WAIMAKARIRI
DISTRICT COUNCIL

Activity Management Plan 2021

Kaiapoi Wastewater Scheme

3 Waters | July 2021

Prepared by

Waimakariri District Council

215 High Street,

Private Bag 1005

Rangiora 7440,

New Zealand

waimakariri.govt.nz

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Document Acceptance

Action	Name		Signed	Date
Prepared by	Gavin Hutchison	Wastewater Asset Manager		17/02/2021
	Simon Collin	Infrastructure Strategy Manager		17/02/2021
	Chris Bacon	Network Planning Team Leader		17/02/2021
Reviewed by	Kalley Simpson	3 Waters Manager		17/02/2021
Approved by	Gerard Cleary	Manager Utilities and Roading		17/02/2021
Adopted by	Council			

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1 Executive Summary

The following table provides a summary of the key asset management issues of the Kaiapoi Wastewater Scheme identified through consideration of the levels of service, consents, asset condition, risk analysis, disaster resilience, growth projections, and capacity assessment:

Table 1: Key Asset Management Components

Resource Consents	The overall Eastern Districts Sewer Scheme is operating well and is generally compliant with the resource consent conditions.
Levels of Service	Based on recent modelling of the Kaiapoi catchment the levels of service for overflows are not currently being met. Inflow and Infiltration investigations are being undertaken in constrained catchments. These investigations will be completed in 2022 after which options will be selected that will reduce overflows to meet the LOS.
Capacity and performance	Modelling has shown that a number of catchments do not have capacity for the peak wet weather flow in a two year event. Investigations and selection of options will be completed in 2021/22. Capital works are planned to begin in 2025/26 to reduce Inflow and Infiltration, and improve capacity.
Asset Condition	While assets in recently developed areas are in generally good condition, reticulation assets in the older parts of the town are only moderate. The CCTV programme will continue to inform renewals priority, and the planned modelling and network upgrade will need to take overall asset condition into account.
Risk Assessment	The Risk Assessment identified the principal risks associated with the scheme are the insufficient reticulation capacity and poor condition of some catchments. These result in occasional blockages which will be addressed through a combination of renewals and mains cleaning.
	The Risk Assessment also identified the vulnerability of pipe joints during a large earthquake.
Disaster Resilience	The Disaster Resilience Assessment indicated that most of the scheme pump stations are vulnerable in an earthquake.
	It also identified the Kaiapoi Wastewater Treatment Plant, and the Treatment Plant outfall pump station will be vulnerable in flooding, earthquakes, tsunami (extreme hazard), wildfire and to public sabotage.
	The scheme has many kilometres of mains vulnerable to liquefaction.
	Options to reduce extreme and high seismic risks to the scheme need to be further investigated, including aligning the DRA and risk assessment methodology to verify the highest priority improvements.
Growth Projections	The scheme is predicted to increase by approximately 82% over the next 50 years. Upgrades of the system will be required to accommodate this growth.

2 Introduction

The purpose of this Activity Management Plan (AMP) is to outline the significant issues associated with the Council's assets and to show how the Council proposes to manage the schemes in the future.

This plan summarises the various components of the Kaiapoi Wastewater Scheme, its condition and performance, and identifies future funding requirements including upgrades where necessary.

The data that has been relied upon to produce this document was taken at the end of the 19/20 financial year. i.e. 30 June 2020 . More up to date scheme statistics are available on document TRIM 121108078891 which is to be updated quarterly.

Further details of the asset management practices used by Council to manage this scheme are summarised in the District Wastewater AMP Overview document.

Projects identified to improve asset management processes for this scheme will also benefit the performance of other 3 waters schemes and are managed at a District level for efficiency.

Projects are also identified within this AMP that will maintain or improve levels of service.

Repair of wastewater supply asset damage from the Canterbury earthquake sequence is complete. No significant legacy effects are expected. As previously "red zoned" areas are redeveloped, new infrastructure appropriate to the new land uses will be built where required.

All figures within this AMP exclude inflation.

3 Related Documents

The following related documents have been used as reference documents or for guidance in the development of some of the sections in this Activity Management Plan

- Waimakariri District Plan
- Population in the Waimakariri District (TRIM 170328030077)
- New Projections for LTP 2021-2031 (TRIM 200908117997
- WDC Asset Management Policy (TRIM 180605062091)
- 2019 Customer satisfaction Survey (TRIM 200313034937)
- Development Contributions Policy 2021/22 (TRIM 200729095963)
- Kaiapoi Sewer Model System Performance Analysis Report 2018 (TRIM 190606080238)

4 Scheme Description (What Do We Have?)

The Kaiapoi Wastewater Scheme is part of the Eastern Districts Sewerage Scheme (EDSS). It is mainly an urban gravity reticulation scheme that consists of a series of inter-linked pumped catchments. The sewage is conveyed via a network of gravity pipes to a number of pump stations, before being pumped to the Kaiapoi Wastewater Treatment Plant at Ferry Road. The new Beach Grove development has a pressure sewer service that is pumped directly to the treatment plant.

The Kaiapoi sewer reticulation is a mixture of relatively shallow (1 metre) and deep (3 to 4 metres) mains. Kaiapoi is a very low lying community with high groundwater tables, especially during winter months.

The Kaiapoi Wastewater Treatment Plant consists of an automatic step screen to remove large solid particles and an aeration basin with four mechanical aerators to reduce the organic load. This is followed by two 4 hectare facultative oxidation ponds operated in parallel. The treated effluent then passes through a 22 hectare infiltration wetland and 2.5 hectare planted wetland.

A schematic view of the treatment system is presented on the following page. Refer to the Eastern Districts Sewer Scheme AMP for a plan of how the Kaiapoi system fits within the overall scheme.

The Rangiora treated effluent also enters the infiltration wetland and is mixed with Kaiapoi's effluent before passing through a 2.5 hectare planted wetland prior to being pumped to the ocean outfall.

A UV disinfection system is available for times when the bacteria levels in the treated effluent are elevated, such as during summer when warmer temperatures increase the bacteria levels leaving the treatment plant.

The reticulation within the Kaiapoi sewer system suffered significant damage during the September 2010 earthquake, which has now been repaired.

Some key statistics (2019/20 year) of the scheme are shown in Table 2 to 6. The extent of the currently serviced area and comprehensive flow data records are presented in Figure 14 and Figure 15.

A schematic view of the treatment system is presented in Figure 1, and a schematic of the network is shown in Figure 2. Refer to the Eastern Districts Sewer Scheme AMP for a plan of how the Rangiora system fits within the overall scheme.

Table 2: Scheme Statistics for 2019/2020

Scheme Parameter	Statistics	Source
Type of Supply	Urban Gravity	
Treatment	Aeration basin, Oxidation ponds, wetland and UV disinfection	
Length of Reticulation	78.4 km	Wastewater Asset Valuation Tables 8-5 and 8-6, pages 59 to 62
Total Replacement Value	$106,850,403	
Depreciated Replacement Value	$80,408,750	
Number of Connections	4,977	2019/20 Rating Query
Number of Rating Charges	5,810	
Average Daily Flow (5 year average)	4,031 m3/day	Flow Data Analysis – Sewer
Average Daily Flow / Connection (5 year average)	857 l/day/con	
Peak Daily Flow (5 year average)	14,393 m3/day	
Peak Daily Flow / Connection (5 year average)	3,036 l/day/con	

Table 3: Wastewater Gravity Pipe Data Summary

Wastewater Gravity pipe length (m) by diameter and pipe material												
Pipe Material	**Pipe Diameter (mm)**											
	50	**100**	**150**	**200**	**225**	**250**	**300**	**375**	**400**	**450**	**>600**	**Total**
Asbestos cement	0m	10m	1,130m	39m	144m	0m	17m	0m	0m	0m	0m	1,339m
Concrete	0m	116m	13,720m	0m	755m	0m	425m	0m	0m	0m	0m	15,016m
Earthenware	0m	248m	0m	0m	0m	0m	0m	0m	0m	0m	0m	248m
Polyethylene	182m	0m	4m	61m	0m	7m	12m	3m	0m	0m	0m	269m
Polyvinylchloride	0m	82m	29,604m	632m	1,527m	247m	5m	497m	0m	11m	72m	32,676m
Other	0m	0m	3,424m	0m	110m	0m	111m	0m	0m	0m	16m	3,660m
Total	**182m**	**456m**	**47,881m**	**732m**	**2,536m**	**254m**	**569m**	**500m**	**0m**	**11m**	**88m**	**53,208m**

Table 4: Wastewater Pressure Pipe Data Summary

Wastewater Pressure pipe length (m) by diameter and pipe material										
Pipe Material	**Pipe Diameter (mm)**									
	50	**100**	**150**	**200**	**250**	**300**	**375**	**450**	**710**	**Total**
Asbestos cement	0m	344m	428m	0m	269m	10m	0m	0m	0m	1,051m
Polyethylene	3,500m	1,561m	2,565m	3,169m	1,958m	410m	0m	2,183m	14m	15,361m
Polyvinylchloride	0m	9m	4,735m	997m	0m	553m	1,882m	0m	0m	8,176m
Other	0m	3m	13m	0m	0m	18m	42m	0m	0m	76m
Total	**3,500m**	**1,917m**	**7,741m**	**4,167m**	**2,228m**	**992m**	**1,924m**	**2,183m**	**14m**	**24,664m**

Table 5: Wastewater Manhole Data Summary

Wastewater Manholes	
Diameter (mm)	**Count**
900	344
1050	674
1200	2
1500	3
>1500	2
Total	**1025**

Table 6: Wastewater Valve Summary

Wastewater Valves	
Diameter (mm)	**Count**
50	87
100	25
150	27
200	11
250	6
300	11
375	11
450	1
600	2
Total	**181**

