Water Supply Asset Management Plan 2018 - 2028

Nelson City Council
te kaunihera o whakatū

Quality Assurance Statement

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Cover Photos:

375mm diameter Butterfly Valve

Stoke High Level Reservoir

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Executive summary

i. The purpose of the plan

The Water Supply Asset Management Plan outlines the current and future operational requirements needed to meet customers' needs in a cost effective manner.

This plan focuses on ensuring assets are operated and maintained to provide the desired level of service, and to meet the current and future community outcomes in a sustainable manner.

The Goal of the Water Supply Activity is to provide a water supply to Nelson City that is capable of abstracting, treating and distributing potable water in an efficient, safe, reliable and sustainable way whilst ensuring that the ecological, recreational and cultural interests of the community in the water sources are recognised and enhanced.

The overall objective of Asset Management planning is to:

Meet a required level of service, in the most cost effective manner, through the management of assets for present and future customers.

This plan will provide the substantiation for budget forecasts put forward in the Long Term Plan (2018-2028) for water supply.

ii. Asset description

The inventory of public water services assets owned by Nelson City Council and managed by the Infrastructure division as at June 2016 is shown in Table ES-1.

Table ES-1: Summary of Water Services Assets June 2016

Asset Category	Quantity	
	km	units
Reticulation	333.8km	
Trunk Mains	45.6km	
Maitai Pipelines	16.3km	
Roding Pipeline	3.9km	
Maitai Water Supply Scheme		1
Roding Dam		1
Treatment Plant		1
Tunnels[1]		3
Reservoirs and Tanks		36
Pump Stations		13
Pressure Reducing / Control Valves		40
Air & Non Return Valves		165

[1] Roding, WTP and Maitai Dam

Asset Category	Quantity	
	km	units
Gate Valves		3,634
Manholes		91
Hydrants		2,559
Meters		20,829
Customer Connections		20,260

Figure ES-1: Water Network Nelson

iii. Key issues

Council's priorities between 2018 and 2028 for the wastewater activity will focus on the following areas:

- ***Sustainable development.***

  This needs to be the focus of all parts of the water supply activity in order to ensure the city can accommodate future growth affordably while recognising the wider environmental, cultural and social values that the community identify as making Nelson a special place. The following are some of the current initiatives that this asset management plan can build on:

  - *Wider inter-departmental and community involvement to improve freshwater quality and quantity available to the rivers at the source.*

    Council's water supply activity is the single largest abstractor of water from the Maitai and Roding rivers. As such it directly impacts on the quantity of water available in these two rivers. Council funds a variety of non-regulatory environmental and behaviour changing programmes such as riparian planting and water conservation education.

  - *Stream water way environmental enhancement eg river bank shade through vegetation planting adjacent the Maitai dam.*

  - *Streams and rivers to be free of manufactured obstructions that impede fish passage. Fish ladders are in place on the intake weir of the south branch of the Maitai River and fish 'trap and transfer' programmes are required for the Maitai and Roding dams to ensure natural fish populations are supported and replenished in the upper catchments.*

  - *Support for development of alternative/emergency supplies such as rainwater harvesting, particularly where there is no reticulation.*

- *Compliance with the **National Policy Statement for Freshwater Management** and other Central Government freshwater reforms such as the Clean Water Package.*

  Council, iwi and the wider community are developing environmental standards for streams and rivers in Nelson based on the requirements of the National Policy Statement. These standards are expected to be the basis of rules in the proposed Whakamahere Whakatū Nelson Plan and will set the scene for water quality improvements into the future. Although rules are yet to be finalised, the following activities that impact fresh water will need to take note of any changes to rules from the date of notification of the proposed plan:

  - *Council's water supply activity relies on water sourced directly from the Maitai and Roding rivers and as such has a day to day impact on the quantity of water available in the rivers.*

  - *The Maitai Dam reservoir is used to supplement flows in the Maitai River by replacing the water abstracted from the south branch with water stored in the dam. No storage is available at the Roding Dam and flow augmentation is not possible.*

- ***Water quality- Maitai Dam Aeration***

  The Maitai Dam reservoir is subject to seasonal variations in oxygen content over its depth. During the summer months this variation becomes pronounced

with lower levels of the dam becoming very low in oxygen (anoxic). The lack of oxygen creates a number of issues for Council:

- *Leads to a challenging environment for aquatic organisms.*
- *Results in elevated levels of iron and manganese in the water as these chemicals become soluble. Using this water to supplement flows in the Maitai River has the potential to lead to adverse environmental impacts in the river.*
- *Likewise the water would need to be conditioned before it could be used as part of the potable supply.*

The most appropriate way to overcome this condition is to aerate the reservoir and mix the water to prevent the loss of oxygen in the bottom layer. The techniques used to achieve this are already used in New Zealand in some of the larger water storage lakes in the North Island.

A budget for this work has been shown in the first five years of the plan with construction in 2022/23.

- ***Development of resilient infrastructure to address climate change predictions and other natural hazards.***

  Best advice to date from the Ministry for the Environment and the National Institute of Water and Atmospheric Studies is that we can anticipate more extremes in our weather including increased droughts and extreme rainfall events.

  A feature of a largely gravity based run of river supply such as Nelson's is that we are dependent upon a continuous flow of clear water in rivers that are some distance away from the treatment plant. High levels of sediment or organic material in the water can lead to damage to pipes and infrastructure and difficulties sterilising the water of harmful bacteria. The distance between intakes and the treatment plant introduces a vulnerability that comes with very long pipelines (some of them on above ground benches and within tunnels) that cross earthquake faults, streams and rivers.

  The keys to the resilience of the supply side of the network are:

  - *The Maitai Dam reservoir. This allows 3.5 million cubic metres of water to be stored as a buffer against droughts and extended periods of rain that discolours the rivers.*
  - *The duplicate raw water delivery lines from the Maitai intakes. The original supply line is largely sited on an above ground bench that follows the course of the river and the recently installed duplicate line is buried in the Maitai roadway. These duplicate delivery pipes provide security against damage to one or the other pipeline.*
  - *The ultra-filtration process at the water treatment plant. The filters in the water treatment plant can remove dissolved organic material and sediment and can use a variety of raw water sources. Completion of the renewal of the existing membranes is programmed for 2018/19.*

  On the delivery side the network is open to many of the same vulnerabilities, with above ground trunk mains and pipes crossing earthquake faults, streams and rivers. In coastal areas liquefaction is recognised as a potential risk to the network.

Resilience comes in the form of an interlinked network that can direct water throughout the city when parts may be damaged and water storage reservoirs that can hold approximately a day's supply of potable water.

- ***Natural Hazard Security of the network in light of the recent Canterbury and Kaikoura Earthquakes and storm events, including wider network hazards- Earthquake fault line and liquefaction.***

  Recent work by Council has focussed on natural hazards that might impact on the city, in particular:

  - *Direct damage from Earthquake shaking;*
  - *Damage from liquefaction in susceptible areas;*
  - *Damage from Tsunami,*
  - *Damage from flooding and major storm events;*
  - *Impact of potential climate change and sea level rise.*

  Because the Maitai Dam is a vulnerable asset, it was designed to withstand 1 in 1000 year seismic and flood events without damage. Key structures are designed to withstand maximum credible earthquake and probable maximum flood without collapse (but not without some damage, possibly requiring decommissioning and major repair work).

  When full, city reservoirs can hold sufficient water for approximately 24 hours average consumption. The more usual capacity, allowing for filling time and continuing use, is 8-10 hours of daytime demand.

  Construction of a new buried pipeline between the dam and the Water Treatment Plant was completed in 2013/14 and between the Water Treatment Plant and Westbrook Terrace in 2016/17.

  The Roding Water Scheme has low and moderate risks to structures, other than a 200m length of pipe between the screenhouse and the chlorinator house. This pipe is suspended on piers along the riverbank.

  While automatic chlorination exists at the water treatment plant, a stand-alone portable chlorinator unit, run by a small petrol generator and using sodium hypochlorite is also held there in case of emergency.

  As a result of the Christchurch earthquakes Council has undertaken a seismic review of the critical elements of the above ground network, starting with the storage reservoirs and sections of the Maitai Dam to the treatment plant trunk main. This work will continue through this proposed plan and be extended to investigate impacts of liquefaction on existing and future infrastructure, impacts of flooding and the long term planning required as a result of climate change

- ***Resource consents for water extraction***

  Nelson City draws its public water supply from three sources:

  - *A run of river source from a weir on the Roding River;*
  - *A run of river source from a weir on the South Branch of the Maitai River;*
  - *An intake tower in a storage dam on the North Branch of the Maitai River;*

  Nelson City Council has three Resource Consents for the water supply covering the abstraction of raw water from both the Roding and Maitai rivers, the continued operation of the Maitai Dam on the North Branch and intake weir on

the South Branch of the Maitai River and the Dam/ intake weir on the Roding River. The consents and expiry dates are as follows:

- *RM 960396 Maitai River expired 1/02/2017;*
- *RM 025151 Maitai River expired 1/02/2017;*
- *RM 975374 Roding River expired 1/10/2017.*

In 2016 applications for consent for the water supply activities on the Maitai and Roding Rivers were lodged. On 31 May 2017 resource consents RM165239, RM165317 and RM165318 were granted for the Roding water supply. As at June 2018 the Maitai Resource Consent application is still being processed. Council will continue to operate the Maitai water supply under the current resource consent until the replacement consent is completed.

Resource consent conditions such as enhanced fish transfer programmes and early cease takes will likely require some long term additional expenditure. Future annual plans will be adjusted as the impact of consent conditions becomes clearer.

Compliance with the conditions of resource consents is mandatory and a level of service has been identified for this purpose.

- ***Water quantity / efficiency of use.***

Water quality and quantity in our rivers is a key issue for the city. As the city water supply is drawn from river sources there will be an increasing tension between the need for potable water to support growth and increased flows in the rivers, particularly over the summer months. Improving the efficiency of use through the following strategies is expected to be an increasing feature of this activity into the future.

- *Repairing the original raw water supply pipeline.*
- *Reducing the level of 'un-accounted for water'*
- *Reducing the level of water lost to leaks in both the public and private networks*
- *Encouraging rain harvesting and storage for garden watering*
- *Developing demand management options*
- *- Improved plumbing and appliance technology, (particularly being driven by the Australian water shortages), future household use will be reduced e.g. superlow flush 4.5/3 litre toilet flush (compared with 11 litre single flush), low use washing machines, low flow shower heads, aerator taps, reuse of grey water for toilets and irrigation etc.*
- *- Increasing awareness of low water use gardening e.g. drought resistant planting, no mow lawns, or no lawns at all*
- *- With intensification, smaller gardens or no gardens at all for many household units*
- *- Reduced use due to reduced supply pressures*
- *- Consumer education on tap use e.g. turn off while brushing teeth, shorter duration showers, showers instead of baths, rinsing dishes in a partially filled sink rather than under a running tap*
- *- Possible greywater and rainwater storage on site for reuse*

- *- More stringent hosing restrictions*
- *- Pricing incentives*

- ***Central Government Regulation***

  The event of the campylobacteriosis outbreak in Havelock North in August 2016 concluded with a Government Inquiry. The focus of the Inquiry was twofold: The security of the source, particularly subsurface bores; and the regulatory framework that applies to drinking water suppliers in New Zealand. Numerous administrative and operational recommendations were made in the two final reports. The Stage 2 report also has a section with a recommendation that the Government look at aggregating supplies of water across the country.

  Nelson City Council's water supply is currently well positioned to comply with any treatment requirements that may arise from future changes to legislation. Raw water is not sourced from bores and all water from the river sources is currently subject to a double barrier of ultra-filtration membranes and chlorination. Council also has a rigorous testing and monitoring regime for chlorine residual levels and bacteria.

  Tasman District Council (TDC) supplies water to the residential area in south Nelson adjacent to Champion Road and Hill Street North as well as the Wakatu Industrial Estate and ENZA. This water is sourced from underground bores and then treated with ultra-violet light prior to supplying the network. While this form of treatment does not provide residual disinfection in the drinking water, TDC do have chlorine dosing equipment available for emergencies or if testing identifies the presence of E.Coli in the reticulation.

  The recommendations of the Government Inquiry largely rely on Central Government enacting legislation before they can be implemented. Some progress on these is likely during 2018-19. Those recommendations that encourage treatment of drinking water and improving compliance with existing regulations have already been actioned by the Ministry of Health.

- ***Raw water source and reticulation quality issues***

  Council has three raw water sources as described above. Of these the Maitai Dam is the only one available when river flows are low or unavailable after rain. In 2016 Council undertook a trial of sourcing all raw water from the Maitai Dam reservoir to test the ability of the treatment plant to meet the needs of the city for a prolonged period. The trial delivered the following results:

  - *Confirmation of the ability to supply the treatment plant with raw water to match the daily demand curve.*
  - *Confirmation of the ability of the new membrane train to treat the water for a prolonged period without loss of functionality. The treatment plant has five separate 'trains' of membranes. Four date from the construction of the plant in 2004 and one from 2015.*
  - *Confirmation of the in-ability of the original four membrane trains to treat the water for a prolonged period without loss of functionality. The existing 'trains' initially performed well and recovered permeability after routine cleaning but as the trial progressed they soon lost permeability. More aggressive cleaning was required that impacts the longevity of the membranes.*
  - *An increase in the number of discoloured water complaints particularly from hospitality providers in parts of the city. These complaints are*

believed to be the result of a significant legacy issue of corrosion products in the cast-iron and steel pipe that make up part of the reticulation.

Long term it is important for the city to be able to rely on the Maitai Dam as a raw water source especially in emergency. In order to regain that confidence the treatment plant membranes are being renewed and the option to pre-treat the water from the dam via a primary clarifier or more regular replacement of the membranes is being further investigated. A budget for this work is shown for years 5-10 of this plan.

- **Water Treatment Plant membrane renewals**

  Renewal of two of the four original membrane trains is being undertaken in 2017/18. The remaining two trains are scheduled for renewal in 2018/19.

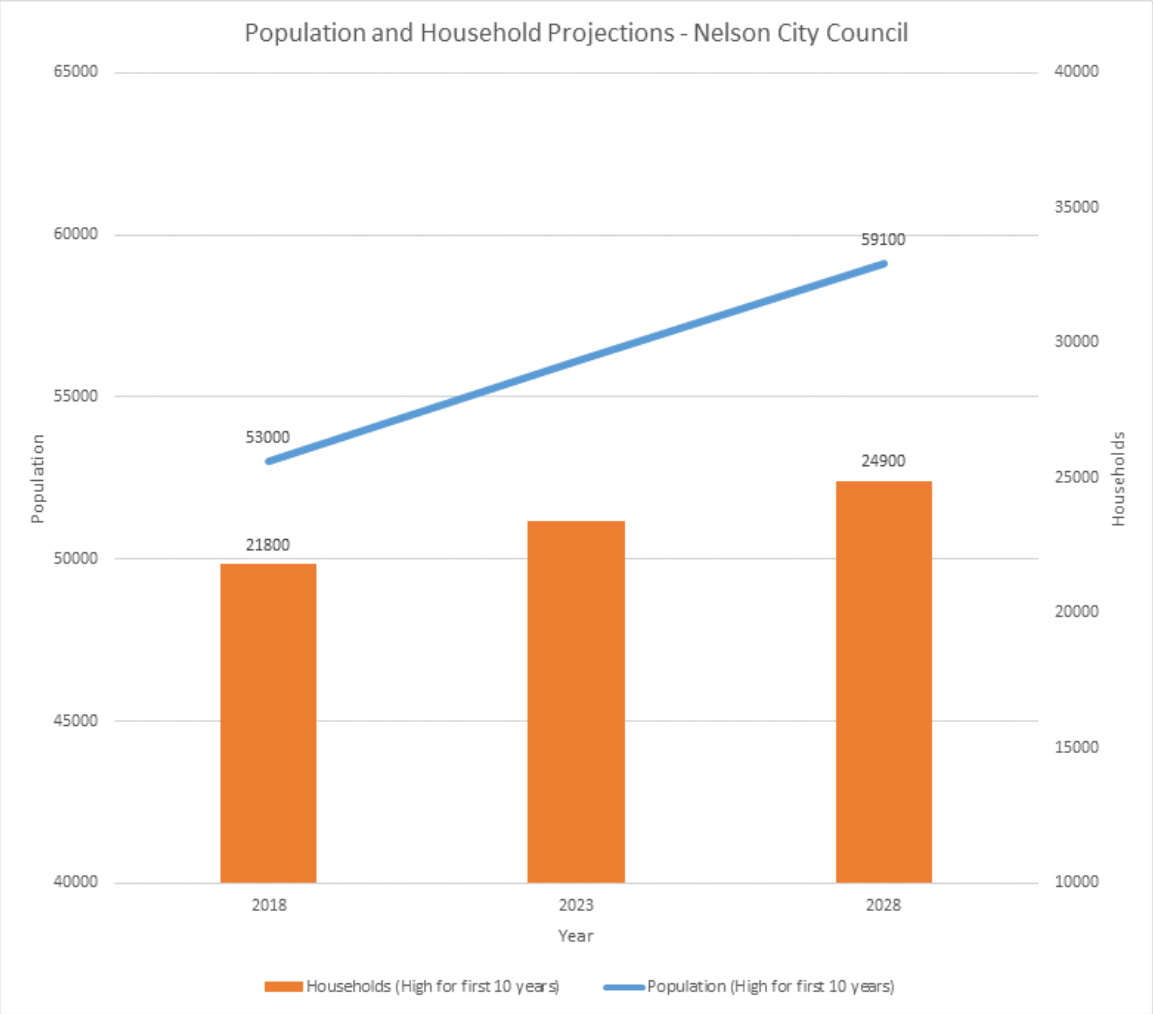
- **Bulk Water Supply South Nelson. Tasman District Council - Engineering Services Agreement**

  - *Tasman District Council supplies water to the residential areas in south Nelson adjacent Champion Road as well as the Wakatu Industrial Subdivision, Alliance Freezing Works and ENZA in Nayland Road. Although the demand from these areas is not great (400,000 – 500,000m3/year) Council does not have the appropriately sized reticulation in place to be able to supply the required fire flows. The supply of water by Tasman District Council is covered in an engineering services agreement between the two Councils that was reviewed in 2015.*
  - *The ongoing supply of water to these areas is dependent upon Tasman District Council securing the long term viability of water from the Waimea Plains via the construction of the Waimea Community Dam. Should this dam not proceed Council can anticipate that new supply mains will need to be constructed to service these areas.*
  - *Nelson City Council has contributed funding to Tasman District Council investigations into the Waimea Dam. For Nelson City to secure a share in the dam (for water required at some future point) a yet to be determined payment would have to be made at the time of construction.*
  - ~~o~~ *Existing options are expected to provide sufficient water for the city in the short – medium term and a share in the Waimea Community Dam is not required for the water supply activity at this stage. Funding has been allocated in 2020/21 for a grant to the Waimea Dam project subject to the conditions that access to 22,000m^3/d be assured and the grant be transferred into a shareholding in the Dam Company at any point in future.*

- **National Policy Statement Urban Development Capacity**

  The National Policy Statement for Urban Development Capacity (NPS-UDC) requires local authorities to ensure there is sufficient development capacity to meet demand in the urban environment in the short term (within 3 years), medium term (3-10 years) and long term (10-30 years). Short-term capacity must be feasible, zoned and serviced while long-term capacity must be feasible, with servicing planned but does not need to be zoned yet. The following graph is based on statistics New Zealand growth projections for the city out to 2028. An increase of approximately 12% in population over this time is expected. The city has adequate water supply sources for this increase.

Figure ES-2: Population and household projections (high), 2018-2028, Nelson



- ***Supply to elevated / new growth areas***

  Growth in the city relies on both water reticulation being available at the right locations and having sufficient capacity in the raw water sources to supply the water treatment plant. Any upgrading of the public network will be undertaken to support growth areas (co-ordinated with other utility upgrades in the same area).

  In some of the more recent hill top developments above the reliable water supply contour level of 100m, the issues of continuity of supply and pressure fluctuations have been resolved by the installation of storage tanks and in some cases pump stations (e.g. Observatory Hill, Austen Ward Heights, Panorama Drive, Springlea, Wastney Terrace). To avoid the need for water towers and allow maximum land development, the standards have been eased so that dwellings with ground floor level less than 30m below the floor of the reservoir are required to install a domestic pressure pump and tank to ensure adequate pressures. Oversize service connections are provided to minimise friction losses. The system works well as the presence of storage tanks ensures continuity of supply. Council property database contains entries advising of these special circumstances. A map of the areas zoned for growth and infrastructure timing is attached below.

  Construction of services to these areas should be carried out in line with Council's prioritisation policy.

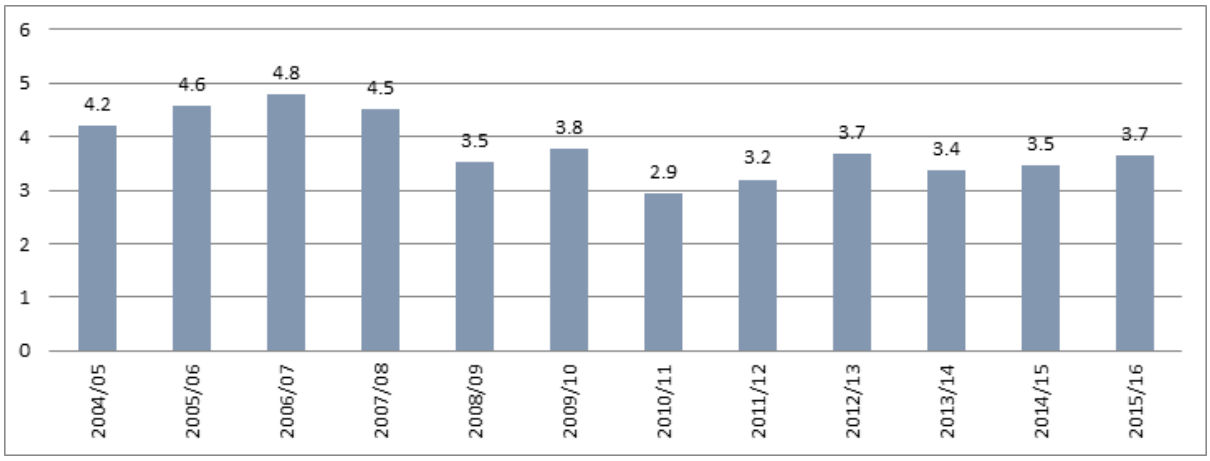
Council is reviewing the proposed Whakamahere Whakatū Nelson Plan and looking at wider prioritisation criteria for future development areas. Infrastructure planning will align with any new policy that is developed. A specific project has been identified to continue desktop investigations started in 2015-17, looking at servicing constraints to areas currently identified for growth.

- ***Water losses / Pressure reduction / Water conservation / Un-Accounted for Water/Water Losses***

  The reporting of annual water losses as a percentage of annual water production is a current level of service measure. As losses are nearly constant each year and water sales (and therefore production) is weather dependent it is not the best measure for tracking un-accounted for water. 'Bench Loss' software has been used to calculate the Infrastructure Leakage Index (ILI) which allows year to year comparisons and also benchmarking between water supply authorities.

  The infrastructure leakage index has been calculated since 2001/02. The results are shown in Figure ES-3.

Figure ES-3: Infrastructure Leakage Index for Nelson



Council has an ongoing project to track real losses within the network and better quantify the other sources of un-accounted for water. Long term improvements will lead to a reduction in the leakage index. As of 2016-17 the majority of the public network in the city had been checked for leaks. While a number of small leaks were found and repaired no substantial leaks were identified. Ongoing investigation of the other sources of un-accounted for water use such as contractor use and fire-fighting services will continue.

2009 bench testing of residential water meters for accuracy confirmed a general view that some of the meters have been under reporting flows and therefore some losses must be attributed to meter performance.

The increasing use of automated meter reading technology in the power supply utility field offers advantages to the water supply activity, principally in reducing costs of meter reading and billing and providing early warning of excess water use that may be an indication of leaks. To date a business case concludes that the cost of installing these meters cannot be justified. Future pricing changes in electronic reading meters may change this. This will be reviewed in future asset management plans.

- ***Condition assessments and renewals strategies***

  Historically asset monitoring to determine condition has been subjective based on local knowledge and experience. Formal procedures now exist to assess asset condition.

  The development and continued use of condition assessment data will support preparation of some form of predictive decay curves for some particular asset types and hence permit prediction of remaining life. Consideration of economic influences and other factors will also be required in the adopted life for the asset type. By considering the current condition point on an assumed decay curve, the profile can predict the effective life (time) before failure. This failure time can be the physical end of life, minimum level of acceptable service, or limit of capacity of the asset.

  The water network is made up a range of materials such as cast iron, asbestos cement, concrete, uPVC, polyethylene, concrete lined steel and ductile iron. Currently Council's renewal strategy is based on replacing asbestos cement pipes that were installed in the 1950's and are showing higher than expected failure rates. Further investigation of the older sections of the network are needed in order to confirm the condition of the steel and iron pipes. As the current asbestos cement pipe renewal programme is expected to continue for the next 8-10 years, enhanced condition assessment of the other pipe types is expected to be part of the renewal strategy from years 5-8.

- ***Older Maitai pipeline Existing Maitai concrete pipeline***

  The Maitai pipeline between the Maitai Dam and the Water Treatment Plant transports the majority of the water used in the City. It has numerous small shrinkage cracks and is vulnerable to slips from above and below the pipeline.

  Council completed the construction of a duplicate Maitai pipeline between the dam and the Water Treatment Plant in 2014 but will continue to use and maintain the existing pipeline, to reduce pumping costs, for as long as it is viable to do so. Repairing the section between the Dam and the Water Treatment Plant is a multi-year project shown in the operations section of this Asset Management Plan for the next ten years at $100k/year.

- ***Water meters - mechanical / electronic***

  The Council installed water meters to every residential property connected to the city water supply in the mid 1990's. These meters have been in continuous use for 20+ years and are nearing the end of their service lives.

  Trends in each property's water usage are tracked and if a meter appears to be "slowing down", then it is removed for testing or replacement. Worn meters tend to under-read and are therefore in that customer's favour, but true costs are not being recovered from the customer who is therefore subsidised by other consumers.

  Residential Backflow Prevention – The dual check valves in the water meter manifold are spring operated and lose effectiveness with time. An increasing number of the valves are also disintegrating in the manifolds and a programme to replace these commenced in 2015/16. As the dual check valve is fitted immediately underneath the meter it was initially considered to be appropriate for them to be replaced at the same time as the meter. The number of failures and risk of pieces of the valves impacting the water meters and household water fittings has led to the need to begin the replacement in advance of the meters.

Commercial and Industrial water meters were installed from 1980 to 1999.

Renewal of commercial and industrial water meters started in 2014/15 and is approximately 25% complete. The work is scheduled to be completed in 2028/29.

The future proposed renewal of residential water meters, scheduled over a three year period from 2018/19 at approximately $1,100,000 per year, will be based on 'like for like' replacement. A business case developed by Council concluded that the installation of electronic reading meters could not be justified on an economic basis.

- ***Fire flows***

  The public supply is designed to also provide an effective firefighting network. Hydrants are installed on all service mains in urban supply areas in accordance with the New Zealand Fire Service Firefighting Water Supplies Code of Practice.

  The New Zealand Fire Service issued a revised Firefighting Water Code of Practice in 2008 with the result that existing fire flows in the city are now lower than desired in many areas largely as a result of the changes to how distances from hydrants are measured.

  Previous versions of this code of practice measured the distances from properties to fire hydrants as a radius centred on the property, the current version now measures the true "along the road" distance. This had the effect of increasing the number of properties that did not meet the distance requirement.

  Upgrades to the fire flows have been ongoing since 2015 with the result that most of the smaller projects have been completed and generally the larger street wide pipe upgrades remain.

  $600,000 is included over the ten years of this plan to continue upgrades to the water network in areas where the fire flows are not being delivered. The areas to be upgraded will be identified using the water network model.

- ***Safety of dams***

  Since 2012 central government has signalled a wish to better regulate the ongoing safety of larger dams. To date the proposed form that this will take and the legislative vehicle to support it has not been decided. The Maitai Dam is Nelson City's largest water storage dam and is also considered a high impact category owing to the number of people in the downstream path should the dam fail catastrophically. In recognition of this Council has annual engineering safety inspections carried out by the design company and five yearly comprehensive safety reviews by an independent expert.

  It is anticipated that the central government policy issues will be resolved in the first five years of this plan and some form of dam safety scheme will apply to a wider range of dams e.g. stormwater detention dams. A budget for the first review of these dams has been included in this plan.

iv. Levels of service

Table ES-2: Levels of Service table 2018 -2028

				Performance Target			
Community Outcomes	**Level of service**	**Performance Measures**	**Previous and current performance**	**2018/19 (Year 1)**	**2019/20 (Year 2)**	**2020/21 (Year 3)**	**2021/22 2027/28 (Year 4-10)**
Our communities are healthy, safe, inclusive and resilient	**Quality** ^Good quality water	The extent to which drinking water supply complies with: a) part 4 of the drinking water standards# (bacterial compliance criteria), and b) part 5 of the drinking water standards# (protozoal compliance criteria)* c) part 8 of the drinking water standards# (chemical compliance) 1	Complied a) and b) 2016/17 Complied a) and b) 2015/16 Complied a) and b) 2014/15 Protozoal compliance is not measured for distribution As treatment plant removes any at source. c) is a new measure in the Long Term Plan 2018-28. In 2016/17, Council complied with part 8 of the drinking water standards at the treatment plant, but the distribution network did not comply.	100% compliance with parts 4, 5 and 8 of the drinking water standards			
		Total number of complaints per 1000 connections about any of the following*: - drinking water clarity - drinking water taste - drinking water odour - drinking water pressure or flow - continuity of supply - Council's response to any of the above issues 2	21 complaints per 1000 connections in 2016/17 35 complaints per 1000 connections in 2015/16	No more than 50 valid complaints per 1000 connections			

				Performance Target			
Community Outcomes	**Level of service**	**Performance Measures**	**Previous and current performance**	**2018/19 (Year 1)**	**2019/20 (Year 2)**	**2020/21 (Year 3)**	**2021/22 2027/28 (Year 4-10)**
Our infrastructure is efficient, cost effective and meets current and future needs	**Reliability** ^A reliable supply of water	Average drinking water standard consumption per day per resident* 3	288L per person per day 2016/17 268L per person per day 2015/16	Normal demand is less than 500L per person per day. This includes both domestic and commercial-industrial			
		% real water loss from the system* 4	23% in 2016/17 29% in 2015/16	Real water loss less than 25%.			
Our infrastructure is efficient, cost effective and meets current and future needs	**Customer Service** ^Prompt response	When attending a call-out in response to a fault or unplanned interruption to the system, the following median response times will be measured: a) attendance for urgent call-outs: from the time notification is received to the time service personnel reach the site b) resolution of urgent call-outs: from the time notification is received to the time service personnel confirm resolution of the fault or interruption c) attendance for non-urgent call-outs: from the time notification is received to the time that service personnel reach the site d) resolution of non-urgent call-outs: from the time notification is received to the time service personnel confirm resolution of the fault or interruption* 2	Median 21 minutes in 2016/17 28 minutes in 2015/16 Median 107 minutes in 2016/17 105 minutes in 2015/16 Median 54 minutes in 2016/17 56 minutes in 2015/16 Median 330 minutes in 2016/17 346 minutes in 2015/16	a) Contractor to attend urgent call-outs in a median time of 30 minutes or less. b) Contractor to resolve urgent call-outs in a median time of 480 minutes or less. c) Contractor to attend non-urgent callouts in a median time of 120 minutes or less. d) Contractor to resolve non-urgent call outs in a median time of 24 hours or less.			

^L.O.S. included in LTP

Ministry of Health (2008), Drinking-water Standards for New Zealand (Revised 2008), Wellington, Ministry of Health

* Performance measures with an asterisk reflect the wording of the Non-Financial Performance Measures of the Department of Internal Affairs (DIA) incorporated into sec261B Local Government Act 2002. This is to allow the DIA to compare these measures across councils. Targets have been adjusted where necessary to align.

Measurement procedures:

1. Ministry of Health grading
2. Report from SR system at 1 July
3. Calculated by metered supply divided by Statistics NZ estimated population
4. Council uses a water balance methodology developed by Water NZ to track and report on un-accounted for water.

v. Future demand

Investigations to date confirm that the capacity of the water supply network below the 100m contour is quite strong. Much of the proposed residential growth in the city can be accommodated for the next 5-10 years without major network upgrades. Some areas of weakness exist with older asbestos cement pipes which will be addressed as the network is renewed. Likewise the reduction of water losses and un-accounted for water also improves the available capacity. The largest unknown is the potential for future 'wet' processing industries to establish in the city.

Table ES-3: Future demand

Water Demand Drivers	Changes to Water Supply Activity
Significant population growth and residential expansion into greenfield areas	New development areas on the periphery of the city and increased density in some existing developed areas leading to increased water demand. See map of areas of growth below.
New 'wet' industries	Growth in the commercial sector that involves wet processing activities increases the demand for high quality potable water services.
Reduction in house occupancy	Activities such as operating washing machines and dishwashers can generate as much water demand for single person dwellings as those that house couples.
Changes in Customer Expectations	Customer expectations are increasingly tending towards higher Levels of Service for reliability and response to complaints.
Community Expectation	Community expectations are increasingly focussed on the uninterrupted supply of good quality water for residential and commercial uses. Recent complaints about dis-coloured water suggests that expectations in some parts of the community are higher than just potable water.
Climatic Changes	In recent years, there has been an increase in the incidence of extreme weather events around the world. The general future expected trend for Nelson is of winters being wetter and the other seasons being drier. More frequent heavy rainfall events will impact on the use of water from the two river sources and drier periods may increase the city's dependence on the Maitai Dam.
Legislative National Policy Statements: • Freshwater Management and • Urban Development Capacity	• Freshwater Management is a cornerstone central government initiative to improve the quality of freshwater bodies in New Zealand. This is expected to impact on both abstraction and discharges to waterways and require an enhanced recognition of the need for efficient use of the water to minimise the volume taken for water supply and improving the quality of the water discharged as compensation. • Urban Development Capacity will ensure each territorial authority makes adequate provision for future population growth in their areas. This will require Council to undertake strategic

Water Demand Drivers	Changes to Water Supply Activity
	growth studies and identify the impact on the demand for water supply services.
Organisational Policies Environmental Sustainability	Development of sustainability strategies that include reduction of direct losses from the network (public and private) and un-accounted for water use from the network.

Council is concentrating on improving services to developed areas and providing services to areas that are currently being developed (Residential, Rural Zone High Density Small Holdings, Suburban Commercial, and Industrial). Servicing of other areas covered by the Services Overlay, because one or more servicing constraints have been identified as needing to be addressed prior to the complete development of that property/area, will be considered as Council develops a policy on prioritising these areas. The specific projects to facilitate future growth, identified in this Asset Management Plan, therefore consist of works required to eliminate servicing constraints on the former.

Figure ES-4 below shows the growth areas in the city as they currently stand. Generally sufficient water is available in most of these areas although developers will need to install storage tanks and pumps in elevated areas which lie above the 100m contour.

A review of the residential demand is expected over the next three years as Council prepares the proposed Whakamahere Whakatū Nelson Plan. The likely impact on the water network will be reflected in future asset management plans.

Figure ES-5 Peak Water Demand compares the capacity of the water sources and water treatment plant with the actual peak day water usage over the last 15 years. With the completion of the renewal of the treatment plant membranes in 2018/19 the city will be able to treat and supply approximately 50,000m3/day. This is expected to meet the city's growth out beyond 2080-2100.

Infrastructure planning process for growth projects

Figure ES-4: Nelson Growth Areas and Infrastructure Timing

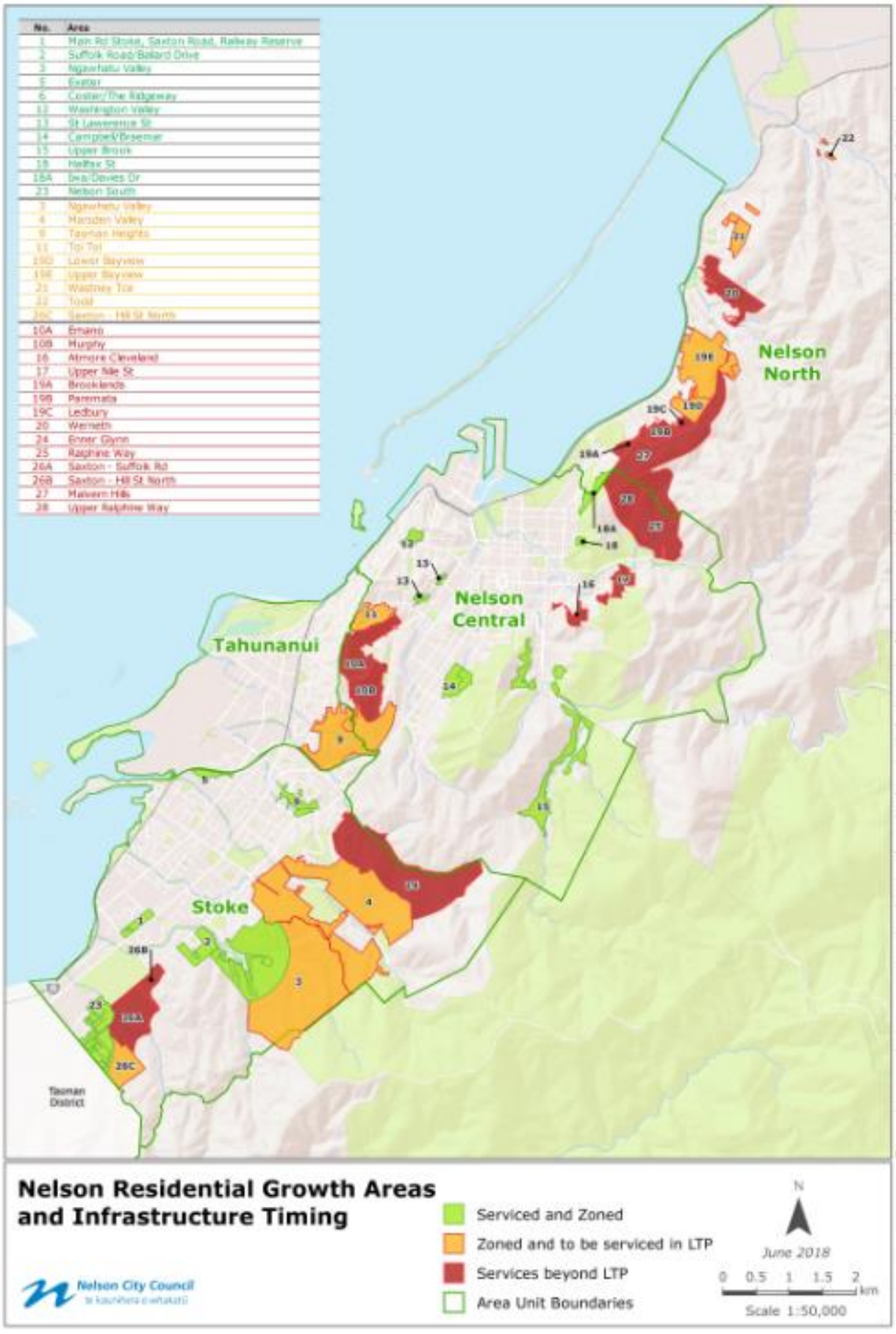
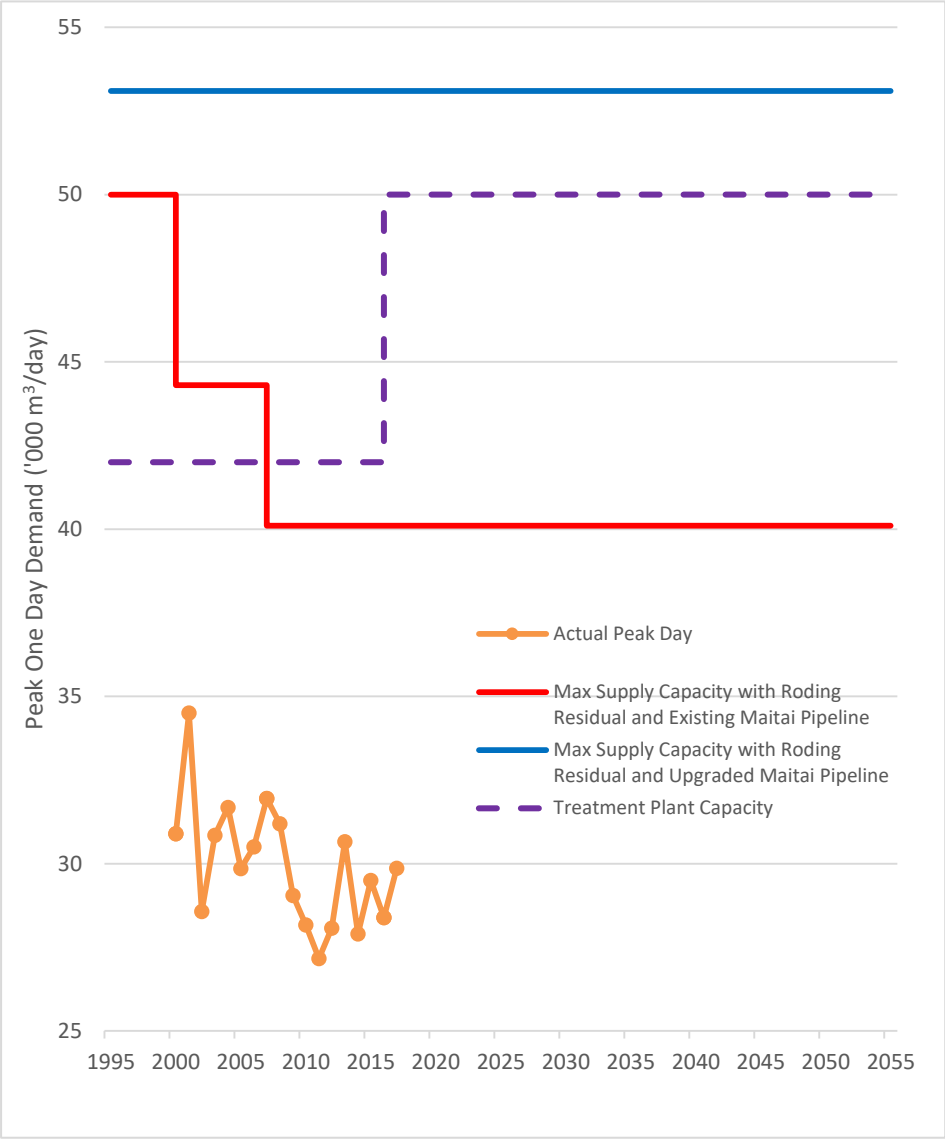


Figure ES-5: Peak Water Demand



vi. Lifecycle management plan

Assets have a lifecycle as they move through from the initial concept to the final disposal. Depending on the type of asset, its lifecycle may vary from 10 years to over 100 years.

Table ES-4: Nominal Working Life of Water Assets (Years)

Type	Low Pressure	High Pressure	Trunk Main	Maitai Pipeline	Roding Pipeline
Asbestos Cement (Black)	80	70	65		
Asbestos Cement (Fibrolite)	80	70	65		
Ductile Cast Iron	110	95	90		
Pit Cast Iron	120	105	100		
Spun Cast Iron	100	90	85		
Concrete		65	60	58	75

Type	Low Pressure	High Pressure	Trunk Main	Maitai Pipeline	Roding Pipeline
Copper	90	80	75		
Galvanised Iron	70	55	50		
HDPE	85	70	65		
PVC	85	70	65		65
Concrete Lined Steel	90	80	75		75
Pitch Lined Steel	90	80	75	58	

The following figure shows the theoretical renewal year of the pipe assets based on renewal by age.

Figure ES-6: Estimated Replacement Value / Material Distribution

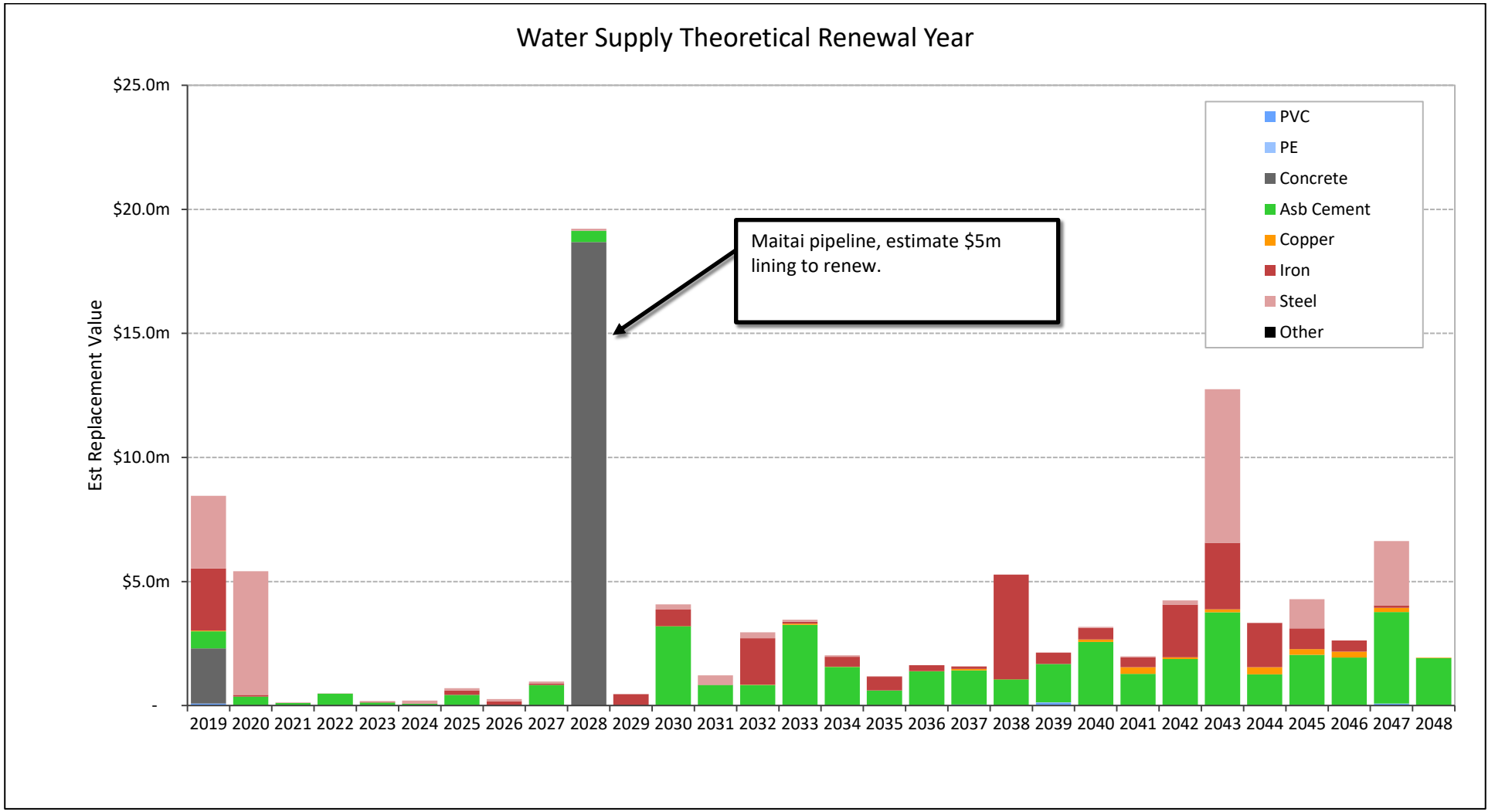
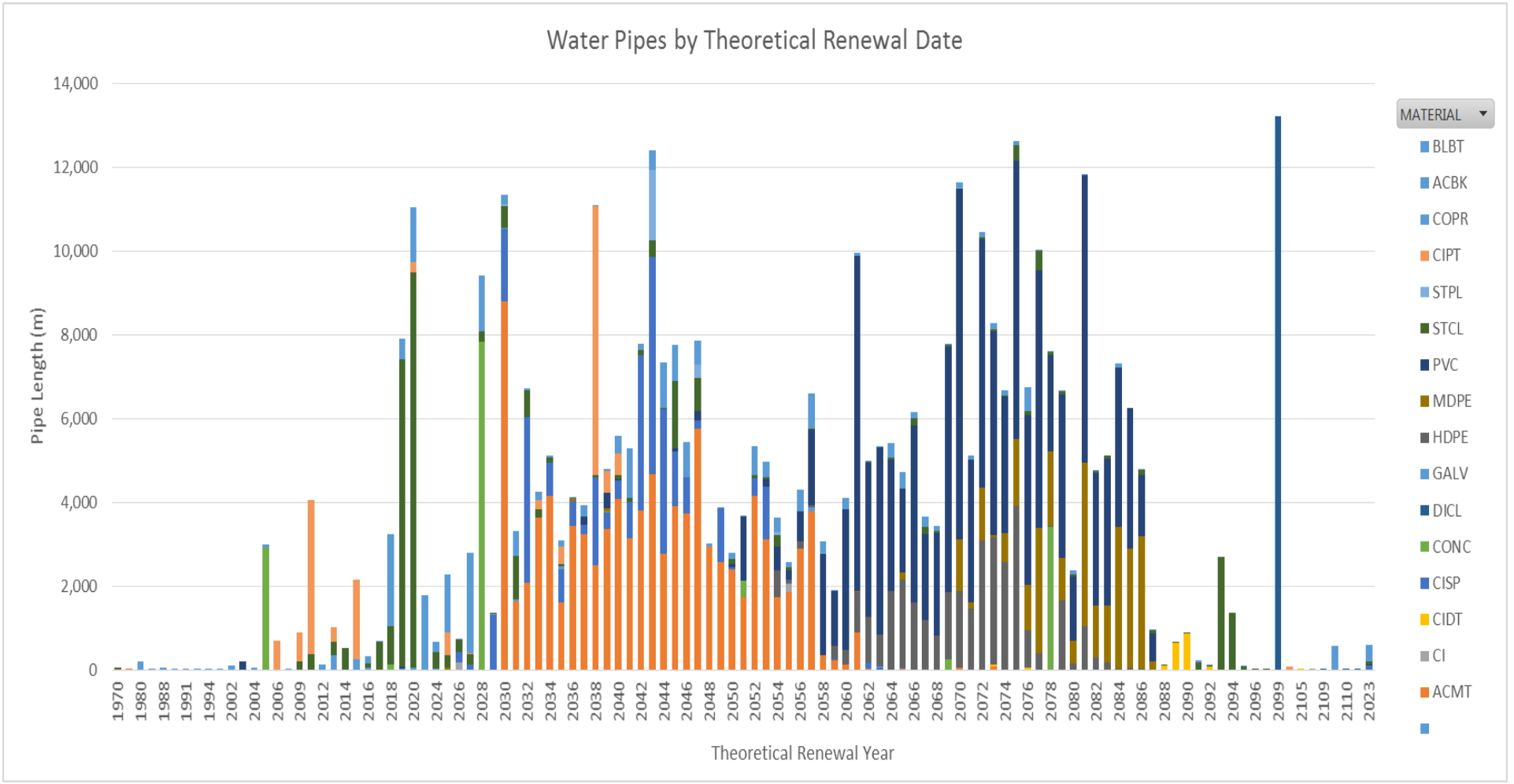


Figure ES-7: Theoretical Renewal Year / Material Distribution



vii. Risk management plan

Nelson City Council is committed to using risk management principles and techniques to understand and appropriately manage all internal and external factors and influences which affect the achievement of its objectives. Doing this will:

- Provide a reliable basis for sound decision making
- Increase the likelihood of achieving objectives
- Provide an agreed basis for prudent risk taking
- Enable the organisation to understand the level of risk associated with each decision as well as the Council's aggregate exposure to risk
- Improve accountability and assurance of control
- Enable the Council to avoid threats and seize opportunities
- Foster an organisational culture based on reasonable foresight and responsible hindsight.

The Council's standardised risk assessment method explicitly follows the process part (section 5) of AS/NZS 31000:2009.

Risk analysis involves consideration of the sources of risk, their consequences and the likelihood that those consequences may occur.

The following consequences are considered:

- Safety
- Health
- Asset performance/Service Delivery
- Environmental/Historical/Cultural
- Financial
- Political/Community/Reputational
- Relationship with Iwi
- Legal compliance
- Information/Decision support

Consequences of an event are rated 1 - 5 (Insignificant to Extreme). Likelihood is then rated 1 – 5 (Rare to Almost certain) to calculate a risk level rated 1 – 5 (Very Low to Very High).

The objective of risk analysis is to separate the low impact risks from the major impact risks, and to provide data to assist in the evaluation and treatment of the risks.

The specific objectives that guide the Water supply risk analysis are taken from the Water supply levels of service:

- Quality – good quality water
- Quality – Acceptable water pressure
- Reliability – a reliable supply of water
- Health and Safety – adequate flows of water

- Customer service – a prompt response to reported network issues
- A network that protects the natural environment

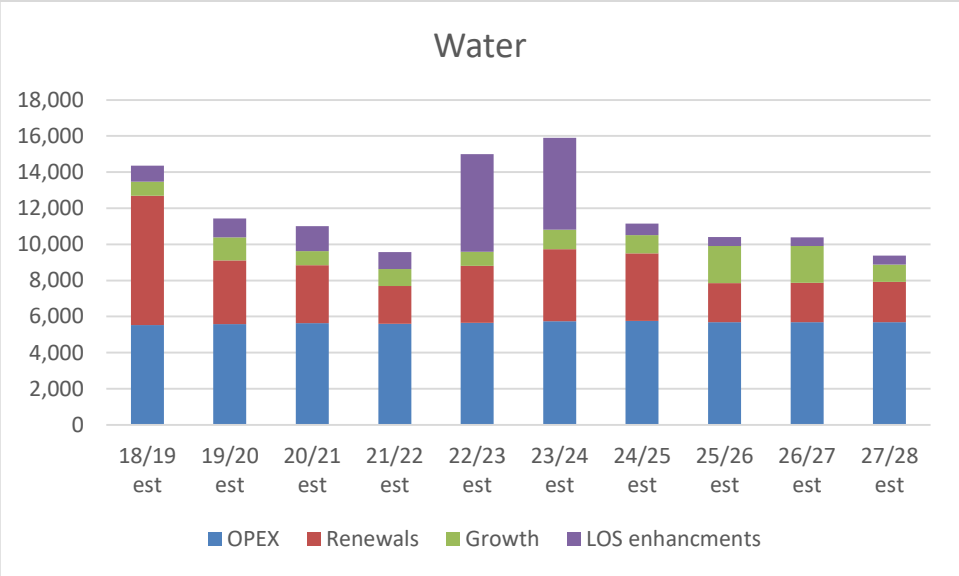
As noted in the priority section, uncertainty around possible future LOS changes (eg Freshwater NPS) and the risk-based decision framework feature in this area.

viii. Financial summary

Water Expenditure

The following graph charts the proposed expenditure for the next ten years.

Figure ES-8: Water proposed expenditure to 2027/28



Expenditure for the water supply activity varies over the term of the plan. Renewals expenditure is high in 2018/19 with the renewal of the last two trains of membranes. The slight spike in year 2022/23 and 2023/24 relates to two larger construction projects (Atawhai storage reservoir and Maitai Dam aeration) coinciding in the same years.

Table ES-5: Water Expenditure Years 1-10 of the 2018/28 Long Term Plan

Account	2018/19 LTP Final Uninflated	2019/20 LTP Final Uninflated	2020/21 LTP Final Uninflated	2021/22 LTP Final Uninflated	2022/23 LTP Final Uninflated	2023/24 LTP Final Uninflated	2024/25 LTP Final Uninflated	2025/26 LTP Final Uninflated	2026/27 LTP Final Uninflated	2027/28 LTP Final Uninflated
7005 Water Supply	**14,351.2**	**11,437.5**	**11,000.5**	**9,567.7**	**14,991.7**	**15,898.1**	**11,142.9**	**10,404.2**	**10,393.4**	**9,372.1**
Expenses	**5,530.6**	**5,584.7**	**5,641.6**	**5,606.9**	**5,655.1**	**5,744.7**	**5,760.6**	**5,691.8**	**5,698.1**	**5,686.8**
Base Expenditure	3,299.0	3,378.0	3,379.2	3,480.2	3,541.4	3,505.3	3,569.4	3,618.1	3,599.4	3,588.1
Unprogrammed Expenses	1,925.0	1,950.0	1,950.0	1,950.0	1,950.0	1,950.0	1,900.0	1,900.0	1,900.0	1,850.0
Programmed Expenses	306.6	256.7	312.4	176.7	163.7	289.4	291.2	173.7	198.7	248.7
Capital Expenditure	**8,820.6**	**5,852.8**	**5,358.9**	**3,960.9**	**9,336.6**	**10,153.3**	**5,382.3**	**4,712.4**	**4,695.3**	**3,685.3**
Renewals	7,164.2	3,519.0	3,208.5	2,087.3	3,149.9	3,986.4	3,736.4	2,164.9	2,164.9	2,234.9
Capital Growth	778.0	1,278.0	778.0	940.2	778.0	1,090.2	1,010.2	2,060.2	2,043.0	963.0
700576152801. NCC - TDC Link	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	20.0
700576203165. water pump stations - upgrades	0.0	0.0	0.0	0.0	0.0	100.0	20.0	20.0	1,000.0	0.0
700576302809. Water Treatment Plant Upgrades	0.0	0.0	0.0	0.0	0.0	162.2	162.2	162.2	165.0	165.0
700576502313. Capital: Atawhai Res & pump Ma	0.0	0.0	0.0	162.2	0.0	0.0	0.0	0.0	0.0	0.0
700576503231. Ngawhatu Valley high level reservoir	0.0	0.0	0.0	0.0	0.0	50.0	50.0	1,000.0	0.0	0.0
70057691. Vested Assets	778.0	778.0	778.0	778.0	778.0	778.0	778.0	778.0	778.0	778.0
700576913164. Suffolk Road (Saxton to Ngawhatu) water upgrade	0.0	150.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
700576913166. Suffolk Road to Hill Street Trunk water main	0.0	350.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Capital Increased LOS	878.4	1,055.9	1,372.4	933.5	5,408.7	5,076.8	635.8	487.4	487.4	487.4
700579151058. Capital: Pressure Reduction	54.1	0.0	54.1	0.0	54.1	0.0	54.1	0.0	55.0	0.0
700579151064. Capital: Ridermains	167.6	167.6	167.6	59.5	59.5	59.5	59.5	59.5	59.5	59.5
700579151081. System Improvements	64.9	64.9	64.9	54.1	0.0	54.1	0.0	55.0	0.0	55.0
700579151168. Capital: Backflow Prevention	162.2	162.2	162.2	162.2	162.2	162.2	162.2	162.2	162.2	162.2
700579152140. Capital: Atawhai Trunkmain	10.0	44.1	54.1	102.7	1,800.0	1,800.0	0.0	0.0	0.0	0.0
700579152800. Pressure Enhancement	0.0	62.2	108.1	100.0	0.0	0.0	0.0	0.0	0.0	0.0
700579162131. Fire Flow Upgrades	0.0	0.0	0.0	0.0	25.0	25.0	25.0	0.0	0.0	0.0
700579162802. DMA establishment	50.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
700579162803. Water Loss Reduction Programme	216.3	216.2	216.2	216.2	216.2	216.2	216.2	100.0	100.0	100.0
700579162807. Natural Hazards Risk Remediation	58.1	108.1	108.1	50.0	0.0	0.0	0.0	0.0	0.0	0.0
700579501180. Other Sundry: Maitai Planting	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8
700579502314. Capital: Atawhai No.2 Reservoi	50.0	50.0	300.2	50.0	1,081.0	2,702.5	0.0	0.0	0.0	0.0
700579502810. Dam Upgrades	50.0	100.0	100.0	108.1	2,000.0	108.1	108.1	0.0	0.0	0.0
700579503142. Maitai Pipeline Hazard mitigation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	100.0

700579903259. Water supply H&S risk mitigation programme	10.0	20.0	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0
70057997. LoS: investigation, options, testing, engagement	-25.6	0.0	-43.7	0.0	0.0	-61.4	0.0	0.0	0.0	0.0

ix. Asset management practices

Information systems

All asset information is stored on Arcinfo (a computer based geographical information system) and Infor Asset Management System.

The Council has a number of information systems (Infor, InTouch, Network Model, and closed circuit television archive) that are not integrated. The ongoing integration of these systems will assist in the optimisation of operations, renewals and the ongoing development of the stormwater activity.

Accounting and Financial Systems

The Nelson City Council uses integrated computer software supplied by MagiQ

Geographical Information System

Data captured is required to be accurate to within a tolerance of +/- 0.3m. In inaccessible areas, it is not considered economic to search for buried fittings and the best estimated position has been entered with the accuracy limitation flagged. Procedures are in place to update new data into the Geographical information system on a monthly basis via Nelson City Council engineering staff.

Data on assets associated with renewal and upgrade capital are now updated into the asset register by Nelson City Council Engineering and Finance staff. This ensures a high level of reliability.

Modelling

Infoworks v.8 is populated from the Geographical Information System. The Network Model is used to calculate fire hydrant flows, verify design pipe sizes for new works and check the capacity of the system to cope with future development.

SCADA Telemetry

Council has a "Kingfisher" SCADA (Supervisory Control and Data Acquisition) system and an "Intouch" system at the base station. The system is used to monitor and control critical aspects of the network such as the dams, treatment plant, reservoirs, pumps and control valves.

Asset management Recording System – Infor

The use of the Infor system has enabled the following:

- Customer enquiries being logged directly and sent immediately to the contractor for action.
- Contractor directly enters resolution confirmation at completion of job.
- Tracking of expenditure on assets to allow assets that have a disproportionately high maintenance cost to be identified - upgrade or renewal can then be prioritised.

x. Monitoring and improvement programme

The Nelson City Council water supply Asset Management Plan is a regularly revised and evolving document and will be reviewed annually and updated at least every three years to coincide with the Annual and Long Term Plans and to incorporate improved decision making techniques, updated asset information, and Nelson City Council policy changes that may impact on the levels of service.

The Asset Management Plan will be improved throughout its life cycle as further information about the water supply assets are collected in terms of condition, performance and service delivery. Nelson City Council is committed to advanced data collection and management systems that will allow for a greater appreciation of the performance and condition of the Nelson City Council assets.

Nelson City Council will report variations in the adopted annual plan budgets against the original asset management plan forecasts and explain the level of service implications of budget variations.

Internal Audit

Internal audits will be taken every three years to assess the effectiveness of the plan in achieving its objectives. The internal audit will also assess the adequacy of the asset management processes, systems and data.

Statutory Audit

The Local Government Act requires that an independent, annual audit of the operations of the Nelson City Council be carried out.

Benchmarking (trending) of the activity through Audit NZ, Local Government NZ and Water NZ benchmarking initiatives is carried out at the request of these organisations to give increased understanding of:

- The efficiency and efficiency variations of individual activities.
- Effects of any programmes instigated by the Asset Management Plan.
- Operating costs over range of individual activities.

Examples of types of benchmarking that are to be considered include tracking progress, responsiveness to service calls, operation costs i.e. $/m/year and energy costs. As data is obtained and implications understood the benchmarking can be used for additional or revised Levels of Service and can be incorporated into a graphical display.

In 2014 Nelson City Council participated in a Local Government New Zealand benchmarking exercise for water based utilities.

