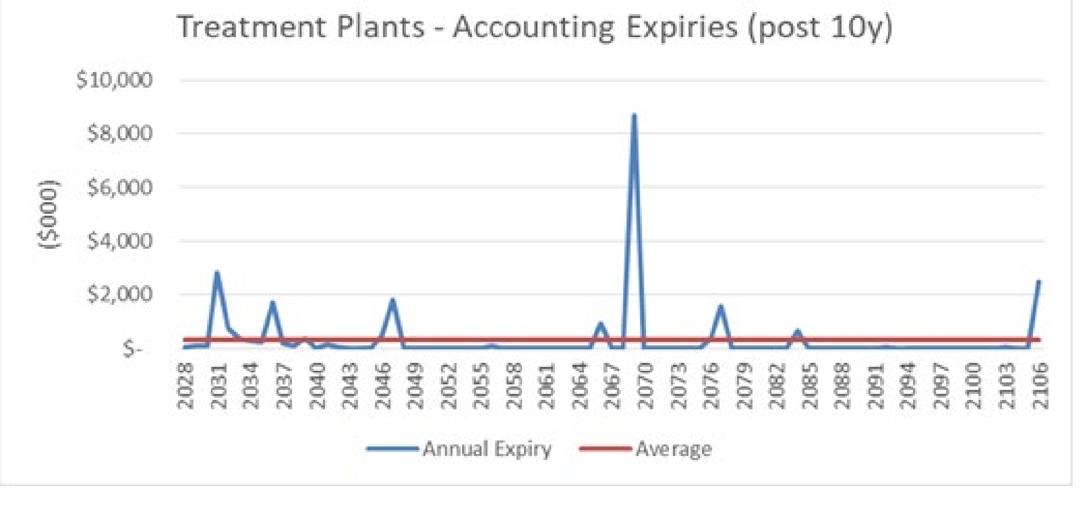
Specific Renewals Projects include:

- WTP Sludge Disposal in 2018/19 – This project is driven by consent condition requirements to empty the sludge lagoon and dispose of the sludge. Sludge disposal methods will be reviewed in the future. One option is to use a screw press to increase the dry solid content.
- Critical Spares in 2020/21 – This project is based on the planned review of critical spares referred to in the Improvement Plan in the Water Supply AMP: General Volume - Section 9 (Improvement Plan). It will mainly focus on P&E spares for WTPs, but may also include reticulation and pump station spares.

The accounting expiries for the years beyond 2030/31 are shown in **Figure 6**. There are two major items:

- Renewal of the NPWTP clarifier tube settlers at a cost of approximately $2.0m in 2031. These are already showing signs of failure and may require renewal as part of the inspection and repair of the sludge cones. This will be assessed and included in the next LTP (2024-2034) if required.
- Renewal of the NPWTP clarifiers and filtration shells at a cost of approximately $9.0m in 2070

Figure 6: Accounting expiries post 10 years



The general 10 year expenditure forecast for Renewals Projects is included in **Table 22** in **Section 8: Financial Summary** of the **Water Supply AMP: General Volume.**

2.5 Disposals

No asset disposals are planned over the 10 year AMP period.

2021-2031 Water Supply Asset Management Plan

2021-2031: He Rautaki Whakahaere Rawa mō Te Wai Whakarato

Volume 3 - Pump Stations

Pukapuka Tuatoru - Ngā Taupuni Mapu

Contents

List of Tables

1. Introduction

This volume provides descriptions for the assets covered by the pump stations asset category of the Water Supply AMP. It also contains details for the asset management lifecycle of these assets.

The purpose of pump stations is to boost water pressure and flow to the required service levels to convey water to distribution zones where flow by gravity is not possible.

The six pump stations are located in Okato WTP, Oakura WTP, Cowling Road, Tikorangi Reservoir, Mangorei Reservoir and Veale Road Reservoir.

1.1 Asset Descriptions

Details for the six pump stations are provided in **Table 1.**

Table 1: Pump Station descriptions

Location	Description
Okato WTP	Feed farms uphill of the WTP.
Oakura WTP	Feeds properties uphill of the WTP in the Surrey Hill Road area.
Cowling Road	Feeds the Davies Road and Cowling Road area.
Tikorangi Reservoir	Feeds the Motunui/Tikorangi zone as well as enhancing the rate of filling the Urenui Reservoir.
Mangorei Reservoir	Feeds upper Mangorei Road (rural supply) area.
Veale Road Reservoir	Feeds the Veale Road, Shelter Grove, and Cabot Place urban supply zone.

All pumps are powered by an electrical motor driven via a connected gearbox. Each pump station has at least two pumps, configured in either working/standby mode, high/low demand mode or twin duty at times of high demand. This provides some redundancy for outages caused by failure or maintenance.

Pump station components include pumps, valves, piping, meters, cables, controls/SCADA and the associated buildings. The pump station buildings are included in the **Property AMP: Volume 8 – Water and Wastes Buildings.**

2. Lifecycle

2.1 Identify Need and Plan

The requirement for new pump stations in the District is often a result of planned development. At present investigation is being undertaken into a new pump station for the Upper Carrington growth Area. The timing of this is uncertain but it will be required to allow development of this area. In addition, the existing Veale Rd pump station will need to be modified as part of the Patterson Road watermain project.

2.1.1 Asset Condition

No formal asset conditions are recorded for pump stations in the asset inventory. Despite this, pump station assets are generally considered to be in Good Condition (Grade 2) with a few known exceptions that have been addressed or will be addressed in either renewals plans or through reactive maintenance.