Table 7: Data References

Data Reference	Trim Reference
Flow Data Analysis – Sewer	121108078891
2020 3 Waters Asset Valuation	200824109857
2020 50 Year Water and Sewer Growth Forecast	200224024348
2019 Customer Satisfaction Survey	200313034937

Figure 1: Treatment Plant Schematic

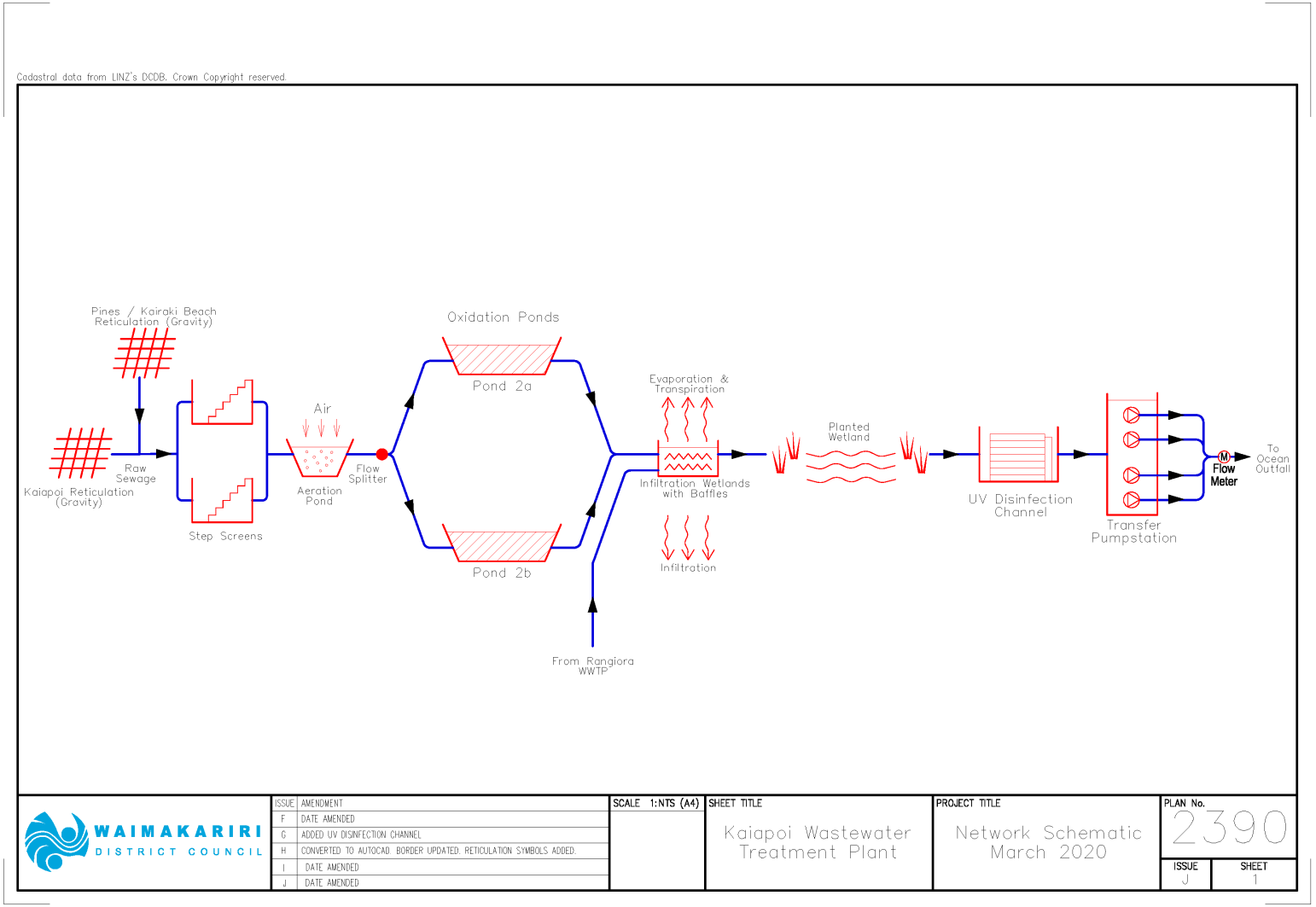
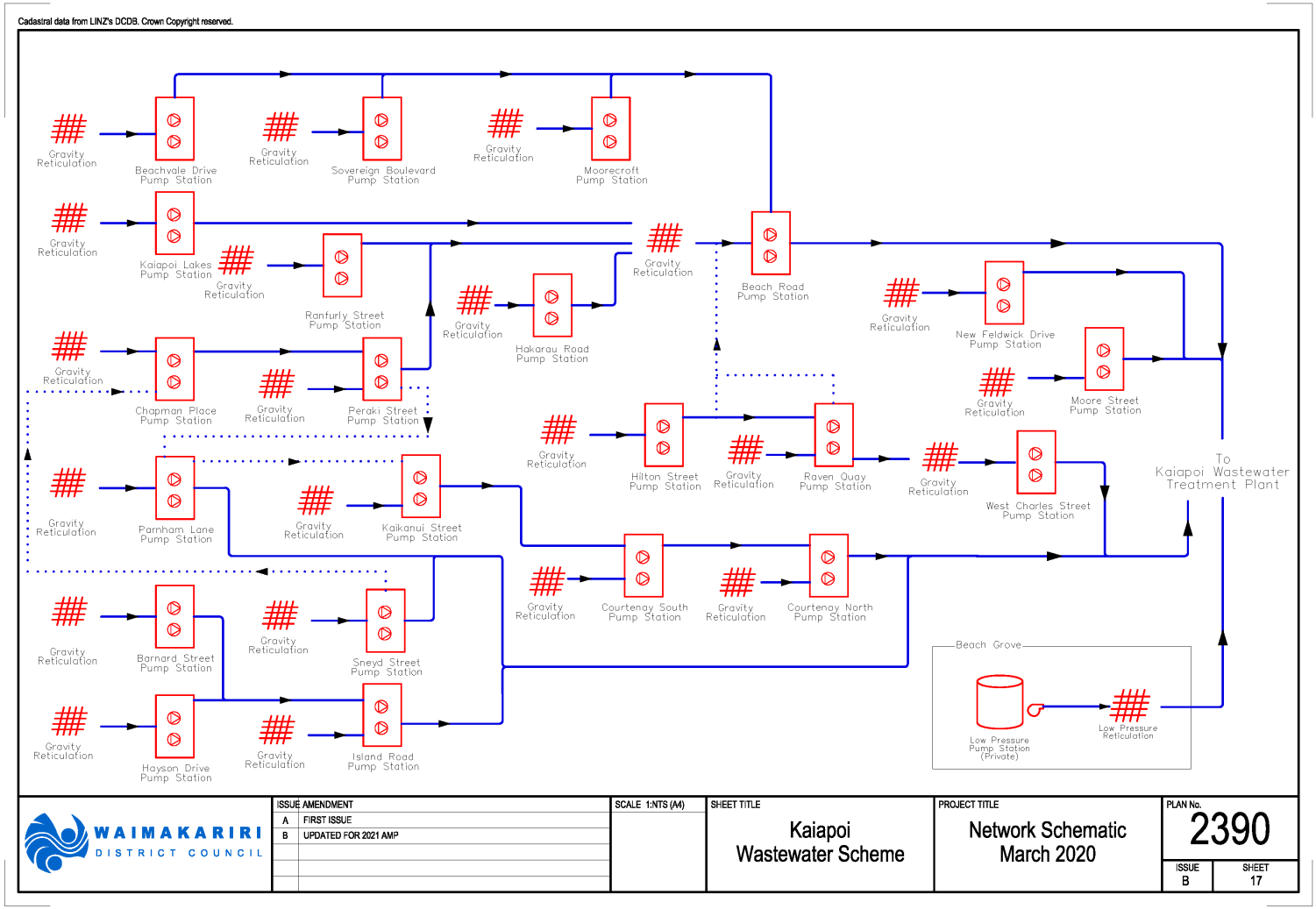


Figure 2: Network Schematic



5 Scheme Management Issues (What Do We Need to Consider?)

There are a number of key aspects to consider when managing a sewer scheme, these include:

- Target & actual levels of service
- Asset condition & criticality
- Capacity & performance of the supply
- Risks associated with the supply
- Growth predictions for the scheme

These issues have been assessed in detail and are explained in the following sections.

5.1 Levels of Service

Table 8 sets out the performance measures and targets for the scheme, and performance achievement against targets since 2008.

Mandatory performance measures are measured at the district wide level and are not included in the individual wastewater scheme AMPs. They are located in the District Overview Wastewater Activity Management Plan. However there is considerable overlap between the measures at Scheme and District levels. Mandatory measures cover overflows, consent compliance, time to respond to faults, and complaints. The Scheme LOS measures include more detail, and cover complaints, consent compliance, overflows and outages, but not response times, which are only measured at scheme level.

None of the WDC targets are expected to change over the 10 year LTP period, so only the one target value has been shown in this document.

Performance in Table 8 is measured against the performance measures set in 2018, as part of the 2018-28 Long Term Plan process. Going forward from 2021 onwards, performance will be against the modified set of performance measures that were presented to the Council's Utilities and Roading Committee in 2020 (refer report 200406043184[v2]), and subsequently approved by Council. These revised levels and targets are detailed in the District Overview Water Supply Activity Management Plan.

Table 8: Elective (non-mandatory) Levels of Service Targets and Performance Measures as Assessed in 2020

** Note A "Y" indicates that the LOS has been met, and an "N" indicates it has not been met*

 # Details of performance measures may have been modified between various revisions of the AMP. The Previous Results reported are as assessed against the most relevant performance measure at the time of assessment.