The effectiveness of the Asset Management plan will be monitored by the following procedures:

- Financial expenditure projections prior to year end
- Resource consent monitoring as required by consents
- Operations and Maintenance reports on a monthly basis
- The ongoing updating of the asset register of the pipe assets when repairs are carried out and the attributes are compared with the asset register attributes

Table ES-6: Improvement Programme

Improvement Programme
Develop Contamination Response Plan
Establish Condition Model for asbestos cement pipe and cast-iron pipe
Maitai Dam comprehensive Safety Review
Routinely calibrate the accuracy of the Network Analysis so that accurate predictions are provided

Improvement Programme
Improve reporting on levels of service, particularly those that are based on Council service requests and work orders to contractors. Resolve issues with how the information is recorded and recovered.
Review asset lives using NAMs– NZ Infrastructure Asset Valuation and Depreciation Guidelines
Improve accuracy of condition assessments.
Continue the water loss identification and reduction programme
Review the lifelines risk assessment and response
Continue investigations into dis-coloured water issues

1. Introduction

1.1. Background

Historically, the Nelson City Council has been the predominant water provider to the residents of Nelson. Over the last 25 years the Nelson City Water Supply has been significantly improved from a basic supply with a Ministry of Health water supply grading of Ed (Unacceptable level of risk for source/treatment, Unsatisfactory Level of risk) for distribution to a modern system with a grading of Ab (Completely satisfactory – extremely low level of risk, Satisfactory – very low level of risk).

Source

The existing Maitai and Roding sources can provide sufficient water to meet the City's needs in a 1 in 60 year drought for the foreseeable future. By provision of a rubber weir on top of the Maitai Dam spillway the water storage can be increased by 350,000m3, equivalent to 20 years demand growth at current levels. Future wider demand strategies will enable the existing supply to be adequate until into the 22nd Century for current projected population increases. Sufficient water of high quality is therefore available for urban supply for the foreseeable future.

As part of the replacement resource consents for the Nelson water supply from the Maitai and Roding Rivers Council commissioned an update of the 2007 OPUS drought study report. WSP-OPUS prepared a number of reports looking at a range of demand scenarios for the city out to 2100. The reports conclude that under most demand scenarios the Maitai Dam will provide sufficient drought security for the city in the medium-long term.

Maitai Pipeline

The Maitai pipeline between the Maitai Dam and the Water Treatment Plant transports the majority of the water used in the City. It has numerous small shrinkage cracks and is vulnerable to slips from above and below the pipeline.

Current demand projections show that the Maitai pipeline has sufficient capacity to supply the City (in conjunction with the Roding pipeline and foothills link) through a 1 in 60 year drought until at least 2100. The Maitai pipeline has been identified as the highest risk asset and is a "Lifeline" for the city. Council subsequently resolved that the Maitai pipeline between the dam and the Water Treatment Plant be replaced with a new main down the Maitai Valley Road, but that the existing pipeline be kept in use to reduce pumping costs, for as long as it is viable to do so.

Trunk Mains and Reservoirs

With increasing development, demand is spreading north and south beyond the current trunk main system. Typically demand is spread over a 16 hour period, whereas water treatment plants and trunk mains function most effectively with demand spread over 24 hours. Also, in times of emergency water should be available in the locality it is needed.

A network of trunk mains and reservoirs is therefore necessary to transport and store water overnight so that peak demand during the day can be met from instantaneous flow and local storage.

Additional trunk mains and reservoirs are therefore proposed to cope with demand from growth.

Reticulation Condition

The reticulation system has to reliably transport the required volumes of water from the trunk mains and reservoirs to the consumers, at sufficient pressure while maintaining quality.

Ongoing condition assessment of the reticulation network is therefore necessary, and timely proactive refurbishment or renewal of the pipes and fittings is proposed.

Backflow Prevention

The protection of the quality of the water supplied to customers is a vital responsibility of any water supply authority. While the quality of the water entering the system is known, chemical or microbiological contamination can occur in some circumstances from water re-entering the system from consumer's premises.

Increased emphasis has been placed on Risk Management by the Ministry of Health in recent years. The 2007 amendments to the Health Act require that water suppliers prepare Public Health Risk Management Plans for their systems, and include the management of risk from backflow.

The Nelson City Council Public Health Risk Management Plan (now named Water Safety Plan under the 2013 amendment to the Health Act 1956) was first completed and approved by the Ministry of Health in 2012. The Water Safety Plan is renewed and approved every five years. The most current version of Nelson City Council's Water Safety Plan was approved in 2017. This plan references the proposal to install backflow prevention devices on all commercial/industrial activities by 2030.

Any new commercial/industrial connections are required to have backflow prevention devices installed at the time of the water supply connection. These backflow prevention devices are to be maintained by the property owner.

Nelson City Council's backflow prevention programme will install backflow prevention devices on all commercial/industrial connections that do not currently have them. As of July 2017 there were approximately 1,300 connections requiring installation of backflow prevention devices. Each connection is assessed based on the property use with high risk connections being targeted first. Backflow prevention devices are also being installed concurrently with the commercial water renewal programme. Approximately 120 backflow prevention devices are installed each year. At this rate the backflow prevention programme will meet its target of completion by 2030. Nelson City Council retains ownership of all backflow preventers installed under this programme and will carry out annual tests and any required maintenance indefinitely.

Table 1-1: Backflow Prevention Programme

Priority Rating		Backflow Prevention Devices required as at 2012	Backflow Prevention Devices required as at July 2017	July 2017 - Feb 2018 progress	Remaining
High	e.g. hospitals, mortuaries, chemical plants, laboratories, cooling towers, hairdressing salons, public swimming pools,	695	519	9	510

	food processing and other manufacturing plants,				
Medium	e.g. irrigation systems, drink dispensers with carbonators, commercial laundries and rainwater tanks connected to internal plumbing	676	490	41	449
Low	e.g. properties that could cause a nuisance by colour, odour, or taste but do not endanger health.	395	291	23	268
	TOTAL:	1766	1300	73	1227

Critical Assets

Critical Assets are defined in the Asset Management Plan as assets that are essential to providing a water supply in times of emergency (albeit at a reduced level of service), or have an unacceptable consequence in event of failure.

Critical assets have been identified as:

- Headworks including dams and intakes
- Raw water trunk mains
- Raw water pump stations
- Water Treatment Plant including Clearwater Reservoir
- Treated water trunk mains
- Treated water pump stations

Reservoirs

With these assets operating, treated water will be available in each suburb for distribution by water tanker or personal collection and by watermain as damaged reticulation is repaired and brought back into service.

Water Supply Compliance

The Nelson City Council supply is assessed by the Ministry of Health on an annual basis for compliance with the drinking water standards.

1.1.1. Purpose of the plan

The Goal of the Water Supply Activity is to provide a water supply to Nelson City that is capable of abstracting, treating and distributing potable water in an efficient, safe, reliable and sustainable way whilst ensuring that the ecological, recreational and cultural interests of the community in the water sources are recognised and enhanced.

The purpose of this Water Supply Asset Management Plan is to support the goal of the water activity by ensuring that assets are operated and maintained to provide the

required level of service and to meet community outcomes for present and future customers in a sustainable and cost effective manner.

The content of the Asset Management Plan further supports the purpose by:

- Demonstrating responsible, sustainable management and operation of water assets which represent a significant, strategic and valuable asset belonging to Nelson City.
- Justify funding requirements.
- Demonstrating regulatory compliance under Section 94(1) of the Local Government Act 2002 which in summary requires the Long Term Council Community Plan to be supported by:
    - *Quality information and assumptions underlying forecast information.*
    - *Framework for forecast information and performance measures are appropriate to assess meaningful levels of service.*
- Demonstrating clear linkage to community agreed outcomes with stated levels of service.

The contribution of water services to the Community Outcomes and Asset Management objectives will be seen through:

- Meaningful stakeholder consultation to establish service standards.
- Implementing a programme of inspections and monitoring of the network to assess asset condition and performance.
- Undertaking a risk based approach to identify operational, maintenance, renewal and capital development needs, and applying multi-criteria analysis techniques to select the most cost effective and sustainable work programme.
- Ensuring services are delivered at the right price and quality.
- Achieving the appropriate level and quality of asset management practice.
- Continuing programme of capital works.
- Futureproofing and resilience

The overall objective of Asset Management planning is to:

Meet a required level of service, in the most cost effective manner, through the management of assets for present and future customers.

This plan will provide the substantiation for budget forecasts put forward in the Long Term Plan (2018-2028) for water supply.

1.1.2. Relationship with other planning documents

Infrastructure Strategy

In 2014 the Local Government Act 2002 was amended to include section 101B - a requirement for local authorities to prepare an infrastructure strategy as part of the Long Term Plan. The strategy is expected to look at least thirty years into the future and detail the issues that the local authority can reasonably foresee. The office of the Auditor General has provided guidance documents for authorities to use when developing the strategy. The National Policy Statement – Urban Development Capacity impacts on the Infrastructure Strategy. It requires local authorities to ensure there is

sufficient development capacity to meet demand in the short, medium, and long term (10 – 30 years) with projects required to be identified.

Much of the work required for the strategy comes from the development of this asset management plan and in order to avoid un-necessary duplication this plan focusses on the first ten years of the thirty year strategy timeframe.

Proposed Whakamahere Whakatū Nelson Plan

The Nelson City water supply is a run-of-river supply and is the largest abstractor of water from the Maitai and Roding Rivers. Resource consents are required for most of the activities that are necessary to operate the water supply. The proposed Whakamahere Whakatū Nelson Plan is currently being developed by the Nelson City Council as the replacement for the Nelson Resource Management Plan. While the impact of the plan on the operation of the water network will become clearer as the proposed plan rules are developed it is expected that there will be an increased emphasis on water quality as the proposed plan responds to the National Policy Statement for Fresh Water Management. Any future water activities will need to meet the requirements of the proposed Whakamahere Whakatū Nelson Plan when it becomes operative, with cost implications identified in future asset management plans as they become obvious. The proposed plan will also include Council's response to the requirements of the NZ Coastal Policy Statement and the National Policy Statement Urban Development Capacity.

Current Nelson Resource Management Plan

The Nelson Resource Management Plan (NRMP) is the operative plan established under the Resource Management Act 1991. The NRMP is a regulatory document that covers both district and regional activities. Council seeks to operate the current network in compliance with this document. To that end Council holds a range of resource consents for site specific activities including the abstraction of water from the Maitai and Roding rivers and structures in the rivers.

Environmental Activity & Asset Management Plans

Fresh water quality is a key component of the central government environmental programme for New Zealand. The National Policy Statement for Fresh Water Management is expected to halt the decline in fresh water quality and lead communities to the point of actively improving it.

Council's investigations of water quality show very good results in upper catchments where undisturbed native bush predominates and lesser quality through farm/forestry areas and urban sections of the catchment.

Freshwater quality improvements will be maximised where the source of the negative impacts can be addressed rather than the community relying on 'end of pipe' treatment techniques.

Where water supply activity works involving streams and rivers are undertaken by Council, environmental protection is considered in the design and resource consent process. Future emphasis is expected in the following areas:

- Stream waterway environmental enhancement from the south branch intake downstream to the earlier North Branch fork e.g. natural gravel management in beds where practicable, protection of natural river banks, river bank shade through vegetation, protection of fish spawning areas, protection of natural 'pool and riffle' stream bed form, natural meanders where possible, free of manufactured obstructions that impede fish passage where practicable.

- Trap and Transfer programmes to ensure fish are assisted past the larger Maitai and Roding dams where obstructions cannot be remedied.
- Improved quality of water discharged to the Maitai River from the Maitai Dam reservoir.

Among the activities that improve water quality are the following:

- various riparian planting initiatives under this asset management plan and the environment activity plan.
- freshwater and sediment contaminant monitoring.
- controls on storage and use of hazardous materials under the current and proposed resource management plans and;
- the establishment of re-forestation areas under the reserves asset management plan.

Community Engagement – Environmental Activity

Council funds a variety of non-regulatory environmental programmes which contribute to environmental enhancement of freshwater and coastal areas, and encourage the community to play their part in improving freshwater. Programmes include Nelson Nature; Healthy Streams; Rainwater Harvesting; Only Rain Down Drains; Riparian Planting; water conservation education; citizen science stream monitoring; advocacy for consumer options such as copper free brake pads and zinc free roofing materials; and behaviour change programmes related to littering, disposal of dog poo, car-washing and fly tipping behaviours.

Long Term Plan 2018-28

This asset management plan supports Council in the development of the Long Term Plan 2018-28 by providing the substantiation for budget forecasts put forward in the Draft Long Term Plan for water supply. As the AMP presents the recommendations of the authors for the future operations, maintenance and capital works necessary to meet the levels of service of the utility the Long Term Plan consultation is the means for the community and Council to provide direction on priorities and affordability for the next ten years.

Annual Plan

On an annual basis Council reviews the work programme and budgets for the following year and when changes are required Council will prepare an Annual Plan for public submissions. The Proposed Annual Plan is measured against the current AMP work programme and priorities before being adopted.

Future Development Strategy

In response to the National Policy Statement on Urban Development Capacity Nelson City and Tasman District Council (TDC) are both developing strategies for accommodating projected growth in population and households, as well as the attendant business and other demands this growth will bring. The impact on water volume and quality for these future growth areas is one of the key focus areas for this asset management plan.

Land Development Manual

The Land Development Manual 2010 is the document that sets out Council's engineering requirements for developments under the Nelson Resource Management Plan and is the basis of Council's requirements as a network utility operator under the

Building Act 2004. A review of the Land Development Manual 2010 is currently underway. The proposed new manual is being developed jointly with Tasman District Council and community stakeholders. As a document that is referenced in the Proposed Whakamahere Whakatū Nelson Plan it will be subject to a public notification and submission process.

1.1.3. Infrastructure assets included in the plan

Asset description

The assets covered are from the source water intakes in the water catchments to the point of supply at individual customers' boundaries. This includes dams, intake structures and screens, control equipment, the Water Treatment Plant, tunnels, trunk mains, secondary mains, rider mains, services, valves, hydrants, non-return valves, pressure reducing valves, pumps, reservoirs, and water meters.

The extent of the Nelson City Council water system is detailed in Figure 1-1 below and discussed in detail in the Lifecycle management section.

The inventory of public water services assets owned by Nelson City Council and managed by the Infrastructure division as at June 2016 is shown in Table 1-2. This indicates the extent of the water service and reflects the significant investment within the community.

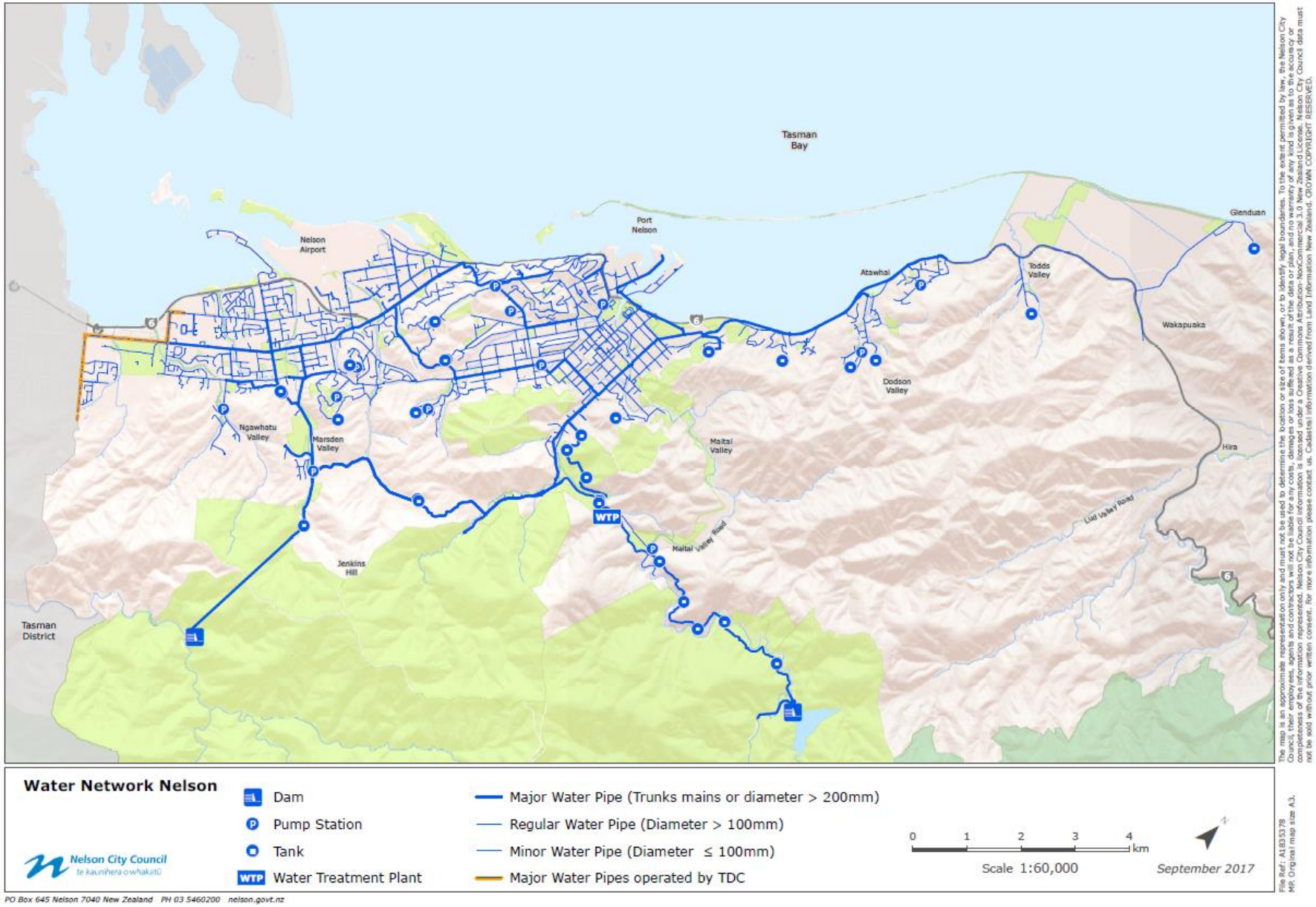
Table 1-2: Summary of Water Services Assets (June 2016)

Asset Category	Quantity	
	km	units
Reticulation	333.8km	
Trunk Mains	45.6km	
Maitai Pipelines	16.3km	
Roding Pipeline	3.9km	
Maitai Water Supply Scheme		1
Roding Dam		1
Treatment Plant		1
Tunnels[2]		3
Reservoirs and Tanks		36
Pump Stations		13
Pressure Reducing / Control Valves		40
Air & Non Return Valves		165
Gate Valves		3,634
Manholes		91
Hydrants		2,559
Meters		20,829

[2] Roding, WTP and Maitai Dam

Asset Category	Quantity	
	km	units
Customer Connections		20,260

Figure 1-1: Water Network Nelson



Water sources

Nelson City Council abstracts water from the Roding, Maitai South Branch and Maitai North Branch Rivers for supply to the urban areas of the City. The water is coarse screened at the intakes and conveyed by raw water trunk mains to the Water Treatment Plant at Tantragee Saddle which was commissioned in August 2004. Supply to the lower levels of Stoke and Tahunanui is available in an emergency from Tasman District Council.

Area covered

The Nelson City water supply area extends to Saxton Field in the south. (The Wakatu Industrial Estate, the north side of Champion Road, Hill Street North, Alliance Group and ENZA Foods, are within Nelson City, but are supplied by Tasman District Council).

In the north the area extends to Todds Valley, The Glen and Hillwood on the Wakapuaka side of the Gentle Annie Hill.

Properties in Marsden Valley, the Maitai motorcamp and a few of the adjacent houses in the Maitai Valley are also supplied.

A population of approximately 45,000 is served by the Nelson City Council reticulated water supply. There are approximately 18,000 residential connections and 2,000 commercial/industrial connections.

1.1.4. Key partners and stakeholders in the plan

The plan recognises the following external and internal key partners and stake holders:

Table 1-3: Key Partners and Stake Holders

Key Partners and Stakeholders	Main Interests
Key Partners	
Tangata Whenua comprising of regional iwi	Environment, cultural heritage
External Stakeholders	
Residents and ratepayers	Public health and safety, service reliability, environment, cost
Industrial and commercial users	Public health and safety, service reliability, environment, cost
Nelson Marlborough District Health Board	Public health and safety, environment
Nelson City Council (unitary authority)	Environment
Tasman District Council	Service provider
Government agencies (MoH, MfE, Audit NZ)	Public health and safety, service reliability, environment, cost
Consultants, Contractors and suppliers	Procurement, technical, projects/programmes
New Zealand Fire Service	Urban and rural fire fighting
Internal Stakeholders	
Councillors and Sub-committees	Public health and safety, service reliability, environment, cost
Staff	Public health and safety, service reliability, environment, cost

Integrating supply with Tasman District Council

Historically Nelson City and Tasman District have linked water supplies with Tasman District supplying a small section of the southern part of Nelson City as well as the Wakatu Industrial Estate. Nelson City supplies Richmond the lesser of 909m3 of water/day or 1/15 of the Roding authorised supply rate, arising from legislation covering the construction of the Roding Dam.

The Council has entered into an Engineering Services Agreement (2015) with Tasman District Council regarding the supply of Roding water to Richmond and the use of the Waimea Supply to serve the Wakatu Industrial Estate, and development off Champion Road and Hill Street North. The supply of water to ENZA and the Alliance Group processing plant is subject to individual contracts between the Tasman District Council and the customer that expire in June 2020.

This agreement combines the other cross boundary infrastructural service of sewer reticulation into one agreement with either party required to give a minimum of three years notice of intention not to renew the agreement.

Under this asset management plan consideration is given to investigating the supply of these areas by Nelson City should the agreement with Tasman District Council be terminated prematurely.

1.1.5. Organisation structure

Council has an activity based structure with operations, maintenance and asset management functions for water supply assets provided by a separate operations and asset management team. Capital projects are managed by specialist project managers in a separate service delivery team.

The day to day operations and maintenance of the network are carried out by an external contractor managed by the team leader – utilities.

Asset management functions are undertaken by separate asset engineers.

1.2. Goals and objectives of asset ownership

1.2.1. Reasons and justification for asset ownership

Council is responsible for the provision of reticulation, treatment and supply along with strategic planning and management functions.

Council also has a role in regulation and enforcement of the existing legislative and regulatory framework (including bylaws) to ensure members of the community act appropriately.

History of Nelson City Council Water Supply

The Nelson City Council and its forebears have been responsible for water supply in the City since the initial Brook Scheme was constructed in 1874. The following are the key milestone events:

- The Roding supply was introduced in 1940.
- The Maitai scheme was commissioned in the early 1960s with a river intake
- The Maitai Dam was completed in 1987
- Subsequently the Brook system was decommissioned in 2000
- The Water Treatment Plant at Tantragee Saddle was commissioned in 2004.

The City has expanded by amalgamation of adjoining areas:

- Tahuna Town Board joined to the City in 1950.
- Stoke was transferred from Waimea County Council in 1958
- Atawhai in 1968
- Wakapuaka and Stoke Rural in 1989
- Subsequently the Glen reticulation was connected in 1991.

Historically the Nelson City Council has been the predominant water provider to the residents of Nelson. The Council's authority to undertake water supply is contained in Section 12 of the Local Government Act 2002. Under Section 25 of the Health Act 1956, the Minister of Health may require a Council to provide sanitary services, which includes waterworks. Although it is discretionary whether or not it provides water, the Council has a long term commitment to carry out this activity.

Nelson City Council does not operate separate rating areas for its water supply zones as they are essentially operated as one large zone.

The role of Council in the water activity is influenced by the following legislative requirements.

The Local Government Act:

The Local Government Act 1974: Provides the authority for Nelson City Council to construct, operate and maintain the Wastewater, Water and Stormwater System.

The Local Government Act 2002: Defines the purpose of local authorities as enabling local decision-making by and on behalf of the community. The Nelson City Council is a local authority established under the Local Government Act 2002 (the Act) with purpose and responsibilities set out in the Act, in particular 10(1)(b), 10(2) and 14(1)(h).

The Health Act 1956:

Places an obligation on Council to improve, promote and protect public health within the District. The provision of water services helps to promote and improve public health.

This Asset Management Plan is written on the basis that water supply is an ongoing core responsibility of Council.

1.2.2. Links to organisation vision, mission, goals and objectives

Vision

Nelson is the Smart Little City

Mission statement

We leverage our resources to shape an exceptional place to live, work and play

Community outcomes

Councils are required by the Local Government Act 2002 to have Community Outcomes – a statement of the measures of success that Council is working to achieve for the community. Council has eight current community outcomes in the Long Term Plan 2018-2028 that are summarised below.

- Our unique natural environment is healthy and protected
- Our urban and rural environments are people-friendly, well planned and sustainably managed

- Our infrastructure is efficient, cost effective and meets current and future needs
- Our region is supported by an innovative and sustainable economy
- Our communities are healthy, safe, inclusive and resilient
- Our communities have opportunities to celebrate and explore their heritage, identity and creativity
- Our communities have access to a range of social, educational and recreational facilities and activities
- Our Council provides leadership and fosters partnerships, a regional perspective, and community engagement

Of these eight, four have direct links with the water supply activity and are discussed in more detail in section 2.2.

Nelson City Council Arts Strategy

Where opportunities present themselves, consideration will be given to the incorporation of artwork in the water network.

1.2.3. Plan framework and key elements

The framework of the Water Asset Management Plan 2018-28 follows the generic layout identified in section 4.2 of the International Infrastructure Management Manual 2015.

The plan has the following key elements:

- Why we need a plan (Introduction)
- What we provide (Levels of service)
- Planning for the future (Future demand)
- How we provide the service (Lifecycle management)
- Dealing with uncertainty (Risk management plan)
- What it will cost and how we pay for it (Financial summary)
- What we're doing to improve (Plan improvement and monitoring)

1.3. AM Maturity

Asset Management is recognised as a critical component of Infrastructure Management globally and this sector has benefited from initiatives to formalise the practice of asset management since November 1996. The Association of Local Government Engineering New Zealand (Inc) and the Institute of Public Works Engineering of Australia have lead the development of the International Infrastructure Management Manual (IIMM) that forms the basis of Infrastructure Asset Management Practices at Nelson City Council.

The IIMM provides an AM Maturity Index. The Nelson City Council Asset Management Policy sets the level of maturity per activity. Refer to the Plan Improvement and Monitoring – Status of AM Practices section of this plan for details about this activity's current maturity status and target levels of maturity.

2. Levels of service

Asset Management Plans set out the level of service Council seeks to provide the community for the respective activity.

Levels of service are the standards Council aims to meet when providing a facility or service in support of community outcomes. They are the measurable effect or result of a Council service, described in terms of quality, quantity, reliability, timelines, cost or similar variables.

It should be noted that LOS are not intended as a formal customer contract, rather, Council's responsibility is initially to aim to achieve these levels and then to achieve them more cost effectively through a process of improvement where it can be met within current budgets.

The levels of service provision for the water supply activity, the current performance and the performance measures and targets by which these will be assessed are defined in this section.

This section also contains information on customer research undertaken, strategic and corporate goals and the legislative requirements adhered to in arriving at the levels of service.

Changes to the levels of service may significantly change funding requirements in some instances.

Performance measures that are included in the Long Term Plan are reported on annually, through the Annual Report.

Council uses the Significance and Engagement Policy to determine the level of engagement required for a particular issue e.g. levels of service change.

Service Level Expectations and Affordability

The levels of service set in this asset management plan are subject to change as legislation changes. The community can also request increases above the minimum levels as long as there is a willingness to fund the financial implications.

2.1. Customer research and expectations

Background

While the Long Term Plan consultation process incorporates the Levels of Service associated with the water supply activity, Nelson City Council has also undertaken a range of consultation processes in the past specifically targeted at gathering information on preferred levels of service or the extent of infrastructure that Council has/will be required to install. The extent of the historical and additional proposed consultation is detailed in Table 2-1 below.

Table 2-1: Water Supply Consultation Processes

Consultation Processes	Date	Reasons for Consultation	Extent of Consultation	Applicable to Which Customer Value
Historical				
Water and Sanitary Services Assessments	2005	To meet sanitary services assessment criteria of Local Government Act 2002	Consultation via the Long Term Council Community Plan for acceptance of the original assessment. Consultation with Medical officer of Health and local iwi and the community for any future review.	Reliability Capacity
Residents Survey	Most years since 1998	Rate satisfaction with services	300 - 400 residents surveyed by telephone	N/A

Consultation Processes	Date	Reasons for Consultation	Extent of Consultation	Applicable to Which Customer Value
		provided by Council		
Water abstraction and structures resource consents for the Maitai and Roding Rivers	2004	Expiry of existing consents	Maitai consent was publicly advertised.	Sustainability
Water Supply Bylaw	2014	Legislative requirement criteria of LGA 2002	Public, business and industry submissions requested. Advertising in local papers. Submissions heard and considered	Sustainability Capacity
Long Term Plan process	Every 3 years	Legislative requirement criteria of Local Government Act 2002	Public, business and Industry submissions requested. Advertising in local papers	Sustainability Reliability Capacity Responsiveness
Annual Plan process	Each year that changes to the Long Term Plan are proposed	Legislative requirement criteria of Local Government Act 2002.	Public, business and Industry submissions requested. Advertising in local papers.	Sustainability Reliability Capacity Responsiveness

Water and Sanitary Services Assessments

The aim of the Water and Sanitary Services Assessments is to enable the Council to gain an overview of the Water and Sanitary Services within its district to help plan and prioritise for any improved level of service and to consider its obligations as a Unitary Authority.

Resource Consents

For the water supply activity Council is required to obtain consents under the Resource Management Act for the abstraction of water and the continued operation and maintenance of structures. These consents set the legal minimum level of service for values such as volumes of water that can be abstracted, minimum flows in the rivers and constraints on operations that impact the quality of the water flowing in the river. Where these applications are publicly notified the opportunity is given for any person to make a submission on the proposal.

Water Supply Bylaw

Council established the bylaw under the Local Government Act to provide a basis for the supply of water to the community and set out the regulatory response for infringements.

The bylaw is advertised using a special consultative process under section 86 of the Local Government Act 2002.

The current Bylaw came into effect 4 March 2015 and will be reviewed by December 2019.

Residents' Survey

The purpose of the Residents' Survey is to get statistically representative resident feedback on Council performance which is used to report on performance measures and identify areas for improvement.

Nelson City Council has been conducting annual surveys of residents since the late 1990s, covering a range of topics. Where possible, questions are repeated to enable comparisons over time. Council's current approach to annual residents' surveys is to run a long (20-minute) survey every three years, timed for the year before the Long Term Plan (LTP), for example, 2017. This allows a wider range of topics to be covered to inform LTP decision-making. In the intervening years, such as in 2016, shorter surveys (up to 10 minutes) are undertaken. These focus on collecting data to report on LTP performance measures and to inform Asset and Activity Management Plans.

2012 Residents' Survey

71% responding as satisfied or very satisfied with water supply.

2013 Residents' Survey

In May 2013 a residents' survey on behalf of the Nelson City Council was carried out. This survey was shortened from previous years and did not specifically seek feedback on the water supply activity.

2014 Residents' Survey

70% responding as satisfied or very satisfied.

Issues identified within water supply were: Quality, Taste, Price.

2015 Residents' Survey

A residents' survey was not carried out in 2015

2016 Residents' Survey

The 2016 residents' survey did not seek feedback on the water supply activity.

The 2017 Residents Survey

Water Supply: The level of satisfaction remains high at 72% satisfied or very satisfied. The three areas of greatest dissatisfaction are Dirty water/poor quality, Chlorine in the water and Taste of water.

Council has investigated dirty water/poor quality issues across the network. They are likely to result from iron pipe corrosion products in the network that are a legacy from the cast-iron and steel pipe sections used in the past. These issues will reduce over time as the network is renewed. In the interim Council will monitor these and continue to carry out regular flushing of the network and seek a means of cleaning the cast iron pipes without disrupting the generally good day to day supply.

Chlorine in the water is used to economically disinfect the water and make it safe to drink. Council has no plans to reduce the emphasis on safety in this area. In 2017 Central Government conducted an Inquiry into water quality issues following the 2016 campylobacteriosis outbreak in Havelock North. One of the Inquiry recommendations is to encourage/mandate treatment (chlorination) of water supplies.

Taste may be linked with the comments on chlorine or may also result from some sections in the reticulation that serve areas where demand is low and water can remain in the main for some time. Council carries out regular flushing of the areas we know about.

Conclusions from Residents' Surveys

Since 2012 the satisfaction level for water supply has remained consistent, rated 4th highest with respondent, with 70 – 72% responding as satisfied or very satisfied.

Quality, taste, and price have been identified as issues by residents.

Long Term Plan

Every three years Council sets out the proposed plans for the provision of services to the community for the next ten years. The long term plan covers the operation of the water supply activity including the reasons for undertaking the activity, levels of service, description of major projects, financial projections and any key risks that have been identified.

Annual Plan

When variations to the long term plan are proposed by Council the Local Government Act requires these be set out in an annual plan for public consultation.

2.2. Strategic and corporate goals

Nelson City Community Outcomes

Councils are required by the Local Government Act 2002 to have Community Outcomes - a statement of the measure of success that Council is working to achieve for the community. Council's community outcomes are set out in the Long Term Plan 2018 – 2028.

Table 2-2: Link between Community Outcomes and the Water Supply Activity

Community Outcome	How this Council activity contributes to the outcome
Our unique natural environment is healthy and protected	Nelson's environment is protected by an efficiently managed water supply network that respects the natural, recreational and heritage values that are present in the rivers that supply the network and works to protect ecosystem health.
Our infrastructure is efficient, cost effective and meets current and future needs	A good quality, sustainable and affordable water supply network meets the needs of our current and future community. Sufficient and appropriate water supply is provided to ensure residential and business growth projections are achieved.
Our region is supported by an innovative and sustainable economy	Water resources have an important role in supporting a range of businesses that rely on clean and reliable water supplies.
Our communities are healthy, safe, inclusive and resilient	Safe and well managed water resources deliver critical health outcomes for the community.

The District and the community outcomes have been developed to provide a link between community issues and the current water supply goal.

Goal of the water supply activity
To provide a water supply to Nelson City that is capable of abstracting, treating and distributing potable water in an efficient, safe, reliable and sustainable way whilst ensuring that the ecological, recreational and cultural interests of the community in the water sources are recognised and enhanced.

This Asset Management Plan updates the goal, reports on the issues surrounding the goal and identifies work necessary to meet the goal.

2.3. Legislative requirements

Legislative requirements form the minimum level of service that Council is required to provide.

The water supply activity is influenced by the following legislative requirements:

Health and Safety at Work Act 2015: Council must ensure the safety of the public and all workers (including contractors) when carrying out works.

The Local Government Act 2002: The Nelson City Council is a local authority established under the Local Government Act 2002 (the Act) with purpose and responsibilities set out in the Act, in particular:

10 Purpose of local government

(1) The purpose of local government is-

(b) to meet the current and future needs of communities for good-quality local infrastructure, local public services, and performance of regulatory functions in a way that is most cost-effective for households and businesses.

(2) In this Act, good-quality, in relation to local infrastructure, local public services, and performance of regulatory functions, means infrastructure, services, and performance that are-

(a) efficient; and

(b) effective; and

(c) appropriate to present and anticipated future circumstances

Sec 11A sets out core services that Council must consider in performing role:

In performing its role, a local authority must have particular regard to the contribution that the following core services make to its communities:

(a) network infrastructure:

(b) public transport services:

(c) solid waste collection and disposal:

(d) the avoidance or mitigation of natural hazards:

(e) libraries, museums, reserves, recreational facilities, and other community infrastructure.

14 Principles relating to local authorities

In performing its role, a local authority must act in accordance with the following principles:

(h) in taking a sustainable development approach, a local authority should take into account-

(i) the social, economic, and cultural interests of people and communities; and

(ii) the need to maintain and enhance the quality of the environment; and

(iii) the reasonably foreseeable needs of future generations.

In 2010 an amendment to the Act (sec 261B Local Government Act 2002) required the Secretary for Local Government to make rules specifying non-financial performance measures for local authorities to use when reporting to their communities. These have been developed for water supply and are incorporated into the levels of service.

The Act also requires that local authorities take a sustainable development approach to everything they do.

Resource Management Act 1991: The Nelson Resource Management Plan (NRMP) is the operative plan established under the Resource Management Act 1991. Council seeks to operate the current network in compliance with this document. To that end Council holds a range of resource consents for site specific activities.

Resource Consents for Water Supply:

Council seeks resource consents where required for all discrete operational activities and capital work projects.

Resource consents for water extraction

Nelson City draws its public water supply from three sources:

- A run of river source from a weir on the Roding River;
- A run of river source from a weir on the South Branch of the Maitai River;
- An intake tower in a storage dam on the North Branch of the Maitai River;

Nelson City Council had three Resource Consents for the water supply covering the abstraction of raw water from both the Roding and Maitai rivers, the continued operation of the Maitai Dam on the North Branch and intake weir on the South Branch of the Maitai River and the Dam/ intake weir on the Roding River. The consents and expiry dates are as follows:

- RM 960396 Maitai River expired 1/02/2017;
- RM 025151 Maitai River expired 1/02/2017;
- RM 975374 Roding River expired 1/10/2017.

In 2016 applications for consent for the water supply activities on the Maitai and Roding Rivers were lodged. On 31 May 2017 resource consents RM165239, RM165317 and RM165318 were granted for the Roding water supply. As at June 2018 the Maitai Resource Consent application is still being processed. Council will continue to operate the Maitai water supply under the current resource consent until the replacement consent is completed.

Compliance with the conditions of resource consents is mandatory and a level of service has been identified for this purpose.

Resource Consents Held for Water Supply

The resource consents associated with the water supply activity for Nelson City Council are detailed in Table 2-3 below.

Table 2-3: Water Resource Consents

Consent Number	Consent Type	Consent Expiry Date	Consent Allowance
RM 165239	Water Permit - Take, Use and Divert water • for the consumptive water take of 254 litres per second from the Roding River for public water supply purposes; • to take up to five cubic metres water per day from the upper Long Gully Weir associated with the maintenance of the screens at the Roding Weir intake; • To dam water behind the Roding Weir; • For the diversion of water over the Roding Weir and through the weir's intake screens; • To dam water in the Roding River by means of a temporary bund for the purpose of trapping and settling sediment upstream of the Roding Weir; • To divert the flow of the Roding River through the upstream diversion tunnel; and • To divert water over the upper and lower Long Gully Weirs.	31 May 2052	The consent holder must at all times control its take so that the flow of the Roding River at the Caretaker's House (Location: 1622820 5421186 NZTM) is not less than: (a) 150 litres per second (l/s); or (b) Natural flow if the natural flow is less than 150 l/s. Abstraction must cease when instantaneous flow is less than 150 l/s at the Caretaker's House flow site. When natural flow in the Roding River is 196 l/s or less for two consecutive days at the Skid Site (Location: 1622820 5421186 NZTM) the consent holder shall cease taking water. The rate of abstraction from the Roding River shall not exceed 254 litres per second. The abstraction of water from Long Gully Stream shall not cause the loss of surface flow connectivity between the upper weir and the Roding River. The volume of abstraction from the upper Long Gully weir shall not exceed five cubic metres per day.
RM 165317	Land Use Consent – structures and disturbances • To use, reconstruct and maintain the Roding Weir structure and the upper Long Gully Weir structure and to authorise the existing lower Long Gully weir; • To disturb the bed for the purposes of flushing gravel through (via the sliding sluice gate) the Roding Weir; • To disturb the bed of the Roding River for the purpose of excavating and relocating gravel over the Roding Weir; • To disturb the bed of the Roding River for the purpose of excavating and relocating gravel through the diversion tunnel; • Operating the diversion tunnel by diverting water and gravel through the sluice gate; and • From time to time to construct, reconstruct, use, alter, extend or demolish a temporary gravel bund in the Roding River for the purpose of diverting sediment through the diversion tunnel.	31 May 2052	
RM 165318	Water Permit to discharge water containing sediment into the Roding River as a result of maintenance of the weir	31 May 2052	

Consent Number	Consent Type	Consent Expiry Date	Consent Allowance
RM 165122	To re-authorise the Nelson Water Supply Scheme on the Maitai River, water permit to dam, divert and take water from the river and water permit to discharge water to the river	Consent still being processed	

National Policy Statement for Freshwater Management 2014

The NPS-FM sets out how Council's will manage water quality and quantity. The NPS-FM requires them to safeguard:

- The life-supporting capacity, ecosystem processes and indigenous species including their associated ecosystems, of fresh water; and
- The health of people and communities, at least as affected by secondary contact with fresh water;

And to ensure the overall quality of freshwater is maintained or improved while:

- Protecting the significant values of outstanding freshwater bodies;
- Protecting the significant values of wetlands; and
- Improving the quality of fresh water in water bodies that have been degraded by human activities to the point of being over-allocated.

With respect to water quantity the NPS-FM also requires safeguarding of life-supporting capacity, ecosystem processes and indigenous species and ecosystems; while also avoiding further over-allocation and phasing out existing over-allocation, improving and maximising the efficient use and allocation of water, and protecting the significant values of wetlands and outstanding freshwater bodies.

National Policy Statement Urban Development Capacity

Land use, development and development infrastructure are integrated with each other in a manner that ensures urban environments have sufficient opportunities to meet demand.

The National Policy Statement for Urban Development Capacity (NPS-UDC) requires local authorities to ensure there is sufficient development capacity to meet demand in the urban environment in the short term (within 3 years), medium term (3-10 years) and long term (10-30 years). Short-term capacity must be feasible, zoned and serviced while long-term capacity must be feasible, with servicing planned but does not need to be zoned yet.

Local authorities with a medium or high growth urban area also need to provide an additional margin of feasible development capacity over and above projected demand of at least: 20% in the short and medium term; and 15% in the long term.

Building Act 2004 - Dam Safety Regulations

The Building Act 2004 requires that dam owners assess their dam against regulatory standards as being high, medium, or low impact in the event of failure, and to provide that information to their regional authority.

In 2015 the Building and Construction Minister confirmed that these requirements were to be removed from the Building Act and new requirements would be considered for inclusion in the Resource Management Act. To date there is no final proposal in place. The Maitai Dam is subject to an annual safety review by the designers and every five years a comprehensive safety review is carried out by a separate specialist dam consultancy.

The National Environmental Standard for Sources of Human Drinking Water

Regulations came into force on 6 June 2008. The purpose of the regulations is to reduce the risk of contamination of drinking water sources by requiring Regional Councils to consider the effects of granting water abstraction consents or discharge consents upstream of drinking water abstraction points. As all the Maitai and Roding

catchments above the intakes are owned by Nelson City Council and managed as a waterworks reserve, there is no specific level of service that comes from these regulations.

The Drinking Water Standards for New Zealand 2005/08

The Drinking Water Standards list the maximum concentrations of chemical, radiological, and microbiological contaminants acceptable for public health in drinking water. The standards also specify the sampling protocols that must be observed to demonstrate that the drinking water complies with the standards.

The Health (Drinking Water) Amendment Act 2007

There is a provision that requires water suppliers, when they become aware that the water is not meeting the drinking water standards to take appropriate steps to correct the problem.

The Ministry of Health currently offers water suppliers regular grading of water supplies to measure compliance with the standards. The grading schedule is shown in Table 2-7 in the Current level of service section.

Havelock North Drinking Water Government Inquiry

The event of the campylobacteriosis outbreak in Havelock North in August 2016 brought about a Government Inquiry.

Recommendations made by the Inquiry broadly fall into the following categories:

- Administrative:
    - Promulgate six principles of drinking water safety
    - Review NZ standards, Health Act and Drinking Water standards and abolish 'secure' classification for bores
    - Establish an independent drinking water regulator
    - Ministry of Health to improve compliance with existing regulations
    - Amend the Resource Management Act to improve water source protection
    - Accelerate the review of the National Environmental Standard for Sources of Human Drinking Water.
- Operational:
    - Encourage/mandate treatment (chlorination) of water supplies
    - Encourage formation of joint working groups to oversee drinking water safety throughout the country
    - Introduce licensing and qualification requirements for suppliers and operators
    - Create dedicated and aggregated drinking water suppliers,
    - Improve the testing and laboratories regime
    - Prohibit high risk bore construction techniques.

The report also has a section with recommendations that the Government look at aggregating supplies of water.

The recommendations largely rely on Central Government to enact legislation before they can be implemented. Some progress on these is likely during 2018-19. Those recommendations that encourage treatment of drinking water and improving compliance with existing regulations have already been actioned by the Ministry of Health.

2.4. Current level of service

Significant negative effects

It is a requirement of the Local Government Act 2002 Amendment Act 2010 (2(1)(c)) to outline any significant negative effects that any activity within a group of activities may have on the social, economic, environmental, or cultural well-being of the local community.

Table 2-4 below identifies the negative effects for the Nelson city Community that the water supply activity may have. It indicates the existing approach or proposed action to address these in future.

Table 2-4: Negative Effects – The Water supply Activity

Effect	Status of Effect		Type of Effect		Impact on Well-Being				Existing Approach or Proposed Action to Address
	Existing	Potential	Negative	Significantly Negative	Social	Economic	Environmental	Cultural	
Pump Stations									
Noise.	Static	Static	√		Minor	Nil	Minor	Nil	High degree of noise mitigation in residential areas ~~during storm events.~~
Environmental									
Growth is constrained by lack of water supply infrastructure	Static	Static	√		Minor	Mod	Minor	Minor	NPS-UDC work for Nelson urban area guides to prioritise roll out to ensure demand is met.
High water demand decreases flow	Static	Static	√		Minor	Minor	Mod	Mod	Resource consent states that abstraction must cease when a minimum flow is met. Water restrictions decrease water use.
Water restrictions during extended dry period	Static	Static	√		Minor	Minor	Minor	Minor	Apply water restrictions in stages to avoid sudden heavy restrictions

Table 2-5: Outlines the current levels of service for 2015-25

				Performance Target			
Community Outcomes	**Level of service**	**Performance Measures**	**Previous and current performance**	**2018/19 (Year 1)**	**2019/20 (Year 2)**	**2020/21 (Year 3)**	**2021/22 2027/28 (Year 4-10)**
Our communities are healthy, safe, inclusive and resilient	**Quality** ^Good quality water	The extent to which drinking water supply complies with: a) part 4 of the drinking water standards# (bacterial compliance criteria), and b) part 5 of the drinking water standards# (protozoal compliance criteria)* 1	The 2016-17 review of the city water supply by the Drinking Water Assessment Unit of the Ministry of Health confirmed that compliance with part 4 of the drinking water standards was achieved for both the source and distribution network and compliance with part 5 of the drinking water standards was confirmed for the source. Protozoal compliance is not measured for the distribution network as the city operates an ultra-filtration treatment plant that will remove any protozoa at source. Achieved 2015/16 Achieved 2014/15	Maintain Ab= grading and ensure potable water supplied to customers	Maintain	Maintain	Maintain
		The total number of complaints received about any of the following: a) drinking water clarity b) drinking water odour c) drinking water pressure or flow d) continuity of supply, and e) the response to any of these issues expressed per 1000 connections to the networked reticulation system* 2	21 complaints per 1000 connections 2016/17 35 complaints per 1000 connections 2015/16	No more than 100 justifiable complaints.*	Maintain	Maintain	Maintain
Our infrastructure is efficient, cost effective	**Reliable**	The average consumption of drinking water per day per resident* 3	288L per person per day 2016/17 268L per person per day 2015/16	Normal demand is less than 500L per person per day.*	Maintain	Maintain	Maintain

				Performance Target			
Community Outcomes	**Level of service**	**Performance Measures**	**Previous and current performance**	**2018/19 (Year 1)**	**2019/20 (Year 2)**	**2020/21 (Year 3)**	**2021/22 2027/28 (Year 4-10)**
and meets current and future needs	^A reliable supply of water	The percentage of real water loss from the networked reticulation system*4	23% real water loss 29.8% real water loss 2015/16	Real water loss is less than 25%.*	Maintain	Maintain	Maintain
		Water usage 5	No exceedances 2016/17 No exceedances 2015/16	Compliance with resource consent abstraction rates	Maintain	Maintain	Maintain
Our infrastructure is efficient, cost effective and meets current and future needs	**Quality** ^Acceptable water pressure	Percentage of customers with acceptable pressure, that is a minimum 30m head and maximum 90m head with a maximum fluctuation <35% from the average pressure received by each customer 6	83% of properties had acceptable water pressure 2016/17 83.7% of properties had acceptable water pressure 2015/16 83.4% of properties had acceptable water pressure 2014/15	Computer model identifies 80% of properties with acceptable pressure	Maintain	Maintain	Maintain
Our communities are healthy, safe, inclusive and resilient	**Health and Safety** ^Adequate flows of water	Meet NZFire Service fire flows (and therefore domestic and commercial/industrial flows) to all parts of the city 6	99.2% 2016/17 95% 2015/16 99% 2014/15	Computer model identifies at least 95% of properties served by the network with acceptable flows	Maintain	Maintain	Computer model identifies at least 95% of properties served by the network with acceptable flows and 99% by 2021/22

				Performance Target			
Community Outcomes	**Level of service**	**Performance Measures**	**Previous and current performance**	**2018/19 (Year 1)**	**2019/20 (Year 2)**	**2020/21 (Year 3)**	**2021/22 2027/28 (Year 4-10)**
Our infrastructure is efficient, cost effective and meets current and future needs	**Customer Service** ^A prompt response to reported network issues	Where attending a call-out in response to a fault or unplanned interruption to the networked reticulation system, the following median response times measured: a) attendance for urgent call-outs: from the time that notification is received to the time that service personnel reach the site, and b) resolution of urgent call-outs: from the time that notification is received to the time that service personnel confirm resolution of the fault or interruption. c) attendance for non-urgent call-outs: from the time that notification is received to the time that service personnel reach the site, and d) resolution of non-urgent call-outs: from the time that notification is received to the time that service personnel confirm resolution of the of the fault or interruption* 2	a) Contractor attended urgent call-outs in a median time of: 21 minutes 2016/17 28 minutes 2015/16 b) Contractor resolved urgent call-outs in a median time of: 107 minutes 2016/17 105 minutes 2015/16 c) Contractor attended non-urgent call-outs in a median time of: 54 minutes 2016/17 56 minutes 2015/16 d) Contractor resolved non-urgent call-outs in a median time of: 330 minutes 2016/17 345.5 minutes 2015/16	a) Contractor to attend urgent call-outs in a median time of 60 minutes or less. b) Contractor to resolve urgent call-outs in a median time of 480 minutes or less. c) Contractor to attend non-urgent callouts in a median time of 660 minutes or less. d) Contractor to resolve non-urgent call outs in a median time of 1440 minutes or less.	Maintain	Maintain	Maintain
Our unique natural environment is healthy and protected	A network that protects the natural environment	Comply with resource consents RM025151 and RM975374 conditions for allowable water abstraction rates, re-vegetation of stream banks and eel and fish passage requirements 5	Compliance reporting was received from the contractor for 2016/17: Maitai River results showed flow and temperature conditions were met. Roding River showed no breaches of the minimum flows. Eel transfer from the Maitai River to the Reservoir was carried out as required, with a total of 98 eels being transferred, and fish passage	100% compliance	Maintain	Maintain	Maintain

				Performance Target			
Community Outcomes	**Level of service**	**Performance Measures**	**Previous and current performance**	**2018/19 (Year 1)**	**2019/20 (Year 2)**	**2020/21 (Year 3)**	**2021/22 2027/28 (Year 4-10)**
			improvements continue to be investigated. Compliance reporting received from the contractor for 2015/16: Maitai River results showed flow and temperature conditions were met. Roding River showed no breaches of the minimum flows. Fish passage improvements at the Maitai Dam, Roding Weir and South Branch Weir improvements were carried out during 2015/16.				

^L.O.S. included in LTP

Ministry of Health (2008), Drinking-water Standards for New Zealand 2005 (Revised 2008), Wellington, Ministry of Health

= Ministry of Health grading system – the upper case 'A" refers to the source and treatment of the water and the 'b' refers to the distribution of the water

* Performance measures with an asterisk reflect the wording of the Non-Financial Performance Measures of the Department of Internal Affairs (DIA) incorporated into sec261B Local Government Act 2002. This is to allow the DIA to compare these measures across councils. Targets have been adjusted where necessary to align.

Measurement procedures:

1. Ministry of Health grading
2. Report from SR system at 1 July
3. Calculated by metered supply divided by Statistics NZ estimated population
4. Council uses a water balance methodology developed by Water NZ to track and report on un-accounted for water.
5. Council RMA infringement records at 1 July
6. Computer modelling

Water Quality

Background

As a water supply authority the Nelson City Council must comply with the Health Act 1956 and supply potable water. The Ministry of Health has an oversight of Council's compliance with this requirement. Additionally the ministry also offers a grading scheme that assesses water suppliers against a range of criteria for both source and distribution.

Recognising both public health and cost considerations, Table 2-6 provides guidance for the minimum grading suggested for different sized communities.

Table 2-6: Ministry of Health Suggested Grading

Community Size	Source and Treatment	Distribution
Greater than 10,000	B	a
From 5,001 to 10,000	B	b
5,000 or less	C	c

The Nelson City water supply was graded "Ab" by the Ministry of Health in May 2016.

Table 2-7: Ministry of Health Grading Schedule

Assessment based on source and treatment factors will result in a grade as follows:

Source and treatment grading

A1	Completely satisfactory, negligible factors
A	Completely satisfactory, extremely low level of risk
B	Satisfactory, very low level of risk when the water leaves the treatment plant
C	Marginally Satisfactory, low level of microbiological risk when the water leaves the treatment plant, but may not be satisfactory chemically
D	Unsatisfactory level of risk
E	Unacceptable level of risk

The A grade for the Nelson City Council water supply source and treatment is due to:

- E. coli compliance
- Protozoa compliance
- Priority 2 compliance (No P2's for the plant)
- Disinfection (with chlorine)
- Adequate record keeping
- Compliance with chemical MAV's (no P2's for the plant)
- Appropriate supervision
- Continuous quality control
- Disinfection with satisfactory residual in reticulation

The distribution grading system is based on the accrual of "demerit" points for various attributes not present. The sum of the demerit points determines the grading as shown in Table 2-8.

Table 2-8: Distribution zone grading

Assessment based on source and treatment factors will result in a grade:

Sum of demerit points	Grade	Description
0-10	a1	Completely satisfactory, negligible level of risk; demonstrably high quality; meets Aesthetic Guidelines in Appendix C and has ISO 9001: 2000 accreditation.
0-10	a	Completely satisfactory, extremely low level of risk
11-20	b	Satisfactory, very low level of risk
21-30	c	Marginally satisfactory, moderately low level of risk
31-45	d	Unsatisfactory level of risk
46 or more	e	Unacceptable level of risk

Reference: Report on Public Health Grading of a Drinking Water Supply – Nelson City Council, Nelson Marlborough District Health Board, May 2008.

The distribution demerit points in the 2008 - 2016 gradings were received for:

Table 2-9: Distribution demerit points 2008 – 2016

Question Topic		2008	2009	2010	2011	2014	2015	2016	Comment from Report on Public Health Grading of a Drinking Water Supply – Nelson City Council, Nelson Marlborough District Health Board, December 2016
Pipe age & records		1	1	1	1	1	1	1	'Fair'
Leak detection & water loss		2	2	2	2	1	1	1	'Fair'
Backflow prevention		4	4	4	4	4	4	4	'Legislative requirements not met but residual disinfectant'
24 hours storage		3	3	3	0	0	0	0	-
Supply pressure		1	1	1	1	1	1	1	'Not yet possible to determine that pressures do not exceed 900kPa in more than 5% of distribution zone'
Free Available Chlorine monitoring		1	1	1	1	1	1	1	'Sampling shows a consistent residual and mean turbidity of less than 1 NTU'
Microbial compliance	-	0	0	0	4	4	4	0	-
Chemical compliance		2	2	2	2	2	2	2	'One lead sample above 50% of the MAV. Several samples for Halo Acetic Acids (HAA's) above 50% of the MAV'
Corrosion of materials							1	1	'Corrosive tendencies'
Distribution Management		0	0	0	0	0	0	7	'Day to day management of the zone is conducted by a person who does not possess an appropriate engineering qualification'
	TOTAL	14	14	14	15	14	15	18	

Grading Gaps

The extreme rain events of December 2011 and April 2013 reduced the available staff time resource within Council, which together with Central Government proposals to review the grading initiative lead to suspending grading assessments until 2014.

Current Grading

The greatest level of demerit points (7) accrue from the day to day management of the zone not being in the hands of a person with an appropriate engineering qualification. The operations and management team has people with the necessary qualifications in the senior management and contract supervisor roles and are satisfied the specific circumstances that attract the demerit points do not pose an un-acceptable risk to customers.

The second greatest level of demerit points (4) accrue from the ongoing programme to install backflow prevention devices at each site connected to the network. All customers with a connection using a residential style water meter also have a double check valve in the assembly. The programme to complete installation of backflow prevention devices to all other customer connections is expected to be completed within the term of this asset management plan.

Chemical compliance (2). A number of chemicals are present in water supplies from natural sources and resulting from reactions of disinfectants and the constituents of the water. Testing of the network has identified levels of Haloacetic acids that need to be monitored. Haloacetic acids result from the interaction of chlorine with the components of water. In large quantities these can be carcinogenic in some people.

Free Available Chlorine Equivalent (FACE) Monitoring (1). Chlorine is added to the final stage of the water treatment plant process as a long lasting disinfection product. Council continuously monitors the levels of chlorine in the water leaving the treatment plant and at the Stoke high level reservoir but does not continuously monitor for this in the wider network. Tests for available chlorine levels are carried out multiple times per week on a rotation of sites through the city when samples are taken to test for the presence of E.coli. Undertaking a cost/benefit analysis of continuous chlorine level monitoring would be valuable as a means of comparing the relative merits of the current practice versus the enhanced option.

Compliance reporting rather than a grading report is currently preferred by the Ministry of Health. This change has been made in the levels of service going forward.

Reliability

Background

Water Sources

As part of the design of the Maitai Dam, Council has determined that the urban water supply should have the capacity to withstand a 1 in 60 year drought.

An analysis of the flows in the South Branch of the Maitai river by Tasman District Council hydrologists has indicated that low flows for the 1, 50, 90 and 100 year return period droughts are as follows:

1 year:	203 litres per second
50 year:	90 litres per second
90 year:	84 litres per second

100 year: 83 litres per second

The conditions of the existing Resource Consent for the Maitai abstraction require that a residual flow of 175 litres per second be left in the Maitai River from 1 November to 30 April, and 300 litres per second be left in the river from 1 May to 31 October. However, if the river flow is naturally low during this period, the residual flow may be reduced. When the mean daily flow exceeds 140 litres per second the minimum flow is 300 litres per second. When the mean daily flow is less than or equal to 140 litres per second the minimum flow is 225 litres per second. When the mean daily flow is less than 130 litres per second the minimum flow is 190 litres per second. The storage held in the Maitai dam is used to make up the shortfall in natural flows.

As part of the proposed replacement resource consent for the Maitai River it is anticipated that minimum instantaneous flows will be increased.

The conditions of the Resource Consent for the Roding abstraction require that a residual flow of 150 litres per second or the natural flow (whichever is the greater) be left in the Roding River.

Water reticulation

Water supply networks are historically very reliable, with many customers not experiencing a single loss of supply event. This extremely high reliability has tended to make customers assume that reliability is guaranteed.

As a consequence customers are becoming less tolerant of interruptions to the supply. Some industrial and commercial processes which are reliant on a continuous water supply have assumed a continual supply and have no provision for standby facilities.

The continuity of supply can never be guaranteed, in part because many causes of supply failure are beyond the control of the water supply authority. An example is damage to a service main that could be caused by a contractor excavating in the street while working on other utilities (such as electricity, telephone, sewer, etc). Older asbestos cement pipes have deteriorated and are the main source of spontaneous breaks.

The Nelson City Council Water Supply Bylaw warns that water quality or continuity of supply is not guaranteed.

Performance Measurement and Monitoring

The following actions are currently undertaken to monitor the network reliability:

- Record daily headworks supply and treatment plant supply.
- Record the actual time the water supply is interrupted and restored, and number of properties affected.
- Record all complaints regarding "out of water".
- Record time and type of notice of shutdown given to consumers.
- Monitor peak daily demands annually and maintain graphical record to develop future demand curve.

Un-Accounted for Water

Council estimates that the city network has un-accounted for water (UFW) volume of approximately 30% of the water that leaves the treatment plant. This amounts to an average 2.4 million cubic metres per year. This figure is arrived at by comparing the volume of water leaving the treatment plant with the volume that is recorded by customer's meters. Being able to quantify this figure is very important and improving

the accuracy of records is currently a focus of the activity. A programme of repairing reported leaks and proactive leak detection is included in the activity budgets. See appendix E.

Sources of unaccounted for Water (UFW) are found in the following:

- Firefighting and hydrant flow testing;
- Overflows at reservoirs and losses during cleaning;
- Mains testing and flushing;
- Unknown connections;
- Use by contractors.

Controlling UFW can significantly reduce demand. UFW control also has an environmental benefit as it reduces the quantities of water that are required to be abstracted from the river sources.

Pressure

Background

Public Heath Grading of Community Water Supplies 2003 Explanatory Notes and Grading Forms imposes distribution grading "demerit points" where there is:

- Pressure in excess of 900 kPa in more than 5% of the zone; or
- Pressures less than 100 kPa; or
- Pressures lower than 150 kPa in significant parts of the zone during high demand.

New Zealand Fire Service Firefighting Water Supplies Code of Practice 2008 requires 10m head residual running pressure, i.e. pressure remaining in the pipe after abstraction of the firefighting water.

NZS 4404: 2010 Land Development and Subdivision Engineering recommends water supply pressure shall be between 250 kPa and 800 kPa (25m to 80m head)

Council endeavours to maintain water pressure between 30m head and 90m head.

New Zealand Fire Service Firefighting Water Supplies Code of Practice 2008 specifies volume and pressure requirements for the water supply system within the Urban Fire District.

Pressure fluctuation

The maximum available pressure is called the static pressure. This occurs overnight during the low flow period. As demand increases in a pipe network, the friction of the moving water in the mains causes a reduction in pressure known as friction loss.

The working pressure (that experienced by the customer) is the static pressure less the friction loss. Demand varies though the day and year. With increased demand, customers experience lower pressures during the day and in summer. A difference between static pressure and working pressure of more than 35% is considered excessive.

Minimum Pressure

The minimum working pressure at the ground floor level of buildings should ideally be not less than 300kPa (30m head) with an absolute minimum of 150kPa (15 metre head) in exceptional instances. The water supply levels in the 1996 Resource Management Plan were set at 67m (low level zones) and 110m (high level zones) to ensure these standards are met for all new developments.

In some of the more recent hill top developments above the water supply level, the issues of continuity of supply and pressure fluctuations have been resolved by the installation of storage tanks and in some cases pump stations. To avoid the need for water towers and allow maximum land development, the standards have been eased so that:

- Dwellings with ground floor level less than 30m below the floor of the reservoir are required to install a domestic pressure pump and tank to ensure adequate pressures. Oversize service connections are provided to minimise friction losses.

Conditions Book entries advise of these special circumstances. The system works well as the presence of the storage tank ensures continuity of supply.

Maximum Working Pressure

The maximum pressure normally targeted would be in the order of 600kPa (60m head). Due to Nelson's hilly terrain and the ample pressure generated by the elevation of the headworks, Nelson City Council pressures are substantially higher.

In the lower areas of the city, static pressures can range from 400kPa to 950kPa. (40m to 95m head). Pressures in some of these areas have been reduced over the last 20 years (in particular, the Port and the residential areas of Stoke and Tahunanui on the seaward side of State Highway 6), by installing new pressure reducing valves, adjusting down existing pressure reducing valves, or installing new mains. This can cause difficulties where plumbing and sprinkler systems have been designed for existing water pressures.

Pressures in the 60 to 95m head range are still acceptable for domestic supply, although not ideal, and may need reviewing in the future.

Excessive pressures can lead to early failure of mains and contribute to problems of Unaccounted for Water losses.

Of more concern are the areas on the edge of high pressure zones (in particular, the bottom of the Port Hills, the Tahunanui Hills, Toi Toi Valley, Washington Valley and the Grampians. As a cost saving measure when the City was developed, these areas were served by the high pressure mains that also carry water to the top of the hills. Static pressure in some of these areas is in the range of 1400kPa to 1800kPa (140m to 180m head).