2.1.2 Asset Remaining Lives

The life expectancy of pump station assets is variable as it based on construction materials and usage. Concrete structures have a life expectancy of 100 years. Valves and other miscellaneous assets have a life expectancy similar to those described in the **Water Supply AMP: Volume 4 – Reticulation Network.** The life expectancy data for pump station assets has been recorded in EAM.

2.1.3 Critical Assets

Criticality ratings for pump stations assets have not yet been conducted; therefore, there is currently no data recorded in EAM. This is a data integrity issue and is recorded as an improvement action in the **Water Supply AMP: General Volume - Section 9 (Improvement Plan).** However, pump stations are considered to be critical to the continuity of water supply in the areas they feed.

Following asset criticality assessments, the Three Waters Team will develop a focused management plan to ensure the integrity and resilience of critical assets. This is a data integrity issue and is recorded as an improvement action in the **Water Supply AMP: General Volume - Section 9 (Improvement Plan).**

2.1.4 Critical Spares

An assessment of the critical spares required has not yet been conducted for pump station assets. This is an asset data integrity issue and is recorded as an improvement action in the **Water Supply AMP: General Volume - Section 9 (Improvement Plan).**

2.2 Design and Build

See **Section 6: Lifecycle** of the **Water Supply AMP: General Volume** for general information about the design and build of water supply assets.

2.3 Operations and Maintenance

2.3.1 Operations

Water Treatment Plant Technicians are responsible for operating and maintaining pump stations, which includes a weekly general inspection. All pump stations are also monitored remotely, 24 hours per day, via the SCADA system.

2.3.2 Maintenance

Pump stations are maintained on a regular basis. During maintenance the performance of the pumps is evaluated and any necessary remedial work is identified.

NPDC's in-house Electrical and Systems Team maintains the electrical equipment at pump stations. Maintenance includes annual checks and calibration of flow transmitters and pressure gauges.

Vibration issues at the Tikorangi Pump Station require annual vibration analysis to check pump condition and to predict when further maintenance and/or renewal may be required.

The general 10 year Opex forecast for water supply assets is included in **Table 17** in **Section 8: Financial Summary** of the **Water Supply AMP: General Volume.**

2.4 Renewals

Pump station components containing moving parts such as motors, gear boxes, and pumps have finite lives in the region of 15-20 years, depending on usage. As pump stations continue to age, they will require investment in renewals to maintain current levels of reliability. Prior to confirming expenditure on Renewals Projects, the Three Waters Team will undertake condition and criticality assessments and review the RUL of the assets to ensure optimum value from the assets is being achieved.

The general 10 year expenditure forecast for Renewals Projects is included in **Table 22** in **Section 8: Financial Summary** of the **Water Supply AMP: General Volume.**

2.5 Disposals

No asset disposals are planned over the 10 year AMP period. However, due to the Veale Rd pump station upgrades this pump station may need to be disposed.

2021-2031 Water Supply Asset Management Plan

2021-2031: He Rautaki Whakahaere Rawa mō Te Wai Whakarato

Volume 4 - Reticulation Network

Pukapuka Tuawhā - Tūhononga Kōrere Wai

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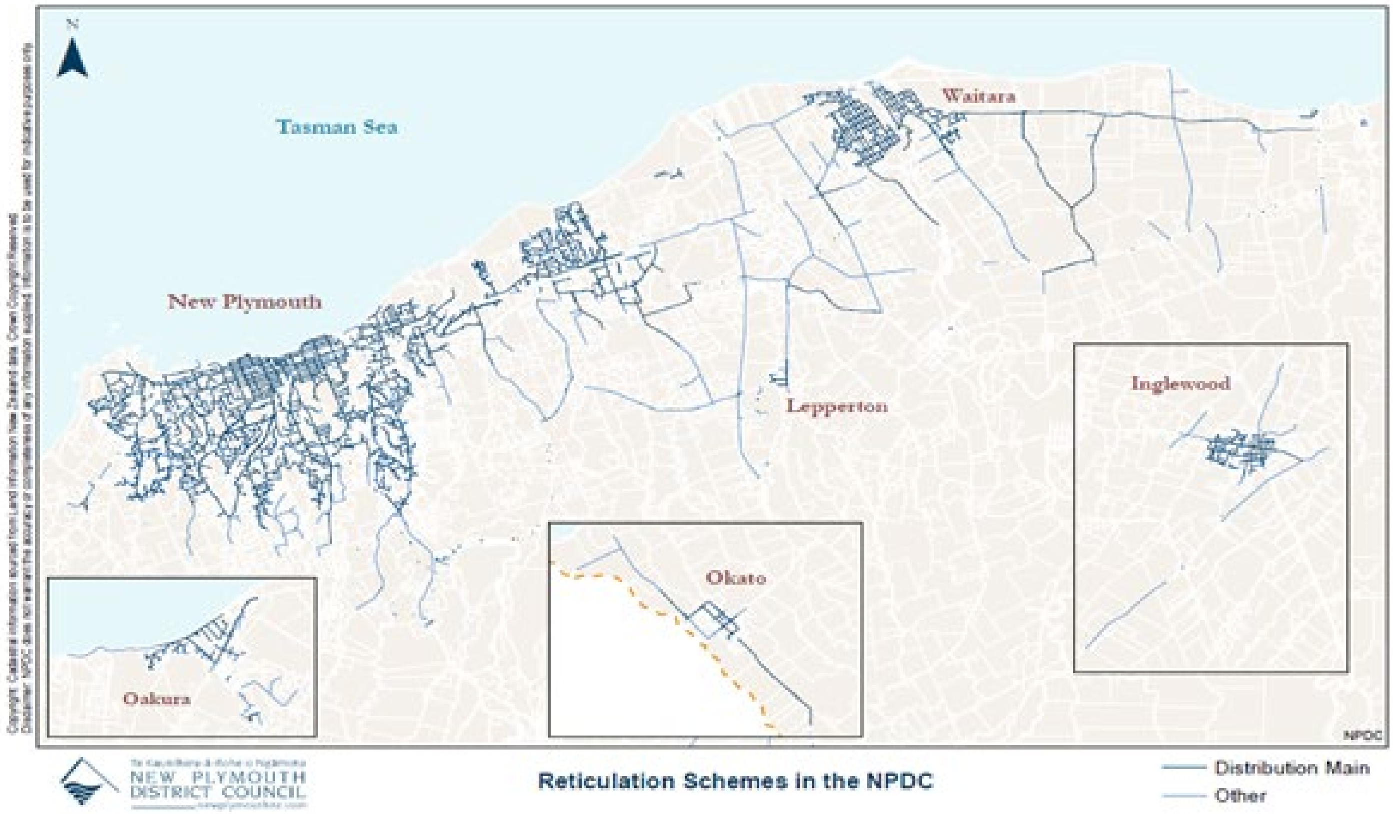
1. Introduction