Section	Level of Service	2018 – 2021 Performance Measure	2018 – 2021 Target	2020				Previous Results#			
				Result	Commentary	Status	Action to Address	2017	2014	2011	2008
Customer Complaints	Complaints - Midges & Insects - Treatment	Number of events that lead to complaints about midges and insects at treatment plants	Nil per Year	Nil	There were no complaints regarding midges or insects. However it has been identified there is a midge problem at the Kaiapoi WWTP.	Achieved	N/A	Y	Y	Y	Y
	Complaints - Odour - Reticulation	Number of events that lead to complaints about odour from the reticulation	Less than 5 per year	2	Two complaints were received	Achieved	N/A	N	Y	Y	Y
	Complaints - Odour - Treatment	Number of events that lead to complaints about odour at treatment plants	Less than 5 per year	1	There was a single complaint in December 2019.	Achieved	N/A	Y	N	Y	N
Resource Consents	Consent Breach - Action required	Number breaches of consent conditions that result in an ECan report that identifies compliance issues.	Nil per Year	Nil	No notices of consent breach were received.	Achieved	N/A	Y	Y	Y	Y
Outages	Outages - Events >8 hours	Number of events that cause a loss of service to any property for >8 hrs (does not include private laterals)	Nil per year	Nil	There were no losses of service greater than 8 hours.	Achieved	N/A	Y	Y	N	Y

Section	Level of Service	2018 – 2021 Performance Measure	2018 – 2021 Target	2020				Previous Results#			
				Result	Commentary	Status	Action to Address	2017	2014	2011	2008
Overflows	Overflows - Existing Reticulation	Minimum return period of rainfall event that can be accommodated in network components designed prior to May 1999 without overflows occurring	1 in 2 year	N	Recent modelling has indicated a significant proportion of the existing Kaiapoi network is not meeting the desired level of service. Additional flow monitoring and further studies are underway to identify mitigation measures.	Not achieved	Additional flow monitoring and further studies are underway to identify mitigation measures.	N	N	N	N
Overflows	Overflows - New Reticulation	Minimum return period of rainfall event that can be accommodated in network components designed after May 1999 without overflows occurring	1 in 5 year	Y	Recent modelling undertaken in Kaiapoi has not identified any overflow issues associated with new reticulation designed to the 5 year level of service.	Achieved	N/A	N	N	N	N
	Overflows - Private Property	Number of recorded overflows on private property found to be the result of (a) blockage in the main (b) Insufficient capacity in the reticulation system for any rainfall up to a 1 in 2 year event, for areas designed prior to 1999. (c) Insufficient capacity in the reticulation system for any rainfall up to a 1 in 5 year event for areas designed after 1999.	Nil per year	Nil	This level of service is met.	Achieved	N/A	Y	N	N	N

5.2 Asset Condition

The current assessment of asset condition is based on theoretical remaining useful life derived from component age and adopted useful life. Adjustments to the remaining life are made to individual components where information is available to suggest the theoretical remaining life is inappropriate.

A rolling wastewater CCTV programme was started in 2008 to survey the reticulation network and assign evidence based condition ratings. These surveys have identified a number of mains faults that have led to a remedial actions including immediate or scheduled repair, decreased remaining useful life and increased renewal priority. However analysis of this survey information has not been well managed due to the lack of appropriate software. The expected purchase of the widely used InfoAsset Manager software for this purpose will significantly improve this situation, and enable better determination of asset condition and remaining useful life.

The CCTV condition information is complemented with maintenance activity records from the field recording wastewater mains blockage and overflow records.

Figure 3 below, shows the assessed pipe condition for all pipes within the scheme. Figure 4 summarises the theoretical asset condition for both the network and headworks in a graph, while Table 9 provides more detail about the value of the assets within different asset condition categories.

Figure 3: Pipe Condition Assessment Report

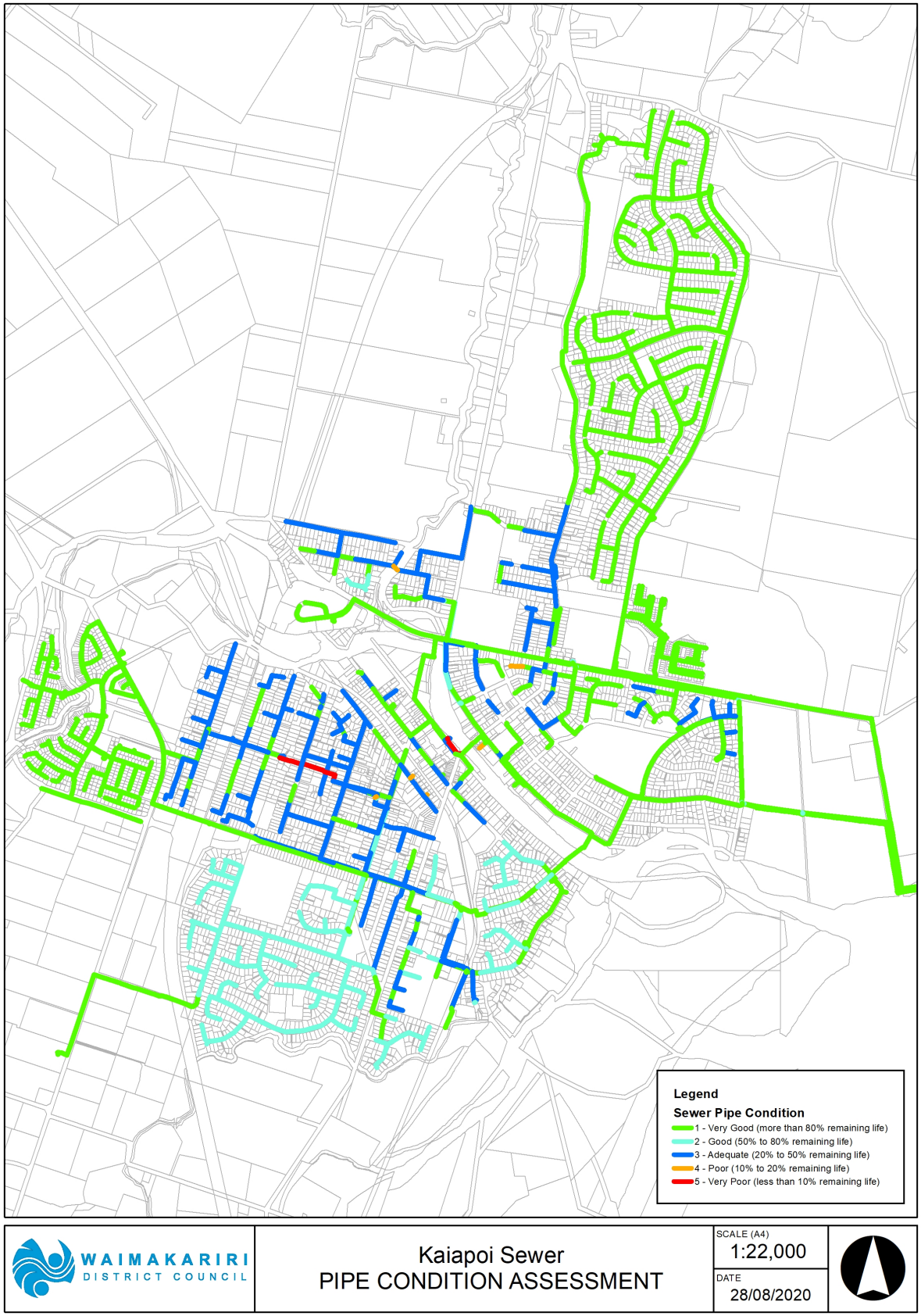
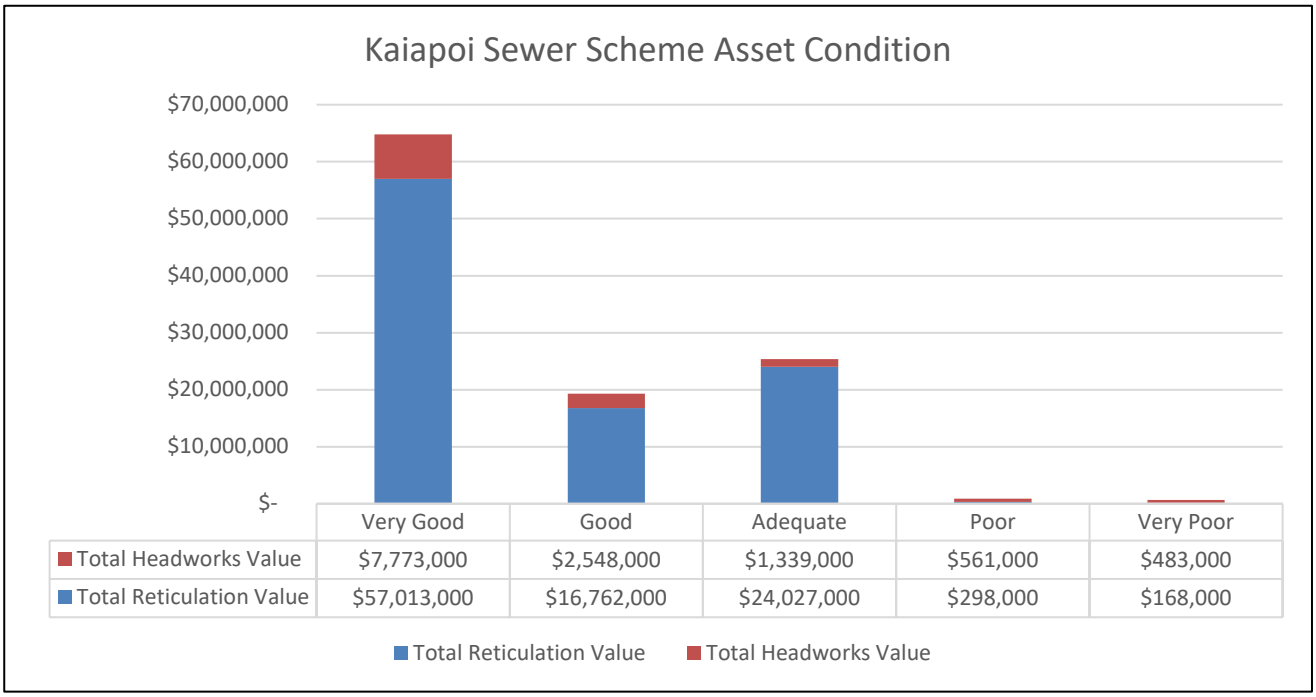


Figure 4: Asset Condition Summary



"Headworks" is inclusive of all above ground assets associated with the wastewater supply scheme e.g. buildings, pump sets.