These pressures are in excess of normal working pressures. It is likely that most of these residents have installed their own pressure limiting valves. As mains in these areas are re-laid the opportunity is taken to provide additional capacity and change them over into the pressure reduced zone.

$500,000 is included in the Capital budget over the next 10 years i.e. $50,000 per year until 2027/28, for system improvements including the installation of new pressure reducing valves and mains to address this problem of excess pressure.

In addition to the above the renewal budget over the next 10 years will be used to lay new mains to better withstand the system pressures.

Performance Monitoring

The following actions are currently undertaken to monitor the network pressures:

- Record all complaints regarding "high or low pressure".
- Monitor pressure at pressure reducing valves daily.

Flow rate

Background

The flow rate available to each customer is the greatest influence on the customer's impressions as to the adequacy of the water supply. Low flow rates cause water to dribble from shower heads and fill basins and baths slowly.

Many low flow problems are caused by inadequacies of the plumbing within the property and this is beyond the control of the Nelson City Council. Therefore the level of service is defined at the point of supply (the toby or service valve).

Flow rate requirements can be divided into three categories:

Domestic Flow Rates

Customer expectations have changed in the last 35 years and whereas 20 litres per minute was previously considered adequate customers now expect 30 litres per minute.

30 litres per minute is the standard aimed for in Nelson. Provided the minimum pressure standards are achieved then this flow rate should be readily available.

One of the symptoms of excessive pressure is too high a flow rate. This can cause water from the cold tap to bounce out of sinks and basins and creates water hammer in both the property's plumbing and the water reticulation system when automatic valves in dishwashers and washing machines close off.

To alleviate these symptoms residents partially close the stopcock at the boundary. This practice shortens the life of the stopcock and increases the Council's maintenance costs.

Resolution of the excessive pressure problem will solve this problem.

Industrial/Commercial Flow Rates

The flow rates required by industrial processors are specific to each individual site. These are almost impossible to predict in advance so reticulation systems in industrial areas are provided with additional capacity.

With the exception of the Port Area, any proposal to use large volumes of water will be restricted by the capacity of the existing local mains to deliver the water and the sewerage system to convey and treat the effluent.

Commercial areas as distinct from industrial areas generally have low water demand except for firefighting.

Fire Fighting Flow Rates

The public supply is designed to provide an effective firefighting network. Hydrants are installed on all service mains in urban supply areas in accordance with the New Zealand Fire Service Firefighting Water Supplies Code of Practice.

The New Zealand Fire Service issued a revised Firefighting Water Code of Practice in 2008.

The required firefighting water supply for each building (other than single or multi-unit housing but excluding multi-storey apartment blocks) must now be calculated for the floor area of the building and the fire hazard category involved rather than being read directly from a table as previously. Any deficiencies identified for particular premises would have to be remedied by the owner by increasing the firefighting water supply, reducing the fire hazard in order to meet the requirements of the code, or installing a fire sprinkler system.

The required flow for single or multi-unit housing (but excluding multi-storey apartment blocks) is 25 litres per second with a minimum of 12.5 litres per second from a hydrant within 135 metres of the risk and a further minimum of 12.5 litres per second from another hydrant within 270 metres of the risk. Different flows are required in Commercial/Industrial areas depending upon the fire hazard (low–medium hazards require 50l/s – 150l/s from a range of operating hydrants).

Previous versions of this code of practice measured the distances from properties to fire hydrants as a radius centred on the property, the current version now measures the true "along the road" distance. This has had the effect of now increasing the number of properties that do not currently meet the distance requirement.

The Fire Service Code of Practice allows that where there is a reliably calibrated and accepted system for computer modelling of flows in a reticulated water system, the Fire Service may accept the outputs from such modelling in place of testing certain fire hydrants.

Generally domestic demand is not critical and the supply of water for firefighting purposes will determine the reticulation pipe sizes required.

Problems with inadequate hydrant flows are experienced in some of the older areas of the City where the original 75mm and 100mm diameter cast iron water mains are incapable of delivering the flow rates required. Renewal work in recent years has concentrated on replacing these mains. The programme of replacing all 75mm diameter cast iron mains in the City was largely completed in 2006/07. This work also helped to address the problems with fluctuating and low pressures.

A specific project to address the issue of fire flows across the city has been underway since 2015/16. To date this work has rectified flows to 149 properties. The areas to be upgraded will be regularly reviewed and identified using the water network model.

Contractors Service Response and System Operation

The Utilities Services Maintenance contract requires that the maintenance contractor responds to calls within appropriate times depending on the circumstances as follows.

Urgent Works

Urgent works are defined in the first column of the response timetable below in Table 2-10.

Response times apply 24 hours per day every day of the year.

The Contractor must respond to and satisfactorily resolve maintenance works within the maximum response times for the specified percentage of cases.

Table 2-10: Urgent Maximum Response Times

Definition of Urgent Works	Investigation and Appraisal Night and Day	Repair Completed	% of Cases
Burst pipes or major leakages likely to affect the water supply or cause damage to pavements or property.	30 minutes	8 hours	95%
No water or pump station failure.	30 minutes	8 hours	95%
Possible serious health risk (life threatening) water quality problem.	30 minutes	2 hours	100%

Non-Urgent Works

Non-Urgent works are as defined in the first column of the response timetable below in Table 2-11.

Response times defined in hours apply 24 hours per day every day of the year.

Response times defined in days are working days (Monday to Friday) excluding public holidays during normal working hours. Such works are programmed by the Contractor on a daily basis.

The Contractor must respond to and satisfactorily resolve maintenance works within the maximum response times in Table 2-11.

Table 2-11: Non Urgent Maximum Response Times

Definition of Non-Urgent Works	Investigation and Appraisal Night and Day	Repair Completed
Minor leaks including from fittings, connections, meters, etc on sensitive hill slopes as identified on drawing 34/78. Missing or damaged service lids.	1 hours	24 hours
Minor leaks including from fittings, connections, meters, etc in areas other than above.	12 hours	3 working days
Water Quality Problems: - Taste and odour - Colour and grit	2 hours	1 working day
Non-serious water quality problems including poor pressure and flow.	N/A	3 working days
Engineers discretionary work	N/A	As agreed

2.5. Desired level of service

Table 2-12: Levels of Service 2018-28

				Performance Target			
Community Outcomes	**Level of service**	**Performance Measures**	**Previous and current performance**	**2018/19 (Year 1)**	**2019/20 (Year 2)**	**2020/21 (Year 3)**	**2021/22 2027/28 (Year 4-10)**
Our communities are healthy, safe, inclusive and resilient	**Quality** ^Good quality water	The extent to which drinking water supply complies with: a) part 4 of the drinking water standards# (bacterial compliance criteria), and b) part 5 of the drinking water standards# (protozoal compliance criteria)* c) part 8 of the drinking water standards# (chemical compliance criteria) 1	Complied a) and b) 2016/17 Complied a) and b) 2015/16 Complied a) and b) 2014/15 Protozoal compliance is not measured for distribution As treatment plant removes any at source. c) is a new measure in the Long Term Plan 2018-28. In 2016/17, Council complied with part 8 of the drinking water standards at the treatment plant, but the distribution network did not comply.	100% compliance with parts 4,5 and 8 of the drinking water standards			
		Total number of complaints per 1000 connections about any of the following*: - drinking water clarity - drinking water taste - drinking water odour - drinking water pressure or flow - continuity of supply - Council's response to the above issues 2	21 complaints per 1000 connections in 2016/17 35 complaints per 1000 connections in 2015/16	No more than 50 valid complaints per 1000 connections			

				Performance Target			
Community Outcomes	**Level of service**	**Performance Measures**	**Previous and current performance**	**2018/19 (Year 1)**	**2019/20 (Year 2)**	**2020/21 (Year 3)**	**2021/22 2027/28 (Year 4-10)**
Our infrastructure is efficient, cost effective and meets current and future needs	**Reliability** ^A reliable supply of water	Average drinking water standard consumption per day per resident* 3	288L per person per day 2016/17 268L per person per day 2015/16	Normal demand is less than 500L per person per day. This includes both domestic and commercial-industrial			
		% real water loss from the system* 4	23% in 2016/17 29% in 2015/16	Real water loss less than 25%.			
Our infrastructure is efficient, cost effective and meets current and future needs	**Customer Service** ^Prompt response	When attending a call-out in response to a fault or unplanned interruption to the system, the following median response times will be measured: a) attendance for urgent call-outs: from the time notification is received to the time service personnel reach the site b) resolution of urgent call-outs: from the time notification is received to the time service personnel confirm resolution of the fault or interruption c) attendance for non-urgent call-outs: from the time notification is received to the time that service personnel reach the site d) resolution of non-urgent call-outs: from the time notification is received to the time service personnel confirm resolution of the fault or interruption*	Median 21 minutes in 2016/17 28 minutes in 2015/16 Median 107 minutes in 2016/17 105 minutes in 2015/16 Median 54 minutes in 2016/17 56 minutes in 2015/16 Median 330 minutes in 2016/17 346 minutes in 2015/16	a) Contractor to attend urgent call-outs in a median time of 30 minutes or less. b) Contractor to resolve urgent call-outs in a median time of 480 minutes or less. c) Contractor to attend non-urgent callouts in a median time of 120 minutes or less. d) Contractor to resolve non-urgent call outs in a median time of 24 hours or less.			

				Performance Target			
Community Outcomes	**Level of service**	**Performance Measures**	**Previous and current performance**	**2018/19 (Year 1)**	**2019/20 (Year 2)**	**2020/21 (Year 3)**	**2021/22 2027/28 (Year 4-10)**
		2					

^L.O.S. included in LTP

Ministry of Health (2008), Drinking-water Standards for New Zealand 2005 (Revised 2008), Wellington, Ministry of Health

* Performance measures with an asterisk reflect the wording of the Non-Financial Performance Measures of the Department of Internal Affairs (DIA) incorporated into sec261B Local Government Act 2002. This is to allow the DIA to compare these measures across councils. Targets have been adjusted where necessary to align.

Measurement procedures:

1. Ministry of Health grading
2. Report from SR system at 1 July
3. Calculated by metered supply divided by Statistics NZ estimated population
4. Council uses a water balance methodology developed by Water NZ to track and report on un-accounted for water.

3. FUTURE DEMAND

Existing situation

The aim is to have the capacity to withstand a 1 in 60 year drought with only sprinkler and hosing restrictions until at least 2035. Outputs in this demand section are therefore calculated on this basis.

Water for the city is extracted directly from both the Maitai and Roding rivers, piped to the treatment plant at the Tantragee saddle and then delivered to the city.

Water from the Maitai river is extracted from a run of river intake on the South Branch of the headwaters or from the Dam reservoir on the North Branch. The dam has been constructed on the North Branch to store water for use in low flow periods and for supplementary water flows to compensate for extraction from the South Branch.

An analysis of the flows in the South Branch of the Maitai river by Tasman District Council hydrologists has indicated that low flows for the 1, 50, 90 and 100 year return periods are as follows:

1 year:	203 litres per second
50 year:	90 litres per second
90 year:	84 litres per second
100 year:	83 litres per second

The Maitai Dam was designed to meet a peak demand of 37,000m3/day through a 75 year return period drought but has the capacity to supply water at the rate of 50,000m3/day through a 60 year return period drought. With the completion of the Water Treatment Plant a further 900,000m3 of water from the bottom of the Maitai Lake can be treated and used for city supply. However, pumping will be required to transport this water to the treatment plant. This additionally available water may need further conditioning prior to use as potable water to address low oxygen levels, elevated organic material levels and heavy metal concentrations.

The existing Maitai pipeline has a maximum capacity of approximately 37,000m3/day.

The Roding Dam has only limited storage and is a run of river intake. Provided there is an adequate flow in the river the Roding pipeline can deliver a maximum of 22,000m3/day. The estimated flow in the Roding River in a 1 in 60 year drought is 11,200m3/day.

However, the Resource Consent for water extraction from the Roding requires that a minimum flow of 150 litres per second, or the natural flow if less than this, be left in the river.

150 litres per second equates to 12,960m3/per day. In a 1 in 60 year drought there is not likely to be any available abstraction from the Roding River.

With the completion of the duplicate Maitai pipeline the 1 in 60 year drought capacity will be:

Maitai	50,000m^3/day
Roding	nil
	50,000m^3/day

The current capacity of the Tantragee Water Treatment Plant is approximately 50,000m3/day. New technology high capacity membranes are expected to extend the plant capacity even further.

The foothills link from the Roding River (Marsden Valley) to the Water Treatment Plant has a maximum capacity of 22,000m3/day. This allows the Maitai pipeline to be shut down for maintenance other than during the peak summer demand. The normal flow is 16,000m3/day to reduce pumping costs. However, when the Maitai Dam spillway stops flowing i.e. when the lake level is below the crest, and there is still sufficient flow in the Roding, Roding water can be used to supply the City, up to the maximum allowed by the resource consent (residual) thereby minimising draw off of stored water from the Maitai Dam.

The principal trunk link between the Water Treatment Plant and Stoke is the foothills link to Marsden Valley. This has a capacity of 16,000m3/day. Because water in the foothills link is pumped, the use of the Marsden Valley route for treated water is minimised to reduce operating costs.

The other trunk link between the Treatment Plant and Stoke is through the Thompson Terrace reservoirs. The size of the trunk mains and the elevation of the reservoirs restricts the gravity flow through this link to approximately 11,000m3/day. However, a booster pump station in Van Dieman Street increases the peak capacity to 14,500m3/day.

The supply capacity to Stoke and Tahunanui is:

Foothills Link	16,000m^3/day
Cross City Link	14,500m^3/day
	30,500m^3/day

As part of the replacement resource consents for the Nelson water supply from the Maitai and Roding Rivers Council commissioned an update of the 2007 OPUS drought study report. WSP-OPUS prepared a number of reports looking at a range of demand scenarios for the city out to 2100. The reports conclude that under most demand scenarios the Maitai Dam will provide sufficient drought security for the city in the medium-long term.

3.1. Demand drivers

Table 3-1: Water Demand Drivers

Water Demand Drivers	Changes to Water Supply Activity
Significant population growth and residential expansion into greenfield areas	Development of new development areas on the periphery of the city and increased density in some existing developed areas leading to increased water use.
Changes in Customer Expectations	Customer expectations are increasingly tending towards higher Levels of Service, in both the reduction of environmental impact and the quality of the water supplied.
Community Expectation	Enhancing the natural environment of streams and rivers and recognition of impacts of climate change, especially drought security.
Climatic Changes	In recent years, there has been an increase in the incidence of extreme weather events around the world. The general trend for Nelson is of winters being wetter and

Water Demand Drivers	Changes to Water Supply Activity
	the other seasons being drier. More frequent heavy rainfall events have been predicted as well as the increasing trend to more extreme dry weather events.
Legislative National Policy Statements: • Freshwater Management and • Urban Development Capacity	• Freshwater Management is a cornerstone central government initiative to improve the quality of freshwater bodies in New Zealand. This is expected to impact on both abstraction and discharges to waterways and require an enhanced recognition of the need for efficient use of the water to minimise the volume taken for water supply and improving the quality of the water discharged as compensation. • Urban Development Capacity will ensure each territorial authority makes adequate provision for future population growth in their areas. This will require Council to undertake strategic growth studies and identify the impact on the demand for water supply services.
Organisational Policies Environmental Sustainability	Development of sustainability strategies that include reduction of un-accounted for water volumes.

Industrial and Commercial Demand

Since the water demand was initially calculated in 1996 there have been significant changes in Industrial and Commercial activities (and therefore water demand) at the Port.

Fin fish quotas are reduced, catches are down, and more processing is carried out at sea or in Asia. The Sanford (South Island) Ltd processing factory at the port has closed and is unlikely to reopen. It is also unlikely that any other similar fish processing factory will be established in Nelson in the foreseeable future.

Port Nelson has increased container and log marshalling areas with the demolition of existing buildings, including the Milk Treatment Station. Further expansion of these areas is likely, until ultimately the area bounded by the existing gated area at Graham Street, Wildman Avenue, and the Calwell Slipway becomes port storage.

Current engineering activities are likely to remain around the slipway area, and current boating activities are likely to remain around the marina area. These activities are not significant water users.

While total demand from the Port area has steadily fallen from 1999, growth of 0.5% per annum (10.5% over 10 years) has been assumed from 2005 for demand purposes.

Commercial/industrial growth in the remainder of the City/Atawhai area is expected to be restricted by lack of suitable land availability and limited sewer capacity. The Nelson Resource Management Plan limits Trade Waste discharge to the sewer to 0.54 litres per second per hectare. Sites in the Central City and St Vincent/Vanguard Streets area are generally small and a major wet industry is not likely to set up in this area. The recent development of New World and Harvey Norman stores in Vanguard Street, together with their associated car parking, has further reduced commercial/industrial land available for wet uses. Commercial users generally have a low water demand.

Recent Commercial/industrial growth in the Stoke/Tahuna area has utilised most of the existing industrial zoned land.

The Nelson- Tasman urban development review has led to co-ordination with Tasman District Council regarding development of new land in the Richmond vicinity for industrial uses taking a regional planning approach. i.e. Industrial growth in Nelson will be low water users on small sites.

A review of the industrial demand is expected over the next three years as Council reviews the Nelson Resource Management Plan. The likely impact on the water network will be reflected in future asset management plans.

Residential Demand

Richmond is entitled to the lesser of 909m3 of water/day or 1/15 of the Roding authorised supply rate.

- A plan change to the Nelson Resource Management Plan has been completed to recognise the subdivision activity in the Saxton Creek area North of Champion Road. This area is currently supplied with water by Tasman District Council. If the present supply arrangement with Tasman District Council continues, this portion of the growth will not need to be supplied from Nelson City sources. However the agreement may be revoked on 3 years notice by either Council.

Improved plumbing and appliance technology, (particularly being driven by the Australian water shortages), future household use will be reduced e.g. superlow flush 4.5/3 litre toilet flush (compared with 11 litre single flush), low use washing machines, low flow shower heads, aerator taps, reuse of grey water for toilets and irrigation etc.

Increasing awareness of low water use gardening e.g. drought resistant planting, no mow lawns, or no lawns at all

With intensification, smaller gardens or no gardens at all for many household units

Reduced use due to reduced supply pressures

Consumer education on tap use e.g. turn off while brushing teeth, shorter duration showers, showers instead of baths, rinsing dishes in a partially filled sink rather than under a running tap.

Possible greywater and rainwater storage on site for reuse

More stringent hosing restrictions

Pricing incentive

Central Government Regulation

Previous Council Urban Growth Strategy documents also predict that some of the population growth will be by intensification of housing in Atawhai, Central Nelson, Hospital, Tahunanui and Stoke areas. This implies that gardens will be smaller and the peak demand per population will reduce.

Council is concentrating on improving services to developed areas and providing services to areas that are currently being developed (Residential, Rural Zone High Density Small Holdings, Suburban Commercial, Industrial). Servicing of other areas covered by the Services Overlay, because one or more servicing constraints have been identified as needing to be addressed prior to the complete development of that

property/area, will be considered as Council develops a policy on prioritising these areas. The specific projects to facilitate future growth, identified in this Asset Management Plan, therefore consist of works required to eliminate servicing constraints on the former.

A specific project has been identified to update desktop investigations, carried out in the past, looking at servicing constraints to areas currently zoned for residential development but restricted by a services overlay.

A review of the residential demand is expected over the next three years as Council reviews the Nelson Resource Management Plan. The likely impact on the water network will be reflected in future asset management plans.

Figure 3-1 compares the capacity of the water sources and water treatment plant with the actual peak day water usage over the last 15 years.

3.2. Demand forecasts

Raw Water and Treated Water Demand:

The following table shows raw water supplied to the WTP and treated water from the WTP. Figures are based on daily flows for the peak flow month for each year.

Table 3-2: Raw Water and Treated Water Demand

Year	Source	Minimum (m^3/day)	Average (m^3/day)	Maximum (m^3/day)
January 2013	Maitai	10,000	15,710	23,000
	Roding	0	7,677	13,000
	WTP	19,226	23,364	30,658
February 2014	Maitai	7,000	12,893	17,000
	Roding	9,000	11,036	14,000
	WTP	18,148	23,461	27,902
January 2015	Maitai	8,717	13,063	18,236
	Roding	631	11,146	12,584
	WTP	18,902	24,969	29,500
January 2016	Maitai	10,257	17,285	23,241
	Roding	0	3,238	11,214
	WTP	17,542	21,593	28,390
January 2017	Maitai	7,819	12,373	20,595
	Roding	0	9,058	12,753
	WTP	17,643	22,579	29,862
December 2017	Maitai	15,000	20,281	25,000
	Roding	5,000	8,188	12,000
	WTP	22,000	25,194	30,000

WATER SOURCES:

CURRENTLY:

RODING PIPELINE CURRENTLY CAN AND DOES SUPPLY 16,000 M3 /DAY PLUS. CAPACITY IS OF THE ORDER OF 20-22,000 M3 /DAY.

EXISTING CONCRETE MAITAI PIPELINE CAN DELIVER 37,000 M3 /DAY.

THE DUPLICATE PIPELINE IS 600MMDIA AND CAN DELIVER THE FOLLOWING(FROM OPUS OPTIMISATION REPORT MAY 2009) AND COMPLIANCE TESTING (AUGUST 2014):

WITHOUT PUMPING 18,144 M3 /DAY.

WITH CURRENT TWO PUMPS RUNNING 30,240 M3 /DAY.

WITH ADDITIONAL PUMPS INSTALLED IT IS POSSIBLE TO SUPPLY UP TO 50,000M3/DAY

THESE ARE STEADY STATE FLOWS. THE WATER RESERVOIRS ARE USED TO BUFFER PEAK HOURLY DEMAND.

Figure 3-1: Peak Water Demand

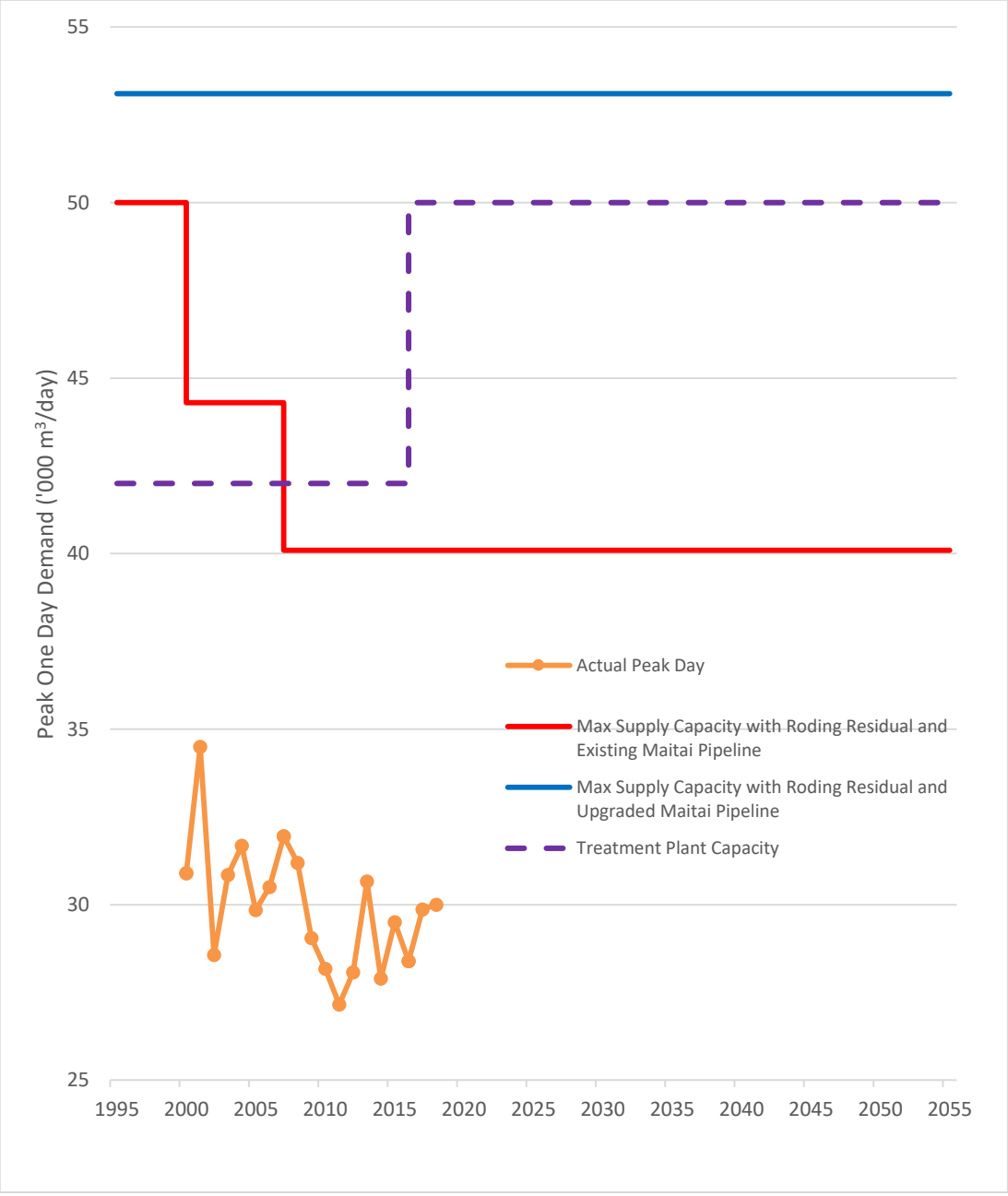


Table 3-3: Peak Daily Demand

Year	Peak Daily Supply (m3/day)	Year	Peak Daily Supply (m3/day)	Year	Peak Daily Supply (m3/day)
2000	30,900	2007	31,950	2014	27,900
2001	34,500	2008	31,200	2015	29,500
2002	28,570	2009	29,050	2016	28,390
2003	30,850	2010	28,170	2017	29,860
2004	31,680	2011	27,160	2018	30,000
2005	29,850	2012	28,070	2019	
2006	30,500	2013	30,660	2020	

Table 3-4: Total Annual Demand

~~Month~~	2008 - 2009		2009 - 2010		2010 - 2011		2011 - 2012		2012 - 2013		2013 - 2014		2014 - 2015		2015 - 2016		2016 - 2017		2017 –2018	
	Maitai (000m3)	Roding (000m3)	Maitai (000m3)	Roding (000m3)	Maitai (000m3)	Roding (000m3)	Maitai (000m3)	Roding (000m3)	Maitai (000m3)	Roding (000m3)	Maitai (000m3)	Roding (000m3)	Maitai (000m3)	Roding (000m3)	Maitai (000m3)	Roding (000m3)	Maitai (000m3)	Roding (000m3)	Maitai (000m3)	Roding (000m3)
Sub-Total	4,696	2,908	4,995	2,977	NA	NA	4,119	3,221	4,722	2,734	4,508	2,815	4,448	2,675	4,899	2,190	4,627	2,322	4,522	2,474
Total ($000m^3$)	7,604		7,972		7,188		7,340		7,456		7,323		7,123		7,089		6,949		6,996	

Based on historical use figures and the supply capacity of the Water sources and treatment plant, Nelson has sufficient water to supply reasonable demands within the city beyond 2050.

As the population increases additional storage reservoirs will be constructed and reticulation upgraded where development requires.

Nelson Population and Household Projections: 2018-2028

Nelson's population projections for the next 10 years are calculated using the Statistics NZ high series

Projections are not predictions and should be used as an indication of the overall trend, rather than as exact forecasts.

Figure 3-2: Population and household projections (high), 2018-2028, Nelson

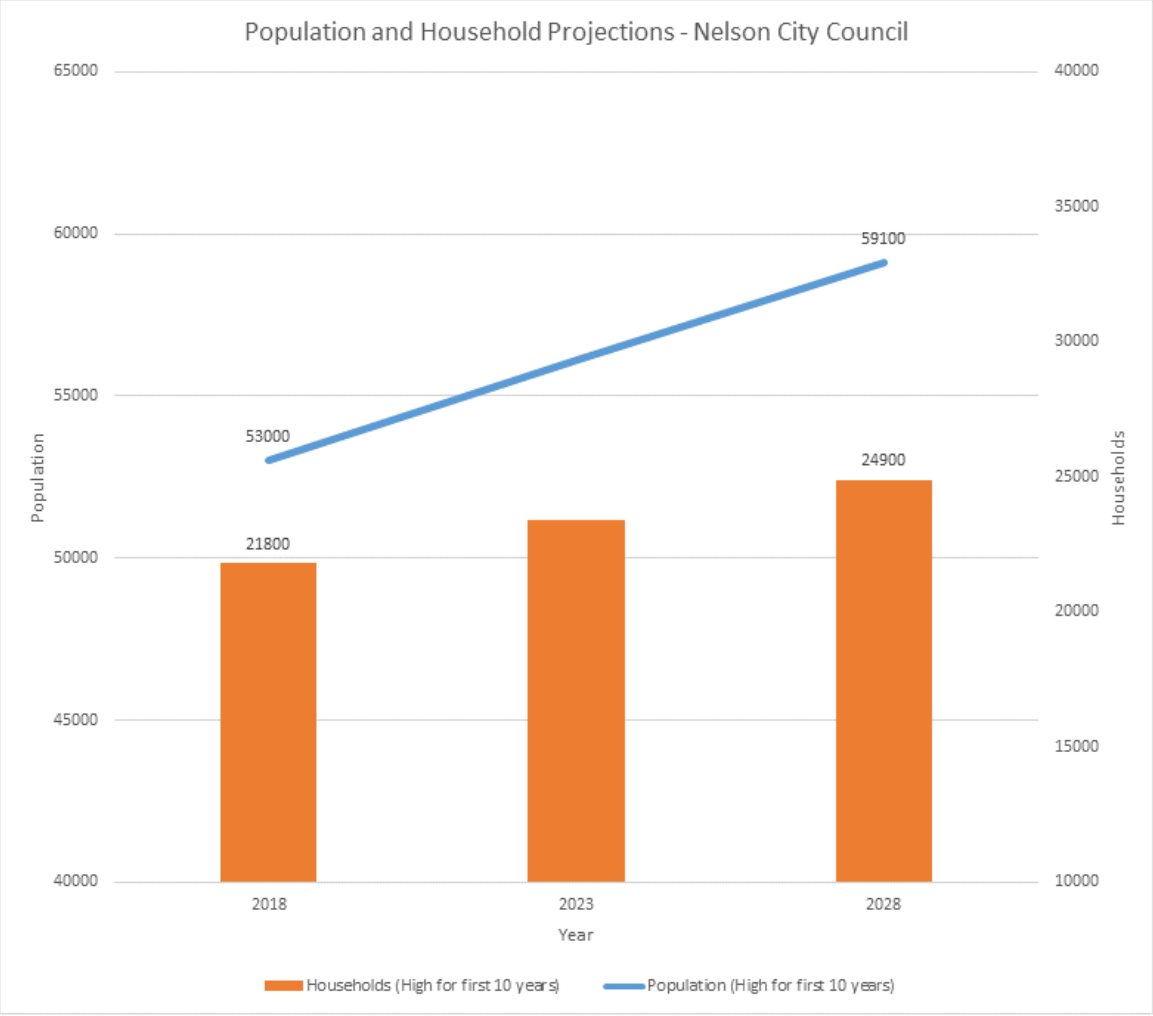
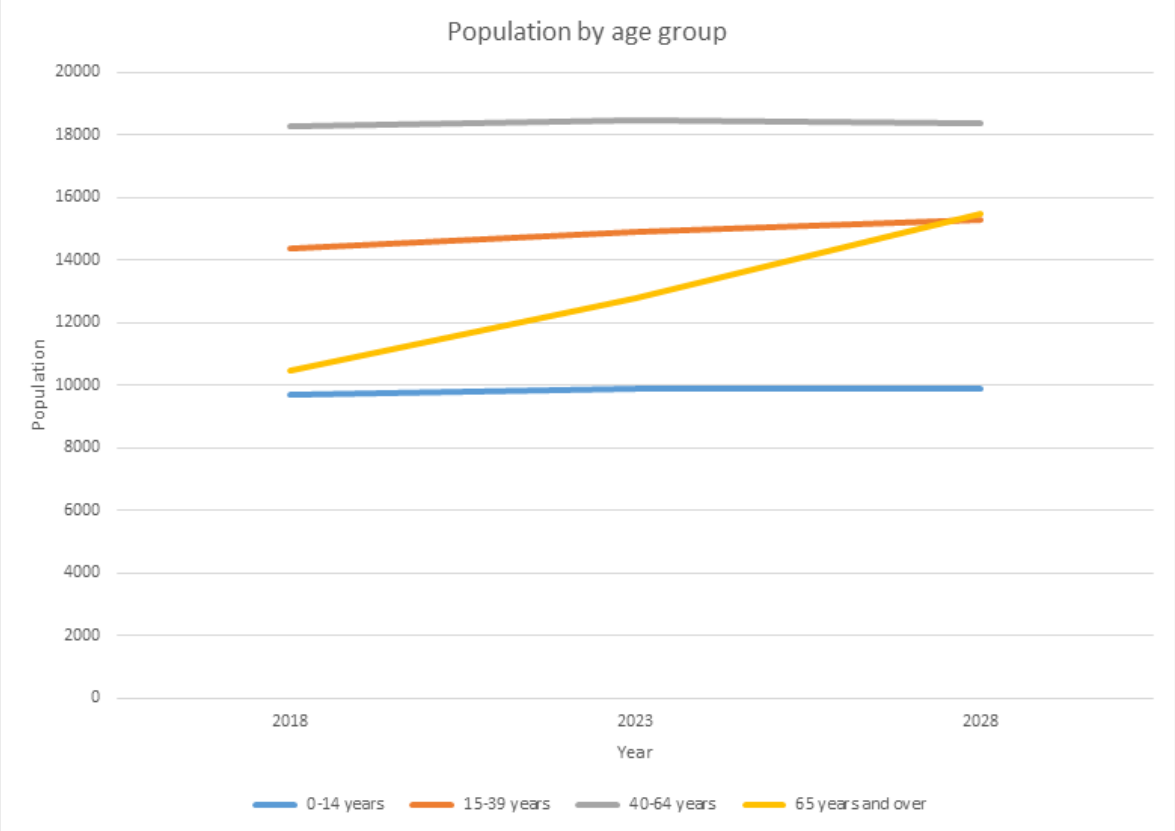


Figure 3-2 shows that, under the high growth scenario, population is projected to increase by 6,100 residents between 2018 and 2028 and the number of households in Nelson will increase by 3,100 households between 2018 and 2028.

One of the key issues facing Nelson is the aging of its population. An aging in the population has a significant impact on what sort of services Council will be required to provide and the ability of future residents to fund rate.

Figure 3-3 shows the projected trends for each age group from 2018-2028.

Figure 3-3: Population Age Trends



Projected demand for National Policy Statement – Urban Development Capacity

The National Policy Statement for Urban Development Capacity (NPS-UDC) requires local authorities to ensure there is sufficient development capacity to meet demand plus an additional margin (Nelson a medium/high growth urban area):

- in the short term (within 3 years) + minimum 20%
- medium term (3-10 years) + minimum 20%
- long term (10-30 years) + minimum 15%

The location of actual growth will depend on where there is capacity for residential growth (residential zoning, infrastructure servicing) and where development is feasible. Residential growth areas and the sequencing of urban development capacity in the short, medium and long term are shown in Appendix I.

3.3. Demand impacts on assets

Peak daily demand figures suggest that Nelson has sufficient raw water source capacity to meet reasonably expected demands for the short-medium term, out to approximately 2060.

As part of the replacement resource consents for the Nelson water supply from the Maitai and Roding Rivers Council commissioned an update of the 2007 OPUS drought study report. WSP-OPUS prepared a number of reports looking at a range of demand scenarios for the city out to 2100. The reports conclude that under most demand scenarios the Maitai Dam will provide sufficient drought security for the city in the medium term.

For the Wakatu estate industrial area and Champion Rd residential subdivisions Nelson City Council currently does not have adequate network capacity to supply these areas and the supply from Tasman District Council is expected to continue in the short term.

Changes to wet industry demand can also impact on the network and these will be monitored over time.

3.4. Demand management plan

Table 3-5: Demand Management Strategies

Strategy	Objective / Description
Regulation	Nelson Resource Management Plan controls water abstraction from river sources. Integrating growth planning with infrastructure provision via the Urban Development Strategy. Measuring and reporting the average daily demand for drinking water. Ensuring water is supplied predominantly through metered connections (emergencies such as fires and natural disasters are likely exceptions). Education and Enforcement of Water Supply Bylaw requirement to avoid wasting water. Track and reduce un-accounted for water volume.
Education	Continuation of non-regulatory community engagement programmes to encourage community to reduce water use especially over the drier months – Link to Environment Activity Management Plan. Re-use of grey water where appropriate for private properties. Encourage use of drought resistant gardens and lawns.

Strategy	Objective / Description
Alternative supply strategies	Private detention tanks and community rainwater harvesting and water use reduction education. Investigating the reuse of treated wastewater from Bell Island. Consult with the community on support for the proposed Waimea Dam in Tasman District.

Universal Metering

The Council resolved to adopt universal metering in 1996 and a capital programme installed a meter for every property. Universal metering has been in operation since 1 July 1999. The maximum two day average in 1997/98 was 42,300m3/day, whereas the peak since universal metering has been in operation is less than 35,000m3/day.

Although the peak one day water usage prior to universal metering reached 42,000m3/day the typical winter usage is in the order of 21,000m3/day. Given that there is virtually no fluctuation in commercial water usage between winter and summer, the difference of 21,000m3/day must be attributed mainly to residential sprinkler usage, although the summer holiday influx of visitors in late December and early January to Nelson does have an impact.

This means that to meet uncontrolled garden watering demand the water supply system needs up to 100% extra capacity which is only used for approximately 10% of the time.

As noted above the introduction of universal metering has reduced the summer peak by over 37%.

Peak demand is most affected by summer drought and consequent garden watering. The drought of 2000/01 is estimated to have a return period of 1 in 30 years. Other years have been average or wetter than average and this is reflected in the peak demands.

The peak one day flows from 2000 are plotted on Figure 3.1.

Other Demand Management

- Use of alternative water sources for non-potable water would reduce the demand from the city water supply, particularly under summer conditions. While rainwater tanks and greywater reuse have some appeal, there are further implications with these, such as:
- The Ministry of Health/Department of Building and Housing reservations as to greywater reuse.
- Financial cost to householder.
- Size of tank versus Nelson rainfall (seasonal pattern and total).
- Siting of rainwater tanks on the property.
- Rainwater tanks needs to be considered in the wider context of sustainability, e.g. environmental cost of producing, transporting and disposing of a tank.
- Plumbing and appliance technology is rapidly advancing, particularly in Australia due to the droughts, and these may actually give better water conservation than tanks/greywater reuse e.g. Very low water usage dual flush toilets 4.5/3 litres per flush compared with 11 litre standard, and normal 11 / 6 dual flush, low water use clothes washers, low flow shower heads.

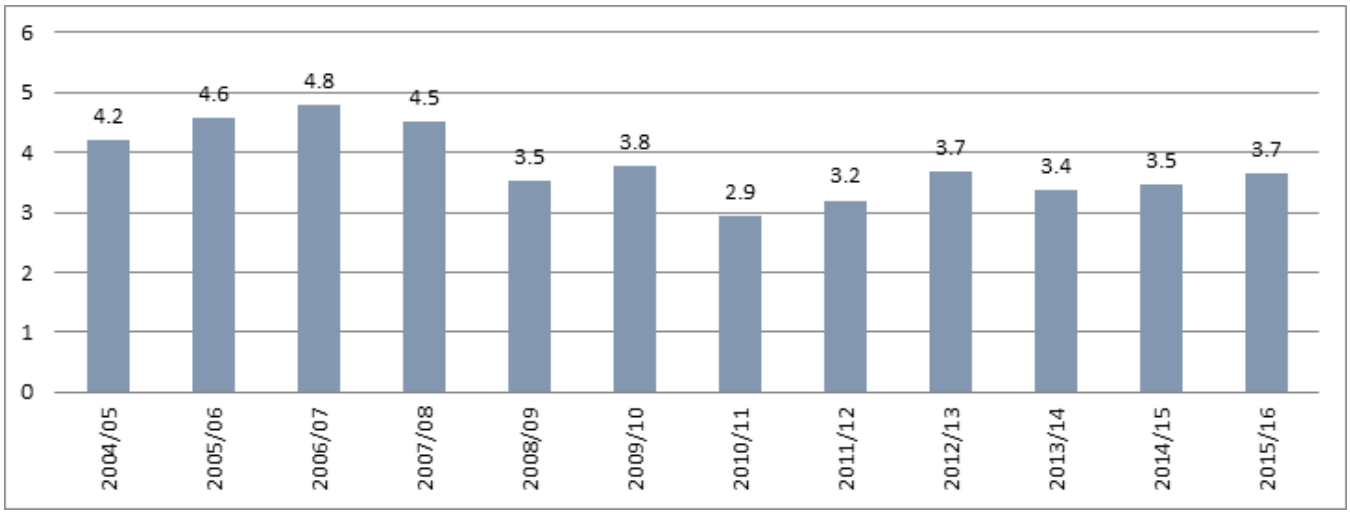
A full evaluation of alternative non-potable water sources suitable for Nelson, taking into consideration Nelson's current and future weather patterns was proposed in the previous Asset Management Plan. This work still needs to be carried out when resources permit.

Un-Accounted for Water/Water Losses

The reporting of annual water losses as a percentage of annual water production is not a satisfactory measure, as losses are nearly constant each year and water sales (and therefore production) is weather dependent. 'Bench Loss' software has been used to calculate the Infrastructure Leakage Index (ILI) which allows year to year comparisons and also benchmarking between water supply authorities.

The infrastructure leakage index has been calculated since 2001/02. The results are shown in Figure 3-5.

Figure 3-5: Infrastructure Leakage Index for Nelson



The Infrastructure Leakage Index has fluctuated over the past with a slight increase apparent over the past two years.

This calculation was made with assumptions regarding un-metered consumption such as flushing of mains, fire-fighting, use by contractors etc. Further work is required to refine these assumptions. The viability of providing metered water tank filling points around the city and where possible metered standpipes for flushing, needs to be undertaken. This would allow more accurate measurements to be entered into the calculation.

The World Bank Banding System for interpreting the Infrastructure Leakage Index is shown in Figure 3-6.

Figure 3-6: World Bank Banding System for Infrastructure Leakage Index

	ILI	Performance in real losses management
For Developed Countries	< 2	A
	2 - 4	B
	4 - 8	C

	> 8	D

World Bank suggested strategies for each band are:

- A (0<ILI<2) Further loss reduction may be uneconomic unless there are shortages; careful analysis needed to identify cost-effective improvement.
- B (2<ILI<4) Potential for marked improvements; consider pressure management, better active leakage control practices, and better network maintenance.
- C (4<ILI<8) Poor leakage record; tolerable only if water is plentiful and cheap; even then, analyse level and nature of leakage and intensify leakage reduction efforts.
- D (ILI>8) Very inefficient use of resources; leakage reduction programmes imperative and high priority.

The water loss evaluation for Nelson is shown in Appendix E.

The Council's maintenance contractor has leak detection equipment which is used to search for and pinpoint the location of suspected water leaks. This service is made available free of charge for locating leaks in private property.

Water leaks on hillsides and areas with clay/rock subsoil usually show quickly on the surface, but on flat and gravel subsoil areas the water from leaks may flow away without coming to the surface. Zone meters have been installed at strategic locations in Stoke and Tahunanui to measure the flow into defined areas. Night-time flows (when there is little domestic demand) can be checked for abnormalities and also the inflow into a zone can be compared with the volume of water sold through the water meters. Additional work is required to break the city into District Metering Areas to better monitor water usage by defined zones.

The Leakage Control Plan is shown in Appendix F.

This level of input will be continued until the scale of UFW can be more accurately established and the need for additional effort assessed. One contributing factor to UFW in Nelson is the very high water pressures in some areas of the City. The Pressure Reduction Plan is shown in Appendix H.

As of 2016-17 the majority of the public network in the city had been checked for leaks. While a number of small leaks were found and repaired no substantial leaks were identified. Ongoing investigation of the other sources of un-accounted for water use such as contractor use and fire-fighting services will continue.

The water supply bylaw controls access to the fire hydrant network and requires approval to be sought prior to taking water, backflow prevention to be in place and records to be kept of the volumes of water taken.

A long term project has also been in place to check the accuracy of residential water meters to ensure that any shortfall in recording can be used in the water balance equation.

Water Conservation Strategy

The Regional Policy Statement requires that the Council as a water user must prepare a Water Conservation Plan to limit or restrict the 'non-essential' portion of the urban water supply in times of drought.

A "Water Supply Conservation Strategy" was re-adopted by the Council in February 2003 to take account of the reduced abstraction available from the Roding River due to the residual flow required to be left in the river as a condition of the Resource Consent.

3.5. Asset programmes to meet demand

Future Urban Development Strategy: Nelson City and Tasman District Council (TDC) are both developing strategies for accommodating projected growth in population and households, as well as the attendant business and other demands this growth will bring and matching it with infrastructure provision as required by NPS-UDC.

Council is concentrating on providing services to areas that are zoned for development (Residential, Rural Zone High Density Small Holdings, Suburban Commercial, Industrial) but are covered by the Services Overlay because one or more servicing constraints have been identified as needing to be addressed prior to the development of that property/area. The projects to facilitate future growth identified in this Asset Management Plan therefore only consist of works required to eliminate servicing constraints on sites zoned for development or as part of the Housing Accord and Special Housing Areas Act 2013 and these have been prioritised in accordance with Council's strategic planning process. A Map of the areas identified for growth is attached in Appendix I.

Capital projects in this asset management plan will provide options reports for parts of these areas and construction of storage reservoirs to buffer demand. Long term planning for trunk main upgrades will be re-assessed as Council formulates a policy of future development areas.

- As future growth projections are available from the national census, the water supply demand for the City will be revised.
- Reports on the Atawhai No 2 reservoir site will be completed and a report on the Tasman District – Nelson City link will be commissioned if required from the outcome of the proposed Waimea Dam in Tasman District.
- Continue the water loss identification and reduction programme.
- Continue the pressure reduction programme where fire flows allow.
- Complete District Metering Areas and monitor demand by area in the city.
- Investigate viability of metered contractor filling points and metered standpipes for flushing to improve UFW results.

The need to ensure resilience in the network to maintain a reduced service in event of emergency and the projected increase in demand caused by development north of Cemetery Point means that Atawhai No. 2 reservoir (2500m3) will be required by about 2021/24. Other reservoirs will be required to serve local growth.

- Malvern Hills to serve the ridge between Botanical Hill and Dodson Valley. This smaller reservoir was shown in the 1998 LTFS for 2001/02 but has been deferred several times until required by development. An options report to identify the best solution for the Atawhai No. 2 reservoir and the upper levels reservoir was completed as a draft in 2016/17. This report will provide the framework for the project to proceed.

- The need for other reservoirs as the city expands has been recognised and allowed for, in general terms, in the capital expenditure tables but not scheduled by exact location as the timing and location of future development is uncertain.

Supply capacity

At the abstraction rates currently authorised in the resource consents, Nelson City has sufficient source water to meet predicted demand through a 1 in 60 year drought for the foreseeable future.

It should be noted that this may change if the resource consent is varied or demand varies from that predicted.

Possible augmentation options to make up any future deficit were considered by Council in 2007. It should be noted that these do not replace the existing sources but merely bridge the difference between existing supply and future demand. Details are in the following reports prepared by Opus International Consultants:

- Maitai Pipeline and Alternative Water Sources – Options and Costs, Opus International Consultants Ltd, 2006
- Feasibility of Raising the Water Level of Maitai Dam, Opus International Consultants Ltd, and Tonkin and Taylor Ltd, 2007

Options are:

- Roding High Dam. A high dam at the Roding could increase the Roding supply. The estimated cost for 10,000m3/day is $20.9million (2008 dollars) and for 20,000m3/day is $34.0 million (2008 dollars).
- Waimea Dam. A fourth possible source of raw or treated water to the city is via the aquifers under the Waimea Plains and/or through the Tasman District Council reticulation. The future of this option is dependent upon a separate process currently underway with the Tasman District Council.
- The present capacity of the Nelson Water Treatment Plant at the Tantragee Saddle is approximately 40,000m3/day with four original membrane trains in place and one new train installed 2016. It is likely that with improved technology the flow rate of new replacement membranes will improve with an increase in capacity to 50,000m3/day. Two trains of the original membranes have been replaced in 2016/17 and the remaining two are programmed for renewal in 2018/19.
- Raising the top water level at the Maitai Dam. An adjustable weir could be installed on top of the existing spillway weir so that additional water could be impounded. Obermyer Spillway gates are bottom hinged spillway gates. They are most simply described as a row of steel gate panels supported on their downstream side by inflatable air bladders. By controlling the pressure in the bladders, the lake elevation can be maintained at user-selected points. The standard pneumatic controller provides accurate upstream pond control, and discharges water appropriately to maintain upstream lake elevation through a range of flows. This means that the existing spillway with such a spillway gate can be used to increase the water level, whilst allowing flood flows through as per normal.
- If the lake level is raised by one metre, the storage is increased by 350,000m3. Additional work would be required to alter the auxiliary spillway and to clear an additional one metre band of vegetation around the lake perimeter. A rough order cost for the complete project is $0.7 million (2008 dollars).
- "Dead" Storage. At present the bottom 900,000m3 of water in the dam cannot be accessed from the original raw water supply pipeline (The pipeline is above ground and higher than the base of the dam. Provision was made at the time

that the dam was built to install a pump in the control building pipe work to enable this water to be pumped out and into the existing Maitai pipeline. However, the new pipeline completed up Maitai Valley Road in 2013/14 is at a level that will enable the "dead" storage to be accessed by using the booster pump proposed in the vicinity of the Maitai Motor Camp.

- The bottom layer of the Maitai dam lake has some organic material as well as elevated levels of heavy metals from the surrounding hills. The seasonal anoxic nature of this layer means that there will likely be additional capital expenditure required to improve the quality of this water should it be required as a source of potable water. There will also be additional operational costs in running the pump when the "dead" storage is utilised.

Extensions to the area supplied

Eastern Foothills

The Foothills Trunk Main is able to provide water to a large area including Upper Brook Valley, upper Enner Glynn Valley, Marsden Valley, the ridge between the Ngawhatu and Marsden Valleys, and Ngawhatu Valley.

Nelson North

When the City water supply was extended to the Glen in 1990, high pressure pipework was laid along State Highway 6 from Allisdair Street to Todds Bush Road, with provision made for a pressure reducing valve at Todds Bush Road. This was to enable increased flow in the pipeline as far as Todds Bush Road.

Provision was also made in the pipework for an extension beyond the Glen turnoff. In 2003 the main was extended by a private subdivider from the Glen turnoff to Hillwood at the foot of Gentle Annie.

Extension over Gentle Annie would provide only a low volume rural restricted supply to existing properties in the area.

At its meeting on 24 October 2002, Council resolved that the pipeline not be extended beyond Hillwood subdivision unless a prior change to the Nelson Resource Management Plan allows more intensive development in the Nelson North area and the costs would be met by those being served.

Covered Storage

Table 3-6: Proposed Reservoirs

Name	Location	Year Proposed	Capacity (m^3)
Atawhai No. 2	Bayview Road or Marybank. Yet to be determined.	2018-23	2,500
Ngawhatu	Ngawhatu Valley. Yet to be determined. (to service future subdivisions)	2025-26	1,000
Future Growth Areas	Nelson- North and South. Yet to be determined.	2034-38	5,000
Proposed Total			8,500

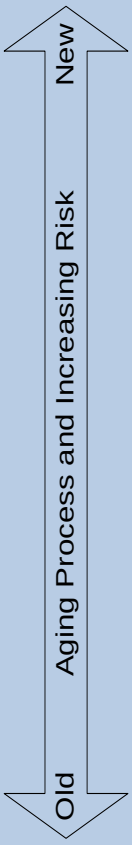
4. Lifecycle management

Lifecycle Management has a direct impact on the provision of water supply services to the residents and businesses of Nelson through the measures that need to be implemented to achieve levels of service. Lifecycle Management will allow Nelson City Council to clearly identify both the short and long term requirements of the stormwater system ensuring that a cost effective service is delivered to the community.

Asset Lifecycle

Assets have a lifecycle as they move through from the initial concept to the final disposal. Depending on the type of asset, its lifecycle may vary from 10 years to over 100 years. Key stages in the asset lifecycle are:

Table 4-1: Asset Lifecycle

	**Asset planning**	When the new asset is designed - decisions made at this time influence the cost of operating the asset and the lifespan of the asset. Alternative, non-asset solutions, must also be considered.
	Asset creation or acquisition	When the asset is purchased - constructed or vested in the Nelson City Council. Capital cost, design and construction standards, commissioning the asset, and guarantees by suppliers influence the cost of operating the asset and the lifespan of the asset.
	Asset operations and maintenance	When the asset is operated and maintained - operation relates to a number of elements including efficiency, power costs and throughput. Maintenance relates to preventative maintenance where minor work is carried out to prevent more expensive work in the future and reactive maintenance where a failure is fixed.
	Asset condition and performance monitoring	When the asset is examined and checked to ascertain the remaining life of the asset - what corrective action is required including maintenance, rehabilitation or renewal and within what timescale.
	Asset rehabilitation and renewal	When the asset is restored or replaced to ensure that the required level of service can continue to be delivered.
	Asset disposal and rationalisation	Where a failed or redundant asset is sold off, put to another use, or abandoned.

Asset Failure Modes

Generally it is assumed that physical failure is the critical failure mode for many assets. However the asset management process recognises that other modes of failure exist. The range of failure modes includes:

Table 4-2: Asset Failure Modes

Structural	Where the physical condition of the asset is the measure of deterioration, service potential and remaining life.
Capacity	Where the level of under or over capacity of the asset is measured against the required level of service to establish the remaining life.

Level of Service Failure	Where reliability of the asset or performance targets are not achieved.
Obsolescence	Where technical change or lack of replacement parts can render assets uneconomic to operate or maintain.
Cost or Economic Impact	Where the cost to maintain or operate an asset is greater than the economic return.
Operator Error	Where the available skill level to operate an asset could impact on asset performance and service delivery.

The Lifecycle Management Programmes cover the four key categories of work necessary to achieve the required outcomes for the water supply activity. These programmes are shown in Table 4-3 below.

Table 4-3: Lifecycle Management Programmes

Management Programme: Management functions required to support the other Programmes - Developed and Implemented by Nelson City Council **Operations and Maintenance Programme:** To ensure efficient operation and serviceability of the assets so that they achieve their service potential over their useful lives - Developed, Managed and Implemented by Nelson City Council **Renewal Programme:** To provide for the progressive replacement of individual assets that have reached the end of their useful lives - Developed, Managed and Implemented by Nelson City Council	Maintaining the service potential of the assets and ensuring that the assets achieve that potential
Development Programme: To improve parts of the system currently performing below target service standards and to allow development to meet future demand requirements - Developed, Managed and Implemented by Nelson City Council	Closing service gaps. Meeting future demand

Table 4-4: Management Strategies

Strategy	Objective/ Description
Strategic Planning	
Human Resources	Develop the professional skills of the staff through adequate training and experience Personal Development Plans will be agreed with staff each year and a register maintained to record training history. Staff are encouraged to belong to appropriate professional bodies and to attend appropriate conferences, seminars and training courses.
Strategic Alignment	This Asset Management Plan will support the achievement of relevant Community Outcomes for Nelson City Council. Community Outcomes for Nelson City Council are set out in the Long Term Plan. The intended contribution of the Nelson City Council water supply services to the achievement of Community Outcomes is shown in this Asset Management Plan.
Service Levels	A clear statement of the water supply services provided and standards to be achieved that directly link to, and support the stated community outcomes, are shown within this Asset Management Plan.
Sustainable Management	Ensures all planning for the management, operation, maintenance, renewal and development of the water supply activity is compatible with sustainable management principles. Nelson City Council will pursue ways of limiting the use of natural resources including energy, valued landscapes (and other natural heritage) and adverse effects on waterways. This will involve auditing the systems and materials used, and developing ways to incorporate sustainable operation and development principles into Nelson City Council activities.
Data Management and Utilisation	
Network modelling	Continue the development of computer-based hydraulic models of the reticulation network. Computer model of the water supply reticulation enables Nelson City Council to: Determine accurately the existing capacity of the system Identify inadequate sections of the system Operate the system in the most efficient and sustainable manner Determine the impact of further development on the system Identify system upgrading requirements Compare options for upgrading the water supply network.
Data Collection	Data collection programmes (condition, performance, asset registers) closely aligned with business needs will be operated in accordance with documented quality processes Data collection, maintenance and analysis are expensive and it is important that programmes and techniques are cost effective and consistent with business needs. Systematic processes will be introduced for the collection and upgrading of essential data based on asset criticality including: Asset attribute information Asset performance data Asset condition data.

Strategy	Objective/ Description
Geographical Information System Data	Geographical information system data will be the subject of defined quality assurance processes. Nelson City Council has quality processes to ensure that all data entered to the Geographical information system meets defined quality standards and supports Asset Management through connectivity with the asset register and Asset Management data storage.
Business Processes	
Asset Management Plan Updates	This Asset Management Plan remains a strategic 'living' document and will be updated as required and reviewed at three yearly intervals to coincide with the Long Term Plan. The scope of the review will be influenced by changes in Community Outcomes for Nelson City Council, service standards, improved knowledge of assets and corporate strategy/ policy and process.
Risk Management	Risk Management is an essential part of Asset Management. Water supply activity risks will be managed by implementing the Risk Management Register for the Water supply activity and the implementation of risk controls to maintain risk exposure at agreed levels. Risk controls will include maintaining appropriate insurance cover, emergency response planning, condition monitoring of critical assets, preventative maintenance, use of Supervisory Control and Data Acquisition, and operations manuals, review of standards and physical works programmes.
Infrastructure Asset valuation	Perform valuations in a manner that is consistent with national guidelines and Nelson City Council corporate policy for valuation cycles which are carried out every 1-3 years to reflect international financial activity and align with the Long Term Plan requirements. Asset valuations are the basis for several key asset management processes including asset renewal modelling and financial risk assessments. Valuations of the water supply system will be carried out based on data from the Asset Management System to ensure audit ability and alignment with other processes.
Monitoring	
Level of Service Standards	Continue with the monitoring procedures to ensure water supply activity is contributing to the community outcomes as stated and that internal controls (service requests, operational contract requirements) are also monitored and managed
Asset Performance	The performance of the water supply assets are monitored as an input to asset renewal and asset development programmes. The Monitoring includes: Customer service requests Asset failure records Asset Maintenance records Compliance with Resource Consents Critical asset audits Supervisory Control and Data Acquisition Legislative compliance
Financial Management	
Budgeting	Expenditure programmes for the water supply activity indicates Council funding and budgets with a 10 year projection.

Strategy	Objective/ Description
	Use the Asset Management Plans to provide sufficient detail to demonstrate the decision making process for those 10 year projections.
Financial management	Manage the water supply activity budget in accordance with statutes and corporate policy. This involves: Economic appraisal of all capital expenditure Annual review of Asset Management Plan financial programmes Recording of significant deferred maintenance and asset renewals Continuous monitoring of expenditure against budget.
Sustainable Funding	Ensure the water supply activity is managed in a financially sustainable manner over the long term. The financial requirements for the provision of the water supply activity, sustainable and to acceptable standards over the long term will be identified and provided for in the budgets. These financial requirements include: Management of the water supply activity Operation and maintenance of the water supply system Asset replacement Asset development to ensure that the ability of the water supply activity to deliver an acceptable level of service is not degraded by growth in Nelson City Council.

The Operations & Maintenance and Renewal Programmes are focused on maintaining the current service potential of assets, and are primarily driven by the condition of assets although asset performance is often an indicator of asset condition.

The Development Programme is focused on closing service gaps by increasing the service potential of the water system and is primarily driven by the performance of assets and the need to accommodate growth in the City.

Community infrastructure is installed and maintained on the understanding that the assets are provided in perpetuity for the benefit of future generations. Longevity of an asset is a prime consideration when design and planning is undertaken for new or replacement components in the network. Sustainability has been reflected in the decision making process when designing and constructing the water supply network.

4.1. Background data

The Council has implemented the Infor Asset Management System. It is used to generate works instructions or Service Request Instructions to the utility services maintenance contractor and to link job instructions to the particular section of the network requiring repair, thereby building up a long term maintenance history of the network.

Once a history has been established, maintenance history and age will be used to assist in a deterioration model that will be used to optimise pipe replacements.

With the purchase of Network Analysis software and monitoring equipment, further work, such as area metering, has been carried out to determine areas of excessive water loss.

4.1.1. Physical parameters

Summary of Assets

Nelson City Council is responsible for a wide variety of assets that constitute the Nelson City Council water supply network. Table 4-5 sets out the summary of assets as at June 2016.

Table 4-5: Summary of Assets as per June 2016 valuation

Asset Catagory	km	units
Reticulation	333.8 km	
Trunk Mains	45.6 km	
Maitai Pipelines	16.3 km	
Roding Pipeline	3.9 km	
Maitai Water Supply Scheme		1
Roding Dam		1
Treatment Plant		1
Tunnels		3
Reservoirs and Tanks		36
Pump Stations		13
Pressure Reducing / Control Valves		40
Air & Non Return Valves		165
Gate Valves		3,634
Manholes		91
Hydrants		2,559
Meters		20,829
Customer Connections		20,260

Table 4-6: Water Mains Lengths by Material as at November 2017

Material	km
Black Asbestos Cement	13.2
Asbestos Cement	96.2
Blue Brute Pipe	.3
Cast Iron	.5
Ductile Cast Iron	1.7
Pit Cast Iron	16.3
Spun Cast Iron	29.8
Concrete	.6
Copper	19.9
DICL	4.3

Galvanised	4.4
High-density polyethylene pipe	53.8
MDPE Medium Density Polyethylene	29.6
PVC	125.8
Steel Concrete Lined	32.1
Steel Pitch Lined	1.2
Grand Total	429.7

Reticulation

Figure 4-1 provides details of the age/material distribution of the Council's water supply network.

Figure 4-2 presents the same information, but showing the theoretical life expectancy.