This volume provides descriptions for the assets covered by the reticulation network asset category of the Water Supply AMP. It also contains details for the asset management lifecycle of these assets.

NPDC's water supply network comprises 805km of reticulation and trunk mains made up of a variety of materials depending on when the system was constructed. These materials include Cast Iron (CI), AC, steel, Polyethylene and Polyvinyl Chloride (PVC). The reticulation and trunk main system also includes pipe bridges, isolation valves, air valves, scour valves, pressure reducing valves, manholes, fire hydrants, services connections, backflow preventers, and meters.

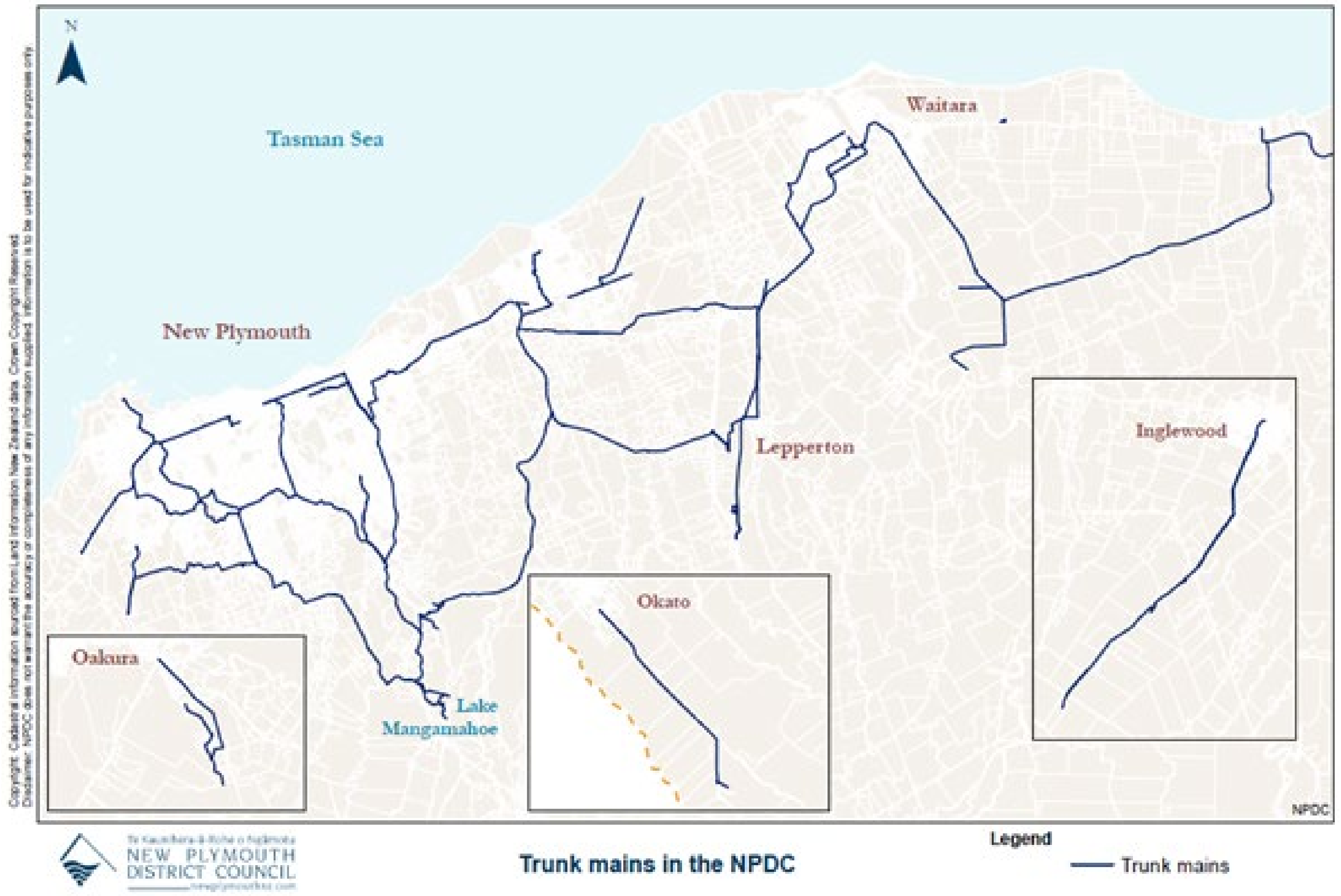
The location of the reticulation schemes in the district is shown in **Figure 1.**

Figure 1: Map of reticulation schemes location



The layout of the trunk mains is shown in **Figure 2.**

Figure 2: Trunk mains layout



As descibed in the **Water Supply AMP: General Volume**, the proposed substantial increase in renewals of three waters infrastructure will improve the asset condition of the reticulation network. This work will be undertaken inconjunction with the growth of the water supply network outlined in the Water Master Plan. Items identified in the Water Master Plan are included in **Section 7: Financial Summary** of the **Water Supply AMP: General Volume**, as expenditure forecasts for the years 2021/22 to 2030/31 and as commentary for the years beyond 2030/31. A nominal provision has also been included to improve the Levels of Service associated with firefighting capacity and to maintain satisfactory water pressure.