Table 9: Pipe Condition Summary

Condition Grade	Definition	Pipeline Quantity	Total Reticulation Value	Total Headworks Value	Total Value
1	Very Good *More than 80% of life remaining*	55.5 km *67%*	$ 57,013,000 *58%*	$ 7,773,000 *61%*	$ 64,786,000 *58%*
2	Good *Between 50% and 80% of life remaining*	10.5 km *13%*	$ 16,762,000 *17%*	$ 2,548,000 *20%*	$ 19,310,000 *17%*
3	Adequate *Between 20% and 50% of life remaining*	16.8 km *20%*	$ 24,027,000 *24%*	$ 1,339,000 *11%*	$ 25,366,000 *23%*
4	Poor *Between 10% and 20% of life remaining*	0.2 km *0%*	$ 298,000 *0%*	$ 561,000 *4%*	$ 859,000 *1%*
5	Very Poor *Less than 10% of life remaining*	0.4 km *1%*	$ 168,000 *0%*	$ 483,000 *4%*	$ 651,000 *1%*
Total		**83.4 km**	**$ 98,268,000**	**$ 12,704,000**	**$ 110,972,000**

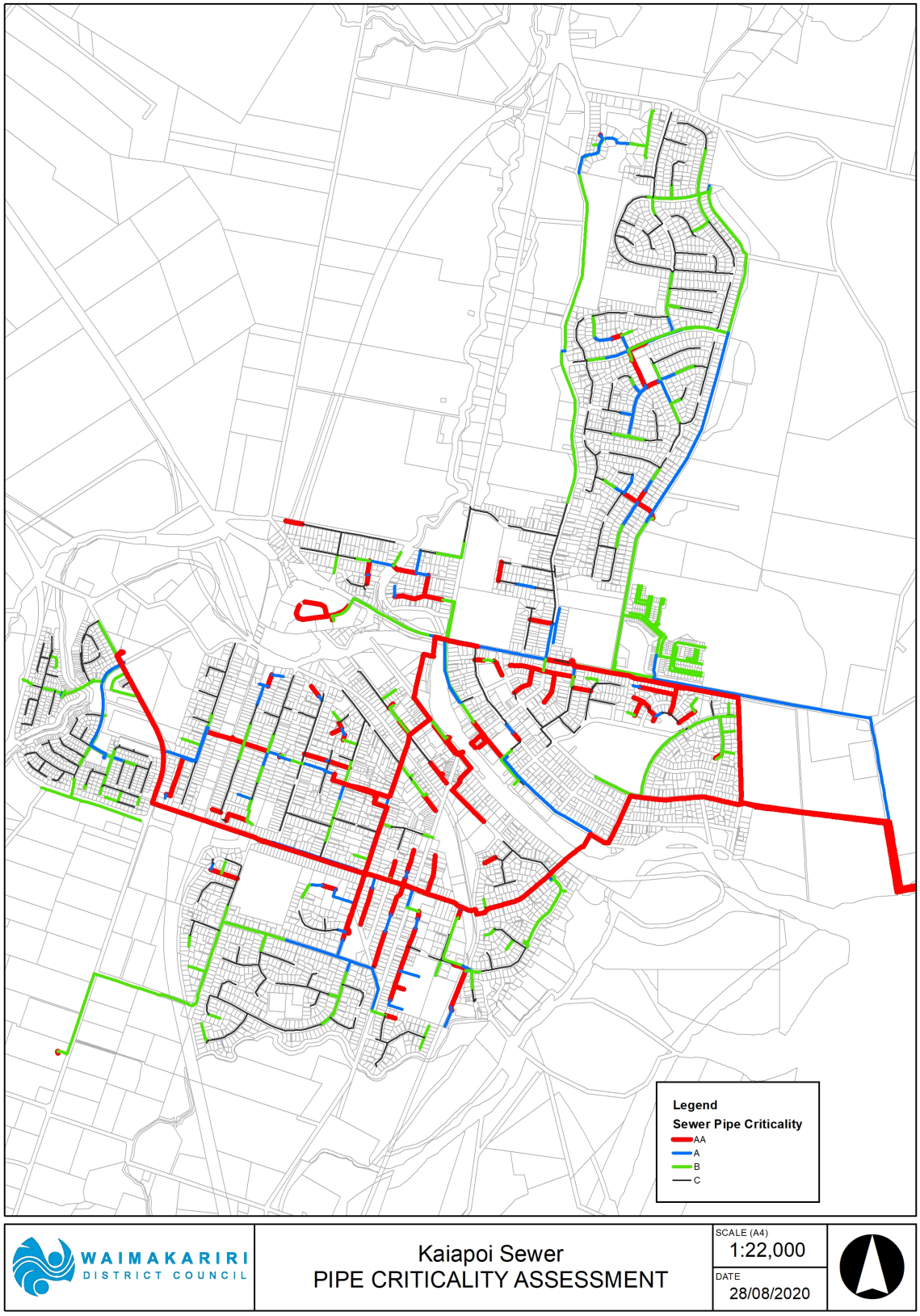
5.3 Asset Criticality

Asset criticality provides an indication of the importance of an individual asset and the corresponding impact on the service delivery should the asset fail for any reason. Criticality is used in risk based investment decisions to help decide when an asset should be replaced to avoid the consequences of failure. The Council has developed an assessment process which scores assets from most critical 'AA' to least critical 'C'. Further details of the criticality assessment methodology is covered in the WS Overview AMP.

The pipe criticality scoring process has been significantly improved through automation and dynamic links to GIS data layers for this AMP.

Figure 5 provides a spatial view of asset criticality for the scheme.

Figure 5: Pipe and Facilities Criticality



5.4 Risk Assessment

An Operational Risk Assessment was first undertaken for the Kaiapoi Wastewater Scheme in 2004, and it has been regularly updated since that time. It was last updated for the 2015 AMP review.

At the last review four high risks remained for the Rangiora wastewater scheme.

The District Wide Overview details the risk events considered and includes a summary of the risk assessment results for all the wastewater supply schemes and is useful in indicating overall wastewater network priorities.

Table 10 summarises the number of events at each level of risk for the Kaiapoi Wastewater Scheme.

Table 10: Number of Events per Level of Risk

Risk Level	2004	2008	2011	2014
Extreme risks	0	0	0	0
High risks	8	3	2	4
Moderate risks	43	46	45	34
Low risks	25	29	31	68
Not applicable	28	29	1	1
Total	**104**	**107**	**79**	**107**

There are four high risks on this scheme as at 2014, as shown in Table 11. One, the decommissioned Courtenay Drive pump station no longer presents any risk, so it has been removed from the table below. Two of the remaining high risk items relate to the condition and capacity of the gravity network. The network has been modelled, but further investigative work is required to determine how best to deal with the issues. Operational funding is budgeted for FY21/222 and 22/23 for this investigative work, with significant capital in the following eight years of the LTP for the capacity upgrade work.

The risk to pipe joints in an earthquake, the fourth identified risk, requires alignment of the Risk Assessment with the Disaster Resilience Assessment likelihood and consequence rating methodologies. This will assist to determine appropriate prioritisation of the hazard and the future resilience actions required.

District wide, moderate risks are being deferred until extreme and high risks have been addressed.

Table 11: Summary of High & Extreme Risks

Risk Event & Cause	Reasoning	Solution	Project Details	Project Ref	2011	2014
COLLECTION						
Overflow or discharge of raw sewerage from gravity reticulation due to insufficient reticulation capacity	Risk increased as a result of better information. Known areas where overflows occur resulting from high I&I with ARI<1yr	AMP modelling work will determine renewals and upgrades required to increase pipeline capacity and reduce I&I	Kaiapoi Capacity Upgrade	URS0029	M	H
Overflow or discharge of raw sewerage from gravity reticulation due to poor reticulation condition (blockages)	Risk increased as a result of better information. Some problem areas, earthquake repairs will address some of these	The implementation of InfoAsset Manager to undertake assessment of CCTV data will allow targeting and programing of pipes with poor serviceability ratings.	InfoAsset Manager softeware implementation	N/A	M	H
Natural disaster & other due to earthquake	Pipe joints could be susceptible to seismic event	Review risk assessment process as part of 2015 AMP improvement plan and use DRA information better inform risk scores	Risk Assessment Update	IP045	H	H

5.5 Disaster Resilience Assessment

The 2009 Disaster Resilience Assessment (DRA) is a desktop study that primarily considered the risks to above ground structures presented by natural hazard events across all Council operated 3 Waters schemes. The original assessment was updated in 2012 using revised hazard and asset behaviour information captured during the 2010-11 Canterbury earthquake sequence.

Risk from earthquake events that could induce liquefaction, on brittle pipes (AC and earthenware) is managed using a reticulation vulnerability score. This is used as an input to the risk based renewals assessment.

Above Ground Facilities

The above ground facilities were assessed for risk of failure against 13 natural and 2 manmade hazard scenarios. The following risk profile (Table 12) reflects the likelihood of the event occurring and the consequence on the community of the facility failing. Hazards classified as having 'No Known Risk' have been omitted from the table.