Figure 4-1: Year of Installation / Material Distribution

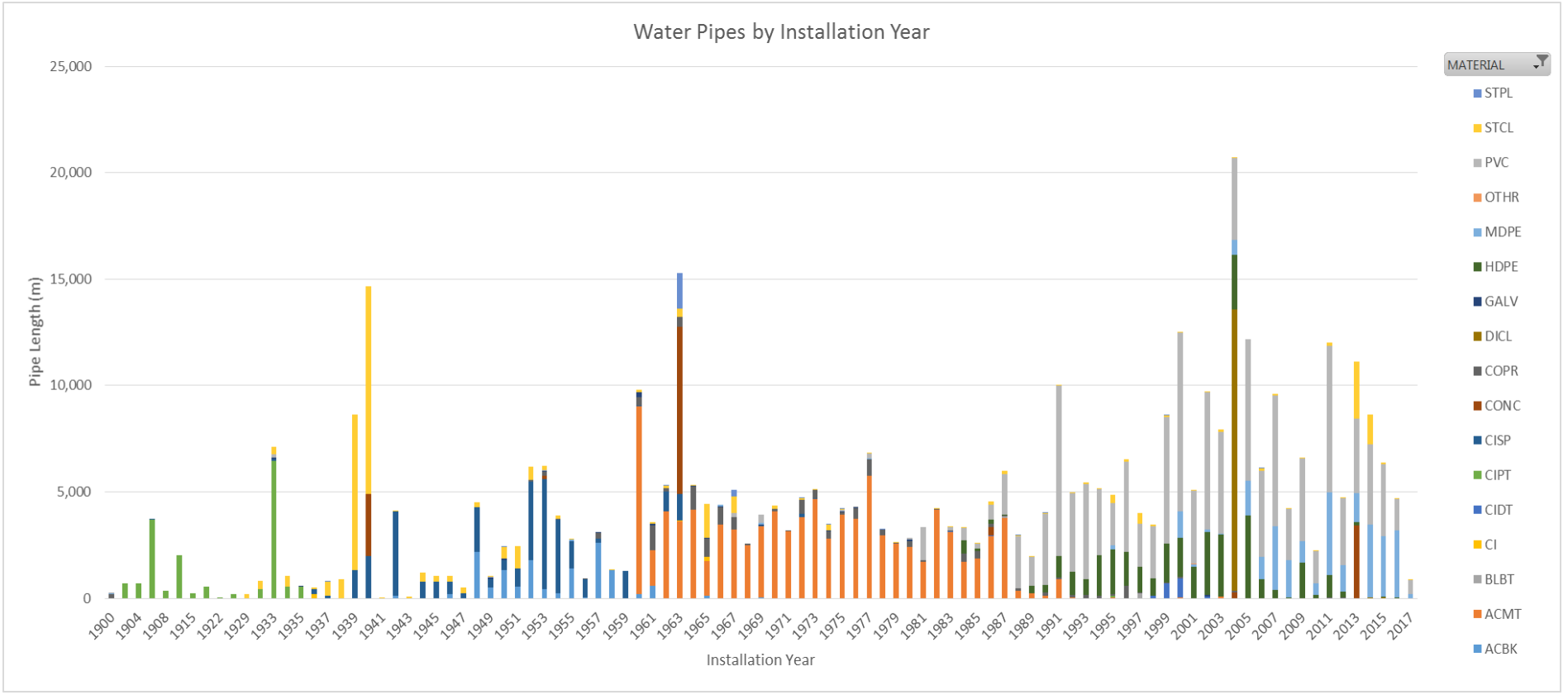


Figure 4-2: Estimated Replacement Value / Material Distribution

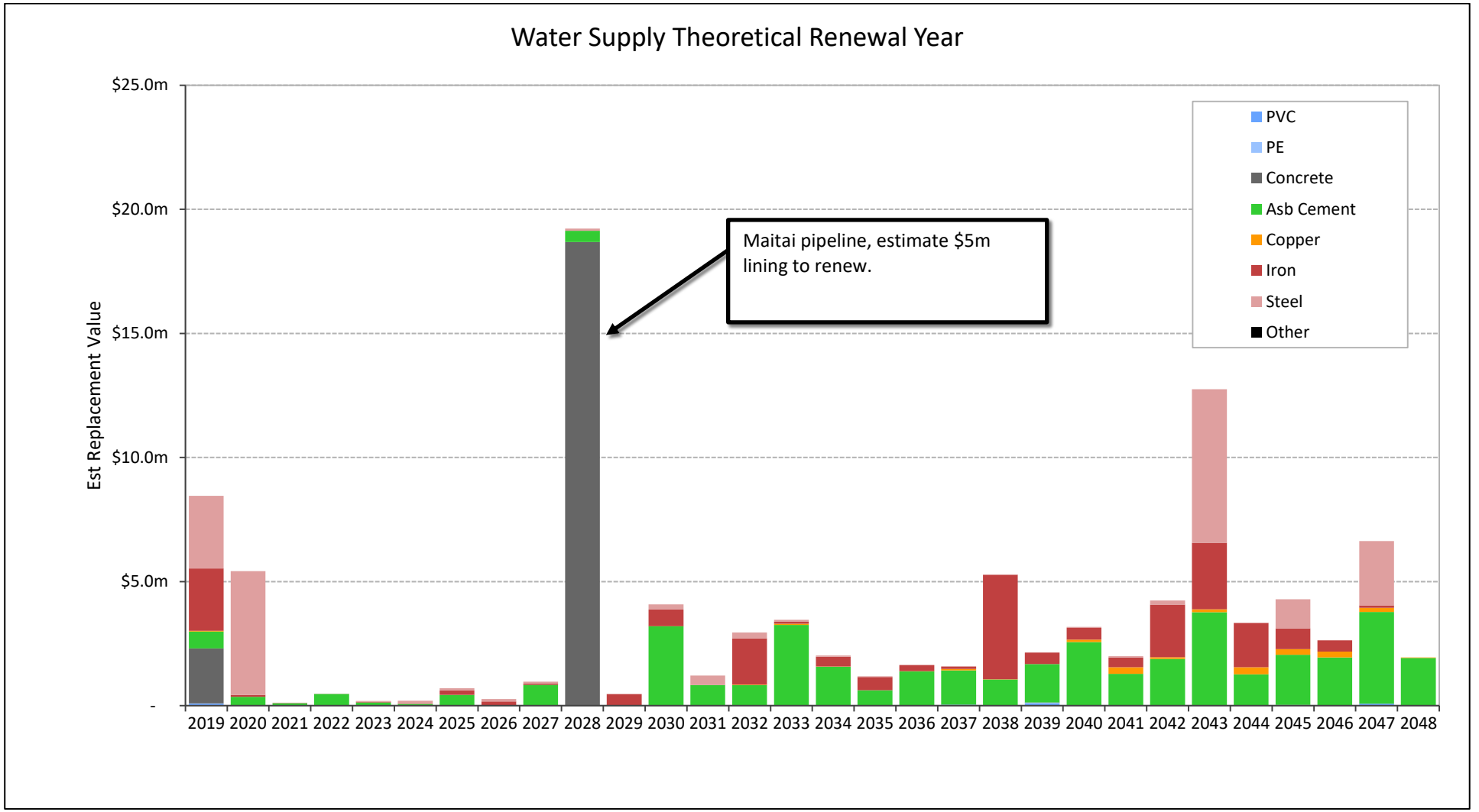


Figure 4-3: Theoretical Renewal Year / Material Distribution

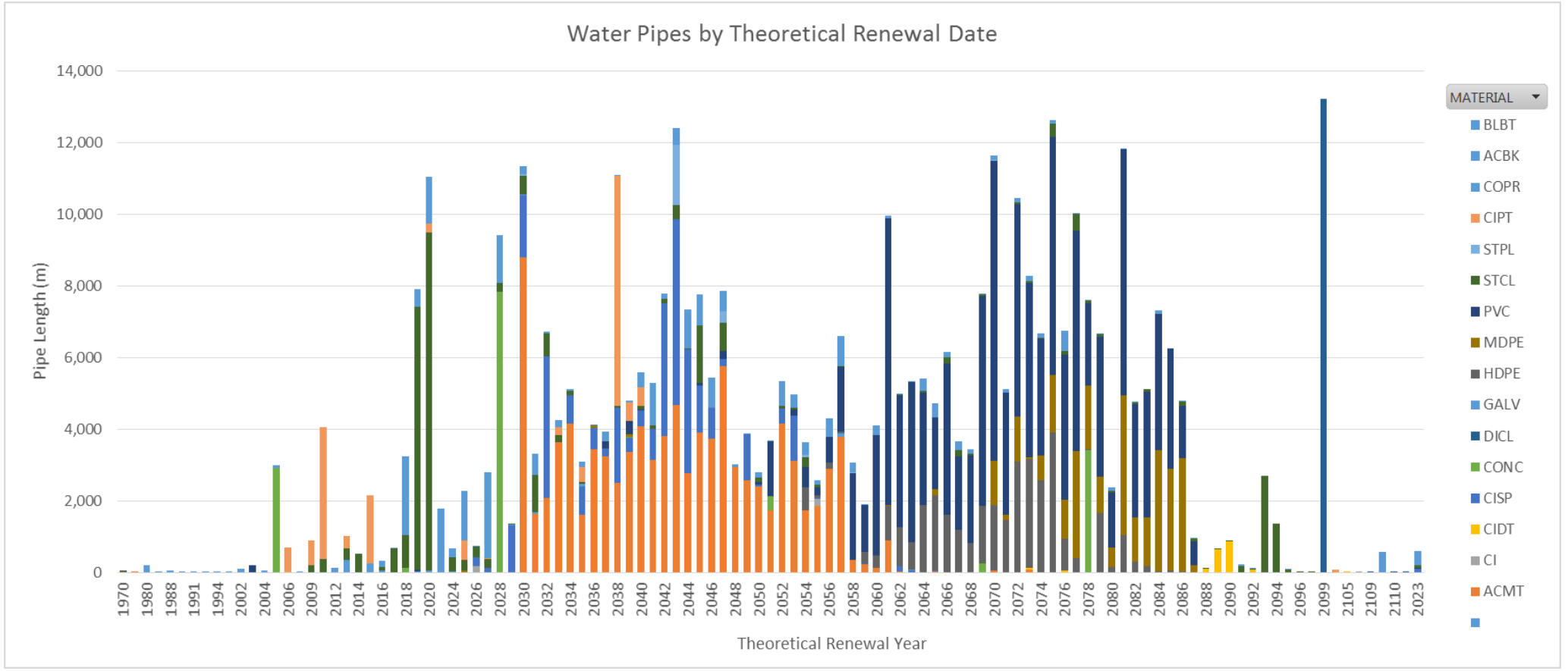


Table 4.7: Working Life of Water Reticulation Assets (Years)

Type	Low Pressure	High Pressure	Trunk Main	Maitai Pipeline	Roding Pipeline
Asbestos Cement (Black)	80	70	65		
Asbestos Cement (Fibrolite)	80	70	65		
Ductile Cast Iron	110	95	90		
Pit Cast Iron	120	105	100		
Spun Cast Iron	100	90	85		
Concrete		65	60	58	75
Copper	90	80	75		
Galvanised Iron	70	55	50		
HDPE	85	70	65		
PVC	85	70	65		65
Concrete Lined Steel	90	80	75		75
Pitch Lined Steel	90	80	75	58	

The nominal working life of the reticulation pipework is based on a survival model prepared on the basis of experience of 10 European water supply systems[3]. The results of the model show good agreement with the experience to date in Nelson City.

High pressure reticulation was assigned a slightly shorter life because of the greater working stresses the pipe and fittings will experience.

Trunk mains have been assigned a shorter life again, because of the more serious implications of a pipe failure and the consequent need for a higher standard.

Fixed structures such as dams, tunnels and reservoirs have been assigned a life of expectancy of 100 years.

Pump station structures have been assigned a life expectancy of 100 years, pipes/valves a life of 70 years, and pumps/control equipment 20 years.

The construction year for each individual section of pipe has been researched from field books, plans and other records. This information has been entered into the database to allow the age of the pipes to be calculated.

Reticulation

The Central City and Port Hills was one of the first areas developed in Nelson and was reticulated with cast iron and steel pipe. The 75mm diameter cast iron pipes have largely been replaced with 100mm or 150mm diameter PVC pipes over the last 10 years. Their performance however suffers from iron tubercles developing on the inside of the pipes. These restrict the flow, and slough off and can cause orange specks in the water which can stain washing and lead to dirty water complaints. However, the strength of the pipe is not affected by the tubercles.

Growths develop on the inside of cast iron pipes caused by iron bacteria. The bacteria are autotrophic and obtain energy from inorganic compounds. They use carbon

[3] Journal of Water Supply: Research and Technology – AQUA Vol. 45, No. 5, pp. 221-231, 1996

dioxide as a carbon source. They oxidise soluble ferrous iron to less soluble ferric iron. The bacteria deposit oxidised iron Ferric Hydroxide as a red-brown coloured slime. Iron bacteria thrive in unlined cast iron pipes.

Another source of dissolved iron was from lower levels of the Maitai Lake when this water is used in preference to turbid water from upper levels when the river is in flood.

There is no simple or inexpensive way of controlling iron bacteria in distribution systems.

The growths can be minimised by using high chlorine residuals, treating the water at source and lining of unlined cast iron pipes.

Cast Iron Watermains

Cast iron pipes generally have a long life before deterioration failure.

The failure of cast iron is often at the joints.

Older pipes are lead jointed. These joints sometimes work loose due to internal pressure, earthquake, or traffic vibration. The joints are repaired by re-caulking where possible or by cutting out the joint area and replacing it with a new section of pipe and two gibault couplings.

There is also a possible health hazard with the lead dissolving in the water, particularly near dead ends where there is reduced flow, and the water is in contact with the joint for longer.

There are proprietary processes to scrape and reline cast iron pipes with either cement mortar or epoxy coatings. This eliminates the effects of tubercles and lead joints as noted above.

It is therefore proposed to investigate the feasibility of refurbishment of cast iron reticulation pipes 100mm diameter and larger rather than abandoning them.

Cast iron pipes may be weakened by changes to the chemical composition of the pipe material over time, such as graphitisation.

Cast iron pipes, being brittle are liable to damage due to traffic loadings and point load over or under another service such as stormwater pipe, etc.

In assessing the reason for a cast iron pipe failure the cause of the failure will be carefully ascertained.

Asbestos Cement Watermains

The Water Supply Managers Group of the New Zealand Water and Waste Association has produced a report entitled "Condition Rating of Asbestos Cement Watermains" which includes (on hard copy and diskette) a copy of: the National Specification for Sampling and Testing, the Life Expectancy Model, the Deterioration/Life Curves, and a copy of the current database of results.

This document will be used to assess the condition of asbestos cement pipes in Nelson.

Pipes of larger diameters and pipes of higher pipe pressure classes have thicker walls to provide the necessary hoop strength.

However pipe wall degradation is nearly constant for all pipe sizes and classes, therefore smaller diameter, lower pressure class pipes will fail earlier, and large diameter higher pressure class pipes may never fail from deterioration.

Most asbestos cement pipe laid in Nelson is Class D. The exceptions are where higher pressure classes were required for specific high pressure lines.

It appears that the relationship between ground conditions and deterioration is not completely proven but may be worth investigating for critical pipelines.

By sampling and testing the remaining wall thickness on existing pipes it may be possible to predict the year of first deterioration failures in each asbestos cement pipeline.

Most AC pipelines in Nelson are 100mm and 150mm Class D pipes, laid between the 1950s and 1980s during the subdivision boom in Stoke, Atawhai and the Victory Square area.

These pipelines are of the same size, class, operating pressure, and ground conditions, and can therefore be aggregated to derive the top down deterioration model for Nelson.

Similarly there are some 50mm diameter class D rider mains which can be aggregated. As noted above these pipes are likely to be the first to fail from deterioration. They are also most likely to fail due to, for example, traffic loading, again due to the relatively thin wall thickness required for the low internal pressure hoop stresses.

A few trunk mains are 200, 300, 375, and 450 mm asbestos cement of varying pressure classes (e.g. the 375mm trunk main from Neale Park to Vickerman Street is C28. A 375mm pressure class C dimension pipe, but with a stronger asbestos cement mix in the wall). As noted above, these pipes are the least likely to fail from deterioration.

Sampling and testing for pipe wall softening will be carried out using the standard methods described in the "Condition Rating of Asbestos Cement Watermains" manual.

Asbestos pipe was imported from Britain and Italy in the early 1950s. It is coated with bitumen and is colloquially known as "Black Asbestos" cement pipe.

New Zealand made "Fibrolite" asbestos cement pipe does not appear to be softening.

A programme of replacing 50mm diameter "Fibrolite" pipe and 100mm diameter "Black Asbestos" pipe has commenced.

Trunk mains

Maitai Pipeline

The Maitai Pipeline was laid in 1963 using 900mm diameter concrete pipe on concrete cradles. 750mm diameter steel pipe was used for the syphons where the pipeline crosses from one side of the valley to the other.

The pipeline is vulnerable to damage from rock fall which can be caused by either major storms or earthquakes. The leakage that can be caused by a rock fall is far more serious than weeps from circumferential cracks.

An inspection in 1998 identified movement in a section of the pipeline near Groom Creek. This was caused by a large earth flow following a period of heavy rain. A 100m long section of affected concrete pipe was replaced by a welded steel pipe, supported on concrete columns, founded on solid ground beneath the earthflow

Stantech (MWH) Ltd have completed a geotechnical assessment of the existing Maitai Pipeline route in 2017. The level of risk is given a rating from low to very high and has been based on:

- Identification of hazards (e.g. rockfall, slumping, shallow sides, etc);
- Likelihood of the event or hazard (e.g. likely to rare);
- Consequence of event hazard (e.g. from insignificant – no leaks or obstructions to major – multiple or greater than 10m of pipe destroyed, access lost, loss of all flow for over 1 month).

A small number of items were identified as needing immediate attention- removal of trees that pose a risk to the pipeline if they fall and inspection of the steel sections at Fiddlers Elbow and adjacent the Maitai Motor Camp. These items will be addressed 2017/18-2018/19.

Since 1989 maintenance effort has been put into repairing the worst of the cracks and sandblasting and painting the steel syphons. To clear the ground from under the pipe to allow complete painting, it has been necessary to construct additional concrete supports under the pipe.

In 2007 Council decided to duplicate the section of the pipeline from the Maitai Dam to the Water Treatment Plant with a new pipe laid down the Maitai Valley Road. The pipe size has been optimised by providing pumping for peak flows. It was also decided that the existing pipeline should be kept in use for as long as possible to minimise pumping costs. As the breakeven point is about 20 years, painting of the steel syphons should be continued in future asset management plans.

On 30 July 2008 a section of the pipeline approximately half a kilometre downstream of the Treatment Plant was damaged by wind thrown trees. Duplication of this section of pipeline (WTP to Westbrook Terrace) with a pipeline laid in Tantragee Road, Brook Street, and Westbrook Terrace has been completed in 2016/17.

Roding pipeline

The Roding pipeline was constructed in the early 1940s at the same time as the Roding weir. The pipeline runs through a 2.7 km long tunnel under the Barnicoat Range, down Marsden Valley and along SH6 to Tahunanui.

The timber shoring in the tunnel was upgraded in 1992 and is considered to be in good condition. The tunnel and the concrete pipeline within it are inspected annually.

The remainder of the pipeline is constructed of steel pipe. Replacement should be programmed within 20 years on an age basis only. Condition inspection was carried out in 2014 and subsequent analysis will be used to determine the actual replacement timing.

Foothills Trunk Mains

The Roding Transfer Pipeline was constructed in 2003/04 using 300mm and 375mm diameter ductile iron pipe. Steel pipe, of the same size, was used where the pipeline crosses two steeply incised creeks.

The pipeline is made up of two pipes buried full length in the same trench.

One pipeline carries raw Roding water from the Marsden Valley (raw water) trunk main to the Water Treatment Plant. The other pipeline carries treated water back to the Marsden Valley (treated water) trunk main.

Water is pumped to a high point (250m) at the saddle between Brook and Enner Glynn valleys. It then falls under gravity the remaining distance. Pressure reducing valves at the Marsden Valley end reduce the pressure to 170m maximum and at the Water Treatment Plant to 7m.

The raw water pipeline is also connected to a hydro electricity generator to capture some of the energy of the water in the pipeline.

Other Trunk Mains

The remainder of the trunk mains in the City have been installed since the 1960s and are in good condition.

Steel Trunk Mains

Steel pipe is used for trunk mains as they are larger diameter, high pressure mains.

Steel pipe suffers from electrolytic corrosion due to "cell effects" between the steel pipe, other metals, and the soil. Where electrons leave the pipe, the metal is eaten away. Properly coated pipe is insulated from the soil and is therefore protected. The coating can however be incomplete, or have been damaged during pipe laying.

The trunk mains in Brook and Tasman Streets (between Larges Lane and Bridge Street), and under the Maitai River (at QEII Drive) are protected by an impressed current system where electrons enter the steel pipe via the coating defect and exit to the soil in a special anode bed. The Fiddler's Elbow Syphon on the Maitai Pipeline is similarly protected, but with a sacrificial zinc anode.

The systems were installed in 1995 and 1996.

In 2000 it was found that the ground anode bed in Bronte Street needed replacement. This was carried out in the 2001 financial year.

An audit of these systems is required in the next five years.

Table 4-8: Working Life of Water Assets (Years)

	Life (Years)
Manholes	
Standard < 1250 dia	84
Standard >= 1250 dia	72
Flow measuring manholes	50
Meter manhole	80
Valves	
Air/NRTN	35
Pressure Reducing	35
Gate valves <250 dia	84
Gate valves >=250 dia	72
Hydrants	
<250 dia	84
>=250 dia	72

	Life (Years)
Maitai Water Supply Scheme	
Dam and platform	200
Concrete structures (spillway etc)	100
South Supply Intake	50
Roding Dam	100+
Other	
Reservoirs	100
Tunnels	100
Stoke reservoir overflow pipe	80
Manifold and meter boxes	80
Service laterals	80
Meters	15

Headworks (including Dams and Intakes)

Maitai Water Supply Scheme

The Maitai Water Supply Scheme was commissioned in 1987. The Scheme can abstract water from the North Branch Reservoir or the run of river intake on the South Branch.

The Maitai Dam is an earthfill dam with crest height approximately 36m above the North Branch riverbed.

Roding Dam

The Roding Weir was commissioned in 1940. In 1972 the concrete structure was raised by 1.5m to its current height of 11m above the downstream riverbed.

The weir initially created approximately 40,000 cubic metres of storage. Major floods in 1985 severely damaged some of the upper catchment so there are now significant amounts of gravel and sand coming down the catchment that have filled in the storage behind the weir. This material has been removed but every time the storage area was cleaned out nature simply delivered more material to fill it in.

With the need for storage reduced by the presence of the Maitai Dam, the decision was taken to build an intake on the downstream face of the weir in 1988. As the water flows over the weir some of it falls through the intake's screens and into the pipe work which then delivers it into the water supply system. This has proved very effective and has stopped a lot of the silt and sand getting into the water supply system. The volume behind the weir has been allowed to fill in and it now appears to have reached a stable level. The storage volume behind the weir is now no more than 3,000 cubic metres. The diversion tunnel gate was renewed in 2002/03. It is now more readily opened to allow gravel to be flushed through on the falling side of a flood, to prevent gravel build up.

Covered Storage

Table 4-9: Current Reservoirs

Name	Location	Material	Year Commissioned	Earthquake design importance category for tank structure
Thompson Terrace No. 1	Ariesdale Terrace	Concrete	1961	4
Thompson Terrace No. 2	Ariesdale Terrace	Concrete	1974	<4
Stoke No. 1	Marsden Valley	Concrete	1996	4
Stoke No. 2	Marsden Valley	Concrete	2006	4
Atawhai No. 1	Walters Bluff	Concrete	2002	4
Clearwater	Tantragee WTP	Concrete	2004	4
Stoke High Level	York Valley Saddle	Steel	2011	4
Observatory Hill No. 1		Concrete		<4
Observatory Hill No. 2		Concrete	2014	4
Panorama Drive		Concrete		4
The Glen		Steel		<4
Various smaller reservoirs and tanks	Various	Concrete	Various	Unknown

Table 4-10: Small Concrete Tanks in Network

Name	Location	Material	Installation Date	Quantity
Todd Bush	Skylark Rise	Concrete	2003	5 tanks
Springlea	22 Springlea Heights	Concrete	2005	1 new tank, 4 existing
Bishopdale	Vista Drive	Concrete	2007	5 tanks
Ledbury Road	1 Norwest Way	Concrete	1994	4 tanks
Strathaven Place	27 Strathaven Place	Concrete	1994	3 tanks
Leach Place	8A Leach Place	Concrete	1991	2 tanks
Atmore Terrace*	41 Atmore Terrace	Concrete	1993	2 tanks

* Atmore Terrace tanks are not currently connected to the reticulation and are used for storage and for firefighting purposes.

Reservoirs

The two reservoirs at Thompson Terrace were constructed in 1963 and 1974. Both reservoirs were strengthened in 1991/92 to improve the seismic performance.

Table 4-11: Reservoir Design Categories

Category	Description
2	Tanks which are intended to remain functional in the emergency period for a major earthquake, for example, firefighting water.
3	Tanks which should be functional in the restoration period for a major earthquake, for example, potable water.
4	Must remain operational and functional post-earthquake

(From NZS 3106: Code of Practice for Concrete Structures for the Storage of Liquids)

In 2000, an engineering inspection was carried out on the roof structure of the 2,500m3 reservoir at Thompson Terrace. It was found that the roof cladding was perforated and that some of the trusses were badly corroded. The roof was replaced in 2001/02 with fibreglass cladding supported by an external steel structure.

A further engineering inspection was carried out on the rest of the reservoir in 2002 while it was drained for roof construction. It was found that the water seals in the floor were in need of replacement. This has been completed.

The Stoke Nos.1 and 2 Reservoirs, Stoke High Level Reservoir, Walters Bluff Reservoir, Clearwater Reservoir and the Observatory Hill Reservoir are of more recent design and are category 2.

There is both mechanical and electronic equipment at the reservoirs to control and monitor refilling.

An additional reservoir at Observatory Hill was constructed in 2014 to provide water storage for the residential subdivisions in the area.

Following the 2011 Christchurch earthquake Council undertook a review of the reservoirs to identify any improvements that could be made using the knowledge gained from Christchurch. To date the smaller Thompson Terrace tank and Walters Bluff reservoir are in the process of being strengthened. A range of minor works to valves and tank draw off points at other tanks are being carried out under the operational contract.

Pump Stations

Nelson has a gravity fed system. (The Marsden Supply is at 170m City Datum and the Clearwater Reservoir at 155m City Datum). There is therefore low dependency on pumps.

The City has thirteen pump stations. All have been constructed since 1990.

Pump Station Locations:

On main raw water delivery line adjacent the Maitai camp ground, Water treatment Plant, Marsden Valley, Princes Drive(two pumps), Thompson Terrace, Wastney Terrace(three pumps), Bishopdale Ave (adjacent no 101), Springlea Ave(two pumps), Hutson Street, Montebello Ave, Van Dieman Street, Austen Ward Heights(one pump), Panorama Drive(two pumps).

At both ends of the Foothills Trunk Main (commissioned 2004) are large inline pump stations. These are critical for the transfer of water to and from the Water Treatment Plant.

There is a large inline underground pump on the cross town trunk watermain in Van Diemen Street. This was designed to boost the flow from the Treatment Plant to Stoke via the Thompson Terrace Reservoir at times of high demand. It is regularly used to part fill Thompson Terrace to maintain the operation of the pump and reduce the risk of sedimentation in the pipework.

The other relatively small above ground pump stations boost water to higher hillside properties.

Pressure Reducing Valves

The City has 40 pressure reducing valves in the reticulation system, Their locations are shown in Figure 1-1 in the Introduction.

Three pressure reducing valves are located at the Marsden Pump Station on the Clearwater Foothills Trunk Main and one is located at the Water Treatment Plant on the raw water foothills trunk main. These were installed in 2004 as part of the Water Treatment project.

At present, pressure gauges linked to the telemetry system monitor the performance of 10 of the pressure reducing valves. These gauges allow for remote monitoring of the pressure in the reticulation and generate an alarm if the pressure moves outside set tolerances. The alarm allows maintenance staff to quickly respond to excess pressures, reducing the impact of damage caused to both public and private pipework.

It is intended to progressively install new telemetry sites to monitor the performance of strategically located valves over the next five years where failure could impact large areas of the city. Target areas for remote monitoring include the CBD, Nelson South and Atawhai zones.

Service Pipes, Manifolds and Meters

Service pipes are the pipes between the watermain and the property street boundary. These pipes are part of the water asset. Pipe materials used are galvanised iron, copper and polyethylene. Galvanised pipes were installed prior to the 1950s. Copper was installed from the 1950s to the 1990s. In recent years polyethylene or polybutylene has been used.

The quantity of each type of pipe is unknown. Whenever a street is upgraded or a new watermain is laid the water service pipes are relaid if they are galvanised. This procedure has been in force since 1990.

Supply pipes are the pipes between the property boundary and the building on the site. These pipes may be shared by several properties where there is a Right of Way or Cross Lease access. Supply pipes are privately owned.

All properties connected to the Water Supply are metered. Meters and manifolds are generally situated at the property street boundary. The exception is where one or more properties are served by a common supply pipe. In this case the meter is located in a practical location where the supply pipe branches to serve only one property. The meter and manifold is part of the water asset, although it may be sited on private property on a private supply pipe.

Manifolds were installed as replacements for all residential toby repairs, and on all new subdivisions from 1993. Manifolds were installed on all other residential properties in

1997 and 1998 as part of the Universal Metering Project. Meters were installed into these manifolds in the first six months of 1999.

In 2009 a small sample (23) of residential water meters were bench tested for accuracy by Water Meter Services Ltd as part of the water losses investigation. These tests were carried out at flows or 0.38 litres per minute, 15 litres per minute and 50 litres per minute. The results show readings ranging as follows:

- Flow 0.38 litres per minute -27.3% to +3.47%
- Flow 15 litres per minute -3.31% to +0.77%
- Flow 50 litres per minute -31.87% to -1.02%

The variability confirmed a general view that some losses must be attributed to meter performance. The testing was repeated in 2013 and 2016/17 to monitor changes and to begin developing a failure curve. The sample tested was quite small in 2016/17 (19 of) and may not be sufficient to develop a reliable curve.

Renewal of the simple double check valve assembly in the meter manifold has been identified as a priority, owing to ongoing failure of these units. This work started in 2015/16 and will be ongoing until the meter replacement programme is concluded.

The increasing use of automated meter reading technology in the power supply utility field offers real advantages to the water supply activity, principally in reducing costs of meter reading and billing and providing early warning of excess water use that may be an indication of leaks. To investigate the feasibility of adopting this technology a trial with 50 meters in a central city residential street began in 2016/17. The meters have been read using hand held wands to test the system and manually for the purposes of invoicing. The appropriate software has been installed and tested for compatibility with the NCC network. It is anticipated that a trial will be carried out in 2017/18 to test the process of automatically generating invoices.

Water Treatment Plant

Commissioned in August 2004, the Water Treatment Plant is made up of several hundred components.

In 2012 an S:CAN unit was installed at the treatment plant to measure the following parameters in the raw water:- total organic carbon, dissolved organic carbon and turbidity; and automatically adjust chemical coagulation dosing. Early results are promising with more efficient use of coagulation chemicals possible. As part of the new abstraction consents for the Maitai and Roding rivers an external review of the water treatment plant was commissioned. This review noted the use of ferric chloride coagulant and reticulation problems encountered during a trial using the Maitai dam as a sole raw water source and recommended a change of coagulant chemical to Aluminium Chlorohydrate. Community consultation will likely be required before any change is made.

In 2013 Council commenced a trial of dosing the raw water delivery from the Maitai with carbon dioxide as a means of adjusting the pH below 8 which will improve the efficiency of the coagulant chemicals used to remove organic loading in the raw water. The pilot trial has proven to be successful in reducing chemical use and the operational contractor is currently making provision for a more permanent installation.

The trial Maitai Dam sole raw water source identified further issues with the soda-ash plant used for pH correction and recommended a change to caustic soda.

The report recommendations will be investigated in 2017/18-2018/19.

Land, Access Roads, Fences, Landscaping and Houses

Land, access roading, fencing and landscaping have now been included in the asset register. These facilities are regularly maintained and are in good condition. The houses at the Maitai and Roding waterworks are listed in Council's fixed asset register.

Pressure

At present, Nelson's water supply is predominantly gravity fed from covered storage reservoirs. This means the elevation of the Water Treatment Plant Clearwater reservoir and Stoke High Level Reservoir determines which areas of the City can be supplied and how much pressure is provided.

Each supply area is further broken down into high level and low level areas. The high level areas work on the full mains pressure generated by the difference in elevation between the reservoirs and the point of supply.

The low level areas have the supply pressure stepped down by pressure reducing valves. This is to protect the mains and domestic plumbing installations from continuously operating under excessively high water pressures.

The Clearwater Reservoir at the Water Treatment Plant is normally used to directly supply the area encompassed by Atawhai, the Brook Valley, Bishopdale, the Port Hills, the Port, and via the Thompson Terrace Reservoirs to Tahunanui and the Tahunanui hillside, and at times Stoke. The reservoir has an effective elevation of 155m above City Datum.

The Saddle Break Pressure Tanks and Stoke High Level Reservoir on the foothills cross-City link between the Brook and Enner Glynn Valley are at an elevation of 255m above City Datum (but the pressure is lowered in Marsden Valley by a pressure reducing valve to 170m above City Datum) and is used to supply Stoke.

The difference in elevation between the two systems means that properties on the Stoke high level areas can experience pressure fluctuations of at least 150kPa (15m head). This fluctuation in cold water pressure (and flow rate) adversely affects showers, washing machines, dishwashers, etc.

4.1.2. Asset capacity/performance

Reticulation

The flow capacity of asbestos cement pipes does not generally deteriorate with time however the failure performance of the product has not met Council's expectations. This is particularly the case with 'Black' asbestos cement. Council's current renewal strategy targets the replacement of this material as a priority.

The trial use of the Maitai Dam as the sole raw water source in 2016 resulted in a large number of dis-coloured water complaints to Council. The source of the dis-colouration is generally believed to be the deposits of iron and manganese in the network. A review of the issue has made a number of suggestions for further investigation to better identify the cause of the deposits being released into the network at that particular time.

Headworks (including Dams and Intakes)

Maitai Water Supply Scheme

The reservoir has a total live storage of 3.3M m3, and dead storage of 900,000m^3.

Covered Storage

Currently the Maitai and Roding together are capable of meeting the water treatment plant capacity of approximately 40,000m^3/day. However, demand is more typically spread over a 16-18 hour period. Therefore storage is required to make full use of the night time supply capacity and to meet peaks in demand during the day.

This storage is also needed to ensure continuity of supply in the event of a major problem (e.g. headworks damage, or trunk main failure) and to provide opportunities to carry out planned maintenance.

The Public Health Grading of Community Water Supplies 2003 Explanatory Notes and Grading Forms imposes distribution grading "demerit points" where there is not covered secure storage of 24 hours average daily demand.

The targeted level of service is 24 hours storage (at average demand) located in the area it is to serve. This standard is met for the smaller hilltop reservoirs and tanks served by pumped systems or night time filling but not for the larger zone reservoirs.

All reservoirs above 100 m^3 (10 in total) have level sensors connected to the telemetry SCADA system. Alarms are monitored 24 hours a day and there is always someone on-call to respond. There are seismic valves on the outlet pipes of nine of the reservoirs over 100 m³ (excluding The Glen and Montebello-privately owned).

Table 4-12: Current Reservoirs

Name	Location	Capacity m3
Thompson Terrace No. 1	Ariesdale Terrace	2,300
Thompson Terrace No. 2	Ariesdale Terrace	5,300
Stoke No. 1	Marsden Valley	2,500
Stoke No. 2	Marsden Valley	2,600
Atawhai No. 1	Walters Bluff	2,500
Clearwater	Tantragee WTP	3,000
Stoke High Level	York Valley Saddle	2,500
Observatory Hill No. 1		300
Observatory Hill No. 2		440
Panorama Drive		185
The Glen		110
Various smaller reservoirs and tanks	Various	1,550
TOTAL CAPACITY		23,285

Table 4-13: Small Concrete Tanks

Name	Location	Number of 22m³ Tanks
Todd Bush	Skylark Rise	5
Springlea	22 Springlea Heights	5
Bishopdale	Vista Drive	5
Ledbury Road	1 Norwest Way	4

Strathaven Place	27 Strathaven Place	2
Leach Place	8A Leach Place	2
Atmore Terrace*	41 Atmore Terrace	2

* Atmore Terrace tanks are not currently connected to the reticulation and are used for storage and for firefighting purposes.

4.1.3. Asset condition

Condition Assessment

Historically asset monitoring to determine condition has been subjective, based on local knowledge and experience. Formal procedures now exist to assist assessment of asset condition in a qualitative fashion.

The development and continued use of condition assessment data is hoped to support the preparation of verifiable predictive decay curves for particular asset types and hence permit prediction of remaining life. Consideration of economic influences and other factors will also be required in the adopted life for the asset type.

By considering the current condition point on an assumed decay curve, the profile can predict the effective life (time) before failure. This failure time can be the physical end of life, minimum level of acceptable service, or limit of capacity of the asset.

Current Position on Condition Assessment

Presently a simple approach to condition assessment is being used.

Whenever the maintenance contractor is working on pipe repairs a condition report is made and entered into the Asset Management System. It is anticipated that this database will be used to plot developing problem areas on a city wide basis and allow relationships between pipe types, construction techniques, age and geology to be developed.

Pipe samples will also be recovered, where unexpected failures occur, so that sophisticated condition assessment can be implemented and the data recorded on the Asset Management System.

The Asset Management System will be used as part of an Optimised Decision Making process. The level of sophistication will increase as the condition data base is developed.

Reticulation

When considering the condition of the reticulation, the City can be considered as three reasonably distinct areas:

- The Central City and Port Hills was one of the first areas developed in Nelson. Smaller diameter reticulation has largely been replaced with 100mm or 150mm dia pipework.
  Most of the more recent (post 1975 introduction of uPVC and PE pipes) reticulation is considered to require minor maintenance only i.e. Condition generally Good.
- Stoke and Tahunanui came within the City boundaries in the 1950's. Water reticulation was provided at that time. Typically cast iron and asbestos cement

pipe was used. Early asbestos cement pipes are softening and starting to fail and needs replacement.
The reticulation is considered to be in satisfactory condition, i.e. Condition generally Good.

- The Atawhai and Stoke South areas have been developed since the 1970's. Asbestos cement and more recently PVC pipe have been used.
  The reticulation is generally considered to be in very good condition, i.e. Condition Very Good.

Asbestos Cement Watermains

Table 4-14: Best Estimate of Condition of Asbestos Cement Watermains

	Very Good	Good	Fair	Poor	Very Poor	Total
Metres Length	73,345	13,793	11,932	7,116	3,284	109,470
%	67.0	12.6	10.9	6.5	3.0	100

Cast Iron Watermains

Table 4-15: Best Estimate of Condition of Cast Iron Watermains

	Very Good	Good	Fair	Poor	Very Poor	Total
Metres Length	-	-	6,082	35,583	6,614	48,281
%	-	-	12.6	73.7	13.7	100

Trunk mains

Maitai pipeline

Cycles of direct sunshine and frosts have resulted in circumferential cracking of the concrete pipes. In areas exposed to the full afternoon sun there are typically three to four cracks per pipe. The flow from the cracks is usually no more than a weep. In the more shady lengths of the line the pipes are in excellent condition. The worst area is immediately downstream of the dam as far as the first syphon.

The pipeline is inspected monthly and also following major storms and earthquakes. In November each year an engineering inspection is made.

A condition assessment of the steel pipeline section was completed in March 2011. This report has evaluated the condition of the pipeline and provided remediation specifications. The pipeline has significant sections requiring repair and recoating.

The pipeline passes through a 240m long tunnel near the Tantragee Saddle. The timber shoring in the tunnel was upgraded in 1994 and is considered to be in good condition. The tunnel is inspected annually.

The maintenance schedule to date is shown in Appendices.

Foothills Trunk Mains

The pipeline is inspected yearly, but is also continuously monitored by computer for sudden changes in pressure and flow. It is in very good condition.

Other Trunk Mains

The remainder of the trunk mains are in good condition.

Steel Trunk Mains

Above ground pipes are inspected annually to ensure that the pipe coating (epoxy or wrapping) is intact.

Because steel pipes corrode through localised action as described in Physical parameters, sampling is not a reliable means of determining pipe condition.

An assessment of the above ground steel pipe sections was carried out in 2011 by Inspection and Consultancy Services Ltd. This assessment concluded that the condition of the protective coating of the above ground pipework on the Maitai raw water pipeline was "poor". Re-coating of this main has been completed.

The overall condition of the mains varies from fair to very good condition i.e. Conditions Grade 1-3.

Headworks (including Dams and Intakes)

Maitai Water Supply Scheme

The performance of the dam is monitored monthly and following major earthquakes. Tonkin and Taylor Ltd, the designers, carry out an annual inspection of the dam and maintenance work is programmed in response to their recommendations and those of the Maitai Caretaker.

Table 4-16: Tonkin & Taylor 2016 Dam Safety Review Summary of dam condition

Dam Element	Current Condition	Comments
Embankment	**Satisfactory**	
Service Spillway	**Satisfactory**	
Auxiliary Spillway	**Satisfactory**	
Intake Tower	**Satisfactory**	
Culvert	**Fair**	Seepage through culvert joints.
Internal Pipework and Valves	**Satisfactory**	
External Pipework	**Satisfactory**	
Control Building	**Satisfactory**	
Mixing Chamber	**Satisfactory**	

While these procedures are effective at ensuring year to year reliability of the main supply dams, more work is needed on assessing the longer term requirements for items such as valves, pipework, and electronic equipment.

Comprehensive Safety Reviews (CSR) of the Maitai Water Supply Dam are commissioned by Nelson City Council every five years to independent consultants to review the original design against current practice. The latest CSR inspection was carried out in January 2014 by Damwatch Engineering. The final report was received in June 2014. The next review is to be repeated in 2019.

Recommendations can be found in Appendices

Roding Dam

There is a caretaker living on site at the Roding Weir. Routine maintenance work is programmed in response to his recommendations.

The scheme is considered to be in very good condition.

Reservoirs

All reservoirs are considered to be in very good condition.

Pump Stations

The condition of the pumps stations is considered to be very good.

Pressure Reducing Valves

The condition of the pressure reducing valves is considered to be good. A number of water main failures in the central city (2016/17) and Kakenga Road have been attributed to failures of PRV's in Franklyn Street and Marsden Valley respectively. A review of causes and servicing requirements is proposed for 2019/20.

Service Pipes, Manifolds and Meters

The condition of service pipes varies from very good to unserviceable.

Manifolds are in very good condition.

Meters range from near new with a condition assessment of very good to nearly 30 years old.

Water Treatment Plant

The plant and equipment is in very good condition.

4.1.4. Asset Valuations

The replacement costs of the water assets are $248.9m at June 2016 as detailed in Table 4-10 below. The majority of the replacement costs are the reticulation mains.

Table 4-17: Water Supply Asset Valuation - June 2016

Asset Category	Quantity		RV	DRV	Depr
	km	units	($)	($)	($)
Reticulation	333.8		81,114,158	43,397,673	1,011,932
Trunk Mains	45.6		22,787,631	10,972,355	309,409
Maitai Pipelines	16.3		22,557,388	13,416,549	320,366
Roding Pipeline	3.9		2,741,626	575,848	30,162
Maitai Water Supply Scheme		1	20,848,700	14,402,600	226,000

Roding Dam		1	2,889,100	855,900	48,300
Treatment Plant		1	22,953,076	12,717,431	854,588
Tunnels		3	11,846,400	10,340,200	55,000
Reservoirs and Tanks		36	13,282,350	10,359,000	160,618
Pump Stations		13	4,237,644	3,059,122	178,850
Pressure Reducing / Control Valves		40	616,053	338,524	16,484
Air & Non Return Valves		165	401,227	222,566	10,985
Gate Valves		3,634	6,471,706	4,223,537	82,052
Manholes		91	338,979	213,359	4,408
Hydrants		2,559	4,851,864	2,471,672	65,197
Meters		20,829	3,792,946	1,313,091	186,584
Customer Connections		20,260	27,214,741	15,416,273	342,318
Total			**248,945,588**	**144,295,702**	**3,903,253**

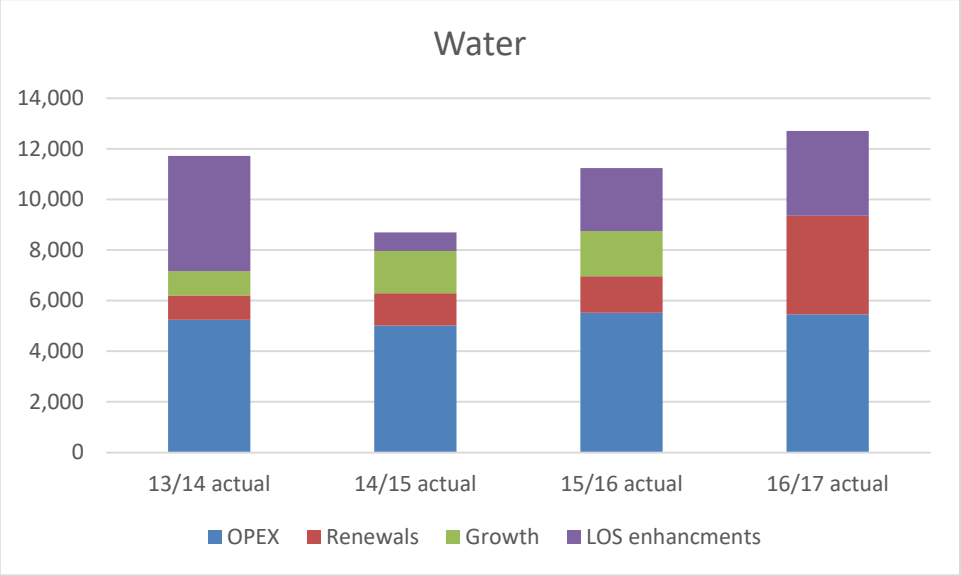
The 2017 indexed depreciated replacement valuation of the water supply assets is $156,331,000.

Valuation Method

Valuations are completed on a bi-annual cycle. Every second year a full revaluation is completed of all assets held by NCC, which is completed by reviewing all assets and valuing them based on recent costs for similar work within Nelson City Council. This work is peer reviewed by OPUS International Consultants Ltd. For the intervening years an Indexed revaluation is completed based on the previous year's full revaluation and a factor of recognised price increase advised by OPUS after allowing for known asset additions and disposals. In addition major assets, (dams, Pump stations etc.) are revalued by OPUS on a replacement value basis. The Depreciated Replacement Value is used to calculate the straight line depreciation over the remaining useful life.

4.1.5. Historical data

Figure 4-4: Graph of Recent Expenditure



4.2. Operations and maintenance plan

Operations and Maintenance strategies set out how the stormwater activity will be operated and maintained on a day-to-day basis to consistently achieve the optimum use of assets and meet levels of service. Operations and Maintenance activities fall into the following categories, each having distinct objectives and triggering mechanisms:

Operations - Activities designed to ensure efficient utilisation of the assets, and therefore that the assets achieve their service potential and the network is capable of meeting required levels of service. Operational strategies cover activities such as energy usage, control of mechanical and electrical plant, inspections and service management.

Maintenance - Maintenance strategies are designed to enable existing assets to operate to their service potential over their useful life. This is necessary to meet levels of service, achieve target standards and prevent premature asset failure or deterioration. There are two types of maintenance:

- Programmed - A base level of maintenance carried out to a predetermined schedule. Its objective is to maintain the service potential of the asset system. And maintenance actioned as a result of condition or performance evaluations of components of the water supply network. Its objective is to avoid primary system failure
- Reactive Maintenance - Maintenance carried out in response to reported problems or system defects. Its objective is to maintain day-to-day levels of service.

Additional planned maintenance work is carried out on the reticulation to address faults identified by the leak detection work.

4.2.1. Operations and maintenance plan

Maintenance Planning

Currently the asset maintenance is a mix of programmed and reactive. Further work moving towards advanced asset management planning techniques for critical components is considered appropriate to apply programmed maintenance programmes

to the widest area of components required to ensure the safe and efficient operation of the network. This approach would allow for maximising the useful life of an asset while minimising the consequences of unforeseen failures.

Method of Delivery

The operation and maintenance of the Nelson City Council water supply activity is carried out using a combination of Nelson City Council staff and external contractors consisting of:

- Network Services internal utilities business unit for design and Supervision (Nelson City Council).
- NELMAC Limited for all reticulation operations and maintenance (CCTO).
- External contractors for specialist activities such as closed circuit television and major overhauls of mechanical equipment.

Pump stations:

The pump stations are inspected weekly, with monthly routine maintenance carried out. Full performance and condition assessment are carried out every two years.

The pump stations follow a 'rolling' pump overhaul programme.

Reservoirs:

Reservoirs are long life above ground structures. Monthly routine maintenance inspections are carried out. Full condition and performance assessment are carried out every five years.

In November 2003 engineering inspections were carried out on Thompson Terrace No. 2, Stoke No. 1, Observatory Hill and The Glen Reservoirs.

Weathering of the concrete dome roof of Thompson Terrace No. 2, corrosion of the internal steel surface of the Glen reservoir, and blistering of the water seals in the Stoke Reservoir were noted.

Remedial work of the Glen was completed in 2005/06.

Seals in the Thompson Terrace No 2 reservoir were partly replaced after seepage was noted in the underdrain collector. Anodes were fitted to the internal ladder to prevent further corrosion.

Seismic shut off valves have been retrofitted to the Stoke No.1 and Thompson Terrace Nos.1 and 2 Reservoirs. The newer Atawhai No. 1, Stoke High Level and Stoke No. 2 reservoirs were fitted with seismic valves during construction.

The pipework at the Thompson Terrace reservoirs has been modified to prevent "short circuiting" of the water flow with possible water quality problems.

Work on replacing the seals to Observatory Hill and Panorama Drive reservoirs was completed in 2010.

Water Treatment Plant:

Each component is maintained regularly on a scheduled maintenance programme in accordance with vendor data.

Operators stationed at the plant regularly inspect, check and calibrate components of the plant to ensure they are performing their design function. The cost of routine maintenance is covered by an operations contract with an external contractor.

Large portions of the plant and the components are computer monitored and alarms are raised if they go outside predetermined performance limits.

Pressure Reducing Valves

The water maintenance contract has been amended to provide for more preventative maintenance to be carried out on the pressure reducing valves so the potential for malfunction is reduced. Further work is required to prevent grit and iron/manganese deposits impacting the operation of these valves. A review of the PRV network will be started in 2017/18 with an upgrade programme identified for the 2021/31 LTP.

4.2.2. Operations and maintenance strategies

Day to day operation and maintenance of the network is carried out by contractors with specific requirements set out in the Maintenance of Utility Services contract.

Level of Service Implications:

For the water supply network to deliver the levels of service it must be intact and functioning. Reactive maintenance must be carried out promptly. Programmed maintenance must be carried out to ensure that downtime is minimised by carrying out maintenance before it becomes reactive.

Demand Implications:

With increasing demand there will be an increase in total variable costs particularly as more water is transported and pumped.

Risk Implications

Intakes, treatment plant and reticulation mains, must all be maintained, kept secure and protected from natural hazards so that they can continue to function through an emergency albeit at a reduced level of service.

Lifecycle Implications

Operations and maintenance is the longest period of the asset lifecycle and ongoing maintenance is necessary to ensure that the design life of the asset is achieved.

Table 4-18: Operations and Maintenance Strategies

Preventative Maintenance	Preventative Maintenance will be carried out in terms of defined routine maintenance items and triggers for these activities to be carried out. These are set out in the Nelmac contract for maintenance of utility services.
Reactive Maintenance	Remedial maintenance will be undertaken as quickly as practically possible to restore an asset to a satisfactory condition after a failure or other unsatisfactory condition has been detected.
Repairs	The detection and repair of faults causing failure will be undertaken as quickly as practically possible. The fault will be isolated and components repaired or replaced as appropriate and then if warranted the item will be tested to ensure that it meets the relevant operational standard.
Redesign and Modification	Redesign may be necessary if an asset or system does not meet its operational objective? Similarly, modifications may be necessary to improve the operating characteristics. Redesign and modifications will

	be undertaken in a methodical manner to ensure alternative options are considered and optimum decisions made.
Operations	
Operations	Operational activities for the reticulation will be undertaken via NELMAC unless specialised advice is required. The water treatment plant operation and maintenance is currently contracted to Fulton Hogan Ltd. Staff will be responsible for the determination and optimisation of planned and unplanned works, work methods and maintenance scheduling to achieve the target service standards.
Physical Works Monitoring	Audits of work will be carried out to verify compliance with standards set out in the appropriate contract.
Operation of Utilities	Utilities such as pumping stations will be operated in terms of defined parameters and standards set out in the operations and maintenance contract.
Incident management	Effectively respond to and manage incidents to ensure system availability and service continuity, and mitigate adverse effects. Maintenance staff and contractors are expected to effectively manage minor incidents. Nelson City Council staff will become involved in serious incidents.
System control and monitoring	Utilise Supervisory Control and Data Acquisition systems to monitor operation of the water supply facilities. The Supervisory Control and Data Acquisition system provides surveillance of the operation of pump stations and reservoirs in the water supply system and provides alarms when equipment fails or when operating parameters are exceeded. The Supervisory Control and Data Acquisition system also records operating data from the pump stations.

4.2.3. Summary of future costs

Table 4-19: Water 10 Year Operations and Maintenance Projections ($000)

Account	2018/19 LTP Final Uninflated	2019/20 LTP Final Uninflated	2020/21 LTP Final Uninflated	2021/22 LTP Final Uninflated	2022/23 LTP Final Uninflated	2023/24 LTP Final Uninflated	2024/25 LTP Final Uninflated	2025/26 LTP Final Uninflated	2026/27 LTP Final Uninflated	2027/28 LTP Final Uninflated
7005 Water Supply										
Expenses	5,530.6	5,584.7	5,641.6	5,606.9	5,655.1	5,744.7	5,760.6	5,691.8	5,698.1	5,686.8
Base Expenditure	3,299.0	3,378.0	3,379.2	3,480.2	3,541.4	3,505.3	3,569.4	3,618.1	3,599.4	3,588.1
Unprogrammed Expenses	1,925.0	1,950.0	1,950.0	1,950.0	1,950.0	1,950.0	1,900.0	1,900.0	1,900.0	1,850.0
Programmed Expenses	306.6	256.7	312.4	176.7	163.7	289.4	291.2	173.7	198.7	248.7

4.3. Renewal/Replacement Plan

Renewal is major work that does not increase the asset's design capacity but restores, rehabilitates, replaces or renews an existing component to its original capacity. This includes:

- Works that do not increase the capacity of the asset but restores them to their original size, condition capacity, etc.
- The replacement component of augmentation works which increase the capacity of the asset, i.e. that portion of the work which restores the assets to their original size, condition, capacity etc;
- Reconstruction or rehabilitation works involving improvements and realignment.
- Renewal and/or renovation of existing assets, restoring the assets to a new or fresh condition consistent with the original asset.

Work over and above restoring an asset to original capacity is creation/acquisition/ augmentation expenditure. However if the additional cost is within 10% of the renewal cost then the total cost will be treated as renewal expenditure.

4.3.1. Renewal identification/strategies

Assets can fail from various modes other than the normally recognised physical, failure or breakage.

Condition assessment is a typical failure mode assessment activity.

To evaluate cost and obsolescence as failure modes it is necessary to capture the asset's operating and maintenance cost information, and to compare this with the lifecycle cost expectations.

As condition assessment and maintenance histories are built up, these will be used in determining renewal priorities.

Level of Service Implications

It is necessary to renew pipes and equipment before they impact on levels of service.

Demand Implications

Renewals will be sized to allow for future demand. Where the increase is greater than 10% then the difference will be funded from capital.

Risk Implications

There is a risk to water quality, financial income, and consumer parity by not undertaking renewals of pipes, meters and dual check valves.

Lifecycle Implications

Pipes and equipment must be renewed before maintenance costs become excessive. Decisions made at the time of renewal have impact on the whole lifecycle costs of the asset.

For the purpose of developing asset renewal programmes the water supply assets have been separated into "discrete" and "non -discrete" assets.

- "Discrete" assets are assets such as pumping stations, which are separately identifiable, accessible and which can readily be inspected.

- "Non discrete" assets are assets such as buried pipelines which are part of an extensive network, are generally below ground and which cannot readily be inspected (other than by techniques such as excavation and closed circuit television).

This renewal strategy deals with the reticulation portion of the network – pipes, valves and associated chambers. Pumpstations, telemetry, water treatment plant and head works are considered separately.

The reticulation system has to reliably transport the required volumes of water from the trunk mains and reservoirs to the consumers, at sufficient pressure while maintaining quality. The water network is made up a range of materials such as cast iron, asbestos cement, concrete, uPVC, polyethylene, concrete lined steel and ductile iron. Currently Council's renewal strategy is based on replacing asbestos cement pipes that were installed in the 1950's and are showing higher than expected failure rates. Further investigation of the older sections of the network are needed in order to confirm the condition of the steel and iron pipes. Figure 4-5 shows an increasing incidence of failures in materials such as concrete lined steel, PVC and HDPE that indicates further investigation will be required to identify causes. As the current asbestos cement pipe renewal programme is expected to continue for the next 8-10 years, enhanced condition assessment of the other pipe types is expected to be part of the renewal strategy from years 5-8.

Where appropriate Nelson City Council uses longer pipe sections, either coiled polyethylene or uPVC replacing shorter cast iron, concrete and asbestos cement pipes, leading to quicker installation and fewer joints.

Figure 4-5: Water Main Failures

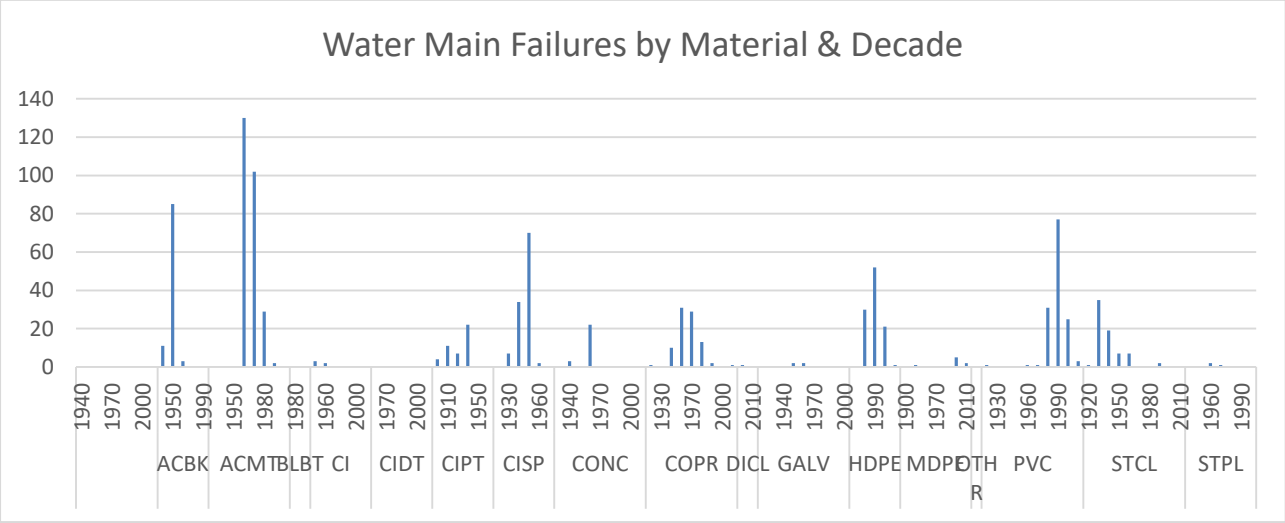


Table 4-20: Renewal Strategies

Strategy	Objective/ Description
Identification of Renewal Needs	To avoid a concentration of asset renewals in a short window of time, when they all reach the end of their life, renewals are set by: Potential development in the city Other Council projects e.g. the condition of water supply pipelines will be inspected prior to major road works to identify the risk of the road being damaged

Strategy	Objective/ Description
	by pipeline failure or the need for pipeline replacement in the short/medium term. Pipelines in poor condition will be programmed for replacement prior to or in conjunction with the road works. Issues identified with asset by location and or materials through condition reports, maintenance records (asset failure and expenditure history), request for service (RFS) records, and observations of public, staff and contractors. 1) Critical assets just before they fail. 2) Others after four or more unexpected failures over the previous five years (sum of all asset of same material and age for the street) and Two breaks occurred on the same asset (individual pipe section) or breaks on the same material on a street being equivalent to one break per 100m or less. 3) Assets that do not meet required fire flow demand and Have two or more failures over the past five years. 4) Alignment with other utility renewals or upgrades where excavation to renew the water supply asset would be undesirable within the next ten years.
Project options	Decision Criteria are weighed. Then Business Options which consider benefits (aligned with the Decision Criteria), dis-benefits, cost, timescale and risks are compared to determine whether to proceed with a renewal or which renewal option to take.
Prioritisation of Renewal Projects	Decisions on renewal works consider the short and long-term effects on the operating and structural integrity of the system
Design	Construct renewal works each year, are generally designed in advance, to maintain level of service. Renewal works are designed and undertaken in accordance with Nelson City Council Land Development Manual that stress the use of long life materials Investment is made in new technologies to rehabilitate existing reticulation where appropriate, rather than excavate and replace.
Deferred Renewals	The quantity and impact of deferred renewals (if any) is tracked The Council recognises that although the deferral of some items on renewal programmes will not impede the operation of many assets in the short term, repeated deferral will create a future Council liability. As Council currently funds asset renewals from depreciation deferred renewals are not expected.

Renewal Plan

- Relining of selected 100mm diameter and larger cast iron pipes will be considered in the future
- Asbestos Cement Pipe - 50mm diameter Fibrolite pipes and 100mm diameter "Black Asbestos" pipes which are identified as being near the end of their economic life are scheduled for renewal from 2007/08 to 2030/31

- Steel Pipe - Steel pipes tend to corrode randomly. Individual sections of steel pipe which fail will be replaced as maintenance expenditure
- Water Treatment Plant Filters – Installation of the fifth train was completed in 2016/17 in order to provide greater flexibility with the filter renewal programme and possibly extend the life of the existing filters. Completion of the renewal of the existing filters is shown in the renewal projections for 2018/19. As the Water Treatment Plant has been in operation for ten years and the filters are guaranteed for 10 years advice from the manufacturer will guide the replacement timetable.
- Water Meters - Residential water meters were installed in 1999, and have a life of 12-15 years. It is cheaper to replace these sizes rather than test and refurbish them. These are expected to be replaced under renewal budgets over 3 years from 2018/19. A detailed business case concluded that the renewal of residential meters should be on a like for like basis with manual read meters.
- Residential Backflow Prevention – The dual check valves in the water meter manifold are spring operated and lose effectiveness with time. An increasing number of the valves are also disintegrating in the manifolds and a programme to replace these has commenced in 2015/16. As the dual check valve is fitted immediately underneath the meter it was initially considered to be appropriate for them to be replaced at the same time as the meter. The number of failures and risk of pieces of the valves impacting the water meters and household water fittings has led to the need to begin the replacement in advance of the meters.

Water Meters

Trends in each property's water usage are tracked and if a meter appears to be "slowing down", then it is removed for testing or replacement. Worn meters tend to under-read and are therefore in that customer's favour, but true costs are not being recovered from the customer who is therefore subsidised by other consumers.

Commercial and Industrial water meters were installed from 1980 to 1999.

Meters on commercial and industrial properties vary in age and size. Most meters have been installed since 1980 in business groups i.e. all schools, all hotels, all hairdressers etc. Meters were installed on parks in 1998, on small users such as offices and small shops as part of the Universal Water Metering project in 1999, and in new subdivisions and developments as they occur. Larger sizes can be refurbished but spare parts for early models are not now available.

Renewal of commercial and industrial water meters started in 2014/15 and is approximately 25% complete. The work is scheduled to be completed in 2028/29.

The future proposed renewal of residential water meters, scheduled over a three year period from 2018/19 at $1,100,000 per year, is based on replacement 'like for like' with mechanical manual read meters.

Existing Maitai concrete pipeline

The Maitai pipeline between the Maitai Dam and the Water Treatment Plant transports the majority of the water used in the City. It has numerous small shrinkage cracks and is vulnerable to slips from above and below the pipeline.

Council completed the construction of a duplicate Maitai pipeline between the dam and the Water Treatment Plant in 2014 but will continue to use and maintain the existing pipeline, to reduce pumping costs, for as long as it is viable to do so. Repairs of the

section between the Dam and the Water Treatment Plant is shown in this Asset Management Plan to commence in 2018/19.