1.1 Asset Description

A summary of the existing water supply reticulation assets is provided in the following **Table 1.**

Table 1: Existing water supply reticulation assets

Asset description	Details	Quantity
Pipes	Abestos cement	164km reticulation mains 45km trunk mains
	Cast iron	65km reticulation mains 7km trunk mains
	Steel	66km reticulation mains 63km trunk mains
	Flexible	355km reticulation mains 40km trunk mains
Pipe bridges	Three Waters Service own 14 specifically built structures that support the water reticulation network	14 bridges
Valves	Mostly gate valves, used to isolate small areas of the network for maintenance purposes. There are also a small number of non-return valves, air release valves, reflux valves, pressure reducing valves, and pressure sustaining valves	5,782 valves
Manholes	Purpose is to provide access to devices such as pressure relief valves.	23 manholes
Fire Hydrants	A point of supply for firefighting they are typically positioned within the road reserve and are marked by a yellow CI lid.	3,613 fire hydrants
Service connections	Service connections (or laterals) comprise the mains connection and the small diameter pipework, toby, manifold, flow restrictor and associated surface box that convey water from the system to the customer owned pipework	28,037 covering 208km
Backflow preventers	Operating the same way as a non-return valve, backflow preventers protect the water supply from undesirable contaminants in customer systems entering the water supply network. They also prevent customer's pipework from losing pressure in instances where mains pressure reduces quickly and prevent syphoning of customer pipework.	459 Backflow preventers

Asset description	Details	Quantity
Meters	Meters measure the volume of water taken by the connected customer. In anticipation of a future universal metering policy, manifold assemblies are now installed at all new domestic water connections and at existing domestic connections when tobies are replaced. To date, approximately 20% of domestic connections are now installed with manifold assemblies.	3,252 meters

2. Lifecycle

2.1 Identify Need and Plan

When developers install new assets to serve new domestic and non-domestic developments, the assets are usually vested with the Council. Assets are built to the NZS 4404:2010 – Land Development and Subdivision Standard. NPDC's specific requirements are defined in the NPDC, STDC and SDC adopted standard for Land Development and Subdivision Infrastructure, which is based on NZS 4404:2010 with local amendments. The Three Waters Service assumes full responsibility for any assets vested with the Council and includes them in operations, maintenance, and future renewal plans.

This first stage of the asset lifecycle includes understanding the asset condition, the remaining useful life of an asset and the identification of critical assets and those which require critical spares. A description of each of these for the water supply reticulation network is provided in this section.

2.1.1 Asset Condition

No formal asset conditions are recorded for the reticulation network in the asset inventory; however, information for reticulation network assets is provided below.

2.1.1.1 Asbestos Cement Pipes

AC pipes deteriorate both internally and externally as the pipe material slowly dissolves and erodes. The rate of internal deterioration is related to the characteristics of the water, with soft water more aggressive than hard water. The external surface of the pipe is affected by the composition of the surrounding soil, with silt material being more acidic than stony sandy material. This is an important factor in predicting the relative priorities of the renewal works programme.

In 2001, a consultant produced the Lifetime Prediction Model for AC pipes, however, since this was initially undertaken this assessment was found to be very conservative. As a result, a new AC pipe sampling programme has started and the Three Waters Team will use the results to determine the actual and predicted condition of AC pipe assets.

Another indication of pipe condition is the rate of required repairs and the causes of failure. When conducting repairs, contractors record the mode of failure in asset management systems for analysis. Information is also gathered about the overall condition of the pipe during reactive maintenance, recording observations made in general visual inspections. This identifies coating failures, corrosion, pipe wall anomalies, and other features.

2.1.1.2 Cast Iron, Steel and Flexible Pipes

The rate of required repairs and the failure mode causing the need for repair is used as an indicator of pipe condition. Contractors record this information and enter it into asset management systems for analysis. Samples of pipes obtained during renewal or repairs are also used to ascertain their condition.

During reactive maintenance the Three Waters Team conduct a general visual inspection about the overall condition of pipes where the information is gathered and recorded, identifying coating failures, corrosion, pipe wall anomalies and other features.

2.1.1.3 Pipe Bridges

The Three Waters Team inspect all exposed pipes on an annual basis. The inspection data generates a table of condition for the pipe and its associated brackets, bolts, blocks, paint, structure, vegetation, barriers, abutments, joints, gibaults, wrapping, moss, and access. The items identified during inspections are generally Opex maintenance activities. This is covered in **Section 2.3.**

All crossings and supporting structures are in Good or Average Condition (Grade 2 or 3).

2.1.1.4 Valves

The Three Waters Team assess valve condition during scheduled six yearly visual inspection/maintenance and performance checks. In general, valves are in Good Condition (Grade 2), although they sometimes require repair works due to leakage caused by vibration from traffic.