Table 12: Risks to Above Ground Facilities

Hazard	Beach Rd PS	Chapman Pl PS	Charles St PS	Courtenay Drive PS	Feldwick Drive PS	Kaiapoi Lakes PS	Kaiapoi WWTP	WWTP Outfall PS	Kaikanui St PS	Moorcroft PS	Parnham Lane PS	Peraki St PS	Ranfurly St PS	Raven Quay PS	Sovereign Boulevard PS
100 yr Local Flooding	H	H	-	-	L	L	H	E	-	-	M	M	M	-	M
475 yr Earthquake Induced Slope Hazard	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
100 Yr Ashley Flood	-	-	-	-	-	-	-	-	-	-	-	-	M	L	-
500 Yr Ashley Flood	M	-	L	M	L	-	M	H	L	L	L	M	M	L	-
3,300 yr Waimakariri Flood	L	-	L	-	L	-	-	-	-	-	-	-	-	-	-
Earthquake (50 yr)	E	M	H	H	H	H	E	E	H	H	H	H	H	M	H
150 Yr Earthquake	H	M	H	M	M	M	H	E	M	M	M	M	M	M	M
475 Yr Earthquake	H	L	M	M	M	L	H	H	L	L	M	M	M	L	L
200 Yr Tsunami	-	-	-	-	L	-	E	E	-	-	-	-	-	-	-
Wildfire	M	L	M	L	L	L	H	H	L	L	L	L	L	L	L
Snow 150 Yr	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Wind 100 Yr	L	L	L	L	L	L	M	M	L	L	L	L	L	L	L
Lightning	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Pandemic	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Terrorism / Sabotage	M	L	M	L	L	L	M	H	L	L	L	M	L	L	L

E = Extreme, H = High, M = Moderate, L = Low, N = No Known Risk

Kaiapoi is located within the zone of high liquefaction susceptibility and liquefaction occurred at five of the wastewater sites during the 2010 earthquake.

Significant inundation of up to 2.3 metres from a worst case distant source tsunami has been modelled for the wastewater treatment plant with lower level inundation at the Outfall pump station.

The Outfall pump station is considered to be at extreme risk from local flooding. Beach Road, Chapman Place and the Wastewater Treatment Plant have been identified at high risk from local flooding.

All wastewater sites in the District have been identified as at moderate risk from lightning and pandemic. Currently only extreme and high risks are being addressed.

The Councils response to some of these risks is being managed at a district level via the DRA Action Plan and related projects. Refer to the District level AMP for details. Since there is some overlap of the DRA and Operational Risk Assessment, a review and potential integration of the risk assessment methodologies is planned, prior to risk assessments next being carried out.

5.6 Growth Projections

Situation

Residential growth in Kaiapoi is expected to occur largely through expansion of the residential zone within the defined urban limits, as set out in the Urban Development Strategy. The projected growth is dependent on the rezoning of land to the north-east of Kaiapoi, or suitable alternative land being rezoned for development.

The overall district population growth scenario used for the 2021 AMP update was supplied by Council's Development Planning Unit, broken into towns and rural areas. Wastewater growth projections were calculated using the New Projections for LTP 2021-2031 (TRIM 200908117997), which was the basis for infrastructure planning.

Due to issues that have occurred with the Census 2018, the population projections that would normally be used as a basis for updating the work previously developed by the Council's Development Planning Unit have not been released by Stats NZ in time for the development of this assessment.

However, based on the historical growth patterns of new dwelling Building Consents over the last three years (636 in 2017/18, 661 in 2018/19 and 615 in 2019/20), the projections used for the previous LTP/infrastructure strategy remain valid to be used for infrastructure planning. As the timeframe for this infrastructure planning is for the thirty years between 2021 to 2051, the previous population projections have been extended out a further three years, as documented in New Projections for LTP 2021-2031 (TRIM200908117997).

It is important to provide a brief comment on COVID19 and the impact it could have on population projections. At the time of writing this paragraph (August 2020), New Zealand is currently in Level 3 restrictions in Auckland and Level 2 restrictions in the remainder of the country. While international migration is currently low arising from the COVID19 travel restrictions, a significant number of New Zealanders are returning home due to the impact of COVID19 on overseas countries. This has contributed to a high level of population growth nationally over the last six months, which has had a flow on effect to growth in the Greater Christchurch and Waimakariri Districts. How long this might continue for and when international migration (from other

countries) might return to pre COVID levels is still to be determined. However the existing population projections remained the most appropriate to use for infrastructure planning at this time.

Demand

Demand on the Kaiapoi wastewater scheme is expected to increase by 72%, by the end of the 2021-31 Long Term Plan (LTP) period. This projection is based on 75 connections being established per year from 2019/20 to 2030/31, as identified in the 2020 50 Year Water and Sewer Growth Forecast Report (TRIM reference number 200224024348).

The number of new residential connections are predicted to increase by 71 per year and commercial connections are predicted to increase by 4 per year, during the 2021-31 Long Term Plan (LTP) period to accommodate this demand. Demand beyond the 2021-31 LTP period (2030/31 to 2070/71) is forecast to transition to a slightly lower growth profile resulting in an average of 52 new connections per year (Table 13).

Table 13: Growth Projections

Kaiapoi	Rates Strike July 2019	Years 1 - 3	Years 4 - 10	Years 11 - 20	Years 21 - 30	Years 31 - 50
	2019/20	2021/22 to 2023/24	2024/25 to 2030/31	2031/32 to 2040/41	2041-42 to 2050/51	2051/52 to 2070/71
Projected Connections	4,884	5,255	5,707	6,313	6,845	7,786
Projected Rating Units	5,693	6,148	6,600	7,206	7,738	8,679
Projected increase in Connections		8%	17%	29%	40%	59%
Projected Average Dry Weather Flow (m3/day)	5,305	5,525	5,830	6,239	6,598	7,234
Projected Peak Wet Weather Flow (m3/day)	47,831	48,933	50,460	52,503	54,299	57,477

Note that the time frames have been chosen to reflect the periods 3, 10, 20 and 30 years from the AMP release date, however due to the time it takes to complete the analysis the base rates strike data used was from 2019/20.

Longer term, connections are projected to increase by 59%. This long term projection is lower than the 2017 growth projection, 82% (used for the 2017 AMP). Both projections utilised the best data and information available to project the connections for the wastewater schemes at the time. The 2017 population projections generally had higher growth for the district in the long term, which is reflected in the growth projection difference for Kaiapoi above.

Average Dry Weather Flow (ADWF) and Peak Wet Weather Flow (PWWF) projections have been based on the assumptions that for future development areas the Engineering Code of Practice

(ECOP) ADWF or PWWF per person is added to the existing flow. The assumptions made to calculate the future ADWF were based on the ECOP, with the residential 0.675m3/prop/day and non-residential 0.2m3/Ha/day; and the future PWWF was based on the ECOP, at residential 3.375m3/prop/day and non-residential 1m3/Ha/day.

On average Kaiapoi's existing inflow and infiltration level is considered very high resulting in well above-average Peak Wet Weather Flow (PWWF).

Projections

Figure 6 & Figure 7 present the projected growth and corresponding demand trends for the Kaiapoi wastewater scheme.