4.3.2. Summary of future costs

Table 4-21: Water 10 Year Renewal Projections ($000)

Account	2018/19 LTP Final Uninflated	2019/20 LTP Final Uninflated	2020/21 LTP Final Uninflated	2021/22 LTP Final Uninflated	2022/23 LTP Final Uninflated	2023/24 LTP Final Uninflated	2024/25 LTP Final Uninflated	2025/26 LTP Final Uninflated	2026/27 LTP Final Uninflated	2027/28 LTP Final Uninflated
7005 Water Supply										
Capital Expenditure										
Renewals	7,164.2	3,519.0	3,208.5	2,087.3	3,149.9	3,986.4	3,736.4	2,164.9	2,164.9	2,234.9

Deferred Renewals

This plan indicates no deferred renewals

Infrastructure strategy

The thirty year infrastructure strategy sets out the longer term renewal forecast for the water supply activity. The overarching strategy is based on renewing the network just in time to avoid disruption to the service and as demands of growth or other asset renewals offer opportunities to reduce cost and community disruption.

4.4. Creation/Acquisition/Augmentation plan

Creation/Acquisition/Augmentation works create a new asset that previously did not exist, or upgrade or improve an existing asset. They may result from growth, social or environmental needs, levels of service. This includes:

- Expenditure which purchases or creates a new asset (not a replacement) or in any way improves an asset beyond its original design capacity.
- Upgrading works which increase the capacity of the asset e.g. for future growth demand.
- Construction works designed to produce an improvement in the standard and operation of the asset beyond its present capacity.

Asset development and asset renewal can occur simultaneously. The purpose of asset renewal is to prevent a decline in the service potential of the assets whereas asset development is concerned with the service improvements, measured by asset performance.

4.4.1. Selection criteria

Level of Service Implication

The capital works for system improvements and ridermains are to address problems with pressure, flow, and continuity of supply to the levels of service required.

Demand Implications

The capital works proposed will address the need for more storage and trunk mains to meet growth requirements. Failure to meet growth requirements will then impact on Levels of Service.

Risk Implications

The capital works proposed address the need for decreasing the risk on the Maitai Pipeline and preventing backflow from commercial and industrial premises.

Lifecycle Implications

Decisions made to construct a capital project will have implications for the life of the asset, as will subsequent design decisions. Optimised decision making will therefore be used to identify and prioritise all potential solutions for water supply projects over $0.5million value.

Selection Strategy

Table 4-22: Selection Strategy

Criteria	Objective / Description
Identification of Upgrade Needs	Asset upgrade needs are identified from analysis of: Demand forecasts System performance monitoring Network modelling Risk assessments (Risk Management Plan), and Customer service requests. A provisional forward capital works programme is maintained and updated at least annually.
Upgrade Project Categorisation	Upgrade Projects will be separated into projects to close service gaps and projects required to accommodate growth. Upgrade projects to close service gaps are generally funded entirely by Nelson City Council. Upgrade projects to accommodate growth may be partly or wholly funded through Development Contributions.
Prioritisation of Upgrade Projects	Upgrade projects are justified and prioritised using a risk based process. Decisions on upgrade works consider the short and long-term effects on the operating and structural integrity of the water supply network. In determining the requirement for capital or asset upgrade works the short and long-term effects on the operating and structural integrity of the system are considered, together with any forecast increase in loading upon the system. Decisions on priorities for new works and renewal of assets for the water supply network are based on the following: • Known problem areas with multiple failures • New growth areas • Primary flow conduits – Trunkmains • Security of supply eg reservoirs, Maitai Dam • Criticality of proposed works • Multiple network project (e.g. incorporating road work, sewer, water assets) • Environmental impacts especially water abstraction, use and Maitai Dam
Project Approval	A long-term upgrade programme is prepared from projects meeting the assessment criteria, and all projects are approved through the Annual Plan process. The actual timing of asset upgrade works will reflect the community's ability to meet the cost, as determined through the Annual Plan process. Scheduled projects meeting assessment criteria not funded are listed on the forward works programme for the following year.

4.4.2. Capital investment strategies

The table below sets out the strategies used for developing capital works programmes for the water supply network. These strategies are intended to progressively close gaps between target service standards (taking account of demographic and economic growth projections) and the current service capability of the asset system.

Table 4-23: Creation/Acquisition/Augmentation Strategies

Strategy	Objective / Description
Project Design	All asset upgrade works will be designed and constructed in accordance with Nelson City Council Engineering Standards/Land Development Manual that stress the use of long life materials, and system design loading. In determining capital or asset upgrade work requirements the short and long term effects on the operating and structural integrity of the system are considered, together with the demands of any forecast increase in loading upon the system. The system will be designed to minimise supply disruptions as far as practically possible by building in an appropriate level of redundancy. The standardisation of designs and specifications will be considered in the interest of facilitating replacement and operational simplicity. All feasible options, including non-asset demand management options and the use of second-hand plant, are considered. Various components of the water supply goal are considered when developing the final detailed design: • Economics of various options • Efficiency of meeting the network need • Cultural values relating to water abstraction
Future Development	Identifies sufficient, feasible development capacity in short, medium and long term and the location, timing and sequencing if infrastructure to support it.
Gifted Assets	The risk, cost and benefits of accepting any new privately funded assets constructed in association with property development will be considered on a case by case basis in approval decisions. Such assets will be accepted into public ownership when satisfactorily completed in accordance with approvals given. Council will not contribute to the cost of such work unless there are exceptional service standard or equity issues.

Capital Plan

System Improvements

Minor works to achieve and maintain the levels of service. Minor issues are identified through modelling, service technician comments and staff knowledge each year. Initially it is proposed to concentrate on water loss correction work to reduce the losses.

Reservoirs and Tanks

Currently the larger tanks are positioned close to the central city area and Stoke. To provide a better level of security for the north of the city a further larger reservoir is proposed for the Bayview/Marybank area within the term of this plan.

Within the next 30 years it is anticipated that development will require additional reservoirs for supply of potable water in emergencies at the Northern and Southern ends of the city.

Atawhai Hills Reservoir and Pump Station

To improve supply capacity and facilitate green field development to the upper levels of the Atawhai foothills, one option considered was a pump station alongside the Walters Bluff reservoir, pumping up to a small storage reservoir (300-500m^3) on the ridgeline above. A detailed options report has been developed from 2015- 2017/18 to identify preferred location(s) for the Atawhai No 2 reservoir and upper level reticulation options.

Ridermains

The renewal budgets allow for the replacement of 50mm and 100mm asbestos cement watermains. However, the Land Development Manual requires a watermain on one side of the street and a ridermain on the other. To accommodate this a separate budget is identified for new ridermain installations.

System Improvements/ Miscellaneous Pipe and Fittings

There is an ongoing need for small improvements to the water network to address localised issues that arise with flow, pressure, taste and turbidity. A budget for these is included in the CAPEX tables. Larger issues are addressed as specific CAPEX projects.

Waimea Community Dam (Lee River Brightwater)

Nelson City Council has contributed funding to investigations led by Tasman District Council into augmentation of water sources on the Waimea Plains. For Nelson City to secure a share in the dam (for water required at some future point) a yet to be determined payment would have to be made at the time of construction.

Other options are expected to provide sufficient water for the city in the short – medium term and a share in the Lee Valley Dam is not required for the water supply activity at this stage. Funding has been allocated in 2020/21 for a grant to the Waimea Dam project subject to the conditions that access to 22,000m^3/d be assured and the grant be transferred into a shareholding in the Dam Company at any point in future.

Backflow Prevention.

Backflow prevention is one of the factors considered in the Ministry of Health water gradings. The water supply does not currently meet Ministry of Health requirements as not all premises have backflow prevention. Backflow is identified as the second highest risk to the water supply.

Reduced pressure backflow preventors have been installed on all connections to sewage treatment plants and pump stations and new connections to Reserve facilities.

The meter manifolds installed on domestic and some commercial connections incorporate a spring loaded dual check valve. While not providing an absolute guarantee, these valves significantly reduce the possibility of accidental contamination

of the water supply from a residential property, which is also considered to be a low level risk of contamination source.

A survey has begun of all commercial and industrial premises to determine the exact backflow prevention needs, so that a programme for installation of backflow preventors can be established. Installation of backflow preventors has been established as an important means of protecting the network from contamination.

The sum of $1.6 million over 10 years ($160,000 per year) has been shown in the Capital Works Projections from 2018/19 for the fitting of backflow preventors to Commercial and Industrial premises in conjunction with meter renewals.

Fire Flows

Budget allowance of $600,000 from 2018/19-2028/99 has been made for works required to improve the fire flow issues in the city. These issues have largely been created by the change in the requirement for fire flows to be available within specified "as measured along the road" distances from fire hydrants, rather than as a straight line measure direct from the hydrant.

4.4.3. Summary of future costs

Table 4-24: Water 10 Year Creation/Acquisition/Augmentation Projections ($000)

Account	2018/19 LTP Final Uninflated	2019/20 LTP Final Uninflated	2020/21 LTP Final Uninflated	2021/22 LTP Final Uninflated	2022/23 LTP Final Uninflated	2023/24 LTP Final Uninflated	2024/25 LTP Final Uninflated	2025/26 LTP Final Uninflated	2026/27 LTP Final Uninflated	2027/28 LTP Final Uninflated
7005 Water Supply										
Capital Expenditure										
Capital Growth	778.0	1,278.0	778.0	940.2	778.0	1,090.2	1,010.2	2,060.2	2,043.0	963.0
700576152801. NCC - TDC Link	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	20.0
700576203165. water pump stations - upgrades	0.0	0.0	0.0	0.0	0.0	100.0	20.0	20.0	1,000.0	0.0
700576302809. Water Treatment Plant Upgrades	0.0	0.0	0.0	0.0	0.0	162.2	162.2	162.2	165.0	165.0
700576502313. Capital: Atawhai Res & pump Ma	0.0	0.0	0.0	162.2	0.0	0.0	0.0	0.0	0.0	0.0
700576503231. Ngawhatu Valley high level reservoir	0.0	0.0	0.0	0.0	0.0	50.0	50.0	1,000.0	0.0	0.0
70057691. Vested Assets	778.0	778.0	778.0	778.0	778.0	778.0	778.0	778.0	778.0	778.0
700576913164. Suffolk Road (Saxton to Ngawhatu) water upgrade	0.0	150.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
700576913166. Suffolk Road to Hill Street Trunk water main	0.0	350.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Capital Increased LOS	878.4	1,055.9	1,372.4	933.5	5,408.7	5,076.8	635.8	487.4	487.4	487.4
700579151058. Capital: Pressure Reduction	54.1	0.0	54.1	0.0	54.1	0.0	54.1	0.0	55.0	0.0
700579151064. Capital: Ridermains	167.6	167.6	167.6	59.5	59.5	59.5	59.5	59.5	59.5	59.5
700579151081. System Improvements	64.9	64.9	64.9	54.1	0.0	54.1	0.0	55.0	0.0	55.0
700579151168. Capital: Backflow Prevention	162.2	162.2	162.2	162.2	162.2	162.2	162.2	162.2	162.2	162.2
700579152140. Capital: Atawhai Trunkmain	10.0	44.1	54.1	102.7	1,800.0	1,800.0	0.0	0.0	0.0	0.0
700579152800. Pressure Enhancement	0.0	62.2	108.1	100.0	0.0	0.0	0.0	0.0	0.0	0.0
700579162131. Fire Flow Upgrades	0.0	0.0	0.0	0.0	25.0	25.0	25.0	0.0	0.0	0.0
700579162802. DMA establishment	50.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
700579162803. Water Loss Reduction Programme	216.3	216.2	216.2	216.2	216.2	216.2	216.2	100.0	100.0	100.0
700579162807. Natural Hazards Risk Remediation	58.1	108.1	108.1	50.0	0.0	0.0	0.0	0.0	0.0	0.0
700579501180. Other Sundry: Maitai Planting	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8
700579502314. Capital: Atawhai No.2 Reservoi	50.0	50.0	300.2	50.0	1,081.0	2,702.5	0.0	0.0	0.0	0.0
700579502810. Dam Upgrades	50.0	100.0	100.0	108.1	2,000.0	108.1	108.1	0.0	0.0	0.0
700579503142. Maitai Pipeline Hazard mitigation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	100.0
700579903259. Water supply H&S risk mitigation programme	10.0	20.0	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0
70057997. LoS: investigation, options, testing, engagement	-25.6	0.0	-43.7	0.0	0.0	-61.4	0.0	0.0	0.0	0.0

4.5. Disposal plan

The disposal plan recognises that there can be activities and costs associated with the decommissioning and disposal of assets which are no longer required as part of the water supply network. In some situations there can be revenue resulting from asset disposal.

Table 4-25: Disposal Strategies

Strategy	Objective/ Description
Asset Disposal	Assess each proposal to dispose of surplus or redundant assets on an individual basis, subject to the requirements of the relevant legislation. Asset disposal will comply with the requirements of the Local Government Act 2002 and in particular the requirement for councils to retain a capability to provide water supply services. Redundant pipes are backfilled or removed where their alignment clashes with replacement pipelines or where their existence is considered dangerous. This is to ensure collapse does not occur. Possible use of abandoned pipes for telecommunication ducts is reviewed on a case by case basis. Currently Chorus and Network Tasman lease access to abandoned gas mains and abandoned water and wastewater pipes.
Disposal for Re-use	Mechanical equipment that has been replaced will be reused for parts or sold as scrap metal unless it is considered to have genuine resale value. In this case, the piece of surplus equipment will be sold with income directed to the Nelson City Council account.
Disposal Value	The residual value (if any) of assets, which are planned to be disposed of, will be identified and provided for in financial projections. Abandoned water pipelines have possible future value for other purposes (such as ducting for cabling). As the extent of this value (if any) is uncertain it is not recognised in the asset valuation.
Record of Abandonment	When a water supply asset is abandoned or replaced the Geographic Information System and fixed asset register are updated. A system of job number creation and asset identification is used to document this process.

Water mains are generally relaid off line. If pipes are left in the ground they are usually sealed at the connections and retained as a possible duct for cables (subject to health and safety concerns about accessing asbestos cement pipes).

Mechanical equipment that has been replaced is cannibalised for parts or sold as scrap metal unless it is considered to have genuine resale value. In this case, the piece of surplus equipment will be sold with income directed to the water supply account.

5. Risk management plan

This section describes the risk management procedures used in the water supply activity.

Applying risk management procedures enables decisions to be made about the best use of limited resources to achieve as much as possible of the Council's objectives from the maintenance and development of the water supply assets.

Threats and opportunities are assessed against water supply objectives and levels of service.

As set out above risk management is not simply about uncertain events with a downside (such as financial loss or legal proceedings). The process can also be used to identify and decide on the merits of uncertain opportunities for the Council to do things more innovatively, sustainably and effectively.

5.1. Critical assets

5.1.1. How critical assets are identified and managed

For practical purposes it is helpful to separately identify critical assets to the delivery of the water supply activity.

The asset manager applies professional judgement based on experience, considering risk of failure and lifelines evaluation to identify critical assets. Generally critical assets are considered to be those assets for which the consequence of failure is unacceptable given the difficulty of repair and/or the strategic role they play, and would result in a major disruption or failure in meeting one or more levels of service.

A more robust framework for identification of critical assets is noted in the improvement programme.

Assets that are considered critical within the Nelson City Council water supply system are:

- Headworks including dams and intakes
- Raw water trunk mains
- Raw water pump stations
- Water Treatment Plant including Clearwater Reservoir
- Treated water trunk mains
- Treated water pump stations
- Reservoirs

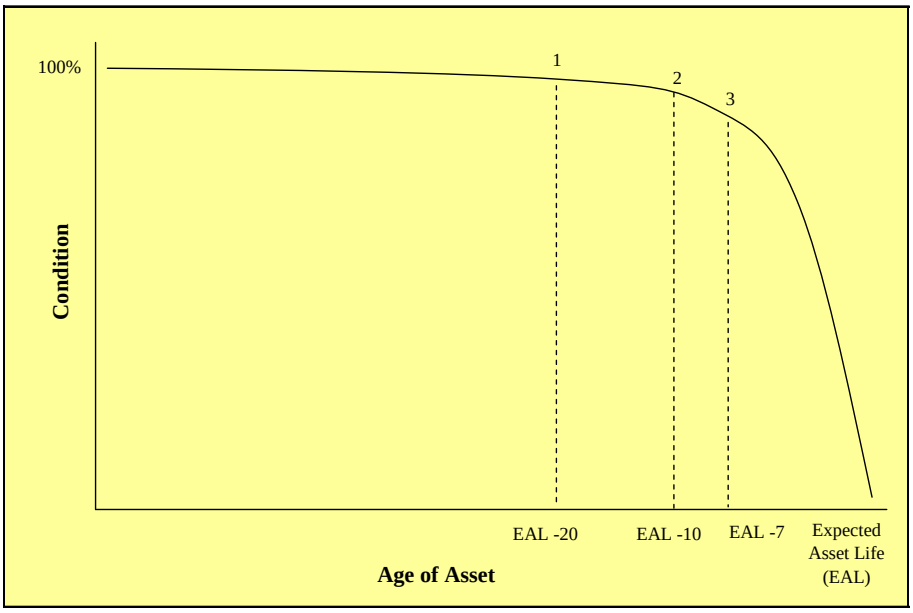
With these assets operating treated water will be available in each suburb for distribution by water tanker or personal collection and by watermain as damaged reticulation is repaired and brought back into service.

By contrast non-critical assets are relatively quickly and easily repaired or replaced and their failure do not disrupt a significant number of customers.

Monitoring and intervention strategies are therefore quite different for both categories of asset. Critical assets attract a greater level of monitoring and ongoing condition assessment, with physical investigations taking place at a much earlier stage. Conversely non-critical assets can be expected to undergo a higher level of repair before complete replacement is considered.

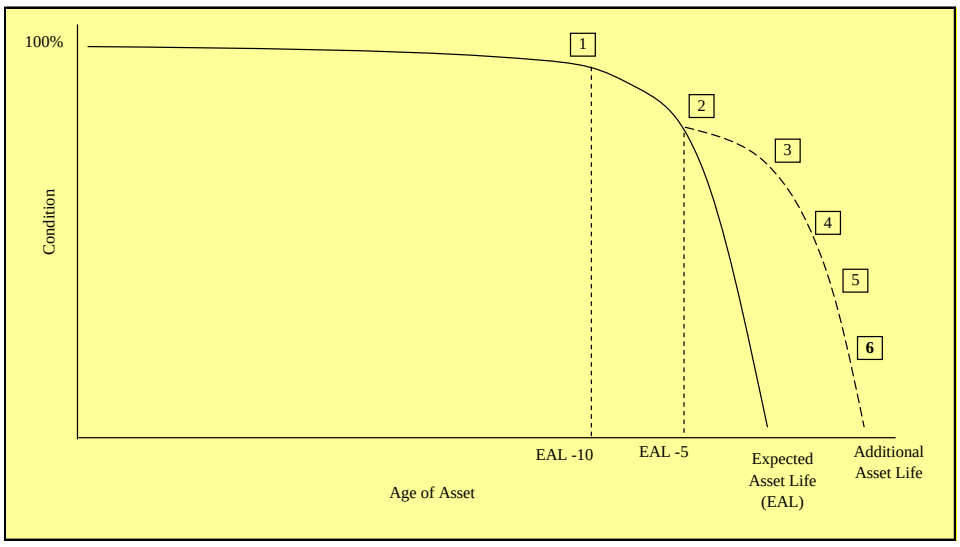
The following shows the nature and timing of interventions for both critical and non-critical assets.

Figure 5-1: Interventions for Critical Assets



Intervention: 1 Desktop review of asset and performance supported by Engineers inspection, 2 Physical inspection and testing of asset and performance review by specialist Structural or Pavement Engineer. 3 Replacement initiated.

Figure 5-2: Interventions for Non-Critical Assets



Intervention: 1 Desktop review of asset and performance, 2 Physical inspection of asset and decision made on extending expected asset life, 3 Repair, 4 Repair, 5 Repair. 6 Replace asset.

The effect of criticality on an asset is highlighted in the following areas:

- Operation and maintenance planning
- Proactive or scheduled maintenance

- Priorities for collecting and determining the required level of reliability of data for Asset Management systems
- Priorities for undertaking condition assessments
- Adjusting economic lives with respect to renewal profiles
- Prioritising/Deferring renewals
- Prioritising expenditure
- Prioritising levels of service reviews

A methodology for determining asset criticality to a component level, along with options, will be determined to integrate criticality into the ongoing operation, maintenance, renewals and capital programme for the water supply activity.

Risk Implications

Intakes, raw water trunk mains, the Water Treatment Plant, treated water trunk mains and reservoirs must all be maintained, kept secure and protected from natural hazards so that they can continue to function through an emergency albeit at a reduced level of service.

Apart from the need to provide very high levels of continuity to meet customer expectations, there are good public health reasons for maintaining pressurised mains at all times.

If watermains are allowed to lose pressure, it is possible that the weight of water in lower sections of mains will reduce the pressure in higher sections of the mains below atmospheric pressure. This will cause a vacuum in pipes which can suck back groundwater into the mains through leaks, or contaminated water from tanks or other containers not properly isolated from the public supply.

Council has established well defined procedures for shutting down watermains by Council staff, the Utilities Maintenance Contractor's staff, and Water Connection Contractor's staff.

The objective of the procedures is to minimise the amount of disruption and inconvenience to customers by using good communication skills and by timing the work to avoid times of peak demand.

Risk summary

Natural Hazards

Recent work by Council has focussed on natural hazards that might impact on the city, in particular:

- Direct damage from Earthquake shaking;
- Damage from liquefaction in susceptible areas;
- Damage from Tsunami;
- Damage from Flooding and major storm events;
- Impact of potential climate change and sea level rise.

The Maitai pipeline between the Dam and Brook Street has been identified as an extreme risk from damage due to earthquake displacement, windfall trees or slips.

The pipeline supplies two thirds of Nelson's water, is above ground, on a sidling bench along the hillside. Repair/replacement of, for example, a 5m length of damaged pipe would take 24-48 hours depending on location (and has proved to be the case in 2008 when high winds brought down trees onto the pipeline). When full, city reservoirs can hold sufficient water for approximately 24 hours average consumption. The more usual capacity, allowing for filling time and continuing use, is 8-10 hours of daytime demand.

Construction of a new buried pipeline between the dam and the Water Treatment Plant was completed in 2013/14.

Design of a new pipeline between the Water Treatment Plant and Westbrook Terrace began in 2014/15 with construction completed in 2016/17.

The Roding Water Scheme has low and moderate risks to structures, other than a 200m length of pipe between the screenhouse and the chlorinator house. This pipe is suspended on piers along the riverbank. A 30m section was washed out in the large flood of January 1986. Subsequently the pipes were more securely fixed and rock armouring was constructed in front of the piers. There is a possibility that a similar large flood could damage the pipe again. Reinstatement would take 2-3 days, during which time the Maitai river and Tasman District Council would be the only sources supplying the City. This risk is acceptable given the large storage volume of the Maitai dam.

Risks posed to the trunk mains range from low to high. The high risk is from earthquake and storm events where sections of key mains could be damaged. Presently stocks of repair materials are held to allow single repairs to each main.

Mutual aid would be required from other water supply authorities to reinstate trunk mains in the event of multiple major breaks.

As a result of the Christchurch earthquakes Council is currently undertaking a seismic review of the critical elements of the above ground network, starting with the storage reservoirs and sections of the Maitai Dam to the treatment plant trunk main looking at the direct impact of earthquake shaking. Future work will focus on near fault proximity of the network, possible impacts of liquefaction on existing and future infrastructure, impacts of flooding and the long term planning required as a result of climate change.

Maitai Water Supply Scheme

Because the Maitai Water Supply Scheme is a vulnerable asset, it was designed to withstand 1 in 100 year seismic and flood events without damage.

Key structures are designed to withstand maximum credible earthquake and probable maximum flood without collapse (but not without some damage, possibly requiring decommissioning and major repair work).

Details of the design parameters of the Maitai Water Supply Scheme are contained in "Nelson City Council Maitai Water Supply Project Design Report", Tonkin & Taylor Limited, 1984.

The Maitai pipeline between the Dam and Brook Street has been identified as an extreme risk from damage due to earthquake displacement or slip.

The pipeline supplies two thirds of Nelson's water, is above ground, on a sidling bench along the hillside. Repair/replacement of 5m of pipe would take 24-48 hours, with town reservoirs holding sufficient water for approximately 8 hours daytime consumption.

Sections of the Maitai pipeline remain close to, or within, the river with some ongoing risk of flood damage. Identification of these sections and regular inspection and maintenance are seen to be the best response.

Roding Water Supply Scheme

The Roding Water Scheme poses low and moderate risks to structures other than a 200m length of pipe between the screenhouse and the chlorinator house. This pipe is suspended on piers along the riverbank. A 30m section was washed out in the large flood of January 1986. Subsequently the pipes were more securely fixed and rock armouring was constructed in front of the piers. There is a possibility that a similar large flood could damage the pipe again. Reinstatement would take 2-3 days, during which time the Maitai river/dam and Tasman District Council would be the only sources supplying the City.

A condition assessment of the raw water trunk main was started in 2013/14 and completed in 2015/16 to allow renewal decisions to be made. A risk assessment of any new pipeline route will be undertaken as part of any renewal design.

Water Treatment Plant

A portable chlorinator using sodium hypochlorite is held at the Water Treatment Plant. It is a complete stand-alone unit, run by a small petrol generator. This has the capacity of dosing 30l/h of sodium hypochlorite, which is sufficient to treat the full Maitai flow of 37,000m3/day.

A separate Emergency Management Plan has been developed covering Risks and Actions specific to the Water Treatment Plant.

A portable chlorinator alternatively powered by either a petrol motor or an electric motor is held at Princes Drive for emergency chlorination using High Test Hypochlorite (HTH) powder. This has a capacity of dosing 24kg of chlorine per hour. This is sufficient to treat 12,000 cubic metres of water per hour at 2 grams per cubic metre (= 2ppm or 2mg per litre).

A small slip occurred to an excavated bank adjacent the plant during the December 2011 rain event. The plant will remain at risk of small surface slips given the excavations undertaken during construction.

Trunk Mains

Risks posed to the trunk mains range from low to high. The high risk is from earthquake damage where sections of key mains would be damaged. Presently stocks of pipes and fittings are held to allow single repairs to each main.

New trunk mains are typically constructed from more ductile materials.

Mutual aid would be required from other water supply authorities to reinstate trunk mains in the event of multiple major breaks.

Reservoirs

All large reservoirs have been fitted or retrofitted with automatic seismic shut off valves. When excess flow from the reservoir is detected (such as from a broken outlet trunk main) the outlet valve is automatically shut and an alarm sent to the Duty Officer via the SCADA system.

In 2013/14 a project to review the seismic response and protection features of the reservoirs, intake structures and pipework at the Maitai Dam and the steel siphons on the Maitai Dam to treatment plant pipeline was initiated. This project has been

developed as a result of the damage to the Christchurch water network from the February 2011 earthquake in that region.

The project has a number of stages which can be modified as results of each stage are available:

Stage 1- Review the seismicity of the sites and compare with the factors from AS/NZS 1170 Structural Design Actions. This provides a quick view of how design standards might have changed since the reservoirs were constructed.

Stage 2- Review the on-site construction details of the pipework and valving arrangements to ensure seismic valves are correctly positioned and pipework details minimise the risk of water loss in earthquakes. This stage will provide an early benefit by ensuring the reservoirs can contain stored water under less than ultimate design level events.

Stage 3- Review the structural adequacy of the reservoir, dams and pipelines. This stage will look at the structural design and detailing of the major components of the network and may be undertaken in a number of stages.

Liquefaction

Ongoing hazard investigation in 2013 identified the risk of liquefaction to the network in parts of Nelson. The initial study was restricted to the Tahunanui area but similar materials are expected to be part of the Port Nelson reclamation.

The risk to the water network in Tahunanui arises from flotation of chambers and damage to the mains from extension, shortening and translation arising from ground movement.

During the operative period of this plan further work will be carried out to better identify at risk components and current industry response.

Water Quality

Risks posed to water quality range from low to extreme. Completion of The Water Treatment Plant in August 2004 has reduced the risk to source water to low.

The extreme risk relates to possible backflow from premises into the water reticulation, thereby putting other consumers in danger. Dual check valves have been fitted to all residential connections as part of the water meter manifold. These will be replaced when the water meters are replaced in 2018-2020. Backflow preventors have been installed at all Nelson City Council drainage pump stations and Council owned buildings and facilities. However, there are fewer protection devices on commercial and industrial premises.

Backflow Prevention

The protection of the quality of the water supplied to customers is a vital responsibility of any water supply authority. While the quality of the water entering the system is known, chemical or microbiological contamination can occur in some circumstances from water re-entering the system from consumer's premises should fittings be wrongly connected or a temporary vacuum develop in the line. The risk from activities such as undertakers, doctors and dentist surgeries are readily understood, however similar issues can also arise in commercial kitchens where food is prepared and cleaning chemicals are used.

Increased emphasis has been placed on Risk Management by the Ministry of Health in recent years. The 2007 amendments to the Health Act require that water suppliers prepare Public Health Risk Management Plans for their systems, and include the management of risk from backflow. Council's Public Health Risk Management Plan was completed in 2012.

Installation of backflow prevention devices is programmed for the next ten years.

Water Safety Plan (Public Health Risk Management Plan)

The Nelson Public Health Risk Management Plan 2012 (now referred to as a Water Safety Plan- post the 2013 amendment to the Health Act 1956) outlines a range of issues that are required to be addressed within the network. Budget has been identified for developing the response to these issues. Any further works that arise from the response will be developed in future annual or long term plans.

5.2. Risk assessment

5.2.1. Approach for assessing risk

The Council's risk management policy provides for assessing risk by:

- Clearly identifying the objectives for which achievement may be uncertain
- Identifying events which could make the achievement of one or more objectives uncertain
- For each event, using best available information (including considering the quality of that information and the controls already in place to manage the risk) to estimate the scale of consequence for an objective if the event happened and estimating a corresponding likelihood. Consequences and likelihoods are estimated using the Council's agreed risk criteria. See Appendix K.
- Selecting the likelihood consequence combination from the council's criteria giving the largest risk for the event.

As this Asset management plan is developed it will progressively apply the criteria required by the Council's updated risk management policy (formally adopted in August 2017) to managing risks. These criteria follow principle (g) of the international standard codifying good risk management practice (ISO 31000:2009) and tailor this generic process to the Council's specific circumstances. It is the organisation's intention to progressively align the risk management practices used in asset management with Council's Policy and Criteria and to apply generally accepted good practice.

Alignment with the new framework is in progress. The identified and assessed risks are not all derived by this process. Some are historical and may be based on a different framework and may have been ranked using criteria other than those adopted by the Council in August 2017. It is our intention to review and update the risks set out in the risk register Appendix K so that the information is all on a consistent basis.

5.2.2. Top risks and how these will be managed

The level of risk established from the assessment process (formally called residual risk) is compared with the Council's residual risk tolerance as set out in Table 3 of the Council's risk criteria.

The table sets out priorities for action and at what level of Council decisions should be taken to either accept (tolerate) the risk or take further actions to manage the risk to achieve a more acceptable risk level.

In many cases risks have already been acted on by officers in the course of the normal work of managing the water supply activity and no further action is required.

In other cases specific decisions may be required to either accept the current level of risk or place actions in this plan to reduce the level of risk.

The following table provides an indication of areas of high residual risk and some information about how these could be further treated (i.e. further controls implemented or choices made to reduce risk levels). The complete Risk Resister can be found in Appendix K.

Table 5-1: Water Supply Risk Register

WATER RISK REGISTER	**Objectives** **Good quality water** **A reliable supply of water** **Acceptable water pressure** **Adequate flows of water** **A prompt response to reported network issues** **A network that protects the natural environment**	**Assessed by Phil Ruffell**

Identification			Analysis: Residual Risk					
Event Description	**Asset Group**	**Consequence**	**Existing Controls**	**Consequence**	**Likelihood**	**Current Risk Level**	**Response**	**Treatments**
MOVEMENT FAILURE CAUSED BY EARTHQUAKE, LANDSLIDE OR SETTLEMENT	**TREATMENT PLANT**	Worse case: water not available until temporary chlorination plant in place and temporary supply from TDC - 1 day to organise	Plant has been designed to a high standard. Regular inspection for likely problems. Temporary supply from TDC	Extreme (5)	Unlikely (2)	High (10)	Reduce	Purchase oddition portable chlorine dosing equipment. Improve supply options from TDC.

Emergency response

Headworks

The Maitai and Roding headworks are manned by resident caretakers employed by the Water Treatment Plant contractor. During the caretaker's absence, resident relief caretakers are employed.

Water Treatment Plant

The Tantragee Water Treatment Plant is manned during normal working hours. After hours and on weekends, operators are able to monitor the plant remotely via a computer dial in system.

The operators also carry cell phones that are linked to the plant control system. Outside working hours, alarms are immediately sent to cell phones, so that the operators can respond immediately.

Supervision

The Nelson City Council Utilities operations and maintenance duty staff carry cell phones on a weekly roster so that at all times a Nelson City Council Operations and Maintenance staff member is available to respond to major network faults or faults that have been escalated by the Treatment Contractor or Network Maintenance Contractor.

Review

The Risk Analysis will be reviewed each year.
In light of the significant seismic activity in Canterbury in 2010/2011 a review of the water reservoirs and sections of the trunk main for damage prevention and post-event response has been undertaken in 2013/14. A separate budget item has been included in the capital works programme for 2018-2028 for any remedial works to the water reservoirs and raw water trunk main sections that are vulnerable to damage. The latter are initially expected to be the steel arch siphons from the Maitai Dam to the water treatment plant.

A more extensive review of the network is required to address the risks identified. This will be undertaken over the duration of this plan and will support the next review of the Nelson- Tasman Lifelines initiative.

Potential Risks

Risks can be seen to arise from many areas of the Nelson City Council, both in the physical aspect for assets and business risks.

Climate Change

Climate change is expected to bring with it more extreme weather in the form of higher intensity and duration rain events (with associated flood damage) and drought periods. The issue will be monitored and future asset management plans will be adjusted to address impacts as they become better understood.

Climate change is an evolving area of research and as such involves significant assumptions with associated uncertainties. Council seeks to limit the impact of those uncertainties by relying on expert guidance from Central Government and programming capital works in a staged fashion. Future upgrades of the water network are based on ensuring the work is designed for demand and conditions anticipated during the service life of the asset.

5.3. Infrastructure resilience approach

The Maintenance Contractors carry out monthly inspections of assets, which include identifying any Health and Safety issues.

Internal Audits of Health and Safety practices for construction works on the water supply assets are carried out periodically.

- ***Development of resilient infrastructure to address climate change predictions and other natural hazards.***

  Best advice to date from the Ministry for the Environment and the National Institute of Water and Atmospheric Studies is that we can anticipate more extremes in our weather including increased droughts and extreme rainfall events.

  A feature of a largely gravity based run of river supply such as Nelson's is that we are dependent upon a continuous flow of clear water in rivers that are some distance away from the treatment plant. High levels of sediment or organic material in the water can lead to damage to pipes and infrastructure and difficulties sterilising the water of harmful bacteria. The distance between intakes and the treatment plant introduces a vulnerability that comes with very long pipelines (some of them on above ground benches and within tunnels) that cross earthquake faults, streams and rivers.

  The keys to the resilience of the supply side of the network are:

  - *The Maitai Dam reservoir. This allows 3.5 million cubic metres of water to be stored as a buffer against droughts and extended periods of rain that discolours the rivers.*
  - *The duplicate raw water delivery lines from the Maitai intakes. The original supply line is largely sited on an above ground bench that follows the course of the river and the recently installed duplicate line is buried in the Maitai roadway. These duplicate delivery pipes provide security against damage to one or the other pipeline.*
  - *The ultra-filtration process at the water treatment plant. The filters in the water treatment plant can remove dissolved organic material and sediment and can use a variety of raw water sources. Completion of the renewal of the existing membranes is programmed for 2018/19.*

  On the delivery side the network is open to many of the same vulnerabilities, with above ground trunk mains and pipes crossing earthquake faults, streams and rivers. In coastal areas liquefaction is recognised as a potential risk to the network.

  Resilience comes in the form of an interlinked network that can direct water throughout the city when parts may be damaged and water storage reservoirs that can hold approximately a day's supply of potable water.

- ***Natural Hazard Security of the network in light of the recent Canterbury and Kaikoura Earthquakes and storm events, including wider network hazards- Earthquake fault line and liquefaction.***

  Recent work by Council has focussed on natural hazards that might impact on the city, in particular:

  - *Direct damage from Earthquake shaking;*

- *Damage from liquefaction in susceptible areas;*
- *Damage from Tsunami,*
- *Damage from flooding and major storm events;*
- *Impact of potential climate change and sea level rise.*

Because the Maitai Dam is a vulnerable asset, it was designed to withstand 1 in 1000 year seismic and flood events without damage. Key structures are designed to withstand maximum credible earthquake and probable maximum flood without collapse (but not without some damage, possibly requiring decommissioning and major repair work).

When full, city reservoirs can hold sufficient water for approximately 24 hours average consumption. The more usual capacity, allowing for filling time and continuing use, is 8-10 hours of daytime demand.

Construction of a new buried pipeline between the dam and the Water Treatment Plant was completed in 2013/14 and between the Water Treatment Plant and Westbrook Terrace in 2016/17.

The Roding Water Scheme has low and moderate risks to structures, other than a 200m length of pipe between the screenhouse and the chlorinator house. This pipe is suspended on piers along the riverbank.

While automatic chlorination exists at the water treatment plant, a stand-alone portable chlorinator unit, run by a small petrol generator and using sodium hypochlorite is also held there in case of emergency.

As a result of the Christchurch earthquakes Council has undertaken a seismic review of the critical elements of the above ground network, starting with the storage reservoirs and sections of the Maitai Dam to the treatment plant trunk main. This work will continue through this proposed plan and be extended to investigate impacts of liquefaction on existing and future infrastructure, impacts of flooding and the long term planning required as a result of climate change.

Insurance

Nelson City Council has insurance cover for the Wastewater, Water & Stormwater services, staff and property as detailed in Table 5-2 below. The insurance cover is updated on a regular basis following valuations to ensure the insurance cover is appropriate for its purpose.

Table 5-2: Water Supply Insurance Provisions

Components / Items	JLT TOS collective				Aon Si collective
	Public Liability	Professional Indemnity	Buildings and Contents	General Insurance	
Reticulation					✓
Pump Stations					
- Electrical				✓	

Components / Items	JLT TOS collective				Aon Si collective
	Public Liability	Professional Indemnity	Buildings and Contents	General Insurance	
- Mechanical				✓	
- Structural				✓	
Staff	✓	✓			
Council Vehicles				✓	
Private property damage related to stormwater damage	✓				
✓ Indicates coverage by that particular insurance type					

Aon South Island (SI) collective

Nelson City Council is a member of an Aon South Island collective of councils from 1 July 2017 after withdrawing from the Local Authority Protection Programme Disaster Fund.

In the event of a natural disaster, the insurance cover will generally cover 40% of the reinstatement cost of infrastructure assets that have been damaged and declared for cover by the Aon SI collective.

The Aon SI collective is a shared program limit, Council has a sub-limit of $160 million plus AICOW – Additional Increased Cost of Working – this allows for additional costs to be paid over and above normal operating costs during a loss. The $160m was deemed to be the mean 1 in 750 ARI (annual return interval) loss estimate.

Emergency Management

Civil Defence and Emergency Response Plans

The following documents are available for guidance in the Civil Defence and Emergency Management:

- Civil Defence Emergency Management Plan.
- Nelson City Council Emergency Procedures Manual - exercises are carried out on a six monthly basis to ensure all staff are familiar with the procedures.

Section 64 of the Civil Defence Emergency Management Act 2002 requires Local Authorities to:

64 Duties of local authorities
(1) A local authority must plan and provide for civil defence emergency management within its district.
(2) A local authority must ensure that it is able to function to the fullest possible extent, even though this may be at a reduced level, during and after an emergency"

Local Civil Defence Emergency Management Arrangements

Nelson-Tasman Civil Defence Emergency Management Group is a joint committee of both Nelson City Council and Tasman District Council.

The Nelson Tasman Civil Defence Emergency Management Group Plan provides for an 'all hazards' approach to emergency management planning and activity within the Civil Defence Emergency Management Group area for Nelson City and Tasman District. The Civil Defence Emergency Management Group Plan states the civil defence emergency management structure and systems necessary to manage those hazards, including the arrangements for declaring a state of emergency in the Group's area. The Group Plan is the primary instrument whereby the community identifies and assesses its hazards and risks, and decides on the acceptable level of risk to be managed and how it is to be managed.

Lifelines Responsibility

Section 60 of the Civil Defence Emergency Management Act 2002 requires Local Authorities to support lifeline utilities as follows:

60 Duties of lifeline utilities
Every lifeline utility must—
(a) ensure that it is able to function to the fullest possible extent, even though this may be at a reduced level, during and after an emergency

Nelson City Council participated in the Nelson-Tasman Engineering Lifelines project as a life line utility.

Water Supply Mutual Aid Plan

The Nelson City Council is a signatory to the Water Supply Mutual Aid Plan administered by the Water Managers' Group of Water New Zealand (New Zealand Water and Wastes Association).

The purpose of the agreement is to:

- Provide a framework for administration and Water Sector co-ordination;
- Create a central register of contact details of personnel with designated authority;
- Create a central register of approximate resource levels available at each of the Agreement signatories (personnel, equipment, specialist materials);
- Define protocols and principles for requesting and providing assistance during an emergency;
- Set a policy for charging and reimbursement of costs;
- Address liability and indemnity issues.

The following table indicates the status of the stormwater schemes in the areas of Risk Reduction, Readiness, Response and Recovery.

Table 5-3: Risk Reduction, Readiness, Response and Recovery Status

Activities Required	Description	Stormwater Status
Risk Reduction	Identifying hazards, describing risks, and taking actions to reduce the probability or consequences of potential events.	Asset Management Plan Risk Register

Activities Required	Description	Stormwater Status
Readiness	Planning and preparation required to equip agencies and communities to respond and recover.	Emergency procedures manual and exercises.
Response	Addressing immediate problems after an emergency.	Mutual Aid Plan.
Recovery	Addressing the long-term rehabilitation of the community.	Nelson-Tasman Civil Defence Emergency Management Group.

Electricity Supply

The electricity lines suppliers are Network Tasman Ltd and Nelson Electricity Ltd.

Energy supply is currently via a contract with Trustpower.

Interconnectivity Effects

Interconnectivity or interdependence between different utilities during and after a disaster is of utmost importance. In the event of failure, access is necessary to visit a site and provide power for recovery or removal of debris. To enable effective and efficient recovery of lifelines from an event which disrupts their service, dependencies on other lifelines must be understood and where necessary, mitigated against.

Figures 5-3 and 5-4 summarise interdependencies between lifelines sectors during business-as-usual and major disaster events where disruption is expected to roads and electricity networks. The ratings presented in this section are illustrative only – obviously the extent of dependence in a response and recovery situation will depend on the specific scenario. The total dependency scores clearly illustrate the importance of electricity, roads, fuel and telecommunications to the other sectors, with air transport, VHF and broadcasting becoming more important in a major disaster event.

Figure 5-3: Interdependency Matrix – Business As Usual

The degree to which the utilities listed to the right are dependent on the utilities listed below	Roads	Rail	Sea Transport	Air Transport	Water Supply	Wastewater	Stormwater	Electricity	Gas	Fuel Supply	Broadcasting	VHF Radio	Telecomms	Total Dependency
Electricity	1	2	3	3	3	3	2		2	2	3	3	3	30
Roads		3	3	3	2	2	2	2	2	3	2	2	2	28
Fuel	2	3	3	3	2	2	2	2	2		2	2	2	27
Tele-comms	2	2	2	2	2	2	2	2	2	2	2	3		25
Water Supply	1	1	1	2		3	1	1	1	1	1	1	2	16
VHF Radio	2	2	2	2	1	1	1	1	1	1	1		1	16
Stormwater	2	1	1	2	1	1		1	1	1	1	1	1	14
Wastewater	1	1	1	2	1		1	1	1	1	1	1	1	13
Rail	1		1	1	1	1	1	1	1	1	1	1	1	12
Sea Transport	1	1		1	1	1	1	1	1	1	1	1	1	12
Air Transport	1	1	1		1	1	1	1	1	1	1	1	1	12
Gas	1	1	1	1	1	1	1	1		1	1	1	1	12
Broadcasting	1	1	1	1	1	1	1	1	1	1		1	1	12

Figure 5-4: Interdependency Matrix – During / Post Disaster Event

The degree to which the utilities listed to the right are dependent on the utilities listed below	Roads	Rail	Sea Transport	Air Transport	Water Supply	Wastewater	Stormwater	Electricity	Gas	Fuel Supply	Broadcasting	VHF Radio	Telecomms	Total Dependency
Fuel	3	3	3	3	3	3	3	3	3		3	3	3	36
Roads		3	3	3	3	3	3	3	3	3	2	2	3	34
Tele-comms	3	2	2	2	3	3	3	3	3	2	2	3		31
Electricity	1	2	3	3	3	3	2		2	2	3	3	3	30
VHF Radio	2	2	3	3	2	2	2	2	2	2	2		2	26
Broadcasting	2	2	2	2	2	2	2	2	2	2		2	2	24
Air Transport	2	1	1		2	2	2	2	2	2	2	2	2	22
Water Supply	1	1	1	2		3	1	1	1	1	1	1	2	16
Stormwater	2	1	1	2	1	1		1	1	1	1	1	1	14
Wastewater	1	1	1	2	1		1	1	1	1	1	1	1	13
Rail	1		1	1	1	1	1	1	1	1	1	1	1	12
Sea Transport	1	1		1	1	1	1	1	1	1	1	1	1	12
Gas	1	1	1	1	1	1	1	1		1	1	1	1	12

3: Required for Service to Function, 2: Important but can partially function and/or has full backup, 1: Minimal requirement for service to function.

Succession Planning

Succession planning within any business is considered necessary to reduce the risk associated with staff leaving the organisation. Succession planning allows institutional knowledge to be passed on, and assists in ensuring continuity of organisational culture.

Currently succession planning is largely by way of multiple staff members involved in administering the activity and detailing strategies for the future in asset management plans. In order to ensure greater effectiveness there is a need to improve planning and recording of strategies over the next three years.

6. Financial summary

This Section sets out financial statements, funding strategy, depreciation forecast and charges for the Water supply Services in Nelson City.

The Local Government Act 2002 (Part 6 Subpart 3) requires local authorities to manage their finances "prudently and in a manner that promotes the current and future interests of the community. This implies compliance with applicable Financial Reporting Standards, which include Public Benefit Entity International Public Sector accounting Standards (PBE IPSAS).

This Asset Management Plan provides the basis for meeting these requirements.

6.1. Financial statements and projections

Definition of Expenditure Categories

All expenditure on infrastructure assets falls into one of three categories:

- Operations and Maintenance Expenditure
- Capital Expenditure –Renewal/Replacement

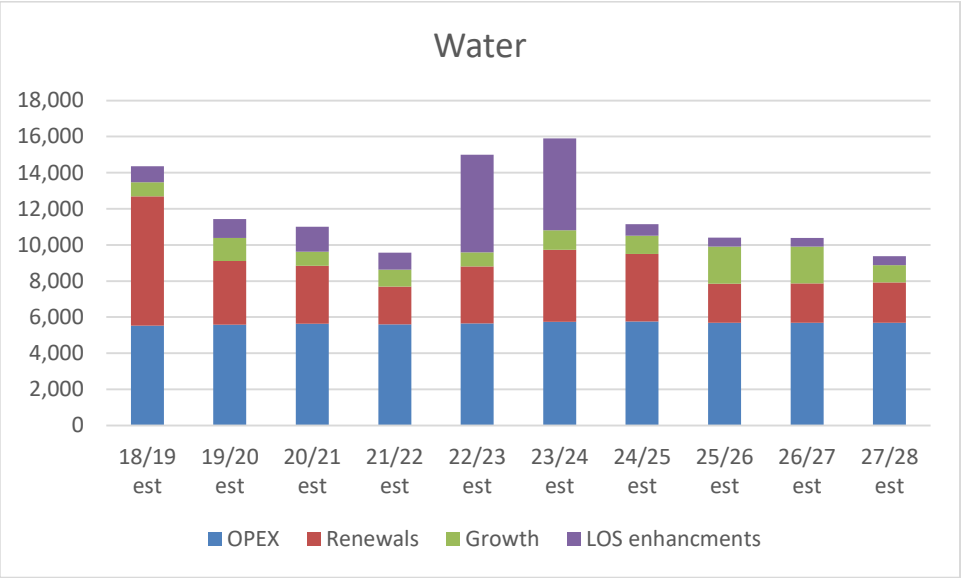
- Capital Expenditure –Creation/Acquisition/Augmentation for both level of service compliance and growth

Table 6-1: Water Expenditure Years 1-10 of the 2018/28 Long Term Plan ($000)

Account	2018/19 LTP Final Uninflated	2019/20 LTP Final Uninflated	2020/21 LTP Final Uninflated	2021/22 LTP Final Uninflated	2022/23 LTP Final Uninflated	2023/24 LTP Final Uninflated	2024/25 LTP Final Uninflated	2025/26 LTP Final Uninflated	2026/27 LTP Final Uninflated	2027/28 LTP Final Uninflated
7005 Water Supply	**14,351.2**	**11,437.5**	**11,000.5**	**9,567.7**	**14,991.7**	**15,898.1**	**11,142.9**	**10,404.2**	**10,393.4**	**9,372.1**
Expenses	**5,530.6**	**5,584.7**	**5,641.6**	**5,606.9**	**5,655.1**	**5,744.7**	**5,760.6**	**5,691.8**	**5,698.1**	**5,686.8**
Base Expenditure	3,299.0	3,378.0	3,379.2	3,480.2	3,541.4	3,505.3	3,569.4	3,618.1	3,599.4	3,588.1
Unprogrammed Expenses	1,925.0	1,950.0	1,950.0	1,950.0	1,950.0	1,950.0	1,900.0	1,900.0	1,900.0	1,850.0
Programmed Expenses	306.6	256.7	312.4	176.7	163.7	289.4	291.2	173.7	198.7	248.7
Capital Expenditure	**8,820.6**	**5,852.8**	**5,358.9**	**3,960.9**	**9,336.6**	**10,153.3**	**5,382.3**	**4,712.4**	**4,695.3**	**3,685.3**
Renewals	7,164.2	3,519.0	3,208.5	2,087.3	3,149.9	3,986.4	3,736.4	2,164.9	2,164.9	2,234.9
Capital Growth	778.0	1,278.0	778.0	940.2	778.0	1,090.2	1,010.2	2,060.2	2,043.0	963.0
700576152801. NCC - TDC Link	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	20.0
700576203165. water pump stations - upgrades	0.0	0.0	0.0	0.0	0.0	100.0	20.0	20.0	1,000.0	0.0
700576302809. Water Treatment Plant Upgrades	0.0	0.0	0.0	0.0	0.0	162.2	162.2	162.2	165.0	165.0
700576502313. Capital: Atawhai Res & pump Ma	0.0	0.0	0.0	162.2	0.0	0.0	0.0	0.0	0.0	0.0
700576503231. Ngawhatu Valley high level reservoir	0.0	0.0	0.0	0.0	0.0	50.0	50.0	1,000.0	0.0	0.0
70057691. Vested Assets	778.0	778.0	778.0	778.0	778.0	778.0	778.0	778.0	778.0	778.0
700576913164. Suffolk Road (Saxton to Ngawhatu) water upgrade	0.0	150.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
700576913166. Suffolk Road to Hill Street Trunk water main	0.0	350.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Capital Increased LOS	878.4	1,055.9	1,372.4	933.5	5,408.7	5,076.8	635.8	487.4	487.4	487.4
700579151058. Capital: Pressure Reduction	54.1	0.0	54.1	0.0	54.1	0.0	54.1	0.0	55.0	0.0
700579151064. Capital: Ridermains	167.6	167.6	167.6	59.5	59.5	59.5	59.5	59.5	59.5	59.5
700579151081. System Improvements	64.9	64.9	64.9	54.1	0.0	54.1	0.0	55.0	0.0	55.0
700579151168. Capital: Backflow Prevention	162.2	162.2	162.2	162.2	162.2	162.2	162.2	162.2	162.2	162.2
700579152140. Capital: Atawhai Trunkmain	10.0	44.1	54.1	102.7	1,800.0	1,800.0	0.0	0.0	0.0	0.0
700579152800. Pressure Enhancement	0.0	62.2	108.1	100.0	0.0	0.0	0.0	0.0	0.0	0.0
700579162131. Fire Flow Upgrades	0.0	0.0	0.0	0.0	25.0	25.0	25.0	0.0	0.0	0.0
700579162802. DMA establishment	50.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
700579162803. Water Loss Reduction Programme	216.3	216.2	216.2	216.2	216.2	216.2	216.2	100.0	100.0	100.0
700579162807. Natural Hazards Risk Remediation	58.1	108.1	108.1	50.0	0.0	0.0	0.0	0.0	0.0	0.0
700579501180. Other Sundry: Maitai Planting	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8
700579502314. Capital: Atawhai No.2 Reservoi	50.0	50.0	300.2	50.0	1,081.0	2,702.5	0.0	0.0	0.0	0.0
700579502810. Dam Upgrades	50.0	100.0	100.0	108.1	2,000.0	108.1	108.1	0.0	0.0	0.0
700579503142. Maitai Pipeline Hazard mitigation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	100.0

700579903259. Water supply H&S risk mitigation programme	10.0	20.0	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0
70057997. LoS: investigation, options, testing, engagement	-25.6	0.0	-43.7	0.0	0.0	-61.4	0.0	0.0	0.0	0.0

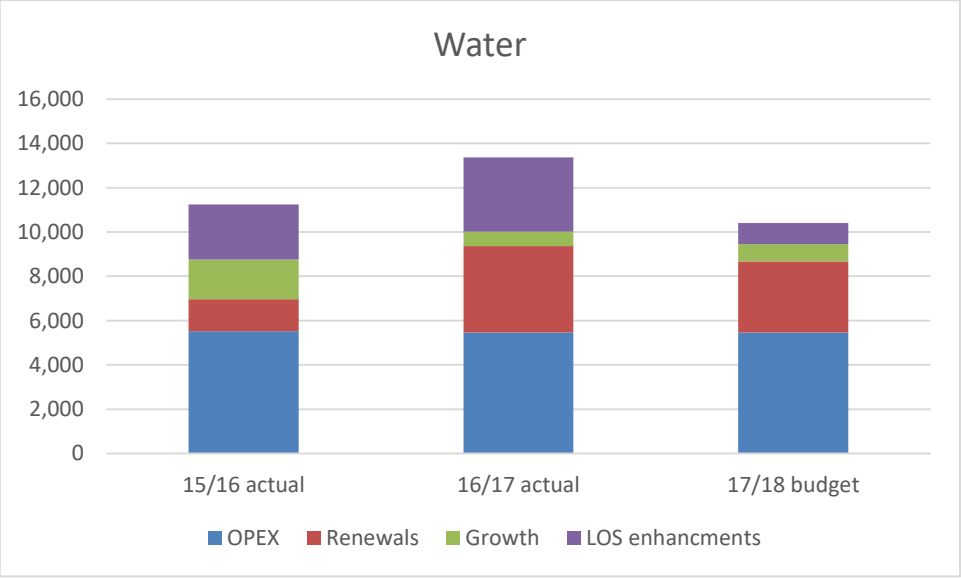
Figure 6-1: Proposed Expenditure



Expenditure for the water supply activity varies over the term of the plan. Renewals expenditure is high in 2018/19 with the renewal of the last two trains of membranes. The slight spike in year 2021/22 and 2022/23 relates to two larger construction projects (Atawhai storage reservoir and Maitai Dam aeration) coinciding in the same years. The spikes in 2026/27 and 2027/28 are due to the proposed upgrade works at the water treatment plant to install a primary clarifier if demand requires.

6.1.1. Trends from the previous 2 – 3 years

Figure 6-2: Recent Expenditure



6.2. Funding strategy

In determining how activities will be funded local authorities are required to take the following into consideration:

- The contribution to the achievement of Community Outcomes (strategic alignment)
- Beneficiaries of each activity (beneficiary/user pays principles)
- The period over which benefits from the activity will occur (intergenerational equity issues)
- The extent to which identifiable individuals contribute to the need to incur expenditure (exacerbator and user pays principles)
- The costs and benefits of funding the activity compared to other activities (cost/benefit, prioritisation principles)
- The impact of funding the activity on the wellbeing of the community (ability to pay principles)

Contributions

The Resource Management Plan has set a financial contribution so that sub-dividers, developers and new industry pay their share of the capital expenditure for reserves purposes each year as part of the costs of growth.

From 1 July 2006 Development Contributions have been collected under the Local Government Act 2002 as detailed in the Long Term Plan.

The remaining costs of collecting, treating and delivering water are funded from user charges.

Water by Meter User Charges

From 1 July 1999 universal metering has been in operation and there is no charge in the general rates for the supply of water.

The Water Pricing Structure Working Party was convened in 2003 and made its recommendation to the Infrastructure Committee which in turn recommended the pricing structure to the full Council meeting on 18 December 2003.

The objective of the pricing structure is to:

- Encourage water conservation.
- Be fair to residential and commercial water users.
- Be simple to administer and readily understood by the public.
- Recognise the opportunity value and fire-fighting value of the water supply system and the benefits this provides to empty sections and houses.
- Provide regular cash flow while avoiding excessive reading and invoicing costs.

The key points in the pricing structure are:

- A house or section without a water connection not be charged a fee.

- All properties on water by meter (including empty sections) should pay a minimum annual charge.
- The fixed costs are approximately 90% and variable costs approximately 10% of the total costs of operating the water supply. If the minimum annual charge was set to recover 90% of costs there would be little incentive to conserve water. Therefore the minimum annual charge was set to recover only 30% of the total costs. This encourages water conservation, but still means that low (or no) volume users do pay a share of the opportunity and fire-fighting value of the supply.
- There being no "entitlement to free water for low usage" associated with the minimum annual charge.
- The minimum annual charge (collected as a daily charge) be set to recover 30% of the estimated water by meter revenue requirement, and that the remaining 70% be recovered as user charges.
- The revenue required from Major Water Users with Even Demand (including financial and operating costs) be calculated based on the value of water supply assets used by those users and allocated as a percentage of peak summer demand for assets sized for peak demand (part of the treatment plant), and as a percentage of water used for assets sized for water volume.
- The charges for Bulk Water Users over 10,000m^3 per year, where there is predominantly summer irrigation, be at the average of the 0-10,000m3 and the 10,000-100,000m^3 rates. This recognises that these Users contribute to the summer peak, but do not use a large part of the reticulation.
- The charges for usage in the 10,000-100,000m^3 band and 100,000+m^3 band be set to recover the revenue calculated above and in the same ratios as used in previous years.
- A revenue issue may arise in the future, if the water reuse project involving treated water from Bells Island is developed. This project would supply irrigation water to the Tahunanui / Stoke area and impact on water sales currently made for this purpose.

Creation/Acquisition/Augmentation

Nelson City Council will review funding requirements and strategies to achieve equitable funding of upgrade works through development contributions.

6.3. Valuation forecasts

Table 6-2: Water Supply Asset Valuation - June 2016

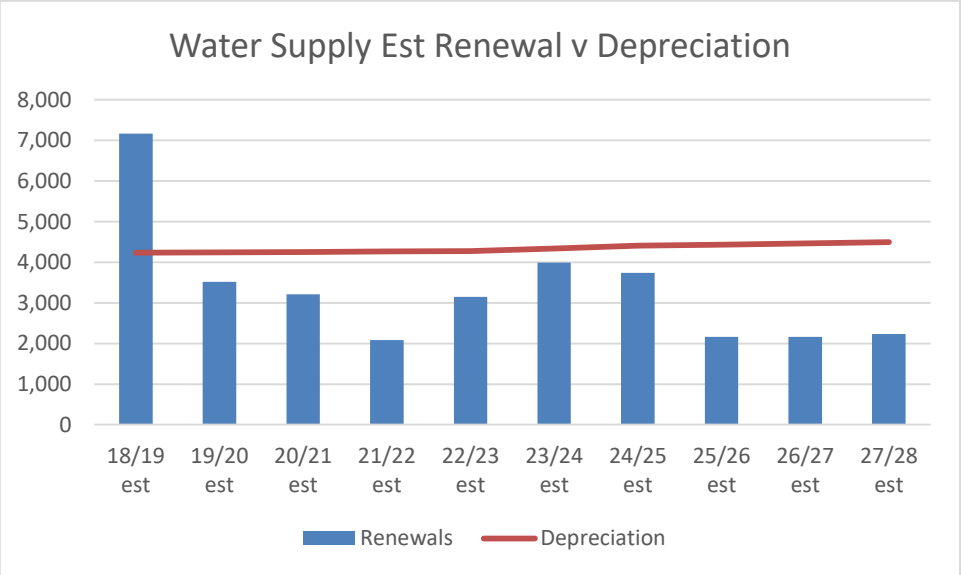
Asset Category	Quantity		RV	DRV	Depr
	km	units	($)	($)	($)
Reticulation	333.8		81,114,158	43,397,673	1,011,932
Trunk Mains	45.6		22,787,631	10,972,355	309,409
Maitai Pipelines	16.3		22,557,388	13,416,549	320,366
Roding Pipeline	3.9		2,741,626	575,848	30,162
Maitai Water Supply Scheme		1	20,848,700	14,402,600	226,000
Roding Dam		1	2,889,100	855,900	48,300
Treatment Plant		1	22,953,076	12,717,431	854,588
Tunnels		3	11,846,400	10,340,200	55,000
Reservoirs and Tanks		36	13,282,350	10,359,000	160,618
Pump Stations		13	4,237,644	3,059,122	178,850
Pressure Reducing / Control Valves		40	616,053	338,524	16,484
Air & Non Return Valves		165	401,227	222,566	10,985
Gate Valves		3,634	6,471,706	4,223,537	82,052
Manholes		91	338,979	213,359	4,408
Hydrants		2,559	4,851,864	2,471,672	65,197
Meters		20,829	3,792,946	1,313,091	186,584
Customer Connections		20,260	27,214,741	15,416,273	342,318
Total			248,945,588	144,295,702	3,903,253

The 2017 indexed depreciated replacement valuation of the water supply assets is $156,331,000.

Table 6-3: 2014 Water Supply Asset Valuation

Asset Category	Quantity	Unit	Replacement Value $,000s
Reticulation High Pressure	104.1	km	32,399,508
Reticulation Low Pressure	219.9	km	61,301,794
Trunk Mains	39.9	km	18,455,112
Maitai Pipeline	9.3	km	17,666,517
Roding Pipeline	3.9	km	2,160,916
Maitai Water Supply Scheme	1		20,670,500
Roding Dam	1		2,859,900
Treatment Plant	1		20,191,669
Tunnels	3		11,677,100
Reservoirs and Tanks	37		13,155,170
Pump Stations	11		2,544,228
Pressure Reducing Valves	32		383,922
Air & Non Return Valves	136		324,224
Gate Valves	3,349		7,273,282
Manholes	94		343,288
Hydrants	2,481		6,323,027
Meters	20,252		3,037,432
Customer Connections	20,161		25,913,634
Total			246,681,222

Figure 6-3: Forecasts of depreciation



6.4. Key assumptions made in financial forecasts

Council is required to identify the significant forecasting assumptions it has made in preparing its ten year Long Term Plan. Assumptions are necessary to allow Council to plan for expenditure and costs over the next ten years. They are the best reasonable assessment made on the basis of currently available information.

The Nelson Long Term Plan details possible and actual significant forecasting assumptions and uncertainties relating to Nelson City Council activities.

As well as the general assumptions that apply as the basis for forecasting budgets across Council's work, the following assumptions apply specifically to water supply:

- Council assumes renewals will be continued at a rate that is sustainable, based on consideration of both resource and financial aspects
- It is assumed that Nelson's climate will remain substantially unchanged for the next decade, with enough rain to meet our water needs. Factors such as climate change and population growth will receive increased analysis as the Infrastructure Strategy is reviewed in future years
- It is assumed that new resource consents for the existing sources of water supply and abstraction volumes will be granted
- It is assumed that there will be reductions in water losses
- Water supply is expected to continue to be funded from water charges and, consistent with Council's financial policies, most of the capital expenditure will be funded from borrowings
- Council will provide education and promotion of the importance of water conservation; however the demand for water is expected to continue to primarily be managed through Council's water charging system
- The service delivery strategy is expected to be sustained for the term of this Long Term Plan
- Existing treatment plant membranes will continue to operate satisfactorily.