2.1.1.5 Manholes

The Three Waters Team assess the condition of manholes annually by visual inspection. Manholes are mainly located at the side of roads, making inspections easier. These assets are generally in Good Condition (Grade 2).

2.1.1.6 Fire Hydrants

The Three Waters Team assess the condition of fire hydrants during scheduled six yearly visual inspection/maintenance and performance checks. In general fire hydrants are found to be in Good Condition (Grade 2), with some repairs required due to leakage caused by vibration from traffic.

2.1.1.7 Service Connections

The Three Waters Team renew service connections when they are found to be in a poor state of repair, either individually through reported leakage or during mains renewals. Service connections are also renewed when existing services are found to be constructed of an inferior material such as galvanised steel or low density polyethylene.

2.1.1.8 Backflow Preventers

The Three Waters Team test backflow preventers annually and generally find them to be operating well and in Good Condition (Grade 2).

2.1.1.9 Meters

The Three Waters Team inspect meters visually during meter reading rounds and found them to generally be in Good Condition (Grade 2).

2.1.2 Asset Remaining Lives

Asset condition is a key parameter in determining the Remaining Useful Life (RUL) of an asset and can be used to predict how long it will be before an asset needs to repaired, renewed or replaced. Asset condition is also an indicator of how well an asset is able to perform its function. The reporting of the RUL of assets is currently recorded in the **Water Supply AMP**. However, most information regarding asset condition has not yet been added to EAM; therefore, information about RUL is also generally not up to date. There is an improvement action in **Section 10: Asset Management Improvement Programme** of the **Asset Management Strategy** to address this.

2.1.3 Critical Assets

Criticality ratings for the reticulation network assets have not yet been conducted; therefore, there is currently no data recorded in EAM.

2.1.4 Critical Spares

The Three Waters Service has identified and procured critical spares for the water supply reticulation network. The majority of spares are held by contractors and used for day-to-day repairs of the reticulation system. Larger and/or atypical spares are stored at the NPWTP. The spares inventory is detailed in ECM#: 7235967.

2.2 Design and Build

See **Section 6: Lifecycle** of the **Water Supply AMP: General Volume** for general information about the design and build of water supply assets.

2.3 Operations and Maintenance

2.3.1 Operations

Typical reticulation and trunk mains operations activities include:

- Response to customer service requests
- Meter reading
- Investigating faults and testing water quality
- Repairing/replacing leaking water trunk mains and/or in the reticulation
- Locating and marking pipelines
- Standing over where third parties are excavating in close proximity to trunk mains

2.3.2 Maintenance

The preventative and predictive (proactive) maintenance activities for each asset type are detailed in **Table 2.**

Table 2: Preventative maintenance schedule

Activity	Frequency
Reticulation Pipes	
Water main refresh (flushing at dead-end hydrants)	3-monthly
Flow and pressure audit	As required
Leakage detection survey	Various depending on area
Water quality testing	As required
Inspect restrictors	Annual
Dudley Road raw water supply flush	Weekly
Pipe Bridges	
Condition inspection	Annual
Valves	
Inspect pressure zone valves	Annual
Clean, exercise and paint	6-yearly
Inspect and service pressure reducing valves	Annual

Activity	Frequency
Valves	
Clear or spray vegetation around valves	6-monthly
Coating of pressure zone and scour valves	6-yearly
Install concrete pad	As required
Hydrants	
Inspect, clean, paint and flow test	6-yearly
Service Connections	
Flow and pressure audit on water manifold	Annual at 51 selected locations with known pressure/flow issues
Backflow preventers	
Inspection and testing	Annual
Manholes	
Paint water manhole lid	6-yearly

Recent improvements in the WTP processes and renewal of some older sections of pipes has resulted in a decrease in the number of reports regarding water taste, odour and colour. Therefore, the Three Waters Team are currently reviewing how frequently water mains need to be refreshed. Reducing the frequency of mains refreshing will reduce total system water loss.

Preventative and predictive maintenance schedules are stored against each asset in EAM and monthly schedules are issued to internal staff and contractors. Details and costs of completed maintenance activities are also recorded and monitored to assist with maintenance optimisation and renewal planning.

Corrective (reactive) maintenance activities include:

- Investigating reports of no water or low pressure
- Repairing leaking water mains
- Repairing leaking services/tobies
- Repairing/replacing leaking/faulty valves
- Repairing/replacing leaking/faulty pressure reducing valves
- Investigating water quality problems
- Identifying maintenance/repair activities during pipe bridge inspections
- Locating and marking water pipes