Figure 6: Population Projections

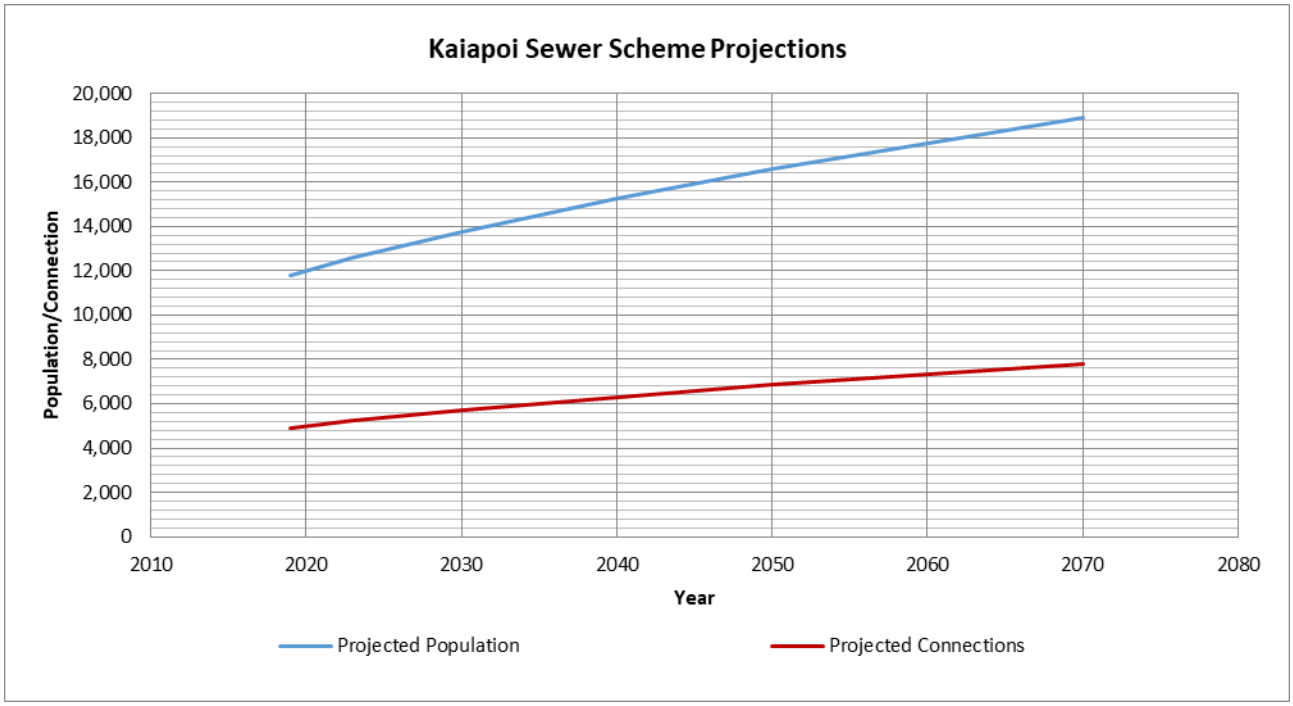
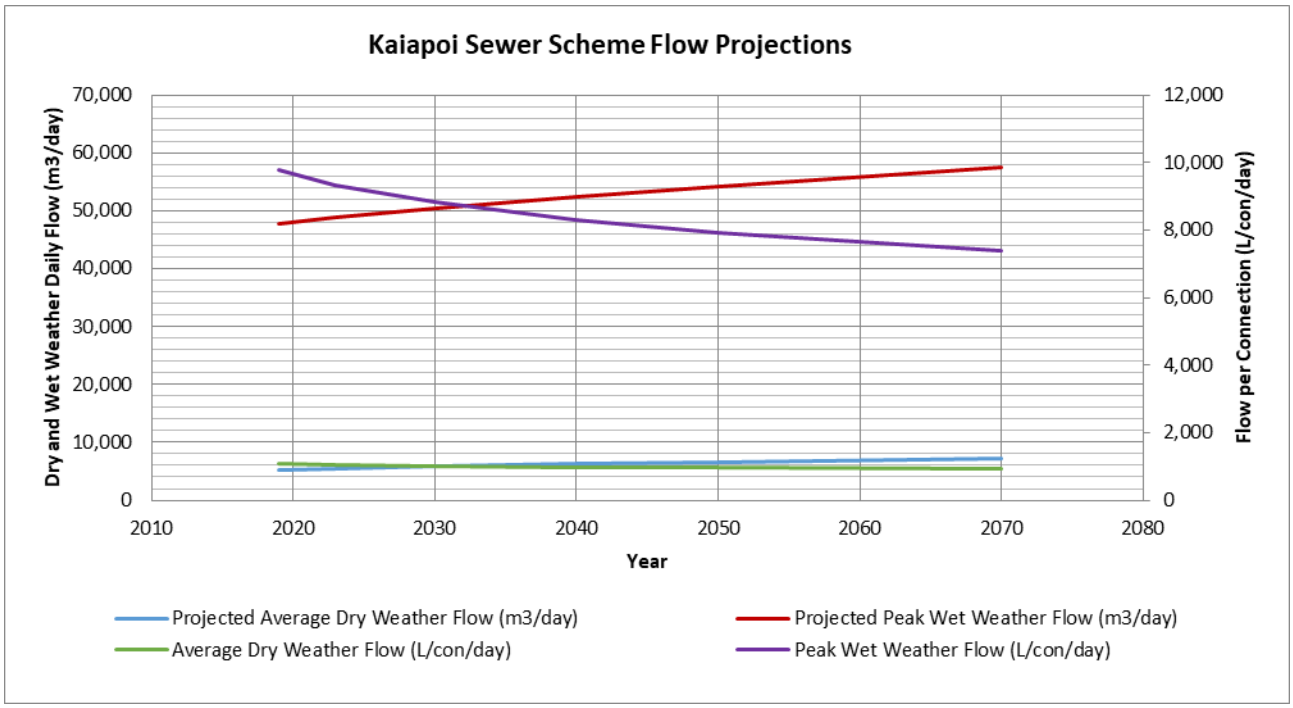


Figure 7: Flow Projections



5.7 Capacity & Performance

This section of the AMP considers the capacity and performance of the Kaiapoi Wastewater Scheme. The specific aspects of the scheme that have been considered are the treatment plant and the reticulation system. These are discussed in more detail in the following sections.

Treatment Plant

The existing treatment system comprises automatic step screen to remove large solid particles and an aeration basin with four mechanical aerators to reduce the organic load. This is followed by two 4 hectare facultative oxidation ponds operated in parallel. The treated effluent passes through a 30 hectare infiltration wetland for further treatment.

The Rangiora treated effluent also enters the infiltration wetland and is mixed with Kaiapoi effluent before passing through a 2.5 hectare planted wetland before being pumped to the ocean outfall.

A UV disinfection system is available for times when the bacteria levels in the treated effluent are elevated, such as the periods after a heavy rainfall event or unfavourable climatic weather conditions that increase or decrease the amount of algae in the ponds.

A study has been undertaken to identify future upgrading requirements to the Kaiapoi WWTP (Beca report no. TRIM 111205058266). This report concludes that the existing treatment plant is well within its design capacity, and following the peer review the Council has determined that no further upgrades are required at this stage.

Reticulation System

The capacity of the sewer reticulation was assessed using a calibrated hydraulic model in 2002/03. The reticulation was re-modelled and calibrated in 2009/10, although not fully documented due to the earthquakes. The model has been updated and calibrated (2019) based on flows at pump stations, but this does not provide a sufficiently detailed understanding of the systems response to wet weather events and further investigation is warranted. Permanent flow monitors have

therefore been installed at a number of locations within the reticulation, data from which will be use to improve the model over the next few years.

A further reason not make the selection of a solution too quickly is that there are a number of significant flood response improvement works under way in Kaiapoi, due for completion in 2023. There is a chance that the removal of significant volumes of stormwater from the catchment, may change the response of the wastewater system to storm events.

The model, updated and recalibrated with this additional information will then be used to carry out a final capacity and performance assessment, and to determine the optimal upgrades necessary to provide sufficient capacity to achieve the following LoS relating to overflows:

- A LoS of a 5 year period between wet weather overflows in new development areas as per the Council Engineering Code of Practice.
- A LoS of a 2 year average recurrence interval between wet weather flows for the existing network.

Completion of this suite of work is programmed for completion by the end of 2022. Design work will follow, with a “placeholder” budget for construction going forward from 2025/26 in the draft LTP.

While this upgrade programme is expected to involve renewing or refurbishing Council assets and increasing their capacity to cope with Infiltration and Inflow, also needing consideration in determining an optimal solution is what approach to take with the private portion of laterals, that will likely be contributing a considerable portion of the I and I.

6 Future Works & Financial Projections (What Do We Need To Do?)

This section covers the future works required to meet the target levels of service, maintain the asset in an acceptable condition, reduce the risks to an acceptable level and accommodate growth.

Financial forecasts do not include inflation

6.1 Operation & Maintenance

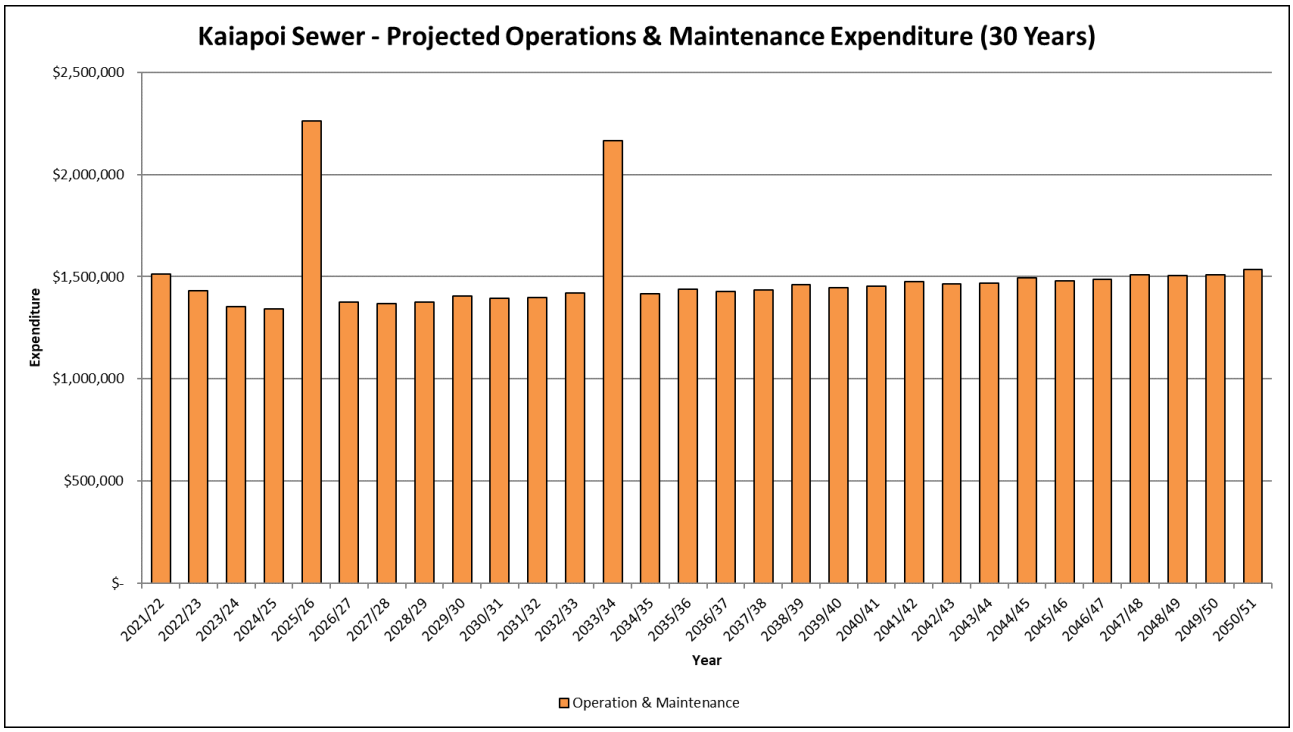
Operation and maintenance (O&M) expenditure incorporates the day to day running of the water supply network and allows the system to carry on functioning to deliver the agreed levels of service.