6.5. Forecast reliability and confidence

Table 6-4 below details the possible and actual significant forecasting assumptions and uncertainties relating to the Nelson City Council water supply system.

Table 6-4: Significant Forecasting Assumptions and Uncertainties

No.	Assumption	Degree of Risk or Uncertainty	Likely Impact if the Assumption is (or is Not) Realised or is Not Acceptable
1	Interest rates for new loans raised or existing debt refinanced during the years are forecasted in the range of 5%.	Low	Level of debt is moderate. Interest costs are not expected to vary significantly.
2	Growth is based on figures provided by statistics New Zealand and Nelson City Council growth projections.	Low	Any significant increase in the growth may require upgrading of reticulation to occur at an

No.	Assumption	Degree of Risk or Uncertainty	Likely Impact if the Assumption is (or is Not) Realised or is Not Acceptable
			earlier stage than presently proposed.
3	The actual remaining lives of assets will not deviate significantly from those contained in the asset valuation.	Medium	Changes in estimated asset lives could lead to significant changes in asset renewal projections, depreciation and renewal budgets.
4	The replacement values are a realistic cost and have taken into consideration engineering fees, resource consents etc.	Low	Replacement values have gone through a review process.
5	Upgrade/capital estimates are as follows: Concept +/- 30% Initial & Planning +/-10 to +/- 25% Delivery/Construction +/- 5% Projects of unusual complexity or presenting landowner / regulatory issues that cannot be quantified and such that estimating with accuracy is difficult, may lie outside these figures.	Medium	Costs of upgrades are estimated only without detailed project planning.
6	Maintenance cost of service for Reticulation and Treatment will be within -5% and +10% of budget.	Low	Historically maintenance costs % variations for reticulation have been low.
7	Depreciation based on estimated useful lives not on condition of pipework.	Medium	If proposed condition assessments indicate that Councils mains have decreased useful lives, depreciation presently taken will be less than that required for replacement.

7. Asset management practices

The goal of infrastructure asset management is to:

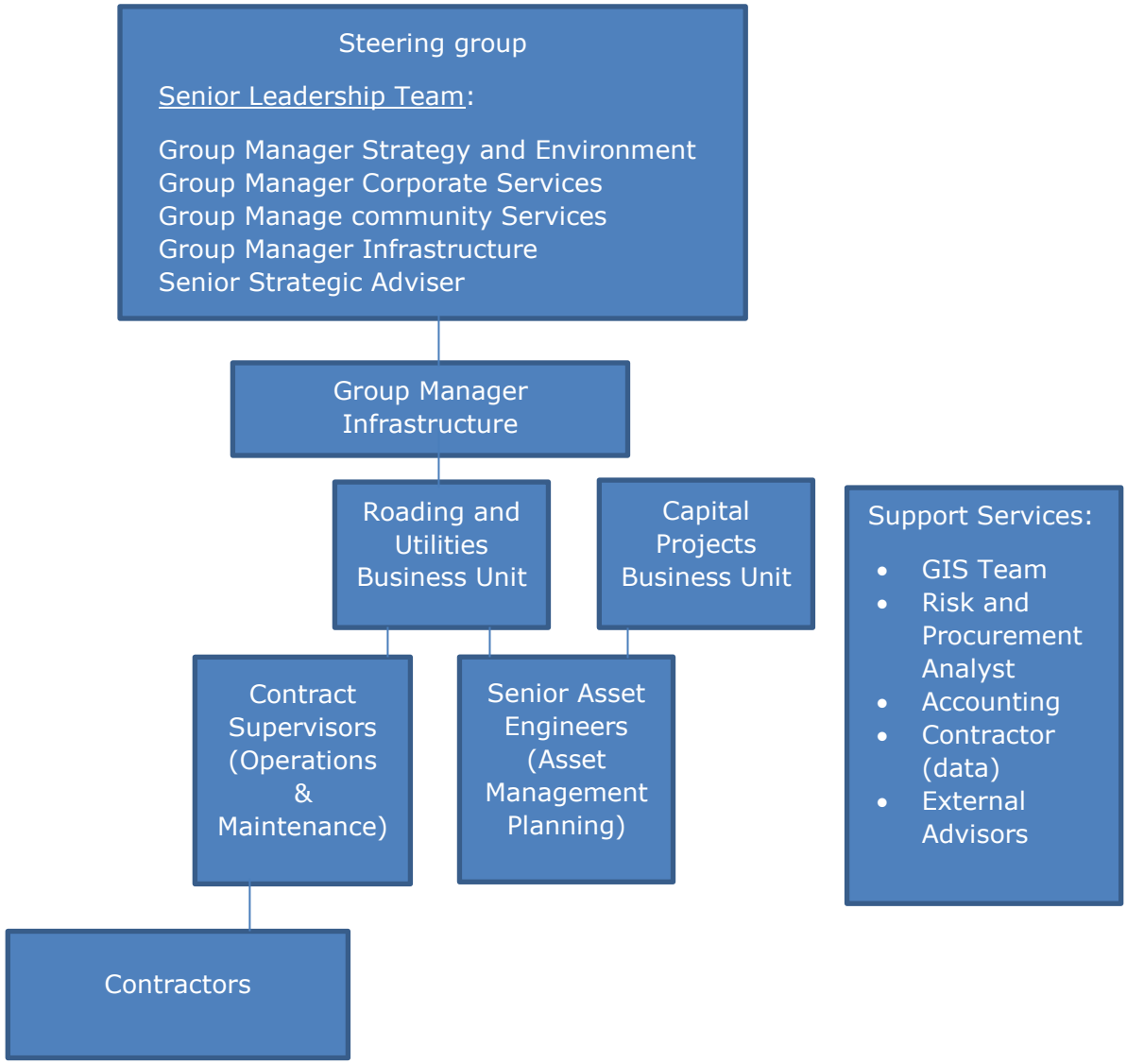
"Deliver the required level of service to existing and future customers in a sustainable and cost effective manner."

A formal approach to the management of assets is essential in order to provide services in the most cost-effective manner, and to demonstrate this to customers and other stakeholders. The benefits of improved asset management are:

- Improved governance and accountability
- Enhanced service management and customer satisfaction
- Improved risk management
- Improved financial efficiency
- More sustainable decisions

The key elements of Asset Management are as shown below:

7.1. Asset management leadership and structure



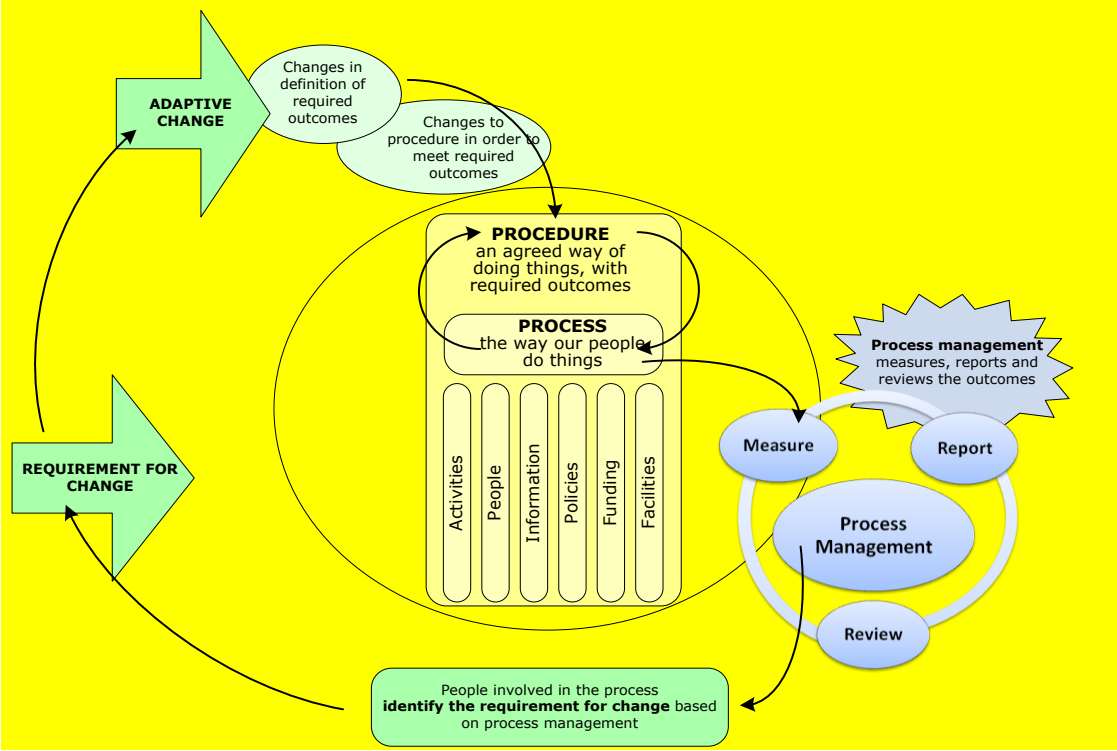
7.2. Management systems

A management system is defined as the set of procedures an organisation needs to follow in order to meet its objectives.

Quality Management

The quality management system is process management based on a quality cycle. It is aligned with ISO 9000, and benchmarked against this standard each year. The focus of the Quality Management programme is to improve the effectiveness and efficiency with which Nelson City Council deliver services to the community; ensuring processes deliver their required outcomes, which are aligned with community outcomes and organisational goals. Required outcomes are typically defined in terms of the core key performance areas - customer satisfaction, legislative compliance, and management of resources (budget and staff time), and employee engagement.

Quality Management Lifecycle:



1: Define the Process: Document the Procedure

NCC's Quality Management system (QMS) is a process-based approach. A process is a set of interrelated or interacting activities which transforms inputs into outcomes. Required outcomes are achieved more efficiently when activities and related resources are managed as a process.

A procedure is an agreed way to carry out a process. A procedure includes and defines:

Required outcomes from the procedure (most important)

- Definition of the required outcome forms the "quality" standard for the process
  - Agreement of the required outcomes tells us what would success look like (our KPIs)
- We need to ensure that required outcomes are recorded so that they can be measured later - not just what needs to be achieved, but when, and how many, and what exceptions

People involved in the procedure (equally important)

- Definition of all of the people involved in all aspects of the process, including the customer, those "doing stuff", those "accountable for stuff" and any suppliers directly involved in the process
- Are the people involved the most effective, most efficient way to do this?

Activities comprising the procedure

- Defining all the activities required and undertaken to achieve the required outcomes
- Are all the activities undertaken necessary, are they in the right order, are the right people doing them, is this the most effective, most efficient way to do this?

Enablers that support the procedure

- The enablers of the process include things like information (and information systems), policies (and culture), funding and facilities. These should be documented as part of the process

Documenting the procedure (activities involved, who does what when, what funding and resources are required) provides a *written procedure* to support the process.

Processes work together to form end-to-end procedures:

Managing interrelated processes improves the organisation's effectiveness and efficiency in achieving its objectives. This means consideration of how processes interrelate to form end-to-end procedures with overall outcomes. The

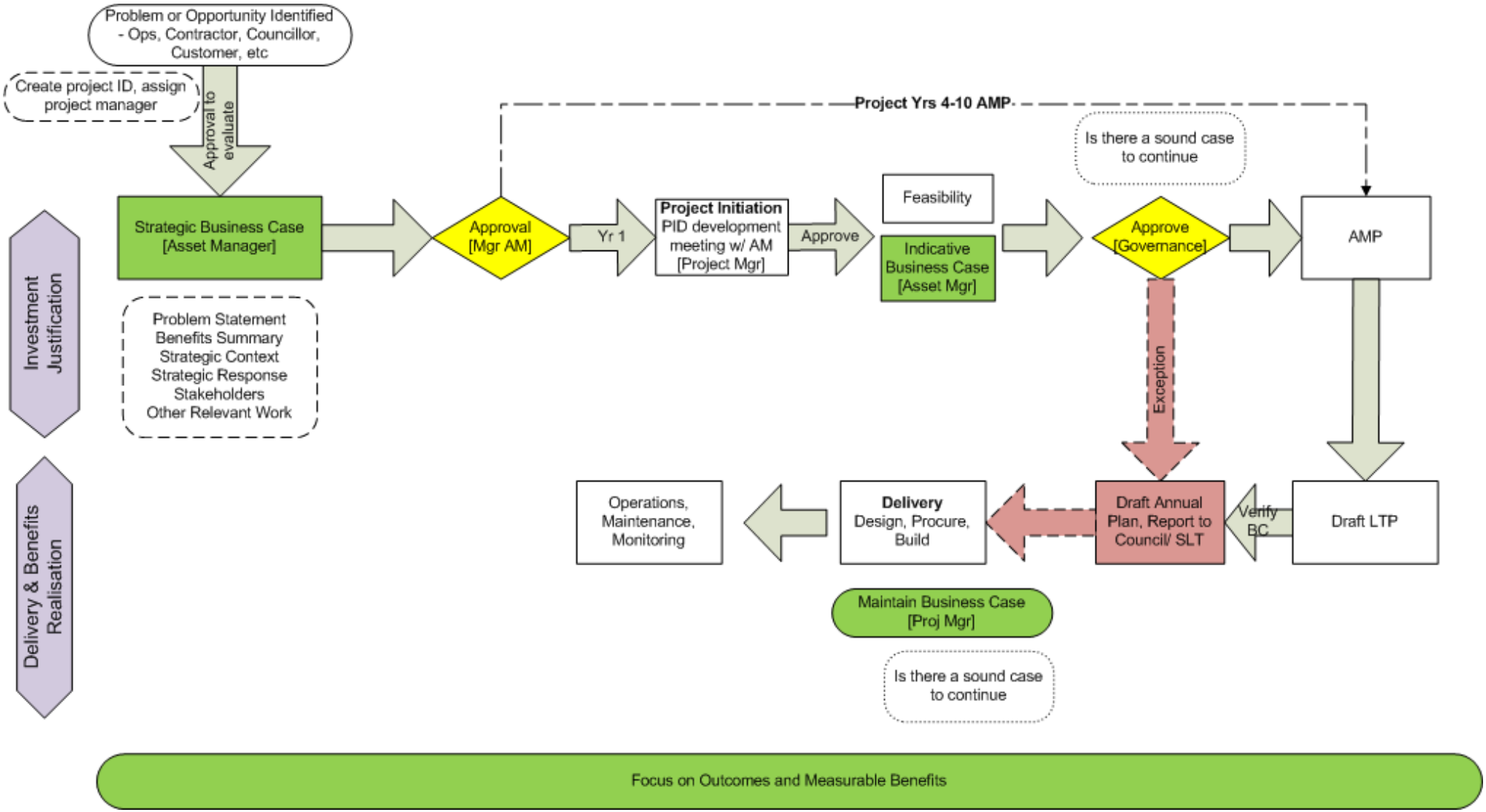
1: Define the Process: Document the Procedure
outputs from one procedure often form the trigger for the next procedure. End-to-end procedures have their own required outcomes.

2: Manage the procedure: Measure, Report and Review
Measuring whether the procedure is being followed and whether outcomes are being met This enables us to apply a factual approach to decision making and to the need for change. • Measure how the process is going – is the procedure being followed – are interim goals being met? Measure the outputs of the process – were these met and did these meet the required outcomes? **Reporting tells us whether procedures are being followed and outcomes being met** • We need to not just know whether outcomes are being met, but to "know that we know" • Reporting gives us options for remediation or consequences of non-conformity **The procedures and the outcomes are subject to review by those responsible and accountable for the process** • Why did we really do this? What did we think we would gain? Did we get that result? • Are we doing the right things? Are we doing them the right way, and are we doing this consistently? Are we getting them done well? Are we getting the benefits? • Review provides a tool for continual improvement of the process by re-examination and change to the required outcome, or by change in the process to achieve the required outcome

3: Improve the procedure: Requirement for Change, then Adaptive Change
Procedure are subject to adaptive improvement to the process and the required outcomes. People involved with processes identify and initiate change: • Are the required outcomes still required? Is there a requirement for change? • Are the activities and people defined in this process the best way to achieve these outcomes? • Are things being done in the right order, and by the right people, in the right places? Is the process being followed? Does everyone do it the way that we've agreed? • Is there anything listed that isn't contributing? Is there something that would contribute more?

Project management

NCC processes for project management require that time, cost, and quality/scope objectives are agreed before project delivery begins. Project management is focussed on ensuring that the desired benefits, as per the agreed business case, are delivered. Project management processes are based on the principles of the PRINCE2™ method. Fiscal approvals, and change approvals are in line with Council delegations and Officer delegated authority



Business case process

7.3. Information systems

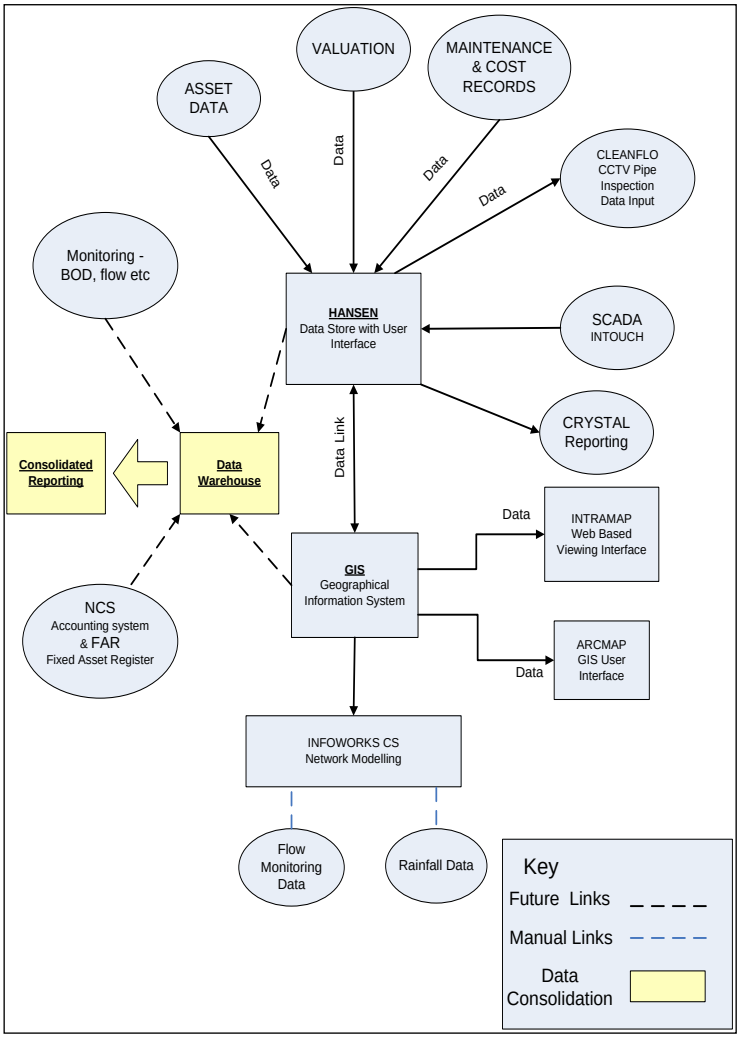
Asset Management Information Systems provide an understanding of assets to optimise lifecycle costs, identify required work, record completed work and cost of work. It benefits general management, long-term planning and data analysis.

All asset information is stored in the Asset Register linked with GIS

An overview of the asset information system in its existing state and future state is depicted in Figure 7-1 below. The warehousing of specific data and further development of reporting will assist in management of the assets.

The Council has a number of information systems (Infor, MagiQ, InTouch, Network Model, and closed circuit television) that are integrated to varying degrees. The integration of these systems is considered to assist in the optimisation of operations, renewals and the ongoing development of the water activity.

Figure 7-1: Asset Information Systems



Asset Improvement Register (ongoing AM practice)

The Asset Improvement Register is used to capture, store, and share ALL discussions, thoughts and concerns with regard to asset performance and improvement

Integrated Accounting, Financial, Electronic Purchase Order, and Service Request Systems

Accounting is currently carried out to Generally Accepted Accounting Principles to comply with the Local Government Act 2002 and Public Benefit Entity International Public Sector Accounting Standards (PBE IPSAS). The Nelson City Council uses integrated computer software supplied by MagiQ. The General Ledger is linked to packages that run Debtors, Creditors, Banking, Rates, Fixed Assets, Invoicing, Water Billing, Job Costing, and Payroll. Internal monthly financial reports are generated by Council significant activity and sub-activity categories although real time data is available at any time. External financial reports by significant activity are published in the annual report.

Service requests record customer questions, enquiries, and complaints.

Electronic Document and Records Management System (EDRMS)

Nelson City Council uses Objective as its electronic document and records management system.

Geographical Information System

Geographical information system was implemented in 1994 with data captured using photogrammetry (1994) and progressively delivered over the following years. Nelson City Council staff carried out accuracy checks on the geographical co-ordinate data supplied, searched all the engineering plans and field books for information on pipe alignment, material and age and entered this information into the Geographical information system.

Accuracy Limitations

The data captured by photogrammetry was required to be accurate to within a tolerance of +/- 0.3m. In inaccessible areas, it was not considered economic to search for buried fittings. Instead, the best estimated position was entered and the accuracy limitation flagged. Similarly, only limited fieldwork has been done to confirm the pipe material and sizes. The accuracy of this information is verified through time by asset data collection procedures.

New assets are recorded from the "as built" plans supplied by the subdivider (for vested assets) or Council's engineering project section (for new capital work).

Maintenance of GIS data

Procedures are in place to update new data into the Geographical information system on a monthly basis via Nelson City Council engineering staff.

Council's Engineering Standards require that any work on a Council sewer must be proposed to Council by means of an engineering plan for approval and an "As-built" record submitted at the completion of works.

Data on assets associated with renewal and upgrade capital are now updated into the asset register by Nelson City Council Engineering and Finance staff. This ensures a high level of reliability.

Closed Circuit Television

Currently, Closed Circuit Television condition inspections are carried out by an external contractor only as required.

The Infor system is used to assist in the selection of pipes to be checked. The Closed Circuit Television inspection records are inputted into the Infor system via Cleanflow.

Asset management Recording System - Infor

The use of the Infor system has enabled the following:

- Customer enquiries being logged directly and sent immediately to the contractor for action.
- Contractor directly enters resolution confirmation at completion of job.
- Tracking of expenditure on assets to allow assets that have a disproportionately high maintenance cost to be identified - upgrade or renewal can then be prioritised.

Nelson City Council principal contractor Nelmac has a live interface with Infor. Any work associated with unscheduled maintenance is entered into Infor work order by the contractor. Completed work orders forms the basis of the contractors' payment.

There are known issues with the existing implementation of Infor surrounding the work order processes including a lack of reporting to trend results and alert for operational issues. With confirming the required reporting outputs for all levels of management the work order processes and data captured by the contractor and/or Nelson City Council staff can be refined to ensure the needs of all parties are met.

ProMapp

ProMap is Nelson City Council's procedures library

Supervisory Control and Data Acquisition System (SCADA)

The Supervisory Control and Data Acquisition system provides surveillance of the operation of pumping stations in the stormwater system and provides alarms when equipment fails or when operating parameters are exceeded. The Supervisory Control and Data Acquisition system also records operating data from the pumping stations.

All of the Nelson City Council's strategic utility components are monitored remotely, at Civic House or by duty staff using laptop computers at home, utilising a telecommunication system.

This system has given Council the ability to ascertain faults and instigate repairs without affecting the service to the consumer and has significantly increased efficiency and reliability of the utility schemes. This function has become critical to the operation of the network and has been supported by Council's in house Information Management team up to now. There is a need to upgrade this package and at the same time consider how the technical requirements can be accommodated with the essentially office based computer network used by the majority of Council staff.

Council has a "Kingfisher" and "Intouch" system at the base station (rationalisation of system occurred in 2005). The system is used to monitor and control critical aspects of all Nelson City Council treatment plants and pump stations, 67 sites are presently monitored that include:

- Waste Water Treatment Plants
- Stormwater Pump Stations
- Wastewater Pump Stations
- Water Treatment Plants

- Water Pump Stations and Reservoirs

Appendix G details the over view of the Supervisory Control and Data Acquisition system. The system is used for:

- Monitoring the operation of sites
- Reporting, trending and analysing historical data
- Alarm monitoring (operators are informed of alarms via text messages to mobile phones)
- Some control functions

Monitoring of water, wastewater and stormwater systems by the Councils Supervisory Control and Data Acquisition system has grown to the point that without the current Supervisory Control and Data Acquisition system, maintaining the existing Levels of Service would be difficult. Supervisory Control and Data Acquisition has given the ability for Council to ascertain faults and instigate repairs without affecting the service to the consumer and has significantly increased efficiency and reliability of the utility schemes. The Supervisory Control and Data Acquisition system is a critical system in Council's operation.

Review and Upgrade

In 2016/17 an extensive upgrade of this package was completed.

Future Strategy for Councils Supervisory Control and Data Acquisition

Council's strategy for the ongoing use of Supervisory Control and Data Acquisition is:

- Maintain Supervisory Control and Data Acquisition system at a high level to ensure system reliability and ongoing reporting ability.
- Increase availability of information to the in-house Business Units in a format that will enable increased efficiencies in operation and management.
- Develop the reporting functions of the system.
- Develop further use of the system to control plant and equipment.

7.4. Service delivery models

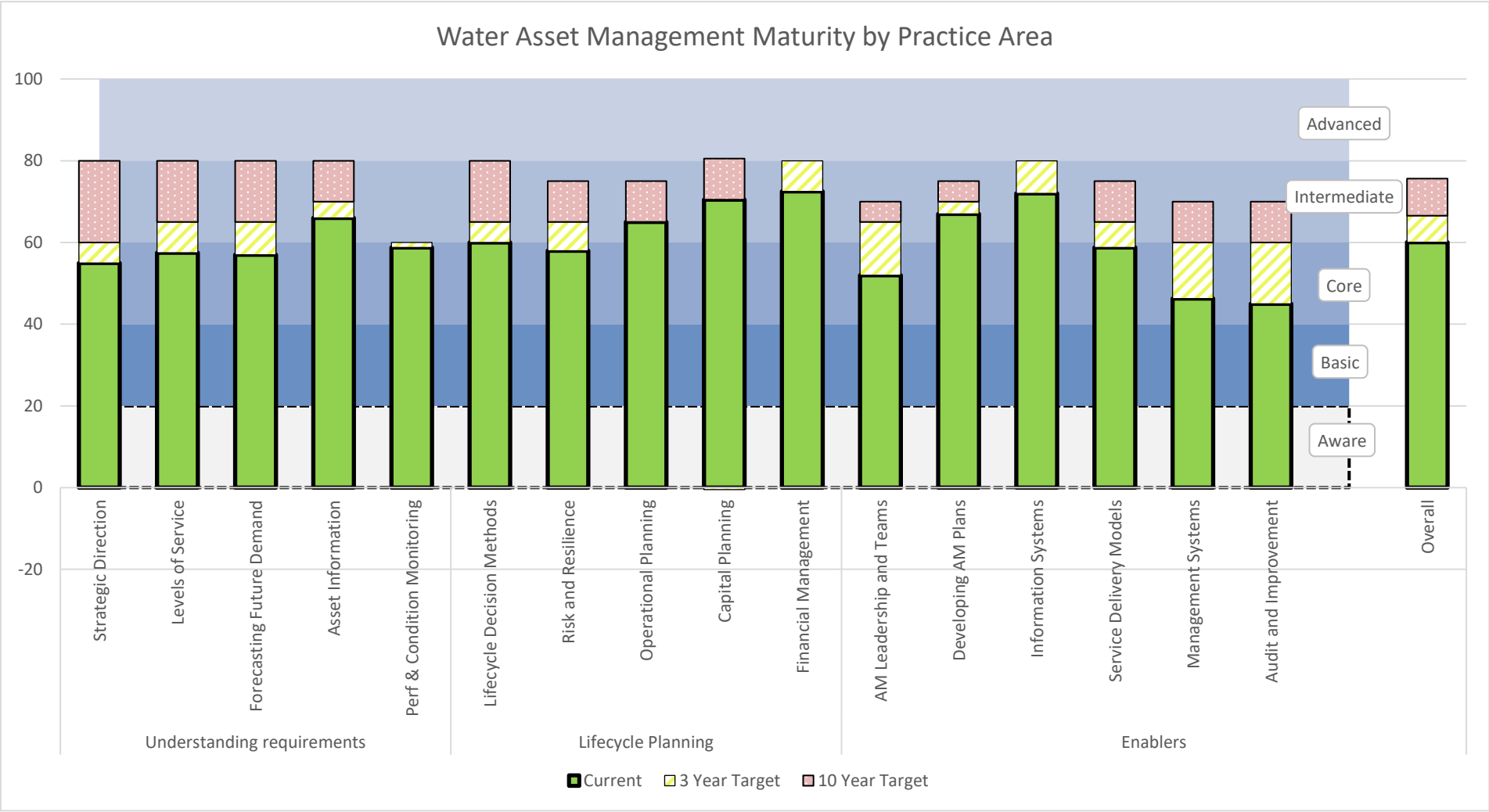
Maintenance contracts have been reviewed and grouped to provide a good balance between price and quality, and use either prequalification or price/quality supplier selection methods. The methods used to procure capital projects will differ depending on the size of the project, but will be either lowest price or price/quality.

Council maintains an in-house professional services capability balanced with external consultants as required to achieve best value for money. Additional professional services are sometimes required.

8. Plan improvement and monitoring

8.1. Status of AM practice

Figure 8-1: Current and desired state of AM processes, data and systems



8.2. Improvement programme

The plan will be reviewed annually and revised every three years to incorporate, amongst other things, improved decision making techniques, updated asset information, and Council policy changes which impact on targeted levels of service.

Improving Accuracy and Confidence in Asset Management Plan

Asset management improvements and associated objectives are noted throughout the Asset Management Plan.

These improvements will improve the accuracy of, and confidence in, the Water Asset Management Plan.

Table 8-1: Improvement Programme

Improvement Programme
Develop Contamination Response Plan
Establish Condition Model for asbestos cement pipe and cast-iron pipe
Maitai Dam comprehensive Safety Review
Routinely calibrate the accuracy of the Network Analysis so that accurate predictions are provided
Improve reporting on levels of service, particularly those that are based on Council service requests and work orders to contractors. Resolve issues with how the information is recorded and recovered.
Review asset lives using NAMs– NZ Infrastructure Asset Valuation and Depreciation Guidelines
Improve accuracy of condition assessments.
Continue the water loss identification and reduction programme
Review the lifelines risk assessment and response
Continue investigations into dis-coloured water issues

Data collection programmes (condition, performance, asset registers) closely aligned with business needs will be operated in accordance with documented quality processes

Data collection, maintenance and analysis are expensive and it is important that programmes and techniques are cost effective and consistent with business needs. Systematic processes will be introduced for the collection and upgrading of essential data based on asset criticality including:

- Asset attribute information
- Asset performance data
- Asset condition data.
- A more robust framework for identification of critical assets

A methodology for determining asset criticality to a component level, along with options, will be determined to integrate criticality into the ongoing operation, maintenance, renewals and capital programme for the water supply activity.

The risk register will be extended to encompass assets down to a component level

8.3. Monitoring and review procedures

Nelson City Council will:

- Implement a continuous improvement approach to asset management planning in the short term.
- Fully review the Asset Management Plan three-yearly in advance of the Long Term Plan. Annual amendments or updates will be undertaken if significant asset management changes occur.
- Report variations in the adopted annual plan budgets against the original asset management plan forecasts and explain the level of service implications of budget variations.

Statutory Audit

The Local Government Act requires that an annual, financial audit of the operations of the Council be carried out. Audits may include all significant activities such as Asset Management planning.

Previous Water Asset Management Plans were examined by Audit New Zealand in the course of audits of the Nelson City Council.

Internal Audit

An internal audit will be taken to assess the effectiveness with which the plan meets its objectives prior to the development of the 2018-28 Asset Management Plan.

Review and Updates

The Water Asset Management Plan programmes and costs will be reviewed and updated annually by 30 August each year for incorporation into the Annual Plan.

Performance Monitoring and Management

The effectiveness of the Water Asset Management Plan will be monitored in various ways and the results used in the updating and revision of the Plan.

Current Level of Service Objectives

Compliance with the current level of service objectives will be monitored by internal audit.

Annual Performance Monitoring

Throughout this Water Supply Asset Management Plan annual performance and monitoring measures are noted.

8.4. Performance measures

Outline of performance measures for the AM system

Benchmarking

Benchmarking of service quality and cost efficiency against similar organisations will be carried out at some future date, most likely once an Asset Management System is operational, and a history has been established.

Local Government NZ embarked on a benchmarking exercise for Council utilities in 2014. Nelson City Council was a contributor to that exercise.

How the effectiveness of the AM plan will be measured

The effectiveness of the Asset Management plan will be monitored by the following procedures:

- Financial expenditure projections prior to year end
- Resource consent monitoring as required by consents
- Operations and Maintenance reports on a monthly basis

The continued monitoring of these procedures and ongoing analysis of results will result in:

- Optimisation of expenditure through the asset lifecycle
- Service levels actively monitored and reported on
- Management of risk and control of failures

9. Appendices

APPENDIX A: GLOSSARY OF TERMS

The following terms and acronyms (in brackets) are used in this Plan.

Appendix Table A-1: Meaning of Words

Term	Definition
Advanced Asset Management	Asset management which employs predictive modelling, risk management and optimised decision-making techniques to establish asset lifecycle treatment options and related long term cash flow predictions. (See Basic Asset Management).
Annual Plan	An Annual Plan is published in years two and three, alternating with the three-yearly Long Term Plan, that sets out Council's updated financial situation, intended activities and work programme for the following three financial years.
Asset	A physical component of a facility which has value, enables services to be provided and has an economic life of greater than 12 months. Dynamic assets have some moving parts, while passive assets have none.
Asset Management	The combination of management, financial, economic, engineering and other practices applied to physical assets with the objective of providing the required level of service in the most cost-effective manner.
Asset Management System	An Asset Management system is a combination of processes, data and software applied to provide the essential outputs for effective Asset Management planning such as reduced risk and optimum infrastructure investment.
Asset Management Plan	A plan developed for the management of an infrastructure asset that combines multi-disciplinary management techniques (including

Term	Definition
	technical and financial) over the lifecycle of the asset in the most cost effective manner to provide a specified level of service. A significant component of the plan is a long-term cash flow projection for the activities.
Asset Register	A record of asset information considered worthy of separate identification including inventory, historical, financial, condition, construction, technical and financial information about each.
Backflow Prevention Device	A mechanical device required by the Drinking Water Protection Regulations to prevent water from private plumbing flowing back into the water supply system and possibly contaminating the public supply. May be a column 10.7m high, a double check valve system or a reduced pressure principle device.
Benefit-Cost Ratio (B/C)	The sum of the present values of all benefits (including residual value, if any) over a specified period, or the lifecycle, of the asset or facility, divided by the sum of the present value of all costs.
Business Plan	A plan produced by an organisation (or business units within it) which translates the objectives contained in an Annual Plan into detailed work plans for a particular, or range of, business activities. Activities may include marketing, development, operations, management, personnel, technology and financial planning.
Capital Expenditure	Expenditure used to create new assets or to increase the capacity of existing assets beyond their original design capacity or service potential. Capital expenditure increases the value of asset stock.
Cash Flow	The stream of costs and/or benefits over time resulting from a project investment or ownership of an asset.
City Datum	The baseline from which heights in the City are measured. It is approximately 12m below mean sea level (so that all numbers are positive).
Closed Circuit Television	A method of inspecting pipes by sending a mobile camera along the length of the pipe to visually record the interior.
Community Plan	See Long Term Council Community Plan.
Components	Specific parts of an asset having independent physical or functional identity and having specific attributes such as different life expectancy, maintenance regimes, risk or criticality.
Condition-Based Preventive Maintenance	Preventive maintenance initiated as a result of knowledge of an items condition from routine or continuous monitoring.
Condition Monitoring	Continuous or periodic inspection, assessment, measurement and interpretation of the resultant data, to indicate the condition of a specific component so as to determine the need for some preventive or remedial action.
Core Asset Management	Asset management which relies primarily on the use of an asset register, maintenance management systems, job/resource management, inventory control, condition assessment and defined levels of service, in order to establish alternative treatment options and long-term cash flow predictions. Priorities are usually established on the basis of financial return gained by carrying out the work (rather than risk analysis and optimised decision-making).

Term	Definition
Corrective Maintenance	The remedial actions performed as a result of failure, to restore an item to a specified condition. Corrective maintenance may or may not be programmed.
Critical Assets	Assets for which the financial, business or service level consequences of failure are sufficiently severe to justify proactive inspection and rehabilitation. Critical assets have a lower threshold for action than non-critical assets.
Current Replacement Cost	The cost of replacing the service potential of an existing asset, by reference to some measure of capacity, with an appropriate modern equivalent asset.
Data Warehouse	A system that is used to centralise a group of disparate databases in an organisation to facilitate access into each of those databases.
Deferred Maintenance	The shortfall in rehabilitation work required to maintain the service potential of an asset.
Demand Management	The active intervention in the market to influence demand for services and assets with forecast consequences, usually to avoid or defer capital expenditure. Demand management is based on the notion that as needs are satisfied expectations rise automatically and almost every action taken to satisfy demand will stimulate further demand.
Depreciated Replacement Cost	The replacement cost of an existing asset less an allowance for wear or consumption having regard for the remaining economic life of the existing asset.
Depreciation	The wearing out, consumption or other loss of value of an asset whether arising from use, passing of time or obsolescence through technological and market changes. It is accounted for by the allocation of the cost (or revalued amount) of the asset less its residual value over its useful life.
Deterioration Rate	The rate at which an asset approaches failure.
Economic Life	The period from the acquisition of the asset to the time when the asset, while physically able to provide a service, ceases to be the lowest cost alternative to satisfy a particular level of service. The economic life is at the maximum when equal to the physical life; however obsolescence will often ensure that the economic life is less than the physical life.
Failure Modes, Effects and Criticality Analysis	A technique for analysing and evaluating a design to ensure that the application has the desired reliability characteristics by obviating those critical failure modes through employment of redundancy, providing alternate modes of operation, derating, or any other means.
Gap Analysis	A method of assessing the gap between a business's current Asset Management practices and targeted future objectives/practices. Also called needs analysis or improvement planning.
Geographic Information System	Software which provides a means or spatially viewing, searching, manipulating, and analysing an electronic database.
Infrastructure Assets	Stationary systems forming a network and serving whole communities, where the system as a whole is intended to be maintained indefinitely at a particular level of service potential by the continuing replacement and refurbishment of its components. The network may include normally recognised ordinary assets as components.
l/sec	Litres per second. A measure of flow.

Term	Definition
Level of Service	The defined service quality for a particular activity (i.e. water) or service area (i.e. water quality) against which service performance may be measured. Service levels usually relate to quality, quantity, reliability, responsiveness, environmental, acceptability and cost.
Life	A measure of the anticipated life of an asset or component; such as time, number of cycles, distance intervals etc.
Lifecycle	The cycle of activities that an asset (or facility) goes through while it retains an identity as a particular asset i.e. from planning and design to decommissioning or disposal.
Lifecycle Cost	The total cost of an asset throughout its life including planning, design, construction, acquisition, operation, maintenance, rehabilitation and disposal costs.
Likelihood	Used as a qualitative description of probability or frequency.
Long Term Council Community Plan	Prepared as a requirement of the Local Government Act 2002, with the purpose of describing Council's activities, describing the 'community outcomes' (goals) of the Council area, providing integrated decision-making and coordinating the resources of Council. It provides a long-term focus for the decisions and activities of the Nelson City Council, and is an important basis for the accountability of the Council to the Nelson community. It provides an opportunity for the public to participate in decisions on activities to be carried out by Council. It covers ten years planned financial expenditure in detail.
m3/day	Cubic metres per day. A measure of flow.
Main	The pipework system that conveys water from the intakes to each street. Trunk mains bring water from the intakes to the City secondary mains water to suburbs. Reticulation mains (or distribution) mains supply water into each street and are fitted with fire hydrants. Rider mains are smaller pipes supplying one side of a street.
Maintenance	All actions necessary for retaining an asset as near as practicable to its original condition, but excluding rehabilitation or renewal. Fixed interval maintenance is used to express the maximum interval between maintenance tasks. On-condition maintenance is where the maintenance action depends upon the item reaching some predetermined condition.
Maintenance Standards	The standards set for the maintenance service, usually contained in preventive maintenance schedules, operation and maintenance manuals, codes of practices, estimating criteria, statutory regulations and mandatory requirements, in accordance with maintenance of quality objectives.
Monitor	To check, supervise, observe critically, or record the progress of an activity, action or system on a regular basis in order to identify change.
Non-asset Solution	A non-asset solution is one where demand for an asset's service is dealt with in a way other than by additional investment in new resources and infrastructure. This might be by regulation (restricting time of use and type of use), economic incentives (such as pricing structures and subsidies), educational campaigns and provision of alternative ways of meeting customers' needs. Non-asset solutions are usually included in a demand management strategy.

Term	Definition
Non-return Valve (NRV)	A mechanical device that allows water to flow in one direction only.
NZ IFRS	International Financial Reporting Standard
Optimised Decision Making (ODM)	An optimisation process for considering and prioritising all options to rectify existing or potential performance failures of assets. The process encompasses NPV analysis and risk assessment.
Optimised Depreciated Replacement Cost (ODRC)	The optimised replacement cost after deducting an allowance for wear or consumption to reflect the remaining economic or service life of an existing asset. ODRC is the surrogate for valuing assets in use where there are no competitive markets for assets, or for their services or outputs.
Optimised Replacement Cost (ORC)	The minimum cost of replacing an existing asset with modern equivalent assets offering the same level of service. The optimisation process adjusts the value for technical and functional obsolescence, surplus assets or over- design.
Payback Period	The time it takes for the cumulative benefits or savings of an investment to pay back the original investment and other accrued costs.
Performance Measure (PM)	A qualitative or quantitative measure of a service or activity used to compare actual performance against a standard or other target. Performance measures commonly relate to statutory limits, safety, responsiveness, cost, comfort, asset performance, reliability, efficiency, environmental protection and customer satisfaction.
Performance Monitoring	Continuous or periodic quantitative and qualitative assessments of the actual performance compared with specific objectives, targets or standards.
Planned Maintenance	Planned maintenance activities fall into three categories: Periodic – necessary to ensure the reliability or to sustain the design life of an asset. Predictive – condition monitoring activities used to predict failure. Preventive – maintenance that can be initiated without routine or continuous checking (e.g. using information contained in maintenance manuals or manufacturers' recommendations) and is not condition-based.
Pressure Reducing Valve (PRV)	A mechanical device that modulates to maintain a constant lower pressure downstream irrespective of flow.
Rehabilitation	Works to rebuild or replace parts or components of an asset, to restore it to a required functional condition and extend its life, which may incorporate some modification. Generally involves repairing the asset to deliver its original level of service (i.e. heavy patching of roads, sliplining of sewer mains, etc) without resorting to significant upgrading or renewal, using available techniques and standards.
Renewal	Works to upgrade, refurbish or replace existing facilities with facilities of equivalent capacity or performance capability.
Remaining Economic Life	The time remaining until an asset ceases to provide the required service level or economic usefulness.
Renewal/Replacement	The complete replacement of an asset that has reached the end of its life, so as to provide a similar or agreed alternative, level of service.

Term	Definition
Repair	Action to restore an item to its previous condition after failure or damage.
Replacement Cost	The cost of replacing an existing asset with a substantially identical new asset.
Reservoir	A large storage area for water. May be uncovered, e.g. Maitai Lake or covered, e.g. stressed concrete reservoirs at Thompson Terrace.
Residual Value	The net market or recoverable value which would be realised from disposal of an asset or facility at the end of its life.
Rider Main	A small diameter watermain on the opposite side of the road from the principal watermain.
Risk Management	The application of a formal process to the range of possible values relating to key factors associated with a risk in order to determine the resultant ranges of outcomes and their probability of occurrence.
Risk Management Process	The systematic application of management policies, procedures and practices to the tasks of establishing the context, identifying, analysing, evaluating, treating, monitoring and communicating risk.
Routine Corrective Maintenance	Corrective maintenance, excluding emergency corrective and programmed corrective maintenance.
Routine Maintenance	Day to day operational activities to keep the asset operating (replacement of light bulbs, cleaning of drains, repairing of leaks, etc) and which form part of the annual operating budget, including preventive maintenance.
Sensitivity Analysis	Testing of the variations in the outcome of an evaluation by altering the values of key factors about which there might be uncertainty.
Service	A service refers to the provisioning of or the actual system of supplying a public need, A water service (pipe) is that section of the reticulation between the main in the street and the property boundary.
Stakeholders	Those people and organisations who may affect, be affected by, or perceive themselves to be affected by, a decision or activity.
Strategic Plan	A plan containing the long-term goals and strategies of the Council. Strategic plans have a strong external focus, cover major portions of the Council's operations and identify major targets, actions and resource allocations relating to the long-term survival, value and growth of the Council.
Tank	A small covered storage area for water. Usually made of concrete and of 23m3 capacity.
Universal Metering	Having water meters fitted to all properties, i.e. ordinary (residential) and extraordinary (commercial, industrial and other non-residential) users.
Unplanned Maintenance	Corrective work required in the short-term to restore an asset to working conditions so it can continue to deliver the required service or to maintain its level of security and integrity.
Useful Life	May be expressed as either: The period over which a depreciable asset is expected to be used, or The number of production or similar units (i.e. intervals, cycles) that is expected to be obtained from the asset.

Term	Definition
Valuation	Assessed asset value which may depend on the purpose for which the valuation is required i.e. replacement value for determining maintenance levels, market value for lifecycle costing and optimised deprival value for tariff setting.

Appendix Table A-2: Acronyms

Term	Definition
AC	Asbestos cement pipe
ADWF	Average dry weather flow
ATAD	Autothermal thermophilic aerobic digestion plant
AV	Average flow
BOD	Biochemical oxygen demand
BTWWTP	Bells Island waste water treatment plant
CCTV	Close circuit television
CDEM	Civil Defence Emergency Management
FAR	Fixed asset register
GAAP	Generally Accepted Accounting Principles
KPI	Key Performance Indicators
LA	Local Authority
LID	Low impact design
LAPP	Local Authority Protection Programme Disaster Fund
LDM	Land Development Manual 2010
LTCCP	Long Term Community Plan
MCA	Multi-Criteria Analysis
NAMS	National Asset Management Steering Group
NCS	Napier Computer System
NPV	Net present value
NRSBU	Nelson Regional Sewerage Business Unit (replaced NRSA in July 2000)
NTL	Network Tasman Ltd
NUGS	The Nelson Urban Growth Strategy
P/S	Pump station
QA/QC	Quality Assurance and Quality Control
RCRRJ	Reinforced concrete rubber ring joint pipe
RMA	Resource management act
SCADA	Supervisory control and data acquisition

Term	Definition
SS	Suspended solids
TA	Territorial Authority
uPVC	Unplasticised Polyvinyl Chloride pipe
WWTP	Wastewater treatment plant

Appendix Table A-3: Geographical Information System List of Code Definitions used by Nelson City Council

Value	Description
2000	2000: Meter type
3000	3000: Meter type
ACBK	Black Asbestos Cement
ACMT	Asbestos Cement
ALUM	Aluminium
ARMC	ArmourCoil
BLBT	Blue Brute Pipe
BLKA	Black Asbestos Cement
BRCK	Brick
CIDT	Ductile Cast Iron
CIPT	PitCast Iron
CISP	Spun Cast Iron
CNIL	Concrete (InsituFORM lined)
CONC	Concrete
COPR	Copper
DRNC	Drainage Coil
EWRE	Earthenware
FGLS	Fiberglass
FLDT	Field Tiles
GALV	Galvanised
HDPE	High-density polyethylene pipe
HELA	Helcoil Aluminium
HELS	Helcoil Steel
MDPE	Medium Density Pe
NAPP	Not Applicable
OTHR	Other
PE1H	Pe 100 Material
POLE	Pole Construction
PRFC	Perforated Concrete

PVC	uPVC
STCL	Steel Concrete Lined
STNY	Nylon Coated Steel: Used in pump stations
STPL	Steel Pitch Lined
UNKW	Unknown

APPENDIX B: WATER SUPPLY CONSERVATION STRATEGY

Note: Strategy is subject to change as replacement resource consents for the Roding and Maitai water supplies are granted.

MAITAI

Refer to Figure A. Please note that the letters below correspond with the same letters in circles in the Figure.

Publicity will be run with the theme "Use Water Wisely" between 1 January and 30 April each year.

When the water level is in this range water will be released from the reservoir into the Maitai River as required by the 'Surplus Water' requirement of Resource Consent 960567.

The arrangement that was established with the Nelson Catchment Board in 1987 is that surplus water is released at a steady rate from the reservoir whenever the flow at the forks drop below 300 litres per second and the lake level is above the acceptable draw down line. The rate of release is reviewed weekly.

When the water level is in this range sprinkler restrictions will be put in place. As a minimum restriction odd numbered properties would be able to water on odd-numbered days and even numbered properties on even numbered days. Advertising will be run to remind the public of these restrictions. Flushing of mains will be reduced.

When the water level is in this range a sprinkler ban will be put in place. The only exception will be high value areas such as bowling greens, golf course greens, cricket pitches and high profile public gardens. Advertising will be run to remind the public of this ban.

When the water level is in this range hosing restrictions will be introduced. Depending on the severity of the situation these measures could include:

- A complete ban on residential hosing
- Restrictions on industrial and commercial use of water e.g. close down automatic car washes, stop washing of cars in Sale Yards
- Approaches to major industries to explain the severity of the situation and request co-operation through minimal water use.
- Increased advertising
- Establishment of a 'Hot Line' for residents to report non-compliance with Water Restrictions.
- Water mains only flushed in response to water quality complaints.

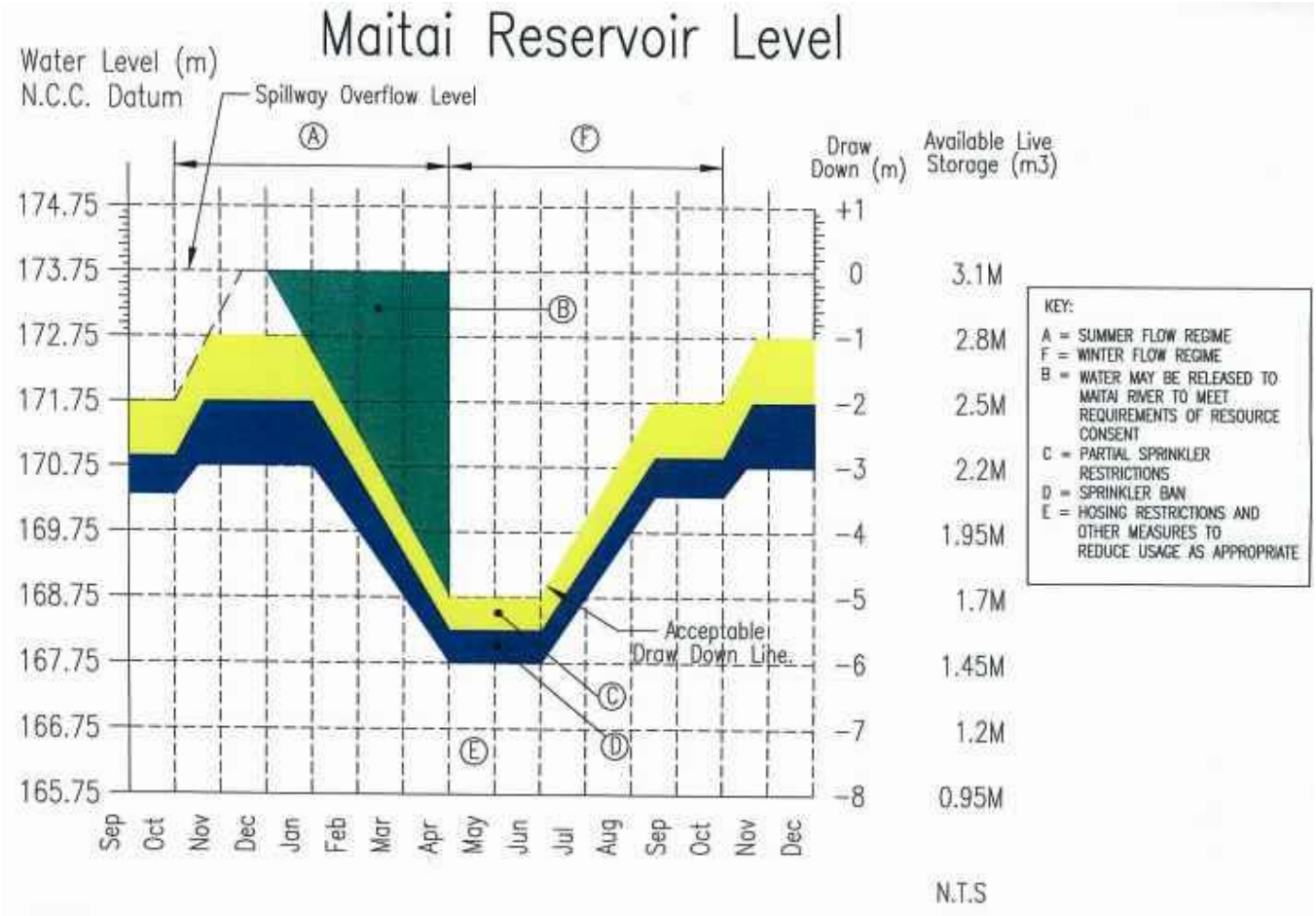
If during the period 1 May to 30 October the minimum river flow is reduced in accordance with Resource Consent 960567 the response shall be the same as for Item E.

NOTE:

This strategy outlines the minimum response to falling water levels in the Maitai Reservoir. Response may be more severe depending on long range weather forecasts.

Water restrictions may be put in place for other reasons such as fluctuating water pressures in the reticulation caused by excessive demand.

Appendix Figure B-1: Maitai Reservoir Level



RODING

When the natural flow of the Roding River above the weir is 196 litres per second or less for two consecutive days (5 year return period low flow), restrictions as in Section C will be put in place.

When the natural flow of the Roding River above the weir is 160 litres per second or less (10 year return period low flow), restrictions as in Section D will be put in place.

When the natural flow of the Roding River above the weir is 140 litres per second or less for two consecutive days (20 year return period low flow), restrictions as in Section E will be put in place.

Note: These measures are in accordance with the requirements of Resource Consent No. 975374

APPENDIX C: LIFELINES

Extract from Civil Defence Emergency Management Act 2002

s60. Duties of Lifeline Utilities

Every lifeline utility must:

- Ensure that it is able to function to the fullest possible extent, even though this may be at a reduced level, during and after an emergency;
- Make available to the Director in writing, on request, its plan for functioning during and after an emergency;
- Participate in the development of the national civil defence emergency management plans;
- Provide, free of charge, any technical advice to any Civil Defence Emergency Management Group or the Director that may be reasonably required by that Group or the Director;
- Ensure that any information that is disclosed to the lifeline utility is used by the lifeline utility, or disclosed to another person, only for the purposes of this Act.

s64. Duties of Local Authorities

A local authority must plan and provide for Civil Defence Emergency Management within its district.

A local authority must ensure that it is able to function to the fullest possible extent, even though this may be at a reduced level, during and after an emergency.

Extract from Nelson Tasman Engineering Lifelines Project Report 2004

Civil Water Supply

Nelson City water supply is sourced from Maitai and Roding river catchments. The water supply network includes dams, intake structures, water treatment plant, tunnels, approximately 320km of pipework, 4 pump stations and reservoir storage of approximately 13,300m^3.

The Maitai Water supply scheme, including the Maitai earthfill Dam, was commissioned in 1987 and is considered to be in good condition except for the trunk main between the dam and Upper Brook Street. The Roding Weir was commissioned in 1940 and is still in good operating condition. Gravel tends to build up behind the weir and requires regular removal.

The Brook Dam, constructed in 1904 as Nelson's original water supply scheme, was decommissioned in 2000. The Maitai trunk pipeline, constructed in 1963, is largely exposed and is vulnerable to landslip with some sections positioned on benched platforms on steep geologically unstable slopes and some sections passing through a tunnel. The pipe is identified as at extreme risk from movement failure caused by earthquake, landslide or settlement. This segment of the network is marked as highest priority for mitigation measures to ensure ongoing water supply is secure. The main is nominated for future replacement in the next five years.

The 65 year old Roding pipeline, which is rated at high risk due to flooding potential, passes through a 2.7km tunnel under the Barnicoat range, and the pipe is programmed to be replaced in 20 years. The Central City and Port Hills Cast Iron mains are all at the end of their life and are all predominantly due to be replaced by 2006/07. Atawhai and Stoke suburbs have more recent pipe systems constructed of AC or PVC and are in good condition.

Reservoirs in Thompson Terrace have been seismically strengthened in 1992/93 and re-roofed in 2001/02. Stoke, Atawhai, and Observatory Hill reservoirs are recent and all are in good condition. Pump stations in Princes Drive, Austen Ward Heights, Van Diemen Street and Panorama Drive have been constructed since 1990 and are considered to be in good condition.

The recently constructed water treatment plant at the Tantragee Saddle is situated close to slopes potentially prone to landslip, however the facility is rated to be at low risk and risks to its operation are assessed in detail in site specific geotechnical reports associated with construction design.

Walters Bluff (Atawhai) reservoir although sited on a splinter fault has been specifically designed and constructed to mitigate risks from fault rupture and earthquake shaking and is rated at low risk to these hazards.

Other mitigation measures identified for Nelson's water network include installation of seismic control valves on reservoirs to secure water reserves in existing storage facilities and prevent loss through failed service lines.

Since this report was completed the Stoke High Level Reservoir has been completed in 2010/11. The reservoir is located on the York/Brook saddle above the land fill site and has a storage volume of 2500 cubic metres. An additional 440m3 reinforced concrete reservoir has been constructed at Observatory Hill in 2014. This takes Nelson's storage to 22,340m3.

The Christchurch Earthquakes of 2010 /2011 lead to significant damage to that city's infrastructure including water storage reservoirs and pipe network from direct shaking and liquefaction. Recognising this, and the results of other natural hazard investigation post the Nelson storm events of December 2011 and April 2013, Nelson City Council is reassessing the risk to the network from earthquakes (including liquefaction, tsunami and direct shaking), flooding, storms and sea level rise.