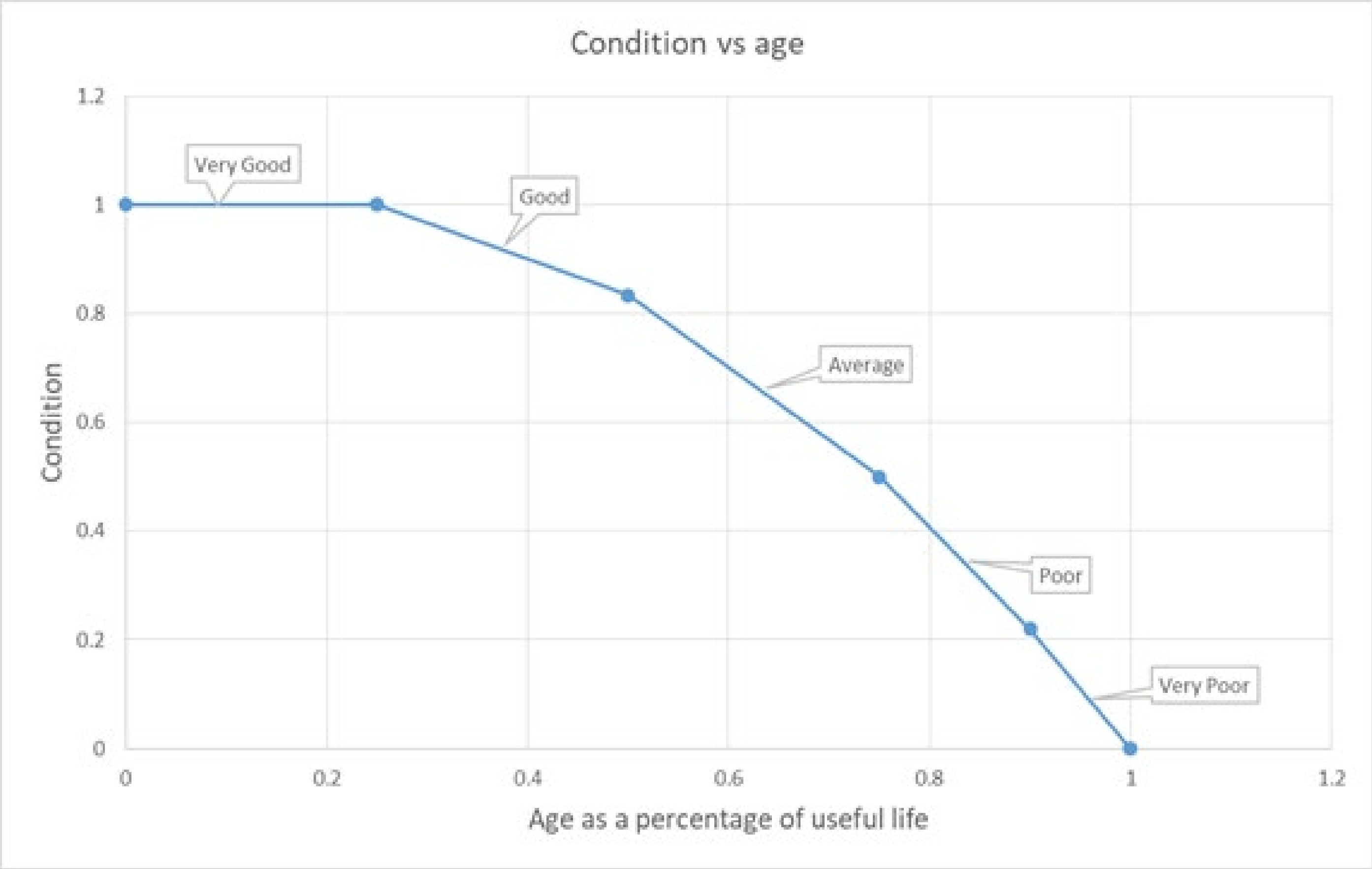
The network maintenance contract schedule for reticulation can be found in the appendices of the 12/PM01 contract Section H (ECM#: 6713455).

The general 10 year Opex forecast for water supply assets is included in **Table 17** in **Section 8: Financial Summary** of the **Water Supply AMP: General Volume.**

2.4 Renewals

The renewal strategy for all three water assets is assessed on either an aged based condition rating or an inspection based condition rating. All water reticulation assets have been aged based condition assessed because Council does not have CCTV footage of these assets to enable an inspection assessment. Water reticulation pipes are difficult to inspect without potentially introducing sources of contamination.

The age based condition rating follows the definition in IIMM represented by the following graph.



All assets are classified as critical assets, important assets, moderately critical assets or low criticality assets. The analysis for asset renewal has been undertaken using Monte Carlo Simulation, a mathematical technique, which is used to estimate the possible outcomes of an uncertain event.

This technique allows for the fact that the true condition of these pipes has not been inspected, yet acknowledges that, for example, critical pipes should not fail. An applied example of this is the renew of critical pipes when they change from poor to very poor condition with an uncertainty of ±5% of their design life. In theory this means we will be (on average) sacrificing 10% of their design life due to proactive replacement.

The Council also considers further optimisation prior to the final confirmation of the work programmes. This will ensure the timing of planned renewals is coordinated with other asset classes to maximise efficiency and minimise disruption e.g. renewing reticulation assets at the same time as wastewater mains work or road resealing.

A general provision for emergency renewals is included in the expenditure forecast. This is to cover the renewal of small sections of failed water mains not included in the planned renewal programme.

2.5 Disposals

NPDC are considering options with ANZCO to exit our Waitara Industrial Supply agreement which would allow us to decommission the reticulation assets associated with this scheme.