The O&M programme includes a combination of reactive and planned tasks. Examples of the differing nature of these tasks is summarised within the Overview document.

While there are no known deferred maintenance items, it is expected that the recent implementation of an Asset Management Information System (AMIS) will enable improved planned maintenance regimes. For example the new system will allow analysis of blockages that will identify where a pre-emptive regular cleaning programme should prevent blockages from occurring.

O&M budgets are set based on a combination of past expenditure (for reactive tasks), cost estimates for planned works, and adjustments going forward to account for growth, inflation, depreciation and any significant new works planned. Further detail of this process is provided in the Overview document. The end result of this is shown in Figure 8.

Figure 8: Annual Operation & Maintenance 30-Year Budget



Expenditure is increased in years 2021/22 and 2022/23 due to network I&I investigations and minor desludging works at the Kaiapoi WWTP will be undertaken. The increase in expenditure in 2025/26 and 2033/34 is for the desludging of oxidation ponds at the Kaiapoi WWTP.

6.2 Renewals Programme

The renewals programme is determined in two stages. The renewals model, details of which are provided in the overview document, provides a long term view of the funding required to ensure that a renewals fund is sufficient to enable future asset renewals, without needing to borrow. For sewer the model is operated at the Eastern Districts Sewer Scheme level, but it provides Asset Managers, at a scheme level, prioritised candidates based on criticality, risk, and expected asset life on for consideration for inclusion in the LTP. Asset Managers consider other factors such as roading renewal programmes in determining final projects for the LTP.

Figure 9 below shows the output from the model only and provides a broad brush spatial view of the likely timeframe for renewals.

Figure 9: Pipe Renewal Time Frames

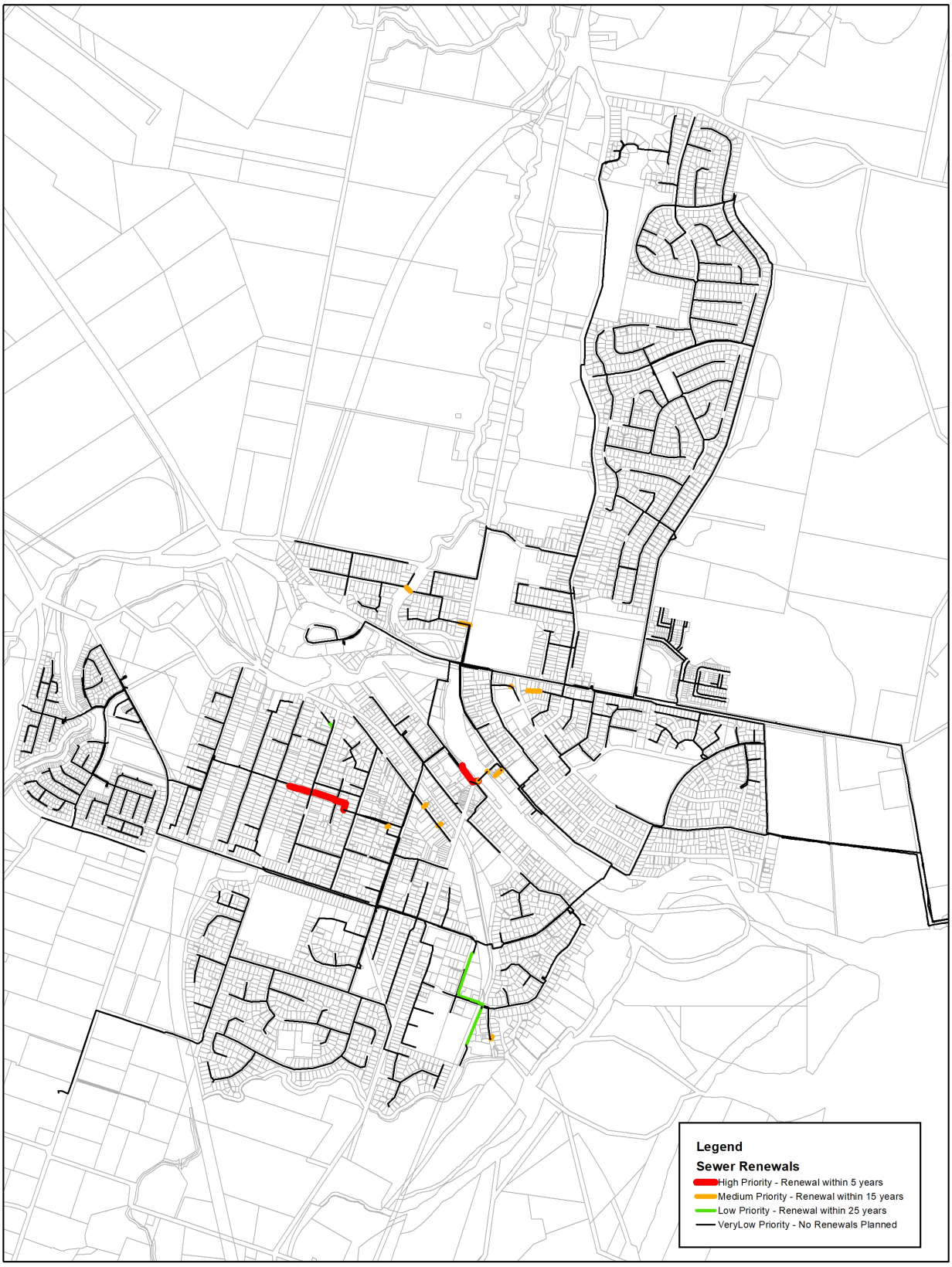
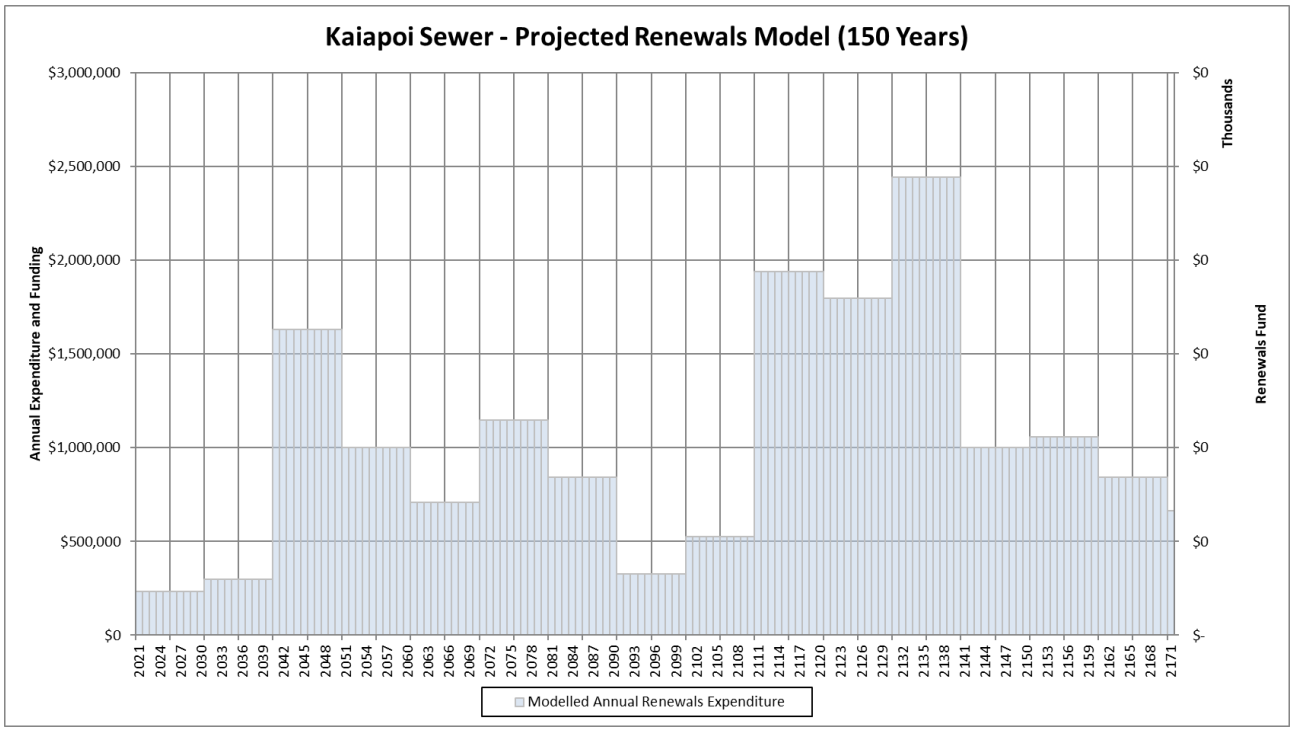


Figure 10 below shows the renewals expenditure from the model only. Budgeted depreciation funding, modelled annual funding required, and the modelled renewals fund are not shown on this graph, but are shown on the equivalent graph in the EDSS AMP. This is because all properties that are connected to the Eastern District Wastewater Scheme (EDWS) are charged using the same set of (differential) rates.

The figure only shows the output from the model, so expenditure shown in the graph for the first ten years may be different from the expenditure shown in the final budget, as adjustments may have been made by the Asset Manager from the direct renewals model outputs. The final renewals budget put forward into the draft LTP, is included in the capital works graph, Figure 10 . There are no deferred renewals.