Appendix Table C-1: Hazard Vulnerability

NELSON TASMAN LIFELINES

Utility: NCC WATER

Completed By: Dave Plant Date: 17/03/2004

Note:

Importance 1-5 (5 most important)
Vulnerability 1-3 (3 most vulnerable)
Impact 1-3 (3 most impact)

Vulnerability to Hazard Earthquake

							Impact				Risk			
Component/Segment	**From**	**To**	**Length**	**Importance**	**Vulnerability**		**Immediately After**	**Period Following**	**Return to Normality**		**Risk Rating 1**	**Risk Rating 2**	**Risk Rating 3**	**Comment**
Stoke #1 Reservoir				5	1		3	3	3		3	3	3	Have been designed to catergory 2 of NZS 3106
Walters Bluff Reservoir				5	1		3	3	3		3	3	3	ie intended to remain functional in the emergency
Clear Water Reservoir				5	1		3	3	3		3	3	3	period for a major earthquake of 1 in 1000 year return
Tompson Tce #2 Reservoir				5	1		3	3	3		3	3	3	Has been strenghtened to catergory 3
Tompson Tce #1 Reservoir				5	1		3	3	3		3	3	3	Has been strenghtened to catergory 2
														(1in 333 year return period)
														However the fitting of seismic valves is necessary
														to retain water from being lost through broken
														distribution lines
														Walters Bluff and Clearwater have been fitted during
														Construction

Utility: NCC WATER

Completed By: Dave Plant Date: 17/03/2004

Note:
Importance 1-5 (5 most important)
Vulnerability 1-3 (3 most vulnerable)
Impact 1-3 (3 most impact)

Vulnerability to Hazard Flooding / Storm Surge / Erosion **Impact** **Risk**

Component/Segment	From	To	Length	Importance	Vulnerability	Immediately After	Period Following	Return to Normality	Risk Rating 1	Risk Rating 2	Risk Rating 3	Comment
Roading Headworks	Screens	Tunnel		4	2	1	3	3	2	6	6	Erosion of pipe bench - Alternative use Maitai Supply
Roading Trunkmain	Tunnel	P.S.		4	2	1	3	3	2	6	6	Erosion of gravels pipe lain in
Maitai Headworks	Screens	Mixing Box		5	2	1	1	1	2	2	2	Erosion of banks pipe laid in - Alternative use Dam Supply
Maitai Pipeline	Mixing Box	Camp		1	3	3	3	3	9	9	9	Localised Erosion / Slipping of pipe bench
Atawhai Trunk Main	Cemetery Point	Marybank		3	1	1	2	3	1	2	3	Storm surge: Protected by Haven, rock protection, Atawhai Rising Main.
												Note: Water Assets not suceptible to flooding damage. Erosion caused by flooding may (refer above)

Vulnerability 1-3 (3 most vulnerable)
Impact 1-3 (3 most impact)

Utility: NCC WATER

Completed By: Dave Plant Date: 17/03/2004

Note:
Importance 1-5 (5 most important)
Vulnerability 1-3 (3 most vulnerable)
Impact 1-3 (3 most impact)

Vulnerability to Hazard Ground Shaking (Earthquake) Amplification

Component/Segment	From	To	Length	Importance	Vulnerability	Impact: Immediately After	Impact: Period Following	Impact: Return to Normality	Risk: Risk Rating 1	Risk: Risk Rating 2	Risk: Risk Rating 3	Comment
City Trunk Main	Tasman St	Scotland St		5	2	1	3	3	2	6	6	
	Scotland St	Ngatitama St		5	1	1	3	3	1	3	3	
	Ngatitama St	Hampden St		5	2	1	3	3	2	6	6	
	Hampden St	Boundary Rd		5	1	1	3	3	1	3	3	
	Waimea Rd	TT Reservoir		5	1	1	3	3	1	3	3	
Roading Trunk Main	Surge Chbr	Marsden Vly		4	1	1	3	3	1	3	3	
	Tunnel Portel	Ridgeway		4	2	1	3	3	2	6	6	
	Ridgeway	Main Road		4	2	1	2	3	2	4	6	
Stoke Reservoir Trunk Main	Marsden Rd	Reservoir		3	1	1	2	3	1	2	3	
Richmond Trunk Main	Marsden Rd	Champion Rd		2	2	1	2	3	2	4	6	
Tahuna Trunk Main	Marsden Rd	Marie St		4	2	1	2	3	2	4	6	
	Marie St	KFC		1	2	1	2	2	2	4	4	
TTR Trunk Main	Annesbrook Dr	TTR		4	1	1	2	3	2	4	6	

Vulnerability 1-3 (3 most vulnerable)
Impact 1-3 (3 most impact)

Utility: NCC WATER

Completed By: Dave Plant Date: 17/03/2004

Vulnerability to Hazard Landslip

Note:
Importance 1-5 (5 most important)
Vulnerability 1-3 (3 most vulnerable)
Impact 1-3 (3 most impact)

						Impact				Risk			
Component/Segment	**From**	**To**	**Length**	**Importance**	**Vulnerability**	**Immediately After**	**Period Following**	**Return to Normality**	**Risk Rating 1**	**Risk Rating 2**	**Risk Rating 3**	**Comment**
Maitai Pipeline	Dam	WTP		5	3	1	3	3	3	9	9	Pipe laid on bench on steep hillside
	WTP	Brook St		5	3	1	3	3	3	9	9	Pipe laid on bench on steep hillside
Thompon Tce Reservoir Pipline	Boundary Road	TTR		4	2	1	3	3	2	6	6	
	TTR	Annesbrook Dr		5	2	1	2	3	2	4	4	
Stoke Reservoir				5	1	1	2	3	1	2	3	) Partially backfilled to support hillside behind
Walters Bluff Reservoir				5	1	1	2	3	1	2	3	) Slopes design by Geotech.
Thompson Tce #1 Reservoir				5	1	1	2	3	1	2	3	) on Spur, set back from slope below
Thompson Tce #2 Reservoir				5	1	1	2	3	1	2	3	)
Clearwater Reservoir				5	1	1	2	3	1	2	3	Slopes designed by Geotech

Vulnerability 1-3 (3 most vulnerable)
Impact 1-3 (3 most impact)

Landslip damaging: Stoke, Thompson Tce, Walters Bluff and Clearwater Reservoirs have been considered not vulnerable similarly Water Treatment Plant and Maitai Dam

Utility: NCC WATER

Completed By: Dave Plant Date: 17/03/2004

Note:
Importance 1-5 (5 most important)
Vulnerability 1-3 (3 most vulnerable)
Impact 1-3 (3 most impact)

Vulnerability to Hazard Ground Shaking (Earthquake) Amplification

							Impact			Risk			
Component/Segment	**From**	**To**	**Length**	**Importance**	**Vulnerability**		**Immediately After**	**Period Following**	**Return to Normality**	**Risk Rating 1**	**Risk Rating 2**	**Risk Rating 3**	**Comment**
Brook Street Trunk Main	WTP	Hillside		5	1		1	3	3	1	3	3	
	Hillside	Hillside Lane		5	1		1	3	3	1	3	3	
	Hillside Lane	Bronte St		5	2		1	3	3	2	6	6	
Atawhai Trunk Main	Bronte St	Bridge St		4	2		1	2	3	2	4	6	
	Bridge St	North Rd		4	2		1	2	3	2	4	6	
	North Rd	Whakatu Marae		4	2		1	2	3	2	4	6	
	Whakatu Marae	Cemetery Point		3	1		1	2	3	1	2	3	
	Cemetery Point	Bayview Rd		3	2		1	2	3	2	4	6	
	Bayview Rd	Tui Glen Rd		2	1		1	2	2	1	2	2	
	Tui Glen Rd	Marybank		1	2		1	2	2	2	4	4	
Walters Bluff Trunk Main	Whakatu Marae	Reservoir		4	1		1	2	3	1	2	3	
Port Trunk Main	North Road	Sealords		2	2		1	2	3	2	4	6	
Maitai Trunk Main	Dam	Fiddlers Arch		5	3		1	3	3	3	9	9	
	Fiddles Arch			5	3		1	3	3	3	9	9	
	Fiddlers	Camp		5	3		1	3	3	3	9	9	
	Camp	WTP		5	3		1	3	3	3	9	9	

Vulnerability 1-3 (3 most vulnerable)
Impact 1-3 (3 most impact)

APPENDIX D: NELSON CITY COUNCIL ADVANCED ASSET MANAGEMENT GAP ANALYSIS - WATER

Appendix Table D-1: Gap Analysis - Water

Water Asset Maturity Assessment					Maturity Levels												w	
Reference	Question	IIMM Descriptors			Aware	Basic	Core	Intermediate	Advanced									
		Process Development and Documentation			Ad hoc processes, minimal documentation.	Process and documentation in development	Main process components developed and documented	Process complete, optimisation developing	Optimised process in place, documentation complete.									
		Coverage (assets, people, frequency)			Rarely	Occasionally	Often	Usually	Always									
		Section	Questions	Why	0-20	25-40	45-60	65-80	85-100	Element %	Element Score (out of 100)	Current Score	Appropriate Target (3 yrs)	Target (10 years)			Reason for scores	Improvement Tasks to close gap
Understanding and Defining Requirements																		
IIMM 2.1	1	**Establishing Strategic Direction**	To what extent has your organisation's AM Policy and AM Strategy been articulated, approved, communicated and acted on? How consistent is this policy and strategy with current government policies?	The AM Policy supports an organisation's strategic objectives. It articulates the principles, requirements and responsibilities for asset management (AM). It articulates the objectives, practices and action plans for AM improvement, audit and review processes. The AM Policy and Strategy may be incorporated into the AM Plan.	Corporate awareness of the benefits of AM.	Corporate expectation expressed in relation to development of AM Plans and AM objectives.	AM Policy and AM Objectives developed, aligned to corporate goals and strategic context.	AM System scope is defined and documented. Strategic context (internal, external, customer environment) analysed and implications for the AM System documented in the Strategic AM Plan.	AM Policy and Strategy fully integrated into the organisation's business processes and subject to defined audit, review and updating procedures.			55	60	80				
		Strategic context (internal / external) analysed and AM implications understood.								25%	50							
		AM Policy sets out AM expectations, objectives and accountabilities								25%	50							
		The organisation's AM System / Framework is defined								25%	60							
		Strategic, tactical and operational goals are aligned across the organisation								25%	60							
IIMM 2.2	2	**Defining and Measuring Levels of Service**	How does your organisation determine what is the appropriate level of service for its customers and then ensure that asset performance is appropriate to those service levels?	Levels of service are the cornerstone of asset management and provide the platform for all lifecycle decision making. Levels of service are the outputs a customer receives from the organisation, and are supported by performance measures. One of the first steps in developing asset management plans or processes is to find out what levels of service customers are prepared to pay for, then understand asset performance and capability to deliver those requirements.	Level of service requirements generally understood but not documented or quantified.	Asset contribution to organisation's objectives and some basic levels of service have been defined. Customer Groups defined and requirements informally understood.	Levels of service and performance measures in place covering a range of service attributes. Annual reporting against performance targets. Customer Group needs analysed.	Level of service and cost relationship understood. Customers are consulted on significant service levels and options.	Customer communications plan in place. Levels of service are integral to decision making and business planning.			57.5	65	80				
		Customer engagement to understand level of service requirements.								25%	55							
		Levels of service and performance measures defined								25%	70							
		Measurement and reporting occurs, including analysis of trends.								25%	70							
		Level of service and cost relationship analysed.								25%	35							
IIMM 2.3	3	**Forecasting Future Demand**	How robust is the approach your organisation uses to forecast demand for its services and the possible impact on its asset portfolios?	This AM activity involves estimating demand for the service over the life of the AM plan or the life of the asset. Demand is a measure of how much customers consume the services provided by the assets. The ability to predict demand enables an organisation to plan ahead and meet that demand, or manage risks of not meeting demand.	Future demand requirements generally understood but not documented or quantified. Demand forecasts based on mathematical analysis of past trends and primary demand factors.	Demand forecasts based on experienced staff predictions, with consideration of known past demand trends and likely future growth patterns.	Demand Forecasts based on robust projection of a primary demand factor (eg: population growth) and extrapolation of historic trends. Risk associated with demand change broadly understood and documented. Demand management considered as an alternative to major	A range of demand scenarios is developed (eg: high/medium/low). Demand management is considered in all strategy and project decisions.	Risk assessment of different demand scenarios with mitigation actions identified.			57	65	80				
		Historical demand / consumption of services recorded and trends analysed history recorded								20%	75							
		Demand factors identified and analysed								20%	60							
		Demand forecast models developed								20%	60							
		Demand management strategies identified and impacts on future demand quantified								20%	45							
		Risk associated with demand uncertainty understood, scenarios are developed and managed								20%	45							
IIMM 2.4	4	**Collecting Asset Information (Asset Knowledge)**	What sort of asset-related information does the organisation collect, and how does it ensure the information has the requisite quality (accuracy, consistency, reliability)?	Asset data is the foundation for enabling most AM functions. Planning for asset renewal and maintenance activities cannot proceed until organisations know exactly what assets they own or operate and where they are located	Asset information in combination of sources and formats. Awareness of need for asset register.	Basic physical information recorded in a spreadsheet or similar (e.g. location, size, type), but may be based on broad assumptions or not complete.	Sufficient information to complete asset valuation (basis attributes, replacement cost and asset age/ life) and support prioritisation of programmes (criticality). Asset hierarchy, identification and attribute systems documented. Metadata held as appropriate.	A reliable register of physical, financial and risk attributes recorded in an information system with data analysis and reporting functionality. Systematic and documented data collection process in place.	Information on work history type and cost, condition, performance, etc. recorded at asset component level. Systematic and fully optimised data collection programme with supporting metadata.			66	70	80				
		Asset hierarchy defined and data requirements for each level of the hierarchy specified.								20%	60							
		Basic physical information captured against assets (age, material, type, etc)								20%	65							
		Spatial / location information recorded or links to GIS from asset register (if separate)								20%	70							
		Asset age / life / replacement cost recorded at asset level (information for valuation / renewals)								20%	70							
		Asset criticality data recorded at asset level								20%	65							
IIMM 2.5	5	**Monitoring Asset Performance and Condition**	How does the organisation measure and manage the condition of its assets?	Timely and complete condition information supports risk management, lifecycle decision-making and financial / performance reporting.	Condition and performance understood but not quantified or documented.	Adequate data and information to confirm current performance against AM objectives.	Condition and performance information is suitable to be used to plan maintenance and renewals to meet over the short term.	Future condition and performance information is modelled to assess whether AM objectives can be met in the long term. Contextual information, such as demand, is used to estimate likely performance.	The type, quality and amount of data are optimised to the decisions being made. The underlying data collection programme is adapted to reflect the assets' lifecycle stage.			58.75	60	60				
		Condition and performance monitoring programmes established								25%	60							
		Condition data captured in asset register								25%	60							
		Performance data captured in asset register (eg: service outages)								25%	50							
		Works costs recorded at asset level								25%	65							

Water Asset Maturity Assessment					Maturity Levels										w	
Reference	Question	IIMM Descriptors			Aware	Basic	Core	Intermediate	Advanced							
		Process Development and Documentation			Ad hoc processes, minimal documentation.	Process and documentation in development	Main process components developed and documented	Process complete, optimisation developing	Optimised process in place, documentation complete.							
		Coverage (assets, people, frequency)			Rarely	Occasionally	Often	Usually	Always							
		Section	Questions	Why	0-20	25-40	45-60	65-80	85-100	Element %	Element Score (out of 100)	Current Score	Appropriate Target (3 yrs)	Target (10 years)	Reason for scores	Improvement Tasks to close gap
Lifecycle Decision Making																
IIMM 3.1	6	**Lifecycle Decision Methods**	How does your organisation go about making decisions on the replacement or refurbishment of existing assets or investment in new ones?	Decision techniques provide the best value for money form an organisation's expenditure programmes. These techniques reveal strategic choices, and balance the trade off between levels of service, cost and risk. ODM is a formal process to identify and prioritise all potential asset and non-asset solutions with consideration of financial viability, social and environmental responsibility and cultural outcomes.	AM decisions based largely on staff judgement.	Corporate priorities incorporated into decision making.	Formal decision making techniques (MCA / BCA), are applied to major projects and programmes, where criteria are based on the organisations' AM objectives.	Formal decision making and prioritisation techniques are applied to all operational and capital asset programmes within each main budget category. Critical assumptions and estimates are tested for sensitivity to results.	AM objectives/targets are set based on formal decision making techniques, supported by the estimated costs and benefits of achieving targets. The framework enables projects and programmes to be optimised across all activity areas. Formal risk-based sensitivity analysis is carried out.			60	65	80		
		Good information available to support AM decisions.								20%	55					
		Options developed and analysed (including 'do nothing')								20%	65					
		Agreed frameworks / techniques applied to support decision making								20%	65					
		Decision frameworks are aligned to straregic objectives / levels of service								20%	65					
		Sensitivity analysis / scenario testing used to assess robustness of result								20%	50					
IIMM 3.2	7	**Managing Risk and Resilience**	How does your organisation manage the interplay between business risks and asset-related risks?	Risk management helps identify higher risks, and identify actions to mitigate those risks. This process reduces the organisation's exposure to asset related risk, especially around critical assets, and drives renewal and rehabilitation programmes and decision making.	Risk management is identified as a future improvement. Risk framework developed.	Critical services and assets understood and considered by staff involved in maintenance / renewal decisions.	Critical assets and high risks identified. Documented risk management strategies for critical assets and high risks.	Resilience level assessed and improvements identified. Systematic risk analysis to assist key decision-making. Risk register regularly monitored and reported. Risk managed and prioritised consistently across the organisation.	Resilience strategy and programme in place including defined levels of service for resilience. Formal risk management policy in place. Risk is quantified and risk mitigation options evaluated. Risk is integrated into all aspects of decision making.			58	65	75		
		Risk policy / framework in place								20%	80					
		Risks are identified and recorded in risk register.								20%	80					
		Risk actions are identified, monitored and reported.								20%	30					
		Strategy for management of critical assets in place								20%	50					
		Assessments of network resilience to major hazards								20%	50					
IIMM 3.3	8	**Operational Planning**	How does your organisation manage the cost effective performance of its key business assets over time (e.g. in terms of utilisation, availability, fitness for purpose)?	Effective operational strategies can mitigate risk, defer the need for asset renewals and minimise service downtime following asset failures. Planning for business continuity and full utilisation of assets are key factors in good asset management processes.	Operational processes based on historical practices.	Operating Procedures are available for critical Operational Processes. Operations Organisational structure in place and roles assigned	Operating Procedures are available for all Operational Processes. Operational Support Requirements are in place.	Risk and Opportunity Planning completed. Operational objectives and intervention levels defined and implemented. Alignment with Organisational Objectives can be demonstrated.	Continual Improvement can be demonstrated for all operational processes. Comparison with ISO 55001 requirements complete.			65	65	75		
		Operational programmes and processes are developed and optimised								25%	65					
		Operational objectives and intervention criteria are defined								25%	65					
		Emergency response arrangements are in place and tested								25%	65					
		Operational performance is monitored and improvements identified								25%	65					
IIMM 3.4	9	**Capital Investment Planning**	What processes and practices does the organisation have in place to plan and prioritise capital expenditure?	Capital investment include the upgrade, creation or purchase of new assets, typically to address growth or changes in levels of service requirements, or for the periodic renewal of existing assets, to maintain service levels. Agencies need to plan for the long term asset requirements relative to future levels of service. The decision on whether to create a new asset is typically the time when there is the most opportunity to impact on the potential cost and level of service. Cabinet expects all capital-intensive agencies to disclose 10 year capital intentions and make appropriate use of the better business cases methodology for programmes and individual investment proposals.	Capital investment projects are identified during annual budget process.	There is a schedule of proposed capital projects and associated costs for the next 3-5 years, based on staff judgement of future requirements.	Projects have been collated from a wide range of sources and collated into a project register. Capital projects for the next three years are fully scoped and estimated. A prioritisation framework is in place to rank the importance of capital projects.	Formal options analysis and business case development has been completed for major projects in the 3-5 year period. Major capital projects for the next 10-20 are conceptually identified and broad cost estimates are available.	Long-term capital investment programmes are developed using advanced decision techniques such as predictive renewal modelling.			70.5	70	80		
		Capital projects are identified and recorded in a register								20%	80					
		Capital projects are scoped and costs estimated for inclusion in budget forecasts								30%	65					
		Capital projects are prioritised within and between activities and work areas								25%	65					
		Renewal forecasts are modelled based on age, condition, performance								25%	75					
IIMM 3.5	10	**Financial Management**	How does your organisation plan for the funding of its future capital expenditure and asset-related costs?	Poor financial management can lead to higher long run life cycle costs, inequitable fees and charges, and financial "shocks". Good collaboration between financial and asset managers is important, especially in relation to long term financial forecasts and asset revaluations. Asset valuation is required by International Accounting Standards, and can be used in lifecycle decision making. Robust financial budgets are a key output of any asset management planning process.	Financial planning is largely an annual budget process, but there is intention to develop longer term forecasts.	Assets re-valued in compliance with financial reporting and accounting standards. 10 year financial forecasts are based on extrapolation of past trends and broad assumptions about the future. Expenditure categories compliant with FRS.	Asset revaluations have a 'B' grade data confidence 10 year+ financial forecasts based on current comprehensive AMPs with detailed supporting assumptions / reliability factors.	Asset revaluations have a 'B' grade data confidence 10 year+ financial forecasts based on current comprehensive AMPs with detailed supporting assumptions / reliability factors.	Asset revaluations have an 'A' grade data confidence. 10 year + financial forecasts based on comprehensive, advanced AM plans with detailed underlying assumptions and high confidence in accuracy. Advanced financial modelling provides sensitivity analysis, demonstrable whole of life costing and cost analysis for level of service options.			72.5	80	80		
		Budget categorisation supports analysis of asset-specific financial requirements								25%	75					
		Long term financial forecasts are developed								25%	65					
		Assets are revalued in accordance with financial reporting standards								25%	80					
		Supporting assumptions and forecasting methodologies are documented and auditable.								25%	70					

Water Asset Maturity Assessment					Maturity Levels								w				
Reference	Question	IIMM Descriptors			Aware	Basic	Core	Intermediate	Advanced								
		Process Development and Documentation			Ad hoc processes, minimal documentation.	Process and documentation in development	Main process components developed and documented	Process complete, optimisation developing	Optimised process in place, documentation complete.								
		Coverage (assets, people, frequency)			Rarely	Occasionally	Often	Usually	Always								
		Section	Questions	Why	0-20	25-40	45-60	65-80	85-100	Element %	Element Score (out of 100)	Current Score	Appropriate Target (3 yrs)	Target (10 years)	Reason for scores	Improvement Tasks to close gap
Asset Management Enablers																
IIMM 4.1	**11**	**Asset Management Leadership and Teams**	What is the level of organisational commitment to asset management? How is this reflected in existing organisation structure, responsibilities and resourcing of AM competencies?	Effective asset management requires a committed and co-ordinated effort across all sections of an organisation.	Leadership is supportive of AM.	AM functions are carried out by small groups. Roles reflect AM requirements.	Position descriptions incorporate AM roles. AM coordination processes established. Ownership and support of AM by leadership. Awareness of AM across most of the organisation.	Organisational structures support AM. Roles reflect AM resourcing requirements and reflected in position descriptions for key roles. Consistent approach to AM across the organisation. Internal communication plan established.	Roles reflect AM requirements and defined in all relevant position descriptions. Formal documented assessment of AM capability and capacity requirements to achieve AM objectives. Demonstrable alignment between AM objectives, AM systems and individual responsibilities			**52**	**65**	**70**		
		Leadership supports and actively advocates investment in AM.								20%	60					
		AM roles and role interfaces are defined.								20%	55					
		Resources (internal and external) to support an effective 'AM System' are in place.								20%	55					
		All staff understand AM and their role / contribution to the AM System.								20%	45					
		AM capability requirements are reviewed and provided								20%	45					
IIMM 4.2	**12**	**Developing AM Plans**	How does your organisation develop, communicate, resource and action its asset management plans?	An asset management plan is a written representation of intended capital and operational programmes for it's new and existing infrastructure, based on the organisations understanding of demand, customer requirements and it's own network of assets.	Stated intention to develop AM Plans	AM Plans contains basic information on assets, service levels, planned works and financial forecasts (5-10 years) and future improvements.	AM objectives are defined with consideration of strategic context. Approach to risk and critical assets described, top-down condition and performance assessment, future demand forecasts, description of supporting AM processes, 10 year financial forecasts, 3 year AM improvement plan.	Analysis of asset condition and performance trends (past/future), customer engagement in setting levels of service, ODM/risk techniques applied to major programmes. Strategic context analysed with risks, issues and responses described.	Evidence of programmes driven by comprehensive decision making techniques, risk management programmes and level of service/cost trade-off analysis. Improvement programmes largely complete with focus on ongoing maintenance of current practice.			**67**	**70**	**75**		
		AMP development includes relevant staff and stakeholders								20%	60					
		AMP content in line with IIMM								20%	65					
		AMP document is of good quality, readable for target audience								20%	65					
		AMPs are integration with other business processes / plans								20%	55					
		AMPs are communicated to / approved by Council / Executive/ key stakeholders								20%	90					
IIMM 4.3	**15**	**Establishing and Maintaining Management Systems**	How does your organisation ensure that it's asset management processes and practices are appropriate and effective?	When AM processes are part of a Quality Management system the organisation is able to operate consistent and reliable processes,, provide evidence that what was planned was delivered, and ensure that knowledge is shared. In short, that processes are appropriate and consistently applied and understood.	Awareness of need to formalize systems and processes.	Simple process documentation in place for service-critical AM activities.	Basic Quality Management System in place that covers all organisational activities. Critical AM processes are documented, monitored and subject to review. AM System meets the requirements of ISO 55001.	Process documentation implemented in accordance with the AM System to appropriate level of detail. Internal management systems are aligned.	ISO certification to multiple standards for large asset intensive organisations, including ISO 55001. Strong integration of all management systems within the organisation.			**46.25**	**60**	**70**		
		Management systems are in place to support AM.								25%	60					
		AM processes are documented within a management system framework								25%	45					
		Processes are subject to review, audit and continual improvement								25%	45					
		AM System is aligned / certified to ISO 55001								25%	35					

Water Asset Maturity Assessment				Maturity Levels								w		
Reference	Question	IIMM Descriptors			Aware	Basic	Core	Intermediate	Advanced					
		Process Development and Documentation			Ad hoc processes, minimal documentation.	Process and documentation in development	Main process components developed and documented	Process complete, optimisation developing	Optimised process in place, documentation complete.					
		Coverage (assets, people, frequency)			Rarely	Occasionally	Often	Usually	Always					
		Section	Questions	Why	0-20	25-40	45-60	65-80	85-100	Element %	Element Score (out of 100)	Current Score	Appropriate Target (3 yrs)	Target (10 years)	Reason for scores	Improvement Tasks to close gap
IIMM 4.4	13	**Establishing and Maintaining Information Systems**	How does your organisation meet the information needs of those responsible for various aspects of asset management?	AM systems have become an essential tool for the management of assets in order to effectively deal with the extent of analysis required.	Intention to develop an electronic asset register / AMIS.	Asset register can record core asset attributes – size, material, etc. Asset information reports can be manually generated for AM Plan input.	Asset register enables hierarchical reporting (at component to facility level). Customer request tracking and planned maintenance functionality enabled. System enables manual reports to be generated for valuation, renewal forecasting.	Spatial relationship capability. More automated analysis reporting on a wider range of information.	Financial, asset and customer service systems are integrated and all advanced AM functions are enabled. Asset optimisation analysis can be completed			72	80	80		
		IS records asset data within a hierarchy								20%	80					
		IS enables tracking of service requests and scheduling of planned maintenance								20%	80					
		IS suports AM analysis (performance evaluation, valuation / renewal forecasting)								20%	70					
		IS reporting supports management and AMP requirements								20%	65					
		Information systems share / exchange data								20%	65					
IIMM 4.5	14	**Service Delivery Models**	How does your organisation procure asset-related services like maintenance and consumables for different classes of assets? How does the organisation exercise control over any outsourced asset management services?	The effectiveness of asset management planning is proven in the efficient and effective delivery of services at an operational level.	AM roles generally understood.	Service delivery roles clearly allocated (internal and external), generally following historic approaches.	Core functions defined. Procurement strategy/policy in place. Internal service level agreements in place with the primary internal service providers and contract for the primary external service providers.	Risks, benefits and costs of various outsourcing options considered and determined. Competitive tendering practices applied with integrity and accountability.	All potential service delivery mechanisms reviewed and formal analysis carried out to identify best delivery mechanism.			58.75	65	75		
		Service delivery roles / functions defined (O&M, capital project delivery, etc)								25%	55					
		Functions allocated to roles / teams / contracts								25%	60					
		Service delivery options are evaluated and a strategy for outsourcing is in place								25%	60					
		Contracts / SLAs are in place for outsourced / in house service delivery								25%	60					
IIMM 4.6	16	**Audit and Improvement**	How does your organisation ensure that it continues to develop its asset management capability towards an appropriate level of maturity?	Well performing agencies give careful consideration of the value that can be obtained from improving AM information, processes, systems and capability. The focus is on ensuring AM practices are "appropriate" to the business objectives and government requirements.	Recognition of AM improvements.	Improvement actions identified and allocated to appropriate staff.	Current and future AM performance assessed and gaps used to drive the improvement actions. Improvement plans identify objectives, timeframes, deliverables, resource requirements and responsibilities	Formal monitoring and reporting on the improvement programme to Executive Team. Project briefs developed for all key improvement actions.	Improvement plans specify key performance indicators (KPIs) for monitoring AM improvement and these are routinely reported. Improvement plans specify key performance indicators (KPIs) for monitoring AM improvement and these are routinely reported.			45	60	70		
		Gap analysis used to identify AM improvement tasks								25%	50					
		Improvement tasks prioritised and developed into an AM improvement plan with allocated resources / timeframes / deliverables								25%	50					
		Project scope / brief developed for major improvement tasks.								25%	40					
		Progress against the AM improvement programme is regularly monitored and reported to management								25%	40					

A – Advanced asset management criteria met

C – Core asset management criteria only met

Appendix Table D-2: Asset Management Gap Analysis

Asset Management Attribute	'Core' Asset Management Planning Criteria	'Advanced' Asset Management Planning Criteria	Current	Desired	Comment	Time
1. Description of Assets	An adequate description of the asset, both physically and in financial terms, with the ability to aggregate and disaggregate information. State the remaining useful lives of assets. A financial description of the assets that is linked to the physical description and meets the requirements of: Financial Reporting Valuation Standards, augmented by the NZ Depreciation and Valuation Guidelines	As for 'Core' plus A reliable physical inventory of assets at both an individual asset level and at a network level. This would include: Physical attributes such as location, material, age etc. Systematic monitoring and analysis of physical condition Systematic measurement of asset performance (including utilisation/capacity)	 A A A		Need to identify all critical assets clearly in Asset Management Plan	
2. Levels of Service	Asset Management Planning should define the level of service or performance required of the asset, linked to the strategic/community outcomes of the organisation. The significant services (for which service levels should be subject to consultation and agreement) should be stated. Define the length of time for which the asset network must deliver the required service.	As for 'Core', plus For each significant service; Evaluating level of service options undertaking consultation on level of service options with the community and other relevant stakeholders (using consultation processes which meet industry recognised standards) adoption by the Council or governing body, of the service level and standards after consultation public communication of the service level & standards in a 'Customer Charter' or equivalent public document regular monitoring & public reporting of the organisation's adherence to agreed service levels and standards.	C C C A	A A A A	 Identify gaps and actions required Identify resources Determine a time frame – next version of asset mgt plan Review targets, resources and timeframe Ensure adequate time for Asset	

Asset Management Attribute	'Core' Asset Management Planning Criteria	'Advanced' Asset Management Planning Criteria	Current	Desired	Comment	Time
		Ensuring the Asset Management plans of each significant service reflect and are based on the agreed levels of services, including technical performance measures which underpin the customer-agreed levels of service and standards	A		Management Plan writing Set up timetable for asset mgt plan re-writes	
3. Managing Growth	Demand for forecasts for each network or facility for a 10 year period are based on latest growth forecasts. Demand management strategies and demand drivers are understood and documented.	Demand forecasts include analysis of the different factors that comprise demand. The sensitivity of asset development (capital works) programmes to demand changes is understood.	A C	A	Undertake a sensitivity analysis of programmes (especially Capex) to demand changes	
4. Risk Management	Risk management to identify critical assets and associated risks and risk management strategies	Management of assets must include recognition and application of the principles of integrated risk management, specifically Risk management should be consistent with AU/NZS4360, and industry good practice such as the NZ Local Government Handbook for risk management Asset risk management should be integrated with other corporate risk management processes Asset risk management should encompass: Identification and risk management strategies for critical assets Engineering lifelines based risk assessments and mitigation plans, including reference to the organisation's disaster recovery and business continuity plans The link to maintenance and replacement strategies	A A A A/C C	A A		

Asset Management Attribute	'Core' Asset Management Planning Criteria	'Advanced' Asset Management Planning Criteria	Current	Desired	Comment	Time
5. Lifecycle (Optimised) Decision-Making	Identify gaps between current service capability and the required service capability to meet future demand and target service levels and reflect these gaps in an asset development programme. Evaluation and ranking, based on suitable criteria, of options for significant capital investment decisions.	The ability to predict robust and defensible options for asset treatments that can assist in achieving optimal costs over the life cycle of the asset or asset network, including: Applying appropriate economic evaluation tools (or other Council endorsed prioritisation systems) in developing short-term project lists, and Using predictive modelling techniques to provide defensible long-term financial forecasts. First grade for critical assets, Second grade for non-critical assets (to be identified in Asset Management Plans)	CC CC	AC AC	Restrict to critical assets only	
6. Financial Forecasts	Asset Management Planning should translate the physical aspects of planned maintenance, renewal and new work into financial terms for at least the ensuing 10 years and in a manner that is fair, consistent and transparent. The forecasts should include sufficient information to enable decline in service potential (depreciation) of an asset to be measured. Guidance on depreciation is included in the NZ Valuation and Depreciation Guidelines.	Asset Management Planning should translate the physical aspects of planned operational, maintenance, renewal and new works into financial terms: Generally over the timeframe in which the asset network must deliver services In more specific terms, over the period for which the organisation has a strategic plan. The compilation of financial forecasts should be consistent, reliable and provable. The sensitivity of the forecasts to potential significant changes in assumptions should be analysed and discussed in the Asset Management plan.	C A A C	A A	Document the thinking behind strategic decisions and link all previous chapters into financials. Identify form of sensitivity analysis to be undertaken Identify basic assumptions and likely impact on programme for financial forecast from change	

Asset Management Attribute	'Core' Asset Management Planning Criteria	'Advanced' Asset Management Planning Criteria	Current	Desired	Comment	Time
7. Planning Assumptions and Confidence Levels	Asset Management Planning should List all assumptions and provisos under which the plan and financial forecasts are prepared. Indicate the degree of confidence of data reliability underpinning the Asset Management plan; particularly • data on asset condition; • data on asset performance; • accuracy of asset inventory; and • demand/growth forecasts. On the basis of the preceding assumptions and confidence of underlying data, provide a level of precision, or confidence, on the expenditure forecasts for the asset network.	As for 'Core', plus Asset Management Planning should: List all the assumptions and provisos in the Asset Management plans, and note key assumptions regarding Asset Management planning in the organisation's strategic plans. Have degrees of confidence on the data as follows: Inventory data: Critical Assets – Grade 1; Non Critical Assets – Grade 2 Condition data: Critical Assets – Grades 1 or 2; Non Critical Assets – Grades 1, 2 or 3 Performance data: Critical Assets – Grades 1 or 2; Non Critical Assets – Grades 1, 2 or 3 (Grades are contained in Appendix C of the Manual) Note: First Grade is critical assets, second is non-critical as identified in Asset Management Plans Condition relates to availability of useful data not the quality of data already obtained.	A AA CC AA		Determination of data requirements Action plan to collect data Analyse data	

Asset Management Attribute	'Core' Asset Management Planning Criteria	'Advanced' Asset Management Planning Criteria	Current	Desired	Comment	Time
8. Outline Improvement Programmes	Asset Management planning should state what needs to be done to improve Asset Management processes and techniques. Improvement programmes should outline: the weak areas how weak areas will be addressed the timeframe over which the improvements will occur; and the resources (human and financial) needed	As for 'Core', plus Improvement programmes should outline key performance indicators for monitoring Asset Management improvement. The improvement plan should comment generally on achievements against the previous plan, and formally report against key performance indicators.	C C	A A	Words are in document but need to be collated in the improvement plan section	
9. Planning by qualified persons	Asset Management planning must be undertaken by a suitably qualified person, for example an engineer specialising in the relevant activity, or a Level 6 (Tactical) or Level 7 (Strategic) National Diploma in Asset Management or equivalent skill level. If plans are prepared by persons not suitably qualified, the plans should be independently assessed by a qualified person. The planning process should be peer reviewed.	As for 'Core Asset Management Plan Criteria'.	A			
10. Commitment	The Asset Management Plan must be approved and adopted by the governing body, Board or Council. This includes approval of the improvement element of the plan.	As for 'Core', plus The organisation must demonstrate that Asset Management plan requirements are being implemented through operational plans, and formally report discrepancies.	A A			

Asset Management Attribute	'Core' Asset Management Planning Criteria	'Advanced' Asset Management Planning Criteria	Current	Desired	Comment	Time
	Asset Management plans must be seen as the key planning tool for infrastructure assets and/or significant physical assets which provide the inputs for Council's strategic plans (Long Term Council Community Plan). Asset Management Plans must be regularly updated to reflect the most current future plans for the assets (it is expected the "Core" Asset Management planning will be significantly revised in the light of action under improvement programme. In the first few years annual revisions of Asset Management Plans are likely).	Asset Management planning is seen as a constantly evolving process, with underpinning Asset Management systems constantly providing better information. It is expected that formal Asset Management plans, and overarching Asset Management strategies will be formally revised every three years, with the timing of revisions linked to the organisation's strategic planning cycles.	A			

Appendix Table D-3: Plan Upgrade History

	Year	Completed Y/N
Levels of Service	2015	Y
Evaluating Service Options	2015	Y
Undertaking Consultation on Levels of Service Options	2015	Y
Adoption by the Council of Levels of Service after Consultation (note 1)	2015	Y
Public Communication of Levels of Service in a "Customer Charter"		N
Managing Growth		
Sensitivity of Asset Capital Works to demand changes	2018	N
Risk Management		

	Year	Completed Y/N
Engineering Lifelines based risk assessments including reference to disaster recovery and business continuity plans	2018	N
Link to maintenance and replacement strategies	2018	N
Lifecycle Optimised Decision Making		
Ability to predict robust and defensible options for asset treatments that achieve optimal lifecycle costs including:		
Applying appropriate economic evaluation tools, and	2018	N
Using predictive modelling techniques to provide defensible long term financial forecasts.	2018	N
Financial Forecasts		
Asset Management Plan translates physical aspects of Operations and Maintenance, Renewal and Capital Works in financial terms:		
Over the timeframe the Network must deliver services, and	2018	N
The sensitivity of Forecasts to potential significant changes in assumptions are discussed and analysed in the Asset Management Plan	2018	N
Planning Assumptions and Confidence Levels		
Have confidence levels on condition data	2018	N
Outline Improvement Programmes		
Improvement programmes outline key performance indicators for monitoring Asset Management improvement	2018	N
Improvement plan should comment on achievement against the previous plan and formally report against key performance indicators	2018	N

Note 1: Consultation on levels of Service is carried out via the Community Plan and Annual Plan consultation processes.

APPENDIX E: WATER LOSSES EVALUATION

Background

Water loss, or "un-accounted for water" is identified as the difference between the volume of water supplied to the network and the summation of the volumes supplied to customers through metered supplies. In Nelson City the supplied volume is split into two parts: the first is the raw water supplied to the treatment plant from the Roding and Maitai supplies and the second is the treated water supplied to the city. The volume of raw water losses is found from the comparison of meters on the raw water supply lines at the Maitai Dam and Roding Dam and the raw water lines at the treatment plant. The volume of treated water losses is found from comparing the recorded volume supplied from the Water Treatment Plant via the three meters that record flows to the main serving a number of Maitai valley properties, the city network via the main to Westbrook Terrace and the return main to the York Valley reservoir and the total volume supplied through the approximately 20,000 metered connections for the same period. The difference is "un-accounted for" water or "lost" water.

This section examines the components and evaluates their impact on the Nelson City water supply losses, and defines the work required to reduce each aspect of the losses.

The components of water loss are well documented in the New Zealand Water and Wastes Association "Benchloss" manual which is based on the International Water Association Water Loss Task Force "Guidance Notes", and the definitions are therefore not repeated here.

Figure D1 show the components and their numerical magnitude. Note the boxes are not to scale.

The following work is being carried out as priorities allow to determine (improve the accuracy of) the numbers

- Collect Water Supply Data
- Test Source Meter for Accuracy
- Collect and assess metered water use data
- Test customer meters for accuracy
- Collect data to quantify unmeasured authorized uses e.g. mains flushing, fire-fighting etc
- Review water accounting and data handling procedures
- Measure water losses including field inspection of reservoirs, tanks, control valves

The following documents set the current Water Loss Reduction Strategy 2015-25:

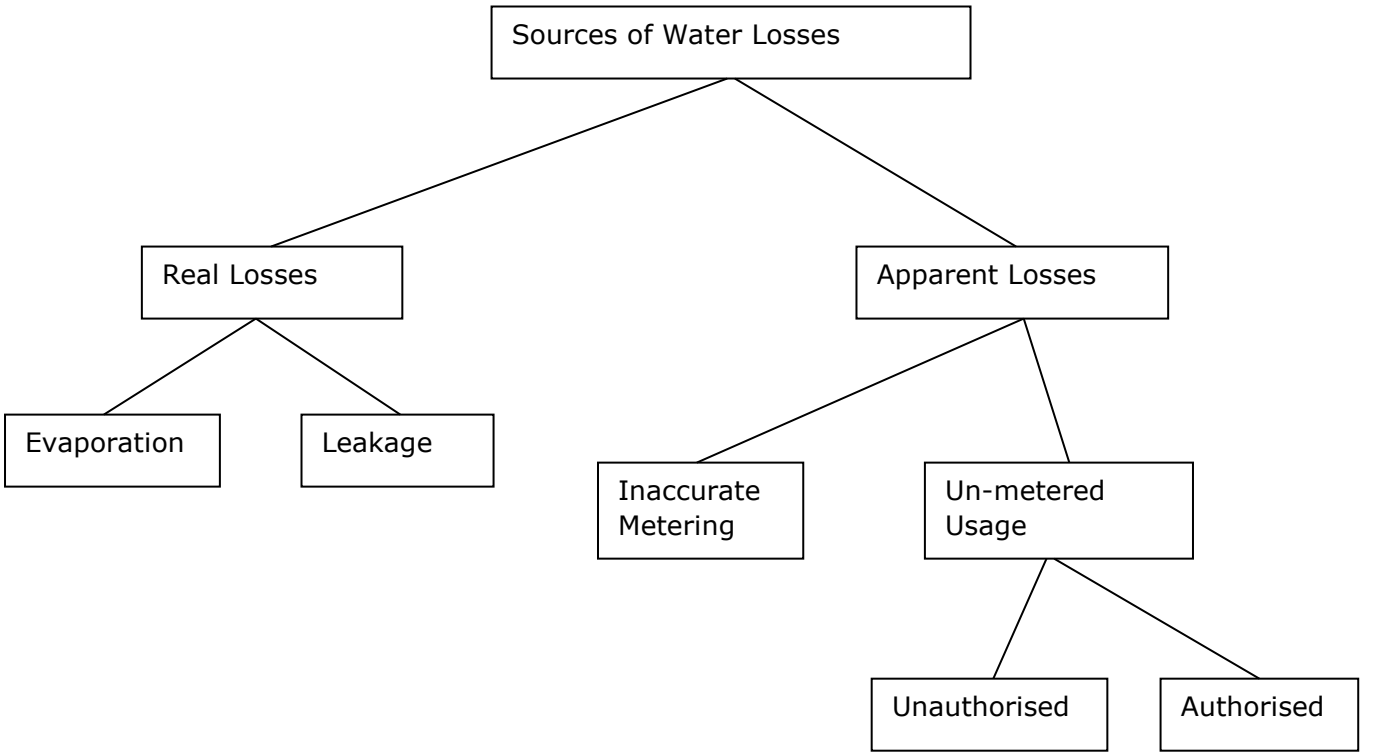
- A1393411 Summary
- A1215831 Detail
- A1335157 Zone Maps
- A1398591 Project Initiation Document

Appendix Figure E-1: The Water Balance Data for 2012/13 Financial Year (latest available)

<table>
<tr>
<td rowspan="2">Own Sources
7391.0 m³x10³
434.5 l/cap/d
+/- 2.0%</td>
<td rowspan="3">System Input
7391.0 m³x10³
434.5 l/cap/d
+/- 2.0%</td>
<td>Billed Water Exported to other systems</td>
<td rowspan="2"></td>
<td rowspan="2"></td>
<td>Billed Water Exported to other systems
3.4 m³x10³ +/- 2.0%
0.2 l/cap/d</td>
<td rowspan="3">Revenue Water
4914.4 m³x10³
288.9 l/cap/d
+/- 1.7%</td>
</tr>
<tr>
<td rowspan="3">Water Supplied
7387.6 m³x10³
434.3 l/cap/d
+/- 2.0%</td>
<td rowspan="2">Billed Authorised Consumption
4914.4 m³x10³
288.9 l/cap/d
+/- 1.7%</td>
<td>Billed Metered Consumption by Registered Customers
4911.0 m³x10³ +/- 1.7%
288.7 l/cap/d</td>
</tr>
<tr>
<td rowspan="2">Water Imported
0.0 m³x10³
0.0 l/cap/d
+/- 0.0%</td>
<td rowspan="2">Authorised Consumption
5008.4 m³x10³
294.5 l/cap/d
+/- 1.7%</td>
<td>Billed Unmetered Consumption by Registered Customers
0.0 m³x10³ +/- 0.0%
0.0 l/cap/d</td>
</tr>
<tr>
<td rowspan="2">Unbilled Authorised Consumption
94.0 m³x10³
5.5 l/cap/d
+/- 8.8%</td>
<td>Unbilled Metered Consumption
0.0 m³x10³ +/- 0.0%
0.0 l/cap/d</td>
<td rowspan="3">Non-Revenue Water
2476.6 m³x10³
145.6 l/cap/d
+/- 6.9%</td>
</tr>
<tr>
<td rowspan="2">Water Losses
2382.6 m³x10³
140.1 l/cap/d
+/- 7.1%</td>
<td>Unbilled Unmetered Consumption
94.0 m³x10³ +/- 8.8%
5.5 l/cap/d</td>
</tr>
<tr>
<td rowspan="2">Apparent Losses
209.2 m³x10³
12.3 l/cap/d
+/- 25.2%</td>
<td>Unauthorised Consumption
5.0 m³x10³ +/- 13.3%
0.3 l/cap/d</td>
</tr>
<tr>
<td>Customer Meter Under-registration
204.2 m³x10³ +/- 25.8%
12.0 l/cap/d</td>
</tr>
<tr>
<td colspan="2"></td>
<td colspan="2">Real Losses
2173.4 m³x10³
127.8 l/cap/d
+/- 8.2%</td>
<td>Real Losses
2173.4 m³x10³ +/- 8.2%
127.8 l/cap/d</td>
<td></td>
</tr>
</table>

Figure E-2 shows the sources of Real and Apparent Water Losses diagrammatically

Appendix Figure E-2: Sources of Water Losses



Note re Authorised Un-metered Usage

Strictly speaking, authorised un-metered usage is not an apparent loss, if it is identified and correctly quantified

Real Losses

Refer figures E-1 and E-2.

Evaporation

All of Nelson's treated water storage is covered.

Evaporation is not considered to be a factor in the water losses.

Leakage

Leakage from trunk mains

The trunk mains are operated at high pressure. Trunk mains are laid under roads or in otherwise visible areas, therefore leaks will show on the surface quickly.

Leakage from trunk mains is not considered to be a factor in the water losses.

Leakage from reticulation pipes

Leakage from reticulation pipes is unquantified. While pipe bursts show at the surface, smaller leaks may go undetected for some time and infiltrate into the ground, particularly in Stoke, Tahunanui and The Wood which are on gravel and sand.

Reticulation pipe leaks are considered to be a major factor in the water losses

Leakage from service pipes

Leakage from service pipes is also unquantified. While pipe bursts and large leaks show at the surface, smaller leaks may go undetected for some time and infiltrate into the ground, particularly in Stoke, Tahunanui and The Wood which are on gravel and sand. Typically leaks in service pipes occur at connections to the main or after the meter where they are mostly found by property owners after the water invoices show a higher than expected usage.

The water leaks in property service pipes that occur after the meter are accounted for, while being unquantified.

Service pipe leaks are considered to be a major factor in the total volume of water lost from the network.

Leakage through Scour Valves

Scour valves are situated in low spots near creeks or storm water mains to facilitate draining of trunk and large diameter reticulation mains. Leaks from scours could go un-noticed for some time. A system has been set up for Nelmac to regularly check scour valves by inspecting the outlets and electronically listening on the valve for water passing.

Leakage through scour valves is not considered to be a major factor in the water losses.

Leaking Hydrants

Hydrants usually only leak after use and the fire service (and others) usually report if they are unable to fully shut off the hydrant. Due to the design of fire hydrants, the shaft glands do not leak when the hydrant is turned off.

Fire Hydrants are situated in the road or other accessible places and are visible, therefore leaks quickly fill the hydrant box and show on the surface unless the ground is particularly porous.

Hydrant leaks are not considered to be a major factor in the water losses.

Leakage from Valves

Unlike hydrants, glands on valves can leak at any position of the valve gate. Valves used to be checked and "exercised" by Nelmac on a 3 yearly basis. However this procedure was ceased when it was found that the process actually initiated many valve gland leaks. Leakage normally fills the valve box and shows on the surface. Valve gland leaks are now repaired on a reactive basis.

Leaks through "shut" valves allow water into an adjacent zone – normally from a high pressure zone into a low pressure zone, but water is not lost from the system.

Leakage through reservoir filling valves is discussed in "reservoir overflows" below

Leakage from valves is not considered to be a significant factor in the water losses.

Bursts

Nelson City Council has quick response times in its level of service. Nelmac's contract requires them to respond to bursts within 30 minutes. Leakage from bursts is allowed for in the water balance, but is not significant.

Bursts are not considered to be a major factor in the water losses.

Leakage from reservoirs

All reservoirs and tanks are above ground and inspected monthly by Nelmac. No leakage from the walls has been noted.

All major reservoirs have underdrains leading to inspection manholes. Nelmac checks these monthly and any leakage is investigated and repairs made. The only seepage in recent years has been at the Thompson Terrace #2 reservoir where (in 2007) there was a slight seepage, and the internal water seals on a sector of the reservoir were renewed.

Reservoir leakage is not considered a factor in the water losses.

Reservoir overflows

All major reservoirs have level recorders, are connected to the SCADA system, and alarmed.

Minor reservoirs and tanks are inspected monthly by Nelmac.

Reservoir overflows are not considered to be a factor in the water losses.

Apparent Losses

Refer figures E-1 and E-2.

Inaccurate Metering

Misreading of meters

Customer meters are read manually and the reading is keyed into a handheld data logger on site. The data is then downloaded electronically to the computer system, where the bills are generated. Reports of exceptionally high or low usage are generated, and the meters are re-read in case there are reading or data entry errors. This process would also identify if the reading for the previous period (i.e. start reading for the current period) held in the archive is incorrect.

Misreading of meters, Data Transfer errors, and Data Analysis errors are not considered to be factors in the water losses.

Residential Meters out of calibration

A sample of 89 manifold water meters has been tested for accuracy over three flow volumes; 0.38lpm, 15lpm and 50lpm (Refer A754715). All were installed as part of the 1999 Universal metering programme and have been in operation for approximately 15 years. A significant number of meters under-recorded flows in the 0.38lpm flow range. It is possible that a component of the water losses may result from under recording flows to consumers.

The water meters will be checked again within the next three years to see if a trend can be shown.

Residential meter accuracy is considered to be a factor in the water loss equation.

Commercial/Industrial Meters out of Calibration

As at June 2008, commercial/industrial water meters have not been tested for calibration. Installation of water meters commenced prior to 1980 and was completed in 1999 at the same time as residential meeting. Therefore some meters are up to 30 years old.

Commercial/industrial meter accuracy is also considered to be a factor in the water losses.

Meters not recording low flows

Large diameter meters do not accurately record low flows. Until recently meters were sized the same as pipe size, i.e. for maximum flow. Large commercial/industrial water meters will therefore be under reading normal and low flows. New installations now have combination (low and high flow) meters installed.

Meters not recording low flows is considered to be a factor in the water losses.

Meters not in System

Occasionally meters are found that have been installed, but have not been entered into Napier Computer Systems water billing system, and are therefore not being read or charged. One recent example was where the connection was approved and completion signed off, but not entered into Napier Computer Systems. A system has been implemented (May 2008) to correlate the 3 steps - connection applications, meter data returns from approved water connection contractors (AWCCs), and water meter records in Napier Computer Systems.

Meters not in the system are not considered to be a significant factor in the water losses.

Un-metered Usage

Unauthorised Un-metered Usage

Illegal hydrant use

The use of water from fire hydrants other than for fire-fighting, testing or mains flushing is contrary to the Water Supply Bylaw. However this has not been enforced to date.

Illegal hydrant use is not considered to be a significant factor in the water losses.

Illegal connections

It is difficult to make illegal connections directly to mains, ridermains and service connections (within legal road) due to their depth and high pressures. However on cross lease or Right of Way sections it is possible to turn off the isolating valve at the street boundary and make an illegal connection on private property before the meter. Most residents would not have the technical ability to make such a connection. Water would still have to be used through the meter to avoid suspicion. Illegal use would most likely be used for garden watering or swimming pool filling. In recent years only one such case was reported by a concerned neighbour.

Illegal connections are therefore not considered to be a significant factor in the water losses.

Authorised Un-metered Usage

Strictly speaking, authorised un-metered usage is not an apparent loss, if it is identified and correctly quantified in the water balance. Assumptions have been made on the following uses.

Firefighting

Water suppliers with a reticulated system are required to provide fire-fighting water to the NZ Fire Service and to not charge for it. The normal fire demand is 25 L/sec (90 m3/hr). Allowing two full hours use of water per week, the fire demand is less than 10,000 m3/yr. (e.g. compare with a single leak of 1 L/sec running for 1 year at 32,000 m3/yr).

Fire-fighting use is therefore not considered to be a significant factor in the water losses.

Other approved use of Fire hydrants

When the fire service receives a request for assistance in supplying water for non- fire purposes they refer their applicant to the Council's Technical Services section for approval. Similarly contractors requiring large volumes of water for subdivision or roading purposes apply for permission to take the water. In both cases the parties are asked to advise the council of the volume used.

Therefore it is only small users of water from hydrants that are not recorded.

Other approved use of fire hydrants is therefore not considered to be a factor in the water losses.

Mains flushing

Dead end mains are regularly flushed by Nelmac to prevent any debris build up where the water velocity is low. Mains are also flushed after repair to remove any debris that has settled. Nelmac have used metered standpipes for this and the volume of water flushed each year has been estimated and included in the water balance.

Mains flushing is therefore not considered to be a significant factor in the water losses.

Mains testing

The volume of water used in the testing, chlorination, and flushing of new mains both on subdivisions and council renewals and capex has been estimated and included in the water balance.

Mains testing is therefore not considered to be a significant factor in the water losses.

Draining mains

The volume of water used to drain mains for repair has been estimated and included in the water balance.

Draining mains is therefore not considered to be a significant factor in the water losses.

Draining reservoirs

The volume of water used in draining reservoirs and tanks for repair and to maintain chlorine residual has been estimated and included in the water balance.

Draining reservoirs is therefore not considered to be a significant factor in the water losses.

Central Business District amenities

Hanging baskets irrigation, Bird scaring tree sprays, Symonds Gas Lamp (in Trafalgar Street outside the Victorian Rose), and drinking fountains at Church steps and Bridge / Trafalgar corner are metered.

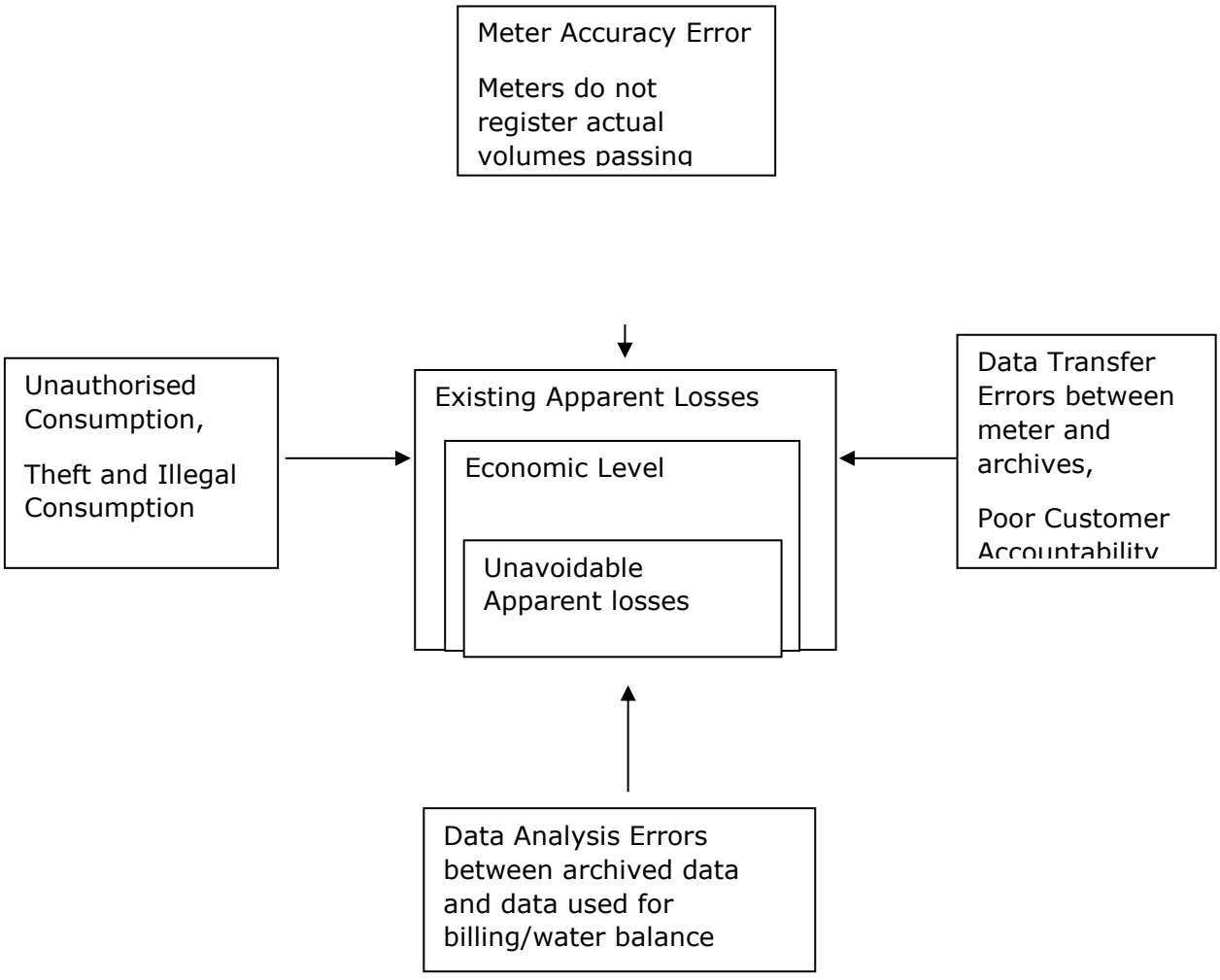
Central Business District amenities are therefore not considered to be a significant factor in the water losses.

Reducing Apparent Losses

Figure E-3 shows the components for managing apparent losses by "squeezing the box". Taking each corrective action will reduce the apparent losses.

Appendix Figure E-3: The Four Components of Managing Apparent Losses

"Squeezing the box"



Considering the four factors in Apparent Losses

- Meter Accuracy
- Data Transfer
- Unauthorised Consumption
- Data analysis

As discussed above, only Meter Accuracy is considered to be a significant factor in the losses and needing priority attention at this time.

Action Plan

Complete residential meter accuracy testing programme to allow 95% confidence.

Schedule replacement of residential meters

Test all commercial/industrial water meters 100mm dia. and over, and repair or replace as necessary.

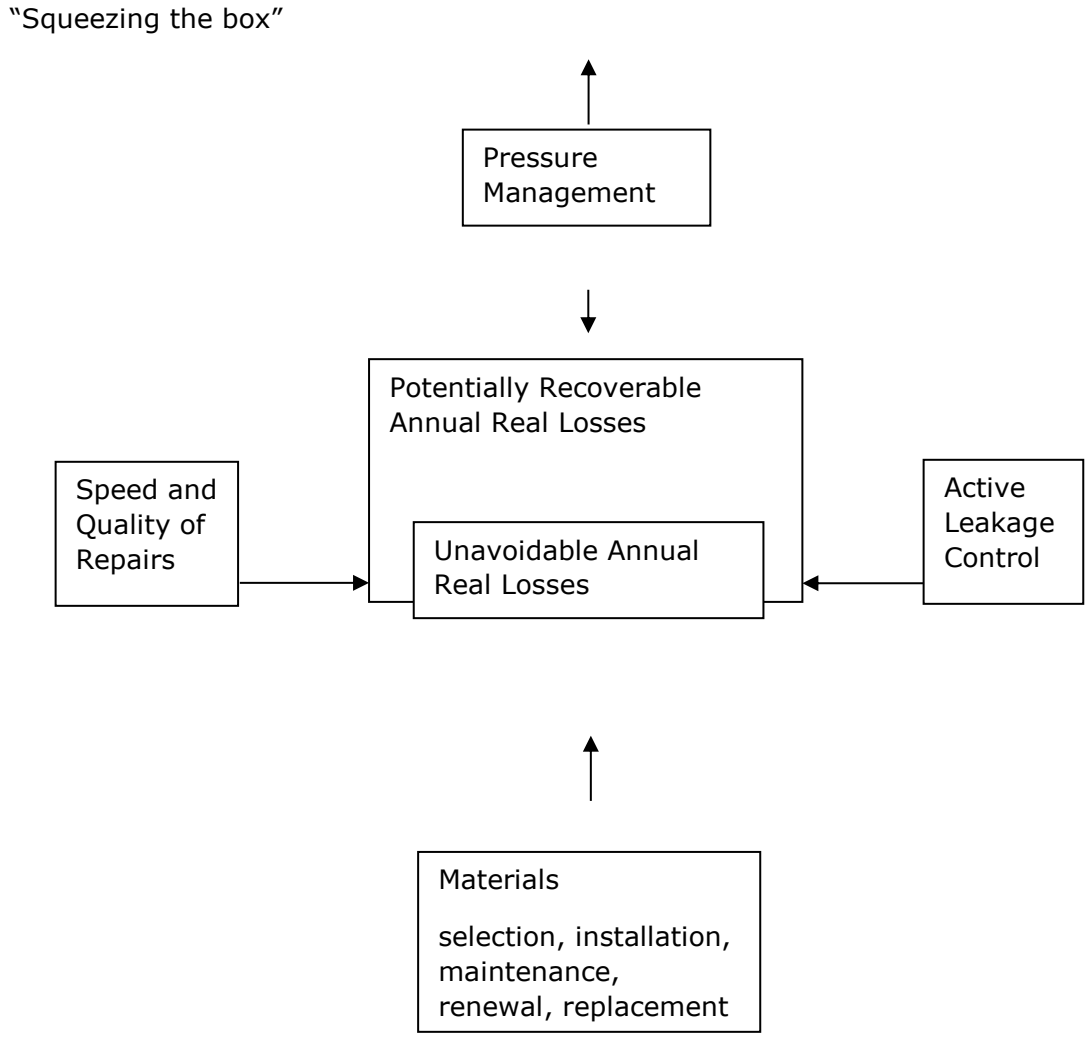
Test all commercial water meters 50 mm dia and over but less than 100mm dia. and replace as necessary.

If water meters 50 mm dia. and over are to be replaced, consider whether a combination meter (low flow/high flow) should be installed.

Reducing Real Losses

Figure E-4 shows the components for managing real losses by "squeezing the box". Taking each corrective action will reduce the real losses.

Appendix Figure E-4: The Four Components of Managing Real Losses



Considering the four factors in Real Losses

Speed and Quality of Repairs. The Nelmac utilities maintenance contract has short response times that are recorded in Hansen and are met. Repairs are made to a high standard. Little "squeeze" is therefore available from Speed and Quality of Repairs.

Materials Selection. The Nelson City Council Engineering Standards specifies the materials to be used in repairs, maintenance, renewals, capital expenditure and assets to be vested. These are of a high and appropriate standard. Little "squeeze" is therefore available from Materials Selection.

Active Leakage Control. Leakage is identified above as a major factor in the losses. Significant "squeeze" is available from Active Leakage Control and it is a matter of priority. The active leakage control action plan is shown in Appendix F.

Pressure Management. Pressure reduction is identified as a major factor in the losses. Significant "squeeze" is available from Pressure reduction and it is a matter of priority. The pressure reduction action plan is shown in Appendix G.

APPENDIX F: ACTIVE LEAKAGE CONTROL PLAN

Proposed Methodology

Divide the water supply system into discrete reservoir/pressure reducing valve supply zones and designate them as District metering areas;

Test and repair isolation valves for District Metering Areas;

Install district flow meters and data loggers;

Night time low flow tests including reading customer meters at beginning and end to quantify demand;

Acoustic leak detection survey to identify leak locations;

Repair located leaks;

Repeat night time low flow tests to confirm repair and quantify "background" losses;

Consider more proactive maintenance program;

Reduce time between leak reports and repairs;

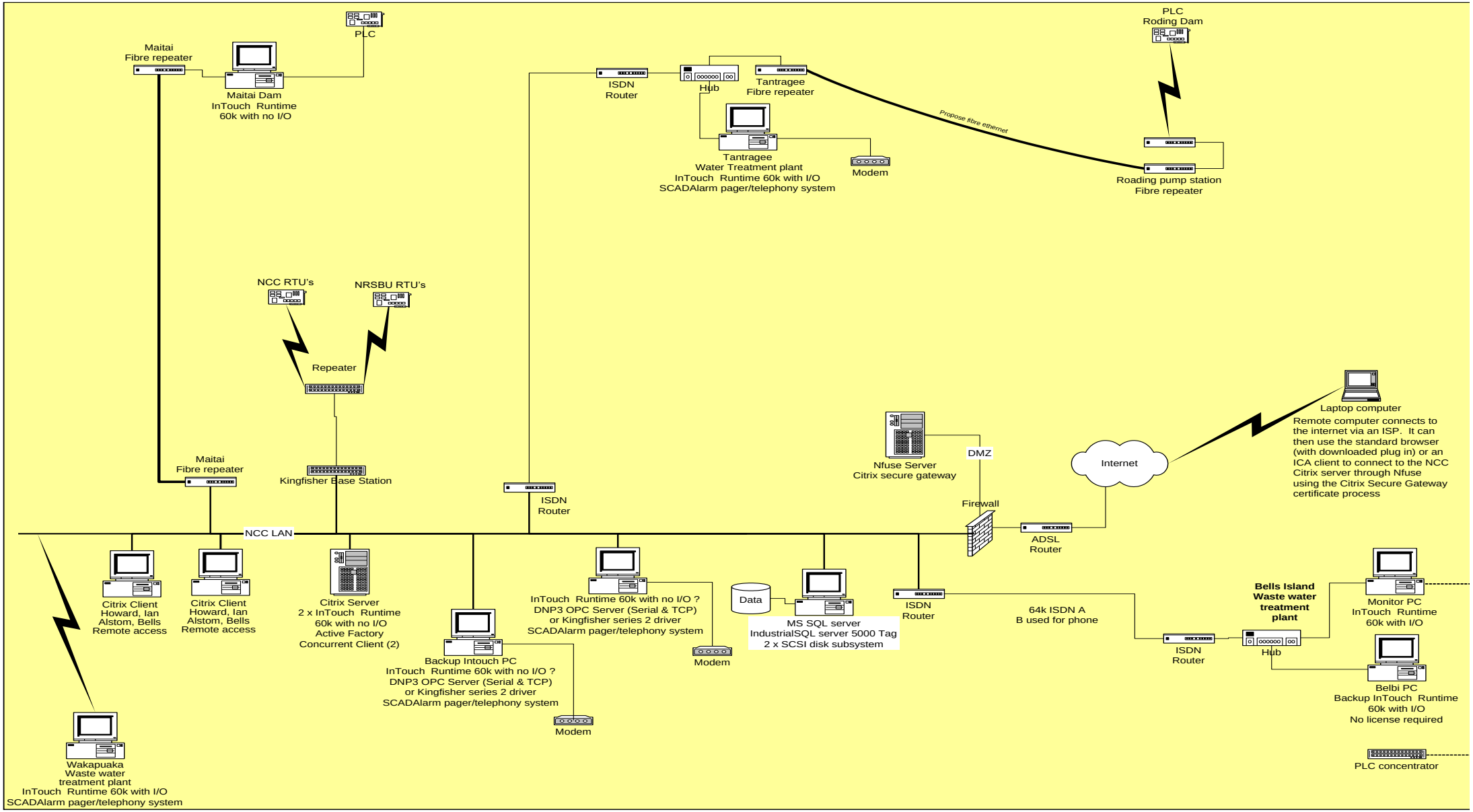
Implement pressure management (refer Appendix G);

Continue main replacement program (currently 50 and 100mm dia. asbestos cement);

Moving to "smart meters", or property owners regularly checking their water meters are good ways of providing early alerts to leaks which allows for prompt repair. Ongoing public education is required.