2021-2031 Water Supply Asset Management Plan

2021-2031: He Rautaki Whakahaere Rawa mō Te Wai Whakarato

Volume 5 - Storage

Pukapuka Tuarima - Ngā Putunga

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1. Introduction

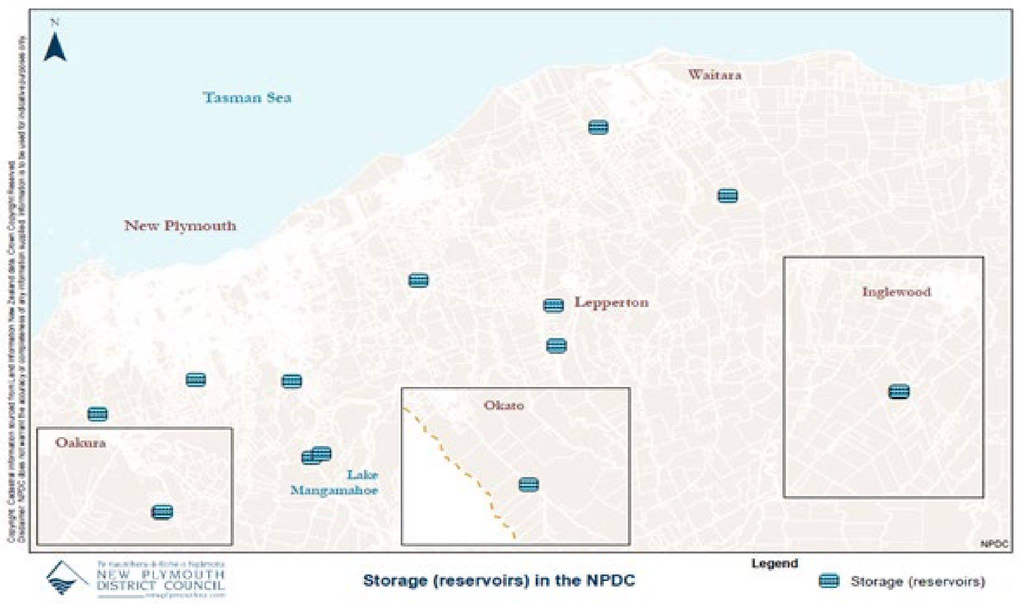
This volume provides descriptions for the assets covered by the storage asset category of the Water Supply AMP. It also contains details for the asset management lifecycle of these assets.

The purpose of water storage assets is to provide storage for treated water prior to use and consumption by residential, business and industrial customers. At the WTP sites, storing treated water also allows sufficient contact time for chlorine disinfection prior to use or consumption by customers.

1.1 Asset Descriptions

There are 19 enclosed treated water storage reservoirs within the district, with associated plant, equipment, valves and piping. The locations for storage assets are shown in **Figure 1.**

Figure 1: Location of reservoir facilities



The number of reservoirs supplied by each WTP is provided below:

- Fourteen reservoirs are supplied by the NPWTP
- Two reservoirs are supplied by the Inglewood WTP
- Two reservoirs are supplied by the Oakura WTP
- One reservoir is supplied by the Okato WTP
- Two reservoirs are supplied with raw water as part of the Waitara Industrial Supply scheme

Table 1 provides further details for storage assets.

Table 1: Reservoir schedule

Treated Water Storage - Reservoir Capacity		
Reservoir	Capacity (m^3)	Constructed
NPWTP #1	4,500	1972
NPWTP #2		2002
Mangorei #1	4,500	1966
Mangorei #2		1972
Mangorei #3	4,500	
Veale Road	9,000	1981
Henwood Road #1	4,500	1985

Treated Water Storage - Reservoir Capacity		
Reservoir	Capacity (m³)	Constructed
Mountain Road #1	4,500	1989
Henwood Road #2	4,500	2021
Mountain Road #2	4,500	2021
Barrett Road	4,500	2010
Faull Road	4,500	2001
Urenui (twin cell)	1,250	2002
Urenui Domain	320	1990
NPWTP Storage Total	**51,070**	
Inglewood #1	4,500	2000
Inglewood #2	3,800	2000
Inglewood WTP Storage Total	**8,300**	
Oakura WTP #1	1,250	1980
Oakura WTP #2	1,250	2002
Oakura WTP Storage Total	**2,500**	
Okato WTP (twin cell)	1,250	2002
Okato WTP Supplied Total	**1,250**	
TOTAL STORAGE	**63,120**	

As part of the Waitara raw water supply system there are two open raw water storage reservoirs with a total capacity of 80,000m3. These reservoirs are situated at Mountain Road, Lepperton and Johnson Street, Waitara; however, they are not currently in use. NPDC is in ongoing discussions with ANZCO regarding ownership and maintenance responsibilities.

Any reservoirs constructed since 2000 meet the seismic design standards of the time. In recent years, the Three Waters Service has conducted a programme to improve levels of seismic resistance for reservoirs constructed prior to 2000.

Reservoir outlet pipes (with the exceptions of Henwood Road #1, Mountain Road #1, and Oakura #1 reservoirs) are now arranged so that in the event of outlet pipe rupture, the reservoir will retain 15% of its contents. Further draw below the 15% mark requires operation of a separate valve and is designed for emergency provisioning and rationed distribution only.

The data presented in this volume regarding the quantity, location, capacity, and age of the assets is classed as Grade A (Highly Reliable). This is due to the Three Waters Team maintaining accurate and up to date details of storage assets for operational purposes.

2. Lifecycle

2.1 Identify Need and Plan

The most recent acquisitions of storage assets was completed in 2021 with the completion of the Henwood Road #2 and Mountain Road #2 reservoirs being commissioned. No other acquisitions are planned over the 10 year AMP period.

2.1.1 Asset Condition

No formal asset conditions are recorded for storage assets in the asset inventory.

2.1.2 Asset Remaining Lives

All water storage reservoirs are constructed of concrete, with an assumed expected life of 80-100 years. The associated P&E has a variety of shorter assumed expected lives.

The life expectancy data for storage assets has been recorded in EAM.

2.1.3 Critical Assets

Water storage assets are considered critical to the continuity of water supply, particularly during emergency situations when WTPs may be inoperative.