APPENDIX G: SCHEMATICS

Appendix Figure G-1: Supervisory Control and Data Acquisition Schematic.



APPENDIX H: PRESSURE REDUCTION PLAN.

Background

Many areas of the city receive pressures in excess of the Levels of Service specified in the Water Supply Asset Management Plan.

High pressures result in

- More pipe failures (particularly Asbestos Cement pipes)
- More water losses from undetected leaks
- Higher customer usage
- Demerit points in the water supply distribution grading
- Reduction in pressure will therefore have long term benefits to the water asset.

Parts of the Stoke area (particularly) have Asbestos Cement pipes that were laid in the 1950's and are starting to fail. Lowering the pressure in these pipes will extend their useful life. However some pipes are under capacity for fire flows when the pressure is reduced so will have to be renewed with a larger diameter pipe.

The renewal and new ridermain projects seek to strategically combine Capex and Renewal funding such that pressures can be lowered in the future.

A ridermain in Tosswill Road laid in conjunction with road upgrading will allow houses on the downhill side of the road to be put on low pressure in the future. Houses on the uphill side will remain on the existing high pressure main, as will the fire hydrants. This area is not high priority for pressure reduction, but the opportunity is being taken lay the ridermain at this time. Additional works yet to be scheduled will include a low pressure pipe from the bottom of Tamaki Street down the steps to the low pressure main on the opposite side of Tahunanui Dve., and a new main in Tosswill Road from Tahunanui Dve to the Chamberlain Street intersection. A similar riderman will also be laid in Chamberlain Street from Tosswill Road to Maire Street in the future.

Recent work in the Enner Glynn/Wakatu area (Beatson Road to Torlesse St) has allowed this area to be transferred to low pressure (107m City Datum). The new pipes have been sized to meet the Fire flow Levels of Service at the reduced pressure. The pressure reducing valve currently at Cawthron Crescent will have to be relocated to the top of Beatson Road near Waimea Road.

The Maitland/Ridgeway area is currently on Marsden Valley High Pressure (170 m City Datum). The proposed works in 2008/09 and 2009/10 will allow this area to be transferred to Treatment Plant/Thompson Terrace. Reservoir High Pressure (155m City Datum). A new pressure reducing valve will be required on the Ridgeway near Marsden Road, and the Austen Ward Heights booster pump station will have to be upgraded to sustain pressures to Leach Place, and the top of Austen Ward Heights / Calamaras Street.

The additional works noted in 5 and 6 above are proposed for "System Improvements" funding.

The lower Port Hills (including Haven Road / Wakefield Quay), Washington Valley, Toi Toi Valley (including Emano / Murphy), Hospital, and Mount Street areas are also on Treatment Plant/Thompson Terrace Reservoir High Pressure (155m City Datum), but should be on low pressure (107 m City Datum). No synergies with renewals are possible in this area and additional funding for Capex is proposed in the Water Supply Asset Management Plan 2009/19.

The City/Atawhai low pressure zone has been split into three zones – Atawhai, The Wood and the Central City. This has enabled the Wood zone to be put on 83m City Datum while the

other two zones remain on 107m City Datum. This split also allows for smaller District Metering Areas.

Lowering of night-time pressure in all pressure reducing valve zones will achieve the benefits listed in 1 above. Additional funding for System Improvements is proposed in the Water Supply Asset Management Plan 2009/19 for the fitting of a variable controller to one pressure reducing valve in each zone, and the resetting of other pressure reducing valves to a lower pressure.

Network Modelling Results

Network Modelling of The Wood Pressure Reduction

Background

The City/Atawhai low pressure zone has been split into three zones – Atawhai, The Wood and the Central City. This has enabled the Wood zone to be put on 83m City Datum while the other two zones remain on 107m City Datum. This split also allows for smaller District Metering Areas.

This was achieved by modelling different scenarios and carrying out the following works:

Completed works as at 2011
Modelling results
The Trafalgar Street pressure reducing valve was reduced from a setting of 107m to 83m.
A new pressure reducing valve was inserted at the corner of Nile and Tory Streets, set to 83m.
Valves were shut at Trafalgar Street bridge (just north of Ajax Avenue), Hardy Street bridge, Bridge Street bridge and in Atawhai Drive just south of Iwa Road to enclose the new lower pressure zone.
It was found that fire flows were no longer achievable in Iwa Road and Walters Bluff. A new pressure reducing valve at the bottom of Walters Bluff (set to 107m) was required to remedy this.
New pressure reducing valves that have been installed.
At the bottom of Walters Bluff set to 107m
In Tory Street at the intersection with Nile Street, set to 83m
Other Misc New Works that have been completed
New valve in Atawhai Drive just south of Iwa Road
Change setting of Trafalgar Street pressure reducing valve to 83m

Network Modelling of Port Hills / Washington / Victory / Toi Toi Pressure Reduction

Background

Currently the Port Hills / Washington Valley / Victory Square / Toi Toi Valley areas are supplied directly at Water Treatment Plant / Thompson Terrace Reservoir pressure, but much of the land is at low level and is therefore receiving excess pressure.

The objective was to model scenarios giving pressures within the Targeted Level of Service in the Water Supply Asset Management Plan (30 m to 90 m head at each property).

The initial attempt to design alterations to the reticulation to achieve lower pressures was hampered by the need to maintain high pressure in the cross city links in the reticulation

(Wellington St, Gloucester St, Washington Road, Hampden Street, Alfred Street, Toi Toi Street etc.).

The second attempt put all the areas onto low pressure and then devised means of providing high pressure to those areas needing it. This was successful.

Results

A 200 pipe is required in Princes Drive (Day's Track to Richardson Street) to provide continuity of supply to the Port Hills / Port area (including Sealord) if the trunkmain from North Road to Vickerman Street is out of action. Note this pipe is not needed for normal operation.

There are a few houses at the top of the southern end of Montreal Road which are above the 67 m contour and will not receive adequate pressure.

Can't achieve a fire flow to a couple of houses at the end of Konini Street (numbers 5A and 7). Can get 12.5 litres per second out of the hydrants outside 16 Konini and 87 Mount Street but these are both over 135m away.

Fireflows were not adequate at the top of Emano Street without upgrading the main in Orsman Crescent. Once this is upgraded to a 150 then we can get 12.5 litres per second at the end of Emano and 12.5 litres per second at the corner of Emano and Orsman which is sufficient.

Cannot achieve 25 litres per second in Mount Street without the non-return valve which brings water from the low pressure system when there is a fire flow.

New pressure reducing valves

At the corner Russell Street and Stanley Crescent supplying into the new low pressure zone in Washington Valley and into the new 150 main supplying the Port/Queens Road area.

Toi Toi below Abraham

Laval Heights to replace shut valve – set to 140m – could be lower

Quebec Road to replace shut valve – reduces from Observatory Hill pressure to Maitai High Level – set to 155m

At the corner of Princes / Richardson supplying into the top of Richardson Street and into Washington Road

Outside 7 Orsman Crescent

New Links

150 to link the new low level system either side of the newly shut valves in Hampden Street at the corner of Kawai Street

150 - Corner of St Vincent and Toi Toi to link the 150 on the southern side of Toi Toi to the 200 in Toi Toi

Need to link the Fountain Place main to the 100 low pressure in Haven Road

100 link between the 100 and 150 in Haven Road south of Vickerman Street

New Mains

370m of 150 main up Russell Street from Haven to Queens

385m of 50 ridermain up Russell Street from Haven Road to Stanley Crescent

235m of 100 main from Russell Street to end of Mt Pleasant Avenue

1070m of 200 main along Princes Drive from Princes/Toi Toi to Princes/Richardson

70m of 150 from new 200 in Princes Dve down to the end of The Cliffs via the reserve.

Upgrade Orsman Cr from 100 to 150 – length 330m

Other Miscellaneous New Works

New non-return valve outside 36 Mount Street – required so that upper Mount Street can achieve fire flows

Small booster Pump (and tank?) Montreal Road / Hutson Street.

New valve outside 41 Wolfe St

New valve outside 17 Mt Pleasant Avenue

New valve outside 16 Albert Road

New valve in Haven Road just north of Russell Street in the 200

New valve by 121 Queens Road

New valve in Haven Road just south of Vickerman Street in the 150 CIPT

Completed works as at 2011
New pressure reducing valve in Laval Heights to replace shut valve – set to 140m – could be lower
New non-return valve outside 36 Mount Street – required so that upper Mount Street can achieve fire flows
New valve outside 41 Wolfe Street.

Network Modelling of Pressure Reduction Wakatu / Enner Glynn / Ridgeway

Background

The Wakatu area (Beatson Road to Torlesse Street) is currently on Treatment Plant/Thompson Terrace Reservoir High Pressure (155m City Datum). The proposed works in 2008/09 and 2009/10 will allow this area to be transferred to low pressure (107 m City Datum). The new pipes have been sized to meet the Fire Flow Levels of Service at the reduced pressure. The pressure reducing valve currently at Cawthon Crescent will have to be relocated to the top of Beatson Road near Waimea Road.

The Maitland/Ridgeway area is currently on Marsden Valley High Pressure (170 m City Datum). The proposed works in 2008/09 and 2009/10 will allow this area to be transferred to Treatment Plant/Thompson Terrace Reservoir High Pressure (155m City Datum). A new pressure reducing valve will be required on the Ridgeway near Marsden Road, and the Austen Ward Heights booster pumpstation will have to be upgraded to sustain pressures to Leach Place, and the top of Austen Ward Heights / Calamaras Street.

Results

A pressure reducing valve was inserted in the Ridgeway just north of Marsden Road. This needs to be set to 'Thompson Terrace Reservoir' pressure, but sufficiently low so that water does not flow north along the new 200 main above. A setting of 142m was sufficient to supply 30m to the top of Arapiki Road and still have the water flowing south along the new main. This setting will have to be established through experimentation and possibly varied seasonally.

A pressure reducing valve was inserted in Beatson Road just below the (eastern) intersection with Scotia Street to achieve fire flows at Beatson / Waimea.

To achieve fire flows in Anglia Street requires upgrading the 100 AC main in Beatson Road to 150 PVC, the 100 AC main in Scotia Street from Beatson to Anglia to 150 PVC and the 100 AC in Anglia to 100 PVC.

To achieve fire flows in Burrough Place requires upgrading the 100 AC in Waimea, Chings, Enner Glynn from Beatson to Burrough to 150 PVC

To obtain fire flows in Cherry Avenue requires a connection into the new 200 main at Baigent / The Ridgeway, upgrading the 100 AC in Baigent from The Ridgeway to Cherry to 150 PVC and upgrading the 100 AC in Cherry to 100 PVC.

Other fire flows which were tested and were adequate are as follows:

- Can get 12.5 litres per second in Newman Drive at Boyes Place (and 12.5 litres per second from above non-return valve)
- Last hydrant on Enner Glynn Road providing Baigent upgraded as above
- Panorama, Arapiki, View Mount, Coster

To achieve the residential pressure level of service in Leach Place, Sophies Way, and the top of Austen Ward Heights and Calamaras Street, a booster pumpstation is required. (The existing small pump and 2x25 cu m tanks do not provide a permanent solution).

If the booster pump is sited at the intersection of Torlesse and Jerningham Streets a link between Torlesse Street and the intersection of Waterhouse and Austen Ward Heights, (or a pressure reducing valve at the intersection of Waterhouse and Austen Ward Heights) is required to maintain fire flows to Coster Street and Calamaras Street.

New Pressure Reducing Valves

In The Ridgeway just north of Marsden Road

In Beatson Road

New Mains

500m of 200 main from Waimea Road/The Ridgeway to The Ridgeway/Torlesse (abandon AC 100). Connection at Baigent Road.

Upgrade 535m of 100 AC to 150 PVC main in Waimea Road, Chings Road, Enner Glynn Road (from Chings Road to Burrough Place) Note : Continue renewal in 100 PVC to Newman Dve.

Upgrade 71m of 100 AC to 150 PVC in Baigent Road from The Ridgeway to Cherry Avenue. Note : Continue renewal in 150 PVC to high point of Baigent Road (start of existing 100 PVC

Renew 220m of 100 AC to 100 PVC in Cherry.

A new 150 PVC (or PE) link between Torlesse Street and Waterhouse Street, Austen Ward Heights intersection via the walkway is needed to maintain fire flows if the pump station is built on the intersection of Torlesse and Jerningham Streets.

Other Misc New Works

New valve in Enner Glynn Road just north of Newman Drive

New valve in Waterhouse just north of Torlesse

Remove the pressure reducing valve in Cawthron Crescent

Future new ridermain at the top end of Scotia Street to Ulster to keep the top houses on high pressure and reduce the others to low pressure

The initial modelling did not include the Austen Ward Heights area above the NRV.

Subsequently a new PS on the intersection of Torlesse and Jerningham Streets was modelled.

Completed works as at 2011
200 main laid from Waimea Road/Beatson Road to The Ridgeway intersection (abandon AC 100). Connected at Ulster Street
Upgrade 338m of 100 AC to 150 PVC in Beatson Road
Upgrade 188m of 100AC to 150 PVC in Scotia Street from Beatson to Anglia
Renew 262m of 100 AC to 100 PVC in Anglia Street
New valve in Scotia Street just south of Ulster

Network Modelling of Pressure Reduction East side of Waimea Road (Motueka Street to Boundary Road)

Background

The East side of Waimea Road between Motueka Street and Market Road is currently on Treatment Plant/Thompson Terrace Reservoir High Pressure (155m City Datum). The proposed works will allow this area to be transferred to low pressure (107m City Datum). The pipe capacities have been checked to ensure that the Fire Flow Levels of Service can be maintained at the reduced pressure.

New Links

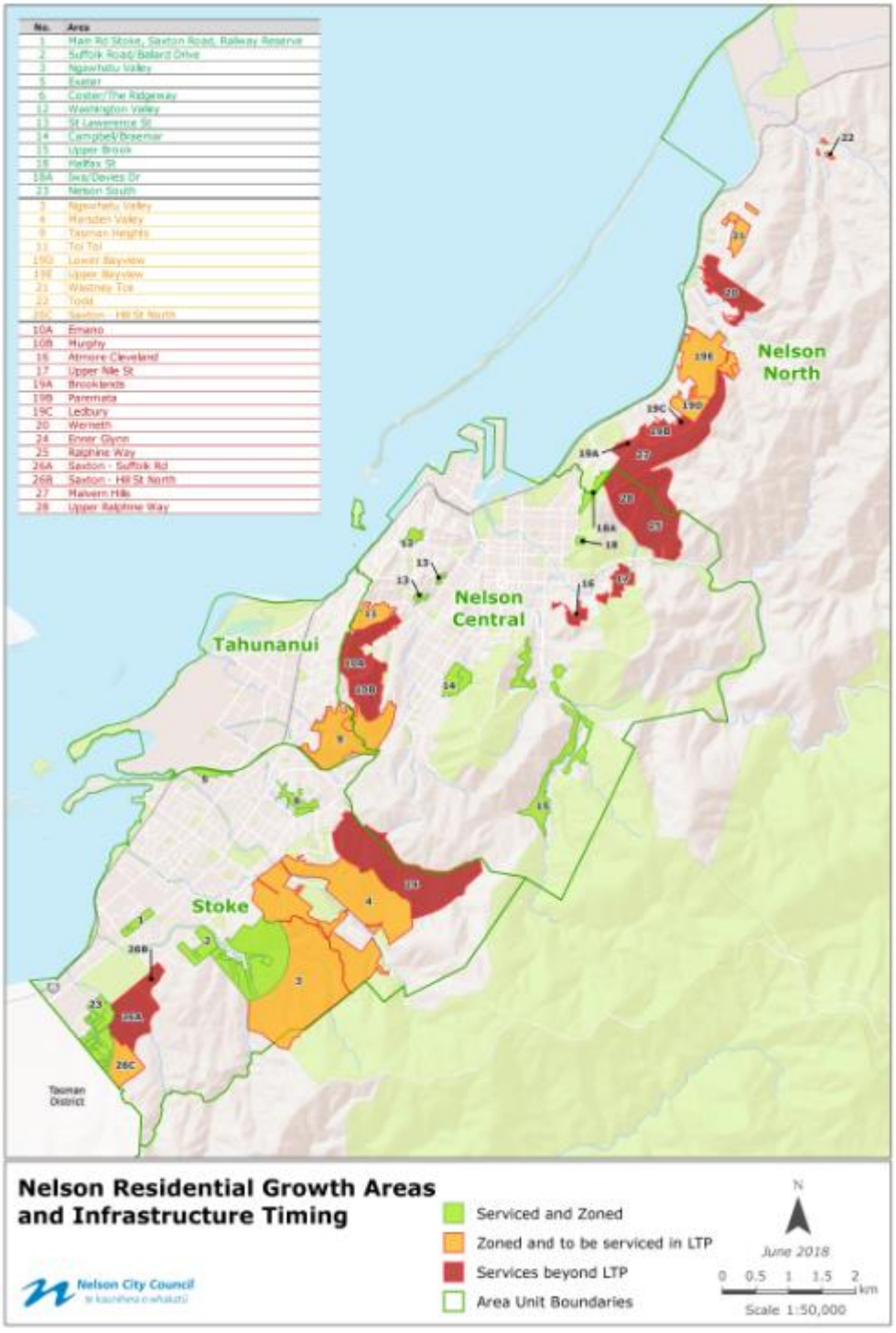
100 link from the 100 AC to the 150 CI in Waimea Road just south of the valve to be shut at Motueka Street

100 link from the 100 AC to the 150 CI in Waimea Road, south of Tukuka Street

100 link from the 100 AC to the 150 CI in Waimea Road, north of Boundary Road

APPENDIX I: INFRASTRUCTURE PLANNING PROCESS FOR GROWTH PROJECTS

Appendix Figure I-1: Growth Areas



APPENDIX J: 30 YEAR INFRASTRUCTURE STRATEGY 2015-45

The requirement for an infrastructure strategy arose from advice provided by Better Local Government programme advisory groups. The strategy is intended to improve local authorities' delivery of core infrastructure and management of physical assets. It should identify strategic issues facing the council and the future implications and is intended to add transparency for residents and ratepayers about these issues and their consequences.

The strategy is included in the LGA 2002 Amendment Act (2014).

This Asset Management Plan contains the information that would form the basis of the water utility section of an integrated strategy, in particular the following are addressed in the sub sections of the plan either directly or as areas that will require future work:

What level of infrastructure investment, if any, is necessary to provide for growth in the community. See section 3.2 -Demand Forecast and section 6.5- Capital Programme;

Managing the timing of investment for growth, to avoid constraints on growth from limited infrastructure capacity while minimising the costs to the community of underutilised infrastructure capacity. See section 3.2 -Demand Forecast and section 6.5- Capital Programme;

What level of investment is needed to maintain, renew and replace existing assets. See section 6.4-Renewal Strategy;

Balancing service level expectations with affordability in the context of demographic changes such as depopulation and aging. See section 2- Levels of Service;

What level of investment, if any, is needed to improve the level of service provided by those assets. See section 2- Levels of Service;

Planning for maintenance, growth and possible increases or decreases in levels of service provided. See section 2- Levels of Service, section 3- Future Demand, section 6.3 -Operations and Maintenance Plan;

Managing or improving public health and environmental outcomes, or mitigating adverse effects on them. See section 2 -Levels of Service;

Managing the risks to and resilience of, infrastructure assets from natural disasters. See section 4- Emergency and Risk Management;

Managing the financial provision for risks to infrastructure assets from natural disasters. See section 4- Emergency and Risk Management;

Indicative estimates of the projected operating expenditure and capital requirements for each year. See section 6.3- Operations and Maintenance Plan, section 6.4- Renewal Strategy, section 6.5 -Capital Programme;

Assumptions about service levels and asset lives on which the projections are based. See section 2- Levels of Service and section 6.2- Asset Valuation and Depreciation;

Assumptions involving significant uncertainty- the nature of that uncertainty and its potential impacts. See section 4- Emergency and Risk Management.

Appendix Table J-1: Water Supply Operation and Maintenance Projections Figures are in 2015 dollars and will be adjusted for inflation in each Annual Plan.

Year		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Long Term Plan		2015/25 LTP			2018/28 LTP			2021/31 LTP			2024/34 LTP			2027/37 LTP			2030/40 LTP			2033/43 LTP			2036/46 LTP			2039/49 LTP			2042/52 LTP		
O&M Expense	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35	2035/36	2036/37	2037/38	2038/39	2039/40	2040/41	2041/42	2042/43	2043/44	2044/45
Administration	2,760	1,650	2,109	1,694	1,659	1,649	1,679	1,649	1,650	1,649	1,660	2,830	2,830	2,830	2,830	2,830	2,830	2,830	2,830	2,830	2,830	2,830	2,830	2,830	2,830	2,830	2,830	2,830	2,830	2,830	2,830
Depreciation		3,996	4,010	4,021	4,032	4,041	4,050	4,082	4,137	4,169	4,187	4,187	4,187	4,187	4,187	4,187	4,187	4,187	4,187	4,187	4,187	4,187	4,187	4,187	4,187	4,187	4,187	4,187	4,187	4,187	4,187
Electricity	458	463	463	463	463	463	463	463	463	463	463	463	463	463	463	463	463	463	463	463	463	463	463	463	463	463	463	463	463	463	463
Water Treatment	1,479	1,600	1,600	1,600	1,600	1,600	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800
WTP Lagoon desludge											100																				
Physical Works – Programmed	204	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205
Physical Works – Reactive	2,080	2,070	2,070	2,070	2,070	2,070	2,070	2,070	2,070	2,070	2,070	2,300	2,300	2,332	2,300	2,300	2,332	2,300	2,300	2,332	2,300	2,300	2,332	2,300	2,300	2,332	2,300	2,300	2,332	2,300	2,300
Headworks	310	216	179	179	204	179	179	179	179	204	400	179	179	179	204	179	179	179	179	204	400	179	179	179	204	179	179	179	179	204	400
Roding Dam Gravel		50	50	5	200											50	50	50	250								50	50	50	250	
Fish Passage		20																													
PHRMP		30																													
Network Capacity - Growth		50	50																												
Back Flow mtce		20	30	40	50	60	70	80	90	100	110	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
Pressure/Flow Rate mtce		30	36	36	36	36	36	36	36	36	36	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Prelim CAPEX reviews		10	10	10	10	10	10	10	10	10	10																				
Natural Hazards Assessment		50	50																												
Water Loss Reduction Strategy		30	30	30	60	60	60	45	15	15	15																				
Total [a] ($,000s)		10,490	10,892	10,353	10,589	10,373	10,622	10,619	10,655	10,721	11,056	12,164	12,164	12,196	12,189	12,214	12,246	12,214	12,414	12,221	12,385	12,164	12,196	12,164	12,189	12,196	12,214	12,214	12,246	12,439	12,385

Appendix Table J-2: Water Supply Renewals Projections

Year		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Long Term Plan		2015/25 LTP			2018/28 LTP			2021/31 LTP			2024/34 LTP			2027/37 LTP			2030/40 LTP			2033/43 LTP			2036/46 LTP			2039/49 LTP			2042/52 LTP		
Renewals Project Area	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35	2035/36	2036/37	2037/38	2038/39	2039/40	2040/41	2041/42	2042/43	2043/44	2044/45
Pipeline	838	544	794	794	850	850	850	900	900	900	950	950	950	1000	1000	1000	1050	1050	1050	1100	1100	1100	1150	1150	1150	1200	1200	1200	1250	1250	1250

Waimea Road Renewal (Little Go Stream)		500																												
Pump Stations - Renewals		0	270	70	3	20	0	13	136	495	497	0	3	28	0	3	0	0	0	0	0	0	0	0	0	15	0	0	0	0
Headworks - renewals	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Reservoir Refurbishment Programme					50	50	50	50	50											50	50	50	50	50						
Residential Meters	50	100	100	500	1,000	1,000	500												1500	1500										
Commercial Meters	301	185	150	150	300	300	300	300	300	300											300	300	300	300	300	300	300	300	300	
Backflow Prevention Renewals												350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350
Water Treatment Plant Membrane Renewals	0	0	0	1,000	1,000	1,000	1,000	0	0	0	0	1,000	1,000	1,000	1,000	1,000	0	0	0	0	0	1,000	1,000	1,000	1,000	1,000	0	0	0	0
Water Treatment Plant Renewals		246	140	206	185	269	169	287																						
Maitai Resource Consent Renewal	80	200	200	200																					80	150	60	50		
Roding Resource Consent Renewal	80	200	200	200																					80	150	60	50		
Roding Pipeline		100	0	0	0	0	100	100	1,000	1,500	1,500																			
Scada		60	70																											
Total (a) ($,000s)	1,249	2,195	1,984	3,180	3,448	3,549	3,029	1,710	2,446	3,255	3,007	2,360	2,363	2,438	2,425	2,413	1,460	1,460	2,960	3,060	1,860	2,860	2,910	2,910	2,860	2,925	1,910	1,910	1,960	1,960	1,660

Appendix Table J-3: Water Supply Capital Expenditure Projections

Year		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Long Term Plan		2015/25 LTP			2018/28 LTP			2021/31 LTP			2024/34 LTP			2027/37 LTP			2030/40 LTP			2033/43 LTP			2036/46 LTP			2039/49 LTP			2042/52 LTP		
Capital Projects	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35	2035/36	2036/37	2037/38	2038/39	2039/40	2040/41	2041/42	2042/43	2043/44	2044/45
Malvern Hills - Atawhai Pump & Ridge Resvr	21	18						150																							

Atawhai #2 Reservoir		87	100	285				1,000	2,500																					
Atawhai Trunk Main					50	95		3,300																						
Backflow Prevention	375	150	150	150	150	150	150	150	150	150	150	200	200	200	200	200														
Maitai Pipeline (Dam-WTP)		2																												
Maitai Pipeline (WTP-Westbk Tce)	100	2,118	2,000																											
Maitai Planting	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Telemetry / control upgrades															100										100					
Pressure Enhancement						150	100					100																		
NCC - TDC Link												100	100	1,000	1,000	1,000														
DMA establishment		50	100	100																										
Water Loss Reduction Programme		200	200	200	200	200	200	200	200	200	200																			
Hira extension												150	1,000	1,000																
Future Growth Additional Storage																					100	100	500	2500	500	500	2,000			
Seismic Risk Upgrades		100	100	100																										
Water Treatment Plant Membranes	1,200	1,066																												
Natural Hazards Risk Assessment					100	100	100																100	250	250	250		1,000	1,000	1,000	1,000
Network Capacity Confirmation for Growth Areas						100	100	100				1,250					100	100	100	1,250						100	100	100	1,250	
Network Upgrades Nelson North															100	100	150	50	1,000	1,000	1,000									
Network Upgrades Nelson Central														100	100	100	1,500													
Network Upgrades Nelson South																						100	100	100	1,500					

Fire Flow Upgrades	100	100	100	200	200																									
Pipe Improvements/ Pressure Reduction	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	
Ridermains	155	75	75	75	155	155	155	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	
System Improvements & Misc Pipes & Fittings	60	60	60	60	60	60	60	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	
Water Treatment Plant Upgrades										150	500	500	500	500																
Dam Upgrades		0	0	0	0	0	0	100	100	100	100	0	100	0	500	500	500	500	150	500	500	500	500	0	0	0	0	0	0	0	
Total (a) ($,000s)	2,231	4,086	2,945	1,230	975	1070	925	5,165	3,115	765	1,115	2,465	2,065	2,965	2,165	2,065	2,315	815	1,415	1,765	3,015	865	1,365	3,015	2,515	1,075	2,565	1,385	1,365	2,415	1,010

APPENDIX K: RISK

Appendix Table K-1: Water Supply Risk Register

WATER RISK REGISTER	**Objectives** **Good quality water** **A reliable supply of water** **Acceptable water pressure** **Adequate flows of water** **A prompt response to reported network issues** **A network that protects the natural environment**	**Assessed by Phil Ruffell**

Identification			Analysis: Residual Risk					
Event Description	**Asset Group**	**Consequence**	**Existing Controls**	**Consequence**	**Likelihood**	**Current Risk Level**	**Response**	**Treatments**
POISON OR ORGANICS ACCIDENTAL SPILLAGE OR SABOTAGE	**INTAKES**	Worse case: significant loss of life	Caretaker on site. Regular inspection of intakes and visitors. Access to intakes controlled overnight by locking access road gate. Maintain vigilance	Extreme (5)	Rare (1)	Medium (5)	Accept	Increase vigilance. Ensure storage reservoirs are full. Control access to intakes
POISON OR ORGANICS ACCIDENTAL SPILLAGE OR SABOTAGE	**RETICULATION**	Worse case: significant loss of life	Reticulation under pressure deters casual sabotage. Access to network controlled through permit process. Maintain vigilance	Extreme (5)	Rare (1)	Medium (5)	Accept	Increase vigilance. Ensure storage reservoirs are full. Control access to intakes
MOVEMENT FAILURE CAUSED BY EARTHQUAKE, LANDSLIDE OR SETTLEMENT	**TREATMENT PLANT**	Worse case: water not available until temporary chlorination plant in place and temporary supply from TDC - 1 day to organise	Plant has been designed to a high standard. Regular inspection for likely problems. Temporary supply from TDC	Extreme (5)	Unlikely (2)	High (10)	Reduce	Purchase oddition portable chlorine dosing equipment. Improve supply options from TDC.

Identification			Analysis: Residual Risk					
Event Description	**Asset Group**	**Consequence**	**Existing Controls**	**Consequence**	**Likelihood**	**Current Risk Level**	**Response**	**Treatments**
MOVEMENT FAILURE CAUSED BY EARTHQUAKE, LANDSLIDE OR SETTLEMENT	**MAITAI PIPELINE**							
	Dam - Water Treatment Plant	Interrupt supply from old pipeline	Regular inspection to look for potential slips and possible rocks or logs that could fall. Cover pipe during logging. Duplicate pipelines from dam to WTP and WTP to Brook Street plus Roding supply.	Major (4)	Unlikely (2)	Medium (8)	Reduce	Construct "avalanche" shutter in known rockfall areas.
	Water Treatment Plant - City	Interrupt supply from old pipeline	Regular inspection to look for potential slips and possible rocks or logs that could fall. Cover pipe during logging. Duplicate pipelines from dam to WTP and WTP to Brook Street plus Roding supply.	Major (4)	Unlikely (2)	Medium (8)	Reduce	Construct "avalanche" shutter in known rockfall areas. Construct alternative main down Brook Valley Road.
MOVEMENT FAILURE CAUSED BY EARTHQUAKE, LANDSLIDE OR SETTLEMENT	**RODING PIPELINE**	Asset performance reduced	Regular inspection to look for potential slips and possible rocks or logs that could fall. Multiple raw water sources	Moderate (3)	Unlikely (2)	Medium (6)	Accept	Construct "avalanche" shutter in known risk areas.
MOVEMENT FAILURE CAUSED BY EARTHQUAKE, LANDSLIDE OR SETTLEMENT	**TRUNK MAINS**	Assed performance reduced	Fitting of seismic valves to water reservoirs to turn off water in event of earthquake. Multiple supply options as network inter-connected	Moderate (3)	Unlikely (2)	Medium (6)	Reduce	Ensure movement joints in network
MOVEMENT FAILURE CAUSED BY EARTHQUAKE, LANDSLIDE OR SETTLEMENT	**RESERVOIRS**	Asset performance reduced	Major reservoirs are designed for 1 in 1000 or 1 in 333 year earthquakes. Ensure seismic valves properly located, ensure construction details adequate.	Moderate (3)	Unlikely (2)	Medium (6)	Reduce	Multiple storage reservoirs. Network interconnection.

Identification			Analysis: Residual Risk				Response	Treatments
Event Description	Asset Group	Consequence	Existing Controls	Consequence	Likelihood	Current Risk Level		
FLOOD DAMAGE	**MAITAI PIPELINE**	Asset performance reduced	Maintain rockwork on riverbank. Keep pipeline full to reduce floatation.	Major (4)	Unlikely (2)	Medium (8)	Share	
FLOOD DAMAGE	**RODING PIPELINE**	Asset performance reduced	Maintain rockwork on riverbank. Keep pipeline full to reduce floatation.	Moderate (3)	Unlikely (2)	Medium (6)	Share	
BACKFLOW CONTAMINATION FROM PRIVATE PROPERTY	**RETICULATION**	Health/reputation damage	Backflow prevention devices incorporated into meter assembly	Moderate (3)	Rare (1)	Low (3)	Reduce	Replace dual check valves
BACKFLOW CONTAMINATION FROM INDUSTRY	**RETICULATION**	Health/reputation damage	Backflow prevention devices incorporated into meter assembly. Separate backflow devices for larger industries.	Major (4)	Rare (1)	Medium (4)	Reduce	Fit backflow preventors to all commercial and industrial premises.
DAMAGE FROM LIQUEFACTION (AT RISK AREAS PORT NELSON, TAHUNANUI/STOKE)	**RETICULATION**	Asset performance reduced		Extreme (5)	Rare (1)	Medium (5)	Reduce	Anchor chambers. New installations designed for seismic movement and liquifaction.
CLIMATE CHANGE/INCREASED RAINFALL/ RIVER INTENSITY AND FLOWS	**MAITAI DAM/ RESERVOIR**	Safety issue if dam spillway capacity inadequate	Dam designed for maximum probable precipitation	Major (4)	Rare (1)	Medium (4)	Reduce	Review design for climate change

Appendix Table K-2: Consequence Rating (Impact)

Rating	Safety	Health	Asset Performance/ Service Delivery	Environmental/ Historical/cultural	Financial	Political / Community/ Reputational	Relationship with Iwi	Legal compliance	Information/ decision support
Exterme (5)	Multiple fatalities of workers or public (MF)	Significant loss of life expectancy for multiple persons or incapacity for more than 1000 person days	Service not provided for more than 5000 person days	Permanent environmental damage on a nationally significant scale and/or permanent loss of nationally significant building, artwork, or other valued entity	Overspend, loss (i.e. spend without result) or income loss of > $5m OR >100% of business unit budget	Major loss of public confidence in Council (>2000 opponents via social media or other mediums) Negative international mainstream media coverage; shareholder or key stakeholder outage; or loss of a key customer	Major breakdown of relationship affecting multiple areas. Refusal to resolve without one or more major concessions from council	Litigation/ prosecution or civil action successful resulting in major (>50% of maximum available) fine/costs awarded and/or imprisonment of council officer.	Multiple errors in information and analysis and presentation misleading (intentionallly or not) or not understandable by non- specialists
Major (4)	Single fatality of workers or public (SF)	Single loss of life expectancy or incapacity for between 100 and 1000 person days	Service not provided for less than 5000 person days but more than 500 person days	Major environmental damage with long-term recovery requiring significant investment and/or loss or permanent damage to a registered historical, cultural or archaeological site or object	Overspend, loss (i.e. spend without result) or income loss of > $1m and <$5m OR between 70% and 100% of business unit budget	Significant negative public reaction likely (200-2000 opponents via social media or other mediums) Negative national mainstream media coverage; significant negative perception by shareholder or key stakeholder; or a customer disruption	Significant breakdown of relationship largely in in one area. Some concessions from council sought before substantive issue considered by iwi grouping affected	Litigation/ prosecution or civil action successful resulting in minor fine(<50% of max available)/ costs awarded.	One major error in information, analysis incomplete and presentation ambiguous
Moderate (3)	Notifiable injury of workers or public.	Incapacity for between 20 and 100 person days	Service not provided for less than 500 person days but more than 50 person days	Measurable environmental harm on a nationally significant scale. Some costs in terms of money and/or loss of public access or conservation value of the site and/or restorable damage to historical, cultural or archaeological site or object	Overspend, loss (i.e. spend without result) or income loss of > $0.5m and <$1m OR between 30% and 70% of business unit budget	Some negative public reaction likely (30-200 opponents via social media or other mediums) Repeated complaints; Regulatory notification; or negative stakeholder, local media attention	Major relationship damaged in a single area but amenable to negotiation	Documented Breach of legislation, no legal action or prosecution or civil action not successful.	Information correct but presentation/ analysis insufficient to support decision on the day
Minor (2)	Serious injury on one person requiring medical treatment (MA)	Incapacity for between 1 and 20 person days	Service not provided for less than 50 person days but more than 5 person days	Medium term environmental impact at a local level and/or development compromising the integrity of a registered historical, cultural or archaeological site	Overspend, loss (i.e. spend without result) or income loss of > $100k and <$500k OR between 10% and 30% of business unit budget	Minor public reaction likely (<30 active opponents via social media or other mediums) Workforce attention; limited external attention;	Relationship damage resolvable through normal communication/ consultation mechanisms	Formal warning of breach from legislative authority.	Information correct, analysis complete but presented in a way which could be misinterpreted
Insignificant (1)	Minor injury requiring only first aid or less (FA)	Incapacity for less than 1 person day	Service not provided for between 1 & 5 person days	Short term and temporary impact requiring no remedial action and/or restorable loss damage to historical/ cultural record	Overspend, loss (i.e. spend without result) or income loss of > $10k and <$100k OR between 5% and 10% of business unit budget	Very limited negative reaction (1 or 2 active opponents via social media or other mediums) Internal attention only from staff directly working on the matter.	Iwi/ tribe/ hapu public dissatisfaction resolvable through routine communication	Breach of minor legislation/ no legal action	Small errors in information or presentation - no effect on decision

Appendix Table K-3: Risk Matrix – Consequences x Likelihood

CONSEQUENCES					LIKELIHOOD of the given consequence occurring			
Insignificant(1)	Minor (2)	Moderate (3)	Major (4)	Extreme (5)	Descriptor	Qualitative guidance statement	Indicative Probability range %	Indicative frequency range (years)
Medium (5)	Medium (10)	High (15)	Very High (20)	Very High (25)	Almost certain (5)	The consequence can be expected in most circumstances OR *A very low level of confidence/information*	>90%	>1 occurrence per year
Medium (4)	Medium (8)	High (12)	High (16)	Very High (20)	Likely (4)	The consequence will quite commonly occur OR *A low level of confidence/information*	20% - 90%	Once per 1-5 years
Low (3)	Medium (6)	Medium (9)	High (12)	High (15)	Possible (3)	The consequence may occur occasionally *A moderate level of confidence/information*	10% - 20%	Once per 5-10 years
Very Low (2)	Low (4)	Medium (6)	Medium (8)	High (10)	Unlikely (2)	The consequence may occur only infrequently *A high level of confidence/information*	2% - 10%	Once per 10 - 50 years
Very Low (1)	Very Low (2)	Low (3)	Medium (4)	Medium (5)	Rare (1)	The consequence may occur only in exceptional circumstances *A very high level of confidence/information*	<2%	Less than once per 50 years

Appendix Table K-4: Residual Risk Tolerance

Risk Level	Description and Action	Authority for continued tolerance	Timing for implementing action	Obligation to promptly advise including advising treatments
Very High	Not normally tolerable, immediate intervention to reduce risk	Full Council on advice from CE	Immediate if possible but no more than one month	Full Council using best practicable means
High	Not normally tolerable, initiate action as soon as practicable to reduce risk below High	SLT or Group Manager (Council at CE discretion)	As soon as practicable but no more than 2 months	SLT or accountable Group Manager (Council at CE discretion)
Medium	Normally tolerable, frequently review to look for opportunities to further reduce risk where practicable	Business Unit Manager	At least within one quarter	Accountable Group Manager
Low	Acceptable risk, routine review for low cost actions to reduce risk further	No specific authority required	Routine review period (e.g. 3- 6 monthly)	None
Very Low	Acceptable risk, no specific actions to reduce further	No specific authority required	Only if incidental to another action	None

APPENDIX L: NELSON WATER TREATMENT PLANT ASSET MANAGEMENT PLAN (A1111654) (A717945)

Nelson City Council

Contract EC 2617
Tantragee Water Treatment Plant
& Transfer Pipeline Asset Mgt Plan

July 2004

Fulton Hogan Ltd MWH
Fulton Hogan MWH Joint Venture

Contract EC 2617
Tantragee Water Treatment Plant and Transfer Pipeline
Asset Management Plan

Contents

Status—AM Plan
Job Number—801/007700

Date—July 2004
Our Ref—amplan

Fulton Hogan Ltd MWH
Fulton Hogan MWH Joint Venture

1. Summary

This document presents the Asset Management Plan for the Tantragee Water Treatment Plant and Roding transfer pipeline system.

The purpose of the plan is to ensure optimal life-cycle use and cost of plant and equipment.

The Plan contains:

- Current and projected service standards to be met by the water treatment plant and Roding pump stations and pipelines.
- Asset Register
- Details of asset condition and performance
- Estimates of useful remaining life of the components of the plant and transfer pipeline system based on condition assessment.
- A maintenance management plan based on the concepts of reliability-centred maintenance.
- A prioritised 5-year component renewals programme based on asset condition and performance.

2. General

The Tantragee Water Treatment Plant and Roding Transfer Pipeline system are newly constructed assets of the Nelson City Council.

Details of these assets are described in the As-Built drawings, and the Operations & Maintenance Manual.

3. Asset Register

Roding Transfer Pipeline:

- Roding Break tank (downstream of tunnel)
- Roding raw water pump station
- Roding raw water pipeline
- Roding raw water saddle tank
- Roding clear water pump station
- Roding clear water pipeline
- Roding clear water saddle tank

Tantragee Water Treatment Plant:

- Building
- CWS tank
- Exterior pipework
- Landscape and road surfaces within fenced enclosure
- Water treatment system within building
- Lagoons, pipes and pump station
- Maitai clear water return pipe

For details of each component reference should be made to the Operations and Maintenance (O&M) manual.

4. Asset Condition and Performance Standard

All assets are new at end of Construction 2nd August 2004.

Performances standards are:

CONDITION	Roding to Tantragee Pump Station/Pipeline Ml/d	Minimum Plant Capacity Ml/d	Tantragee to Roding Pump Station/Pipeline
Initial (to 2008)			
1) Normal Maximum	16 (net through plant)	42	16
2) Emergency	22 (gross)	N/A	N/A
Future (to 2030)			
1) Normal Maximum	16 (net through plant)	52	16
2) Emergency	22 (gross)	N/A	N/A

The initial standards are met by the current assets.
The Future standards require the purchase and installation of equipment for the 5th membrane "train".
Other assets have been sized to provide the required future performance.

4.1 Service Standards

4.1.1 Buildings and structures

Buildings and structures will generally provide service for 50 years. This will be achieved following on-going inspection and periodic maintenance.

4.1.2 Pipelines and Mechanical Plant

Pipelines and pumps will generally provide service for 20 years. This will be achieved following on-going inspection and periodic maintenance.

4.1.3 Electrical Equipment

Electrical equipment will generally provide service for 15 years. This will be achieved following on-going inspection and periodic maintenance.

4.1.4 Controls

Controls will generally provide service for 10 years. This will be achieved by observation during use and prompt attendance to any issues that arise.

5. Remaining Useful Life

The assets are made up of a large number of components.
For details of each component reference should be made to the Operations and Maintenance (O&M) manual.

An Excel spreadsheet of all items of equipment is held electronically at the Water Treatment Plant and in hard copy within the O&M manual.

During the operations phase of the Water Treatment Plant by the Joint Venture, the operator will enter an estimate of the remaining life of each component onto the equipment list spreadsheet.

6. Maintenance Management Plan

The maintenance of the assets will be focussed on ensuring that performance standards are reliably met. Components critical to achieving the required performance are to be maintained as a priority.

During the Operations phase of the WTP by the Joint Venture, the operator will update and manage a maintenance plan.

The maintenance plan will form part of the O&M manual, and be drawn from vendor data on each item.

7. 5-year Renewals Programme

During the Operations phase of the WTP by the Joint Venture, the operator will identify a prioritised 5-year component renewals programme.

This will be entered as a column on the Equipment List.

The operator will use the above mentioned estimate of the remaining life of each component to predict required renewals.

WTP Renewals schedule from contractor March 2015

This schedule will be incorporated into the Annual Plan 2016/17

March 2015

NWTP 10 year renewals schedule

Finacial year	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25
Analysers	130	128	0	0	0	0	0	0	0	0
Blowers	5	9	3	0	0	0	0	398	541	591
CIP Dosing	0	0	0	4	0	0	0	0	55	0
CIP System	25	4	2	0	0	0	0	0	64	0
Ferric Dosing	0	0	0	0	0	0	0	0	54	0
Lower Level	8	0	0	0	0	0	0	98	122	106
Rej & Sup	23	0	0	18	0	0	0	0	110	0
CW PH	1	128	70	20	15	0	0	60	93	67
RW PH	34	83	25	30	0	9	0	0	0	0
Soda Ash	18	0	0	29	0	0	2	2	66	0
Cl2	5	0	0	60	0	0	0	0	71	0
Switch Room	85	0	0	10	13	0	0	0	41	0
Tanks	40	22	0	4	0	0	0	0	120	0
Total ($x1000)	**374**	**374**	**100**	**175**	**28**	**9**	**2**	**556**	**1337**	**764**

Note: This does not include:
Replacement of membrane cassettes
Some electrical and electronic components - see 'Switchboard' sheet attached.
Building Maintanance

Cost based on 5% inflation compounding on 2004 values (indicated in the 'Total' column of the attached sheets)

APPENDIX M: SOLUTIONS TO FIRE FLOW LEVEL OF SERVICE (A706990)

Solutions to Breaches of Fire Flow Level of Service

Champion Tce: 22 properties affected

Create a connection between the 350 main and the 100 main either at 66 or 49 Bisley Ave. This fixes the issue for 21 properties. 8 Bisley Ave is 145m from the nearest hydrant (should be 135m). This can be fixed by shifting the hydrant to the corner by 10 Bisley (but probably not worth it). Bisley Avenue solution likely to require upgrading 40mm rider main to 150dia main to support hydrant flows. Programme in for future AMPlan 2018/19. PR 15/12/2014.

Moncrieff Ave: 10 properties affected

Renew 262m of 100 cast iron main with 100 PVC from the start of Moncrieff Ave to 25 Moncrieff Ave.

Montcalm St: 8 properties affected

Renew 100m of 100 cast iron main from 47 Wolfe St north to the walkway between 31 and 37 Wolfe St. Lay 50m of 100 main up the walkway with a hydrant at the end. This fixes fire flows for 5 properties: 30, 32, 34, 37 and 39 Montcalm St.

Remaining 3 properties: 68Arrow St has no house on it (owned by same owners as 70 Arrow St). 70 Arrow St is 186m from the hydrant at the end of Arrow St. 50 Arrow St also fails. To fix these, renew 620m of 100 CI from Washington Rd, up arrow St, down walkway to Quebec Rd and to end of Arrow St. Extend another 40m to the very end of Arrow St and put on a hydrant and then it will get to within 146m of 70 Arrow St house and fix 50 Arrow St.

Brooklands Rd: 47 properties affected

Renew 480m of 100 AC with 150 main from Atawhai Dr to 54 Brooklands Rd.

Strathaven Pl: 20 properties affected

Note that 27, 31, 35, 39, 40 and 43 Strahaven Pl have C0689 (Non Compliance Fire Service) condition so are not included. Replace 123m of 50 HDPE with 100 main from Strathaven tanks down to where it meets the 150 main. Also put a new hydrant on the high side of the NRV outside 17 Strathaven Pl. Now only 1 property – 34 Strathaven Pl fails.

Tui Glen / Matuku Pl: 31 properties affected

Either put a new 135m 100 dia link down Kereru Way or replace 194m of 100 AC in Tui Glen Rd from Atawhai Dr to Matuku Pl with 150 main (excluding the 42 length which is already 100 PVC).

Hazells Way: 5 properties affected

Replace the first 50m of 40 dia main in Manchester Way with 50 dia main and put a hydrant in at the corner.

Norwest Way / Seawatch Way: 4 properties affected

Note there are 2 fire hydrants on tanks in Seawatch Way to cover the top 6 houses in Seawatch Way. However 10 and 15 Seawatch Way are not adequately covered by these (not within 135m). These are not included in this evaluation as we cannot fix them with reticulation.

Would have to have a pump to fix these as the top hydrant (which still 142m from the furthest house) is not 10m below the tanks.

Chamboard Pl: 3 properties affected

A new hydrant outside the property boundary of 5 and 7 Chamboard Pl at the 89.5m contour will deliver 25l/s and is within 135m of the 3 properties. Note this is only 15m from the existing hydrant so not sure if it's worth it. Install new hydrant outside No7, halfway between existing hydrants.

Princes Dr: 4 properties affected

These are within 10m elevation of Observatory reservoir so pumping would be required.

Point Rd: 4 properties affected

These properties are located near the portion of Point Rd which is subject to high tide so no easy solution.

Orakei St: 4 properties affected

Replace 258m of 100 AC with 100 PVC.

20a Matipo Tce: 1 property affected

The driveway to this house is 200m on its own – would need a dedicated fire main.

Atmore Tce: 6 properties affected

Putting a new hydrant at the 129m contour and 66m of 150 main leading down to it from the tank (new and replace existing 100 dia) gets 25 l/s which fixes 4 properties. 46 Atmore is too far away so would require a pump.

City Heights: 2 properties affected

Need a new hydrant 20m on from the last hydrant (connected by 100 dia main) so that 7 City Heights is within 135m. Also need to replace 100m of 100 dia with 150 dia main from Cleveland Tce to City Heights.

Cherry Ave: 4 properties affected

The Stoke pressure reduction scenario had Baigent Rd from The Ridgeway to Cherry Ave being upgraded to 150 and Cherry Ave being renewed in 100 PVC to fix this.

Willow Ave: 2 properties affected

Upgrade 128m of 100 main to 150 in Ranui Rd from Main Rd to Willow Ave. Upgrade 80m of 100 main to 100 PVC in WilloW Ave from Ranui Rd to the first hydrant.

17B Titoki St

Nearest hydrant is 20m too far away. Need new hydrant outside 17 Titoki.

Mount Street /Konini Street Link

Currently Konini St water is served by a single dead-end main from Gloucester St, at higher pressure. As part of the wider pressure reduction programme it is proposed to reduce the pressure in Konini Street. This will adversely impact on fire flows. This can be resolved by the connection of the Konini St main to the Mount Street water main. This allows for flow to be provided from a ring main.

Properties Needing Further Investigation

10 and 15 Seawatch Way

5 and 5A Te Ata Pl

6 Ngapua Pl

12 Naumai St

9 and 13 Werneth Ridge

49, 51, 53, 55, 56, 58, 60 St Lawrence St

1998 Residents' Survey

In November 1998 AC Nielsen carried out a residents' survey on behalf of the Nelson City Council.

Of the Council's 14 significant activity areas, residents:

- Were least satisfied with the water supply;
- Rated water supply the most important activity area in contributing to quality of life of Nelson residents.

2001 Residents' Survey

In September 2001 AC Nielsen carried out a residents' survey on behalf of the Nelson City Council. Of the Council's 14 significant activity areas, residents again:

- Were least satisfied with the water supply;
- Rated water supply the most important activity area in contributing to quality of life of Nelson residents.

2004 Residents' Survey

In November 2004 AC Nielsen carried out a residents' survey on behalf of the Nelson City Council. This survey was carried out some three months after the opening of the Tantragee Water Treatment Plant.

Of the Council's 14 significant activity areas, residents:

- Rated water supply as the most important activity area contributing to the quality of life for Nelson Residents;
- Were most satisfied with the water supply and gave it a similar satisfaction to parks and open spaces.

Issues identified within Water Supply were:

- Having a permanent, continuous and reliable supply;
- Quality of water, both from taste and health perspective;
- A fair and affordable cost.

2007 Residents' Survey

In August 2007 the Neilson Company carried out a residents' survey on behalf of the Nelson City Council.

Of the Council's 14 significant areas, residents:

- Again rated water supply as the most important activity area contributing to quality of life for Nelson Residents;
- Rated water supply second only to Parks and Open Spaces for satisfaction.

Issues identified within water supply were:

- Cost of the Water Treatment Plant/Cost of water too high;

- Adequate and continuous supply necessary;
- Water quality is a necessity of life and health.

2010 Residents' Survey

In June and July 2010 the Key Research carried out a residents' survey on behalf of the Nelson City Council.

Of the Council's 14 significant areas, residents:

- Perceived water supply as the most important area for Council to focus on;
- Satisfaction is high with regard to water supply with respondents rating this second highest after parks and open space with 73% responding as satisfied or very satisfied.

Issues identified within water supply were:

- Cost of water;
- Quality of water – in terms of taste and smell;
- Security of supply and water pressure.

2011 Residents' Survey

In May 2011 ~~the~~ Key Research carried out a residents' survey on behalf of the Nelson City Council.

Of the Council's 14 significant areas, residents:

- Perceived water supply as the most important area for Council to focus on;
- Satisfaction remained high with regard to water supply with respondents rating this fourth highest with 70% responding as satisfied or very satisfied.

Issues identified within water supply were:

- Cost of water
- Quality of water – in terms of taste

Appendix Table M-1: Maitai Pipeline (over next five years)

Location	Work Done			Work to be Done		
	Support Blocks	Painting	Repairs	Support Blocks	Painting	Repairs
Fiddlers Elbow Syphon		2012/15				
River arch span West abutment (true right) East abutment (true left)	 1991 2000	2012/15				
Motor Camp Syphon River arch span West abutment (true left) East abutment (true right)	Investigate 2011 1995	2012/15 1980 1996				TBA
Andrews Farm Syphon						

Location	Work Done			Work to be Done		
	Support Blocks	Painting	Repairs	Support Blocks	Painting	Repairs
East abutment West abutment		1993 1993		To be abandoned when repairs not viable To be abandoned when repairs not viable		
Brook Street Falling Main				To be abandoned when repairs not viable		
Surge Towers and Valve Specials			2001/02			
Tunnel Repairs			1994			
Concrete Pipe Crack Repairs			1996			ongoing
Rockfall Protection						

Appendix Table M-2: Damwatch Engineering Maitai Dam 2013 Comprehensive Safety Review recommendations:

No.	Recommendation	Report Ref.	Priority
1	It is recommended the flood inundation maps include tables of flood travel times and depths.	2.3	B
2	It is recommended documentation of the PIC assessment based on the updated inundation mapping be prepared to fulfil requirements of the Dam Safety Scheme.	2.4	C
3	It is recommended the as-built drawing of the new pipework be included in the drawing record for Maitai Dam.	3.9	D
4	It is recommended a site specific seismic risk study be performed for Maitai Dam.	4.2.3	B
5	It is recommended potential failure modes for Maitai Dam be developed.	5.0	B
6	It is recommended a characteristic model of Maitai Dam be developed for interpretation of surveillance information.	5.0	C
7	It is recommended the rusted pipework be cleaned and repainted.	6.1	C
8	It is recommended that seepage emerging adjacent to the culvert be monitored with documentation on its development.	6.1	A
9	It is recommended the repairs are made to ensure a smooth finish on the chute floor of the service spillway.	6.1	C
10	It is recommended the spillway chute walls be cleared of trees and bushes to facilitate inspection and prevent damage to the wall from root growth.	6.1	C
11	It is recommended that as-built location and installation details for B23 and B27 be confirmed and indicated on a drawing for the purpose of ongoing data evaluation.	7.3.2	B
12a	It is recommended that the purported water pressure in the upper embankment downstream of the chimney drain be thoroughly investigated and resolved. This should include an assessment of the reliability of the instruments and measured data, and consideration given to supplementary monitoring in this location.	7.3.2	A
12b	It is recommended all piezometer gauges should be calibrated to be accurate in their respective normal reading ranges.	7.3.2	B

No.	Recommendation	Report Ref.	Priority
13	It is recommended that piezometer de-airing operations continue at a frequency appropriate to observed accumulation of air in their data plots.	7.3.2	C
14	It is recommended that bottom of hole reduced levels be established for SB1-3 and BH7 to support ongoing data evaluation.	7.3.2	C
15	It is recommended the right exit area drain be checked for damage or blockage in regards to the new seepage observed (ref: Rec-08).	7.3.3	A
16	It is recommended that the spillway drainage system be assessed for condition and performance, and flushed to maintain functionality, as far as is practicable.	7.3.4	C
17(a)	It is recommended that Maitai Dam survey data be consolidated into a full and continuous historical record, managed in one repository, and that an appropriate suite of time-series and spatial plots be developed to allow evaluation.	7.4	C
17(b)	It is recommended that the dam survey mark locations and movement vectors be plotted onto the as-built valley cross sections so that deformations can be evaluated in the context of foundation geometry.	7.4	C
18	It is also recommended that inspection, monitoring and evaluation requirements be reviewed and updated with consideration of the dam's potential failure modes.	7.5	B
19	It is recommended that monthly routine surveillance data is evaluated at the same monthly frequency by a dam safety engineer.	7.5	B
20	It is recommended that NCC dam surveillance data management arrangements be reviewed by an appropriate advisor and improvements made to ensure quality assurance and security of data. Data presentation methods should also be reviewed and improvements implemented to ensure that surveillance evaluation is continuous and effective.	7.5	B
21	It is recommended inspection of the upstream slope area of the auxiliary spillway be performed following unusual high reservoir levels.	8.2.2	C
22	It is recommended that a full slope stability analysis be performed for Maitai Dam following verification of piezometric conditions within the embankment.	8.3.1	B
23	It is recommended assessment of seismic-induced deformations (settlement and cracking) be performed as part of the slope stability analysis of Maitai Dam following development of ground motions from the site specific seismic risk study.	8.3.1	B
24	It is recommended the potential for internal erosion as a result of seismic induced cracking be assessed at Maitai Dam.	8.3.1	B
25	It is recommended an assessment of potential internal erosion be performed for Maitai Dam embankment materials using current methods of practice.	8.3.2	B
26	It is recommended the risks associated with internal erosion and potential overtopping of the crest be assessed for Maitai Dam.	8.3.2	B
27	It is recommended that the performance characteristics of the Maitai Dam scour offtake are understood for the purpose of emergency dam dewatering.	8.5	B

No.	Recommendation	Report Ref.	Priority
28	It is recommended that procedures for ongoing surveillance activities be formalised, including a process to ensure evaluation, quality assurance and follow up of routine monthly surveillance data collected.	9.3.3	B
29	It is recommended that procedures for the investigation, assessment and resolution of dam safety deficiencies be formalised.	9.3.3	B
30	It is recommended that Maitai Dam appurtenant structures and gates and valves that contribute to reservoir safety be formally identified and testing arrangements made.	9.3.3	B
31	It is recommended that the Maitai Dam Emergency Action Plan is completed, that NCC staff and emergency agencies become highly familiar with it, and that it is tested for effectiveness and areas identified for improvement addressed.	9.3.3	A

Appendix Table M-3: Total Monthly Demand

Month	2008 - 2009		2009 - 2010		2010 - 2011		2011 - 2012		2012 - 2013		2013 - 2014		2014 - 2015		2015 - 2016		2016 - 2017		2017 - 2018	
	Maitai (000m3)	Roding (000m3)	Maitai (000m3)	Roding (000m3)	Maitai (000m3)	Roding (000m3)	Maitai (000m3)	Roding (000m3)	Maitai (000m3)	Roding (000m3)	Maitai (000m3)	Roding (000m3)	Maitai (000m3)	Roding (000m3)	Maitai (000m3)	Roding (000m3)	Maitai (000m3)	Roding (000m3)	Maitai (000m3)	Roding (000m3)
July	420	204	315	280	NA	NA	268	313	309	277	336	239	330	199	328	202	292	243	479	66
Aug	319	298	381	220	NA	NA	286	315	444	140	367	212	299	237	291	228	309	237	496	63
Sept	361	238	485	69	359	208	291	316	353	200	330	226	324	201	331	197	297	238	477	62
Oct	323	299	364	256	348	252	318	258	394	196	403	172	300	288	344	237	391	151	513	74
Nov	423	182	382	322	356	344	346	278	398	288	355	286	434	260	358	275	346	217	557	108
Dec	447	179	435	306	413	252	441	194	429	300	421	273	480	170	426	252	385	233	579	202
Jan	444	322	458	281	410	278	425	278	487	238	443	241	405	346	536	100	384	281	534	109
Feb	345	330	403	307	348	330	325	331	376	271	361	309	451	171	455	201	341	278	387	80
Mar	439	246	456	313	385	267	409	214	393	281	458	225	490	130	359	296	416	230	531	93
Apr	381	247	483	208	398	178	319	268	365	195	418	173	356	201	569	11	492	72		
May	465	108	421	218	467	82	328	267	389	195	298	248	278	260	528	40	492	74		
June	329	255	412	197	349	209	363	189	385	153	318	211	301	212	374	151	482	68		
Sub-Total	4,696	2,908	4,995	2,977	NA	NA	4,119	3,221	4,722	2,734	4,508	2,815	4,448	2,675	4,899	2,190	4,627	2,322	4,533	857
Total ($000m^3$)	7,604		7,972		7,188		7,340		7,456		7,323		7,123		7,089		6,949		5,410	

Appendix Table M-4: Historical Asset Valuations

Asset Category	June 2012				June 2010			
	Quantity	RV	DRV	Depr	Quantity	RV	DRV	Depr
	km/units/ Ha	($)	($)	($)	km/units /Ha	($)	($)	($)
Reticulation High Pressure	107.5	26,732,483	13,502,374	362,648	110.6	25,674,272	12,773,447	347,925
Reticulation Low Pressure	212.6	46,678,091	26,284,959	562,149	211.7	43,133,775	24,479,987	521,883
Trunk Mains	36.8	16,898,455	9,539,672	218,788	37.2	16,125,114	9,400,533	209,401
Maitai Pipeline	9.2	16,392,075	3,717,038	258,490	9.2	17,091,425	4,391,315	272,745
Roding Pipeline	5.7	2,995,194	345,842	37,313	5.7	2,826,891	237,321	37,481
Maitai Water Supply Scheme		19,114,600	14,328,400	208,000		19,114,600	14,328,400	208,000
Roding Dam		2,586,200	1,000,400	43,100		2,586,200	1,000,400	43,100
Treatment Plant		24,779,752	14,215,696	1,198,337		21,888,693	15,672,048	1,130,507
Tunnels	3	10,595,700	9,515,000	50,700	3	10,595,700	9,515,000	50,700
Reservoirs and Tanks	37	11,550,683	9,438,174	145,972	36	9,766,108	7,759,414	128,348
Pump Stations	9	2,262,029	1,315,266	100,538	9	2,097,315	1,384,325	96,140
Pressure Reducing Valves	33	400,870	229,124	11,041	28	315,763	172,995	8,684
Air & Non Return Valves	123	293,225	169,544	8,060	117	263,157	159,341	7,249
Gate Valves	3,249	7,463,915	4,575,426	94,590	3,174	5,472,591	3,283,611	69,304
Manholes	94	343,359	198,440	4,548	93	320,519	191,683	4,215
Hydrants	2,459	5,630,557	2,846,438	71,635	2,450	4,523,400	2,298,685	57,584
Meters	20,122	2,931,042	746,134	173,540	19,851	2,729,116	931,395	166,786
Customer Connections	20,122	25,725,659	15,528,564	321,571	19,851	21,948,103	13,919,568	274,351
TOTAL		223,373,890	127,496,493	3,871,021		206,472,741	121,899,468	3,634,402