Criticality ratings for storage assets have not yet been conducted; therefore, there is currently no data recorded in EAM. This is a data integrity issue and is recorded as an improvement action in the **Water Supply AMP: General Volume - Section 9 (Improvement Plan).**

Following asset criticality assessments, the Three Waters Team will develop a focused management plan to ensure the integrity and resilience of critical assets. This is a data integrity issue and is recorded as an improvement action in the **Water Supply AMP: General Volume - Section 9 (Improvement Plan).**

2.1.4 Critical Spares

An assessment of the critical spares required has not yet been conducted for Storage assets. This is an asset data integrity issue and is recorded as an improvement action in the **Water Supply AMP: General Volume - Section 9 (Improvement Plan).**

2.2 Design and Build

See **Section 6: Lifecycle** of the **Water Supply AMP: General Volume** for general information about the design and build of water supply assets.

2.3 Operations and Maintenance

2.3.1 Operations

Operations for water storage assets consist of general site attendance to conduct routine weekly visual checks/inspections.

2.3.2 Maintenance

In terms of water storage each reservoir should be drained down (scoured), cleaned and inspected (internally and externally) at least once every five years. The Three Waters Service also refurbish the altitude valves during these five yearly inspections and repair any identified leaks. The Three Waters Team are currently behind schedule with this work and plan to correct this over the period of the current LTP.

The Three Waters Service do conduct annual inspections of the P&E and the external structure (including the roof), and are required to use edge fall protection when working at heights. This protection has not yet been installed and may cause delays in scheduled roof inspections. Inspections using drones is now being deployed to avoid this issue.

Recent inspections have identified exposed rebar at the Veale Road reservoir. This will now require remedial works.

Other typical maintenance activities include fault investigation/remediation and SCADA maintenance.

The general 10 year Opex forecast for water supply assets is included in **Table 17** in **Section 8: Financial Summary** of the **Water Supply AMP: General Volume**.

2.4 Renewals

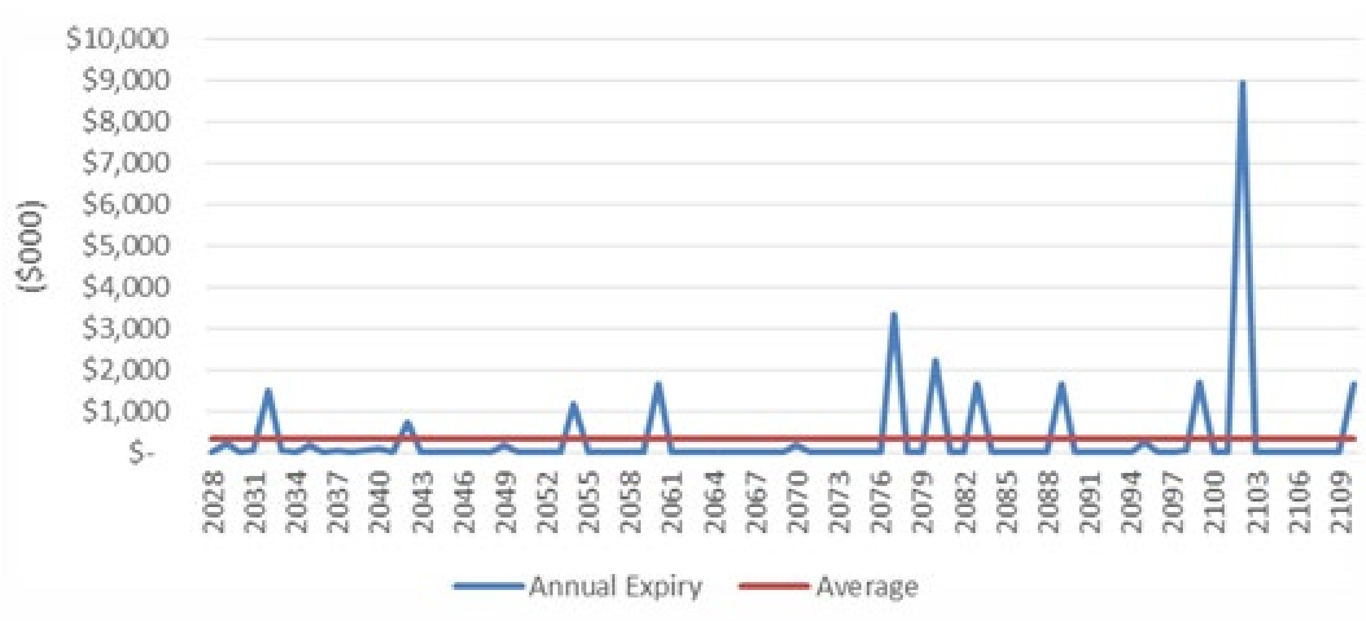
Concrete water storage containment tanks have a life expectancy of 80-100 years. Given that all assets are under 52 years old, there are no renewals required during the 10 year period of the AMP or for the years beyond 2030/31.

As water storage P&E assets continue to age, investment will be required in renewals to maintain current levels of reliability. However, no specific Renewals Projects for water storage assets are planned over the period of the AMP. The general provision for P&E renewals is included in **Table 22** in **Section 8: Financial Summary** of the **Water Supply AMP: General Volume** and is sufficient to cover any planned or unplanned renewals that may occur.

Prior to confirming expenditure on Renewals Projects, the Three Waters Team will undertake condition and criticality assessments and review the RUL of assets to ensure optimum value is achieved from the assets.

The accounting expiries for the years beyond 2030/31 are illustrated in **Figure 2.**

Figure 2: Accounting expiries post 10 years



The graph shows that the major expenditure for renewing concrete structures does not occur until 2078 with other structures requiring renewal in years prior to this.

2.5 Disposals

A number of existing land assets associated with former water storage assets have no further anticipated use and are intended for disposal. This includes minor land holdings associated with the Waitara Industrial Supply raw water storage reservoirs, the disposal of which is contingent on the presumed divestment of this scheme.