Figure 10: Annual Renewals 150-Year Budget



6.3 Capital Works

The following graph shows the 50 year budget for all capital works, including projects driven by growth and levels of service (Figure 10). Renewals expenditure showing in the first ten years of the graph, includes the actual planned programme, not the model output. The sharp increase in spending in years 5, 7, 8, 9 and 10 is from the planned Kaiapoi Capacity Upgrade project to increase system capacity and/or reduce I&I, in order to meet overflow levels of service. Investigation work and determination of the optimal solution is not yet complete, but will be progressed over the first 3 years of the 2021 LTP. Permanent monitors have been installed in the reticulation which will start to provide a more detailed understanding of system response to wet weather events. In addition the significant stormwater improvement works due to be completed in 2022/23 may well change this response, and it would therefore be premature to commence the wastewater capacity upgrade until this work is complete

Figure 11: Projected Capital works Expenditure

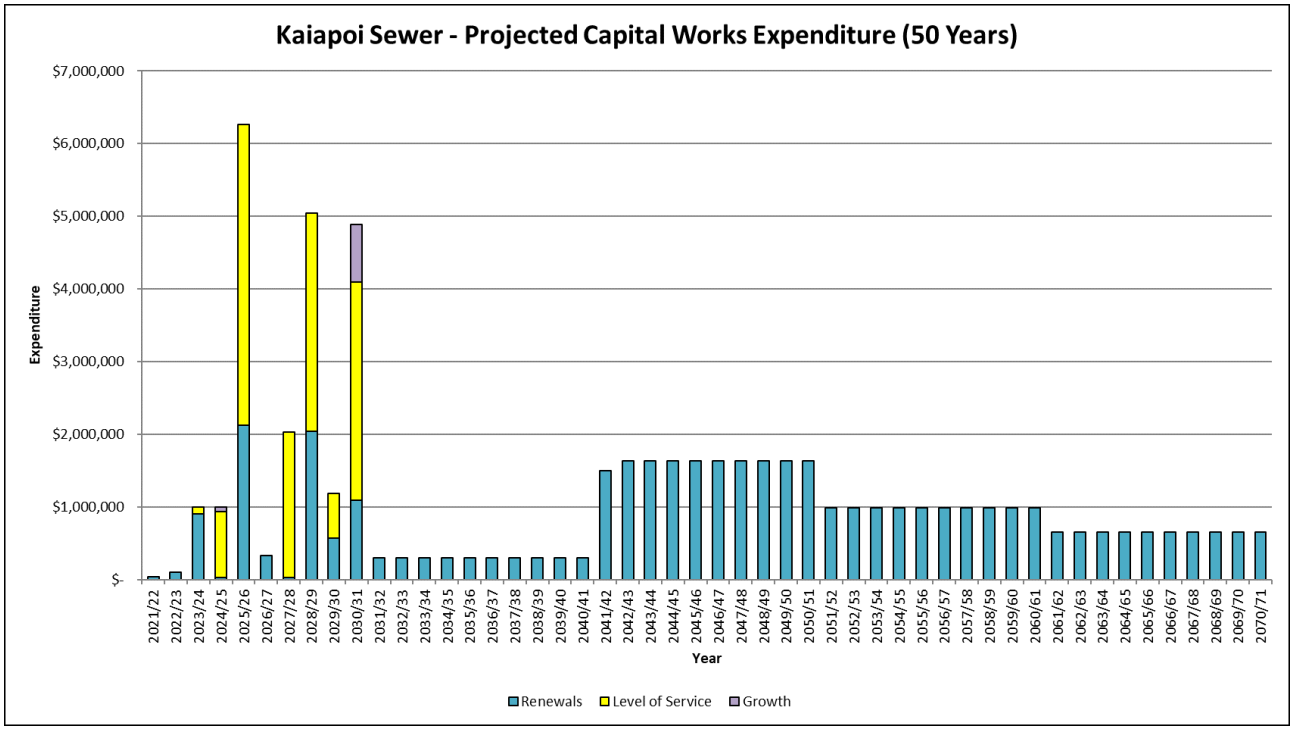


Table 14 on the following page summarises the projected capital works for the next 50 years, including renewals. Figure 13 shows the corresponding location of the projected capital upgrade works.

The level of confidence in the budget for the works (High / Medium / Low) is presented in the table. For a more complete discussion on the level of optimisation, refer to the introductory chapter of the AMP. The figures in the table are not adjusted for inflation.

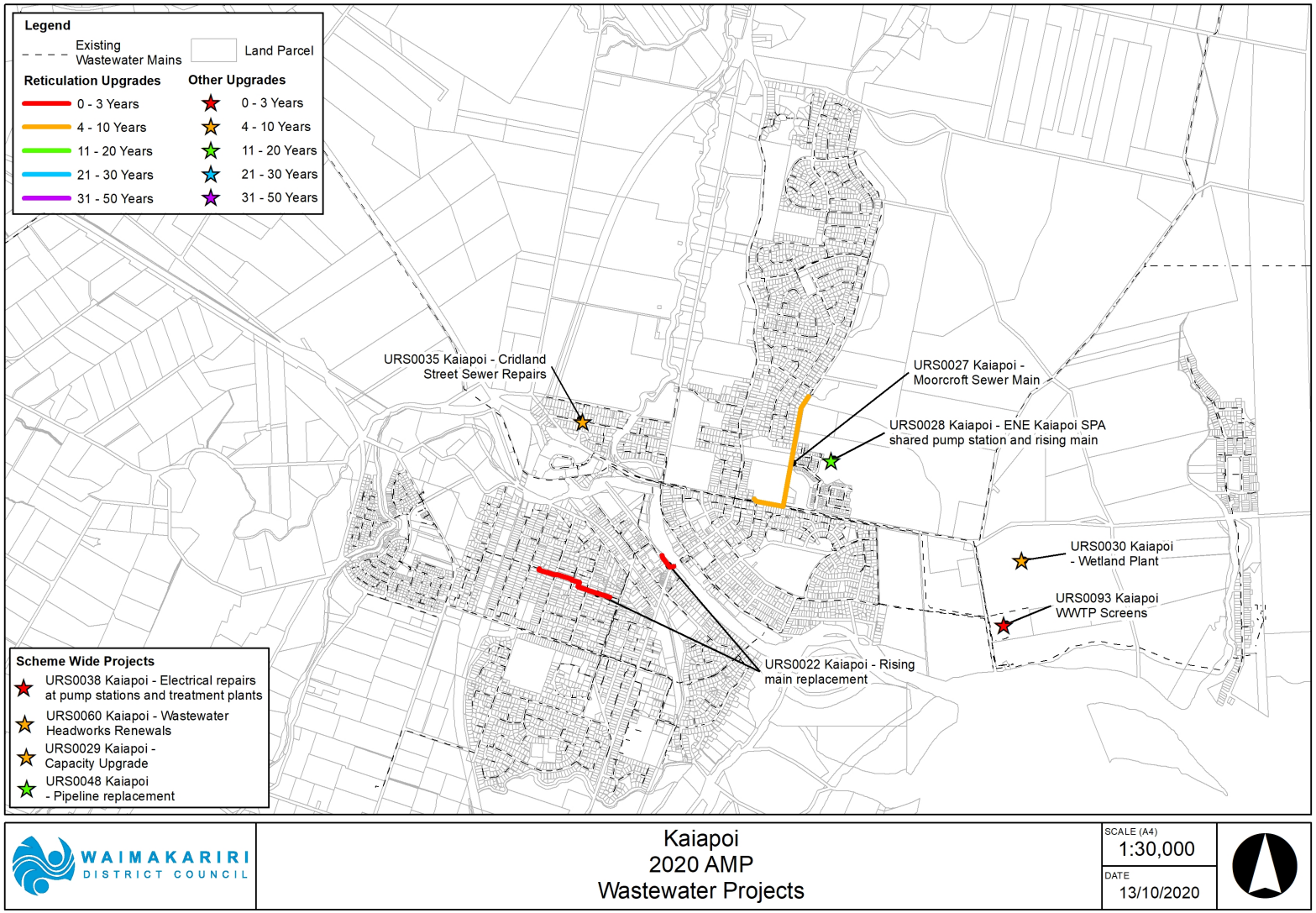
Any programme or project that occurs over a number of years, such as the renewals programme, is only shown within the table for the first year in which it occurs. The Project Value indicates the projected full total cost of the project over the number of years it occurs.

Table 14: Summary of Capital Works (Includes Renewals)

Year	Project ID	Project Name	Level of Confidence	Project Value	LOS Component	Renewals Component	Growth Component
Year 1 - 10							
2022	URS0038	Kaiapoi - Electrical repairs at pump stations and treatment plant	7 - High	$ 142,000	$ -	$ 142,000	$ -
2023	URS0022	Kaiapoi - Rising main replacement	5 - Medium	$ 750,000	$ 100,000	$ 650,000	$ -
2024	URS0093	Kaiapoi WWTP Screens Replacements	4 - Below Medium	$ 300,000	$ -	$ 300,000	$ -
2025	URS0027	Kaiapoi - Moorcroft Sewer Main	6 - Above Medium	$ 70,000	$ -	$ -	$ 70,000
2025	URS0035	Kaiapoi - Cridland Street sewer repairs	3 - Low	$ 900,000	$ 900,000	$ -	$ -
2026	URS0029	Kaiapoi - Capacity upgrade	3 - Low	$ 17,298,000	$ 12,754,000	$ 4,544,000	$ -
2026	URS0030	Kaiapoi - Wetland Plant Investigations	6 - Above Medium	$ 100,000	$ -	$ 100,000	$ -
2027	URS0060	Kaiapoi - Wastewater Headworks Renewals	2 - Very Low	$ 10,920,802	$ -	$ 10,920,801	$ -
2031	URS0028	Kaiapoi - ENE Kaiapoi SPA shared pump station and rising main	6 - Above Medium	$ 794,000	$ -	$ -	$ 794,000
Year 11 - 20							
2032	URS0048	Kaiapoi - Pipeline replacement program	3 - Low	$ 26,125,704	$ -	$ 26,125,705	$ -
Grand Total				$ 57,400,506	$ 13,754,000	$ 42,782,506	$ 864,000

Figure 12 shows the proposed new works, where sufficient detail for the project has been determined.

Figure 12: Projected Capital Upgrade Works (not to scale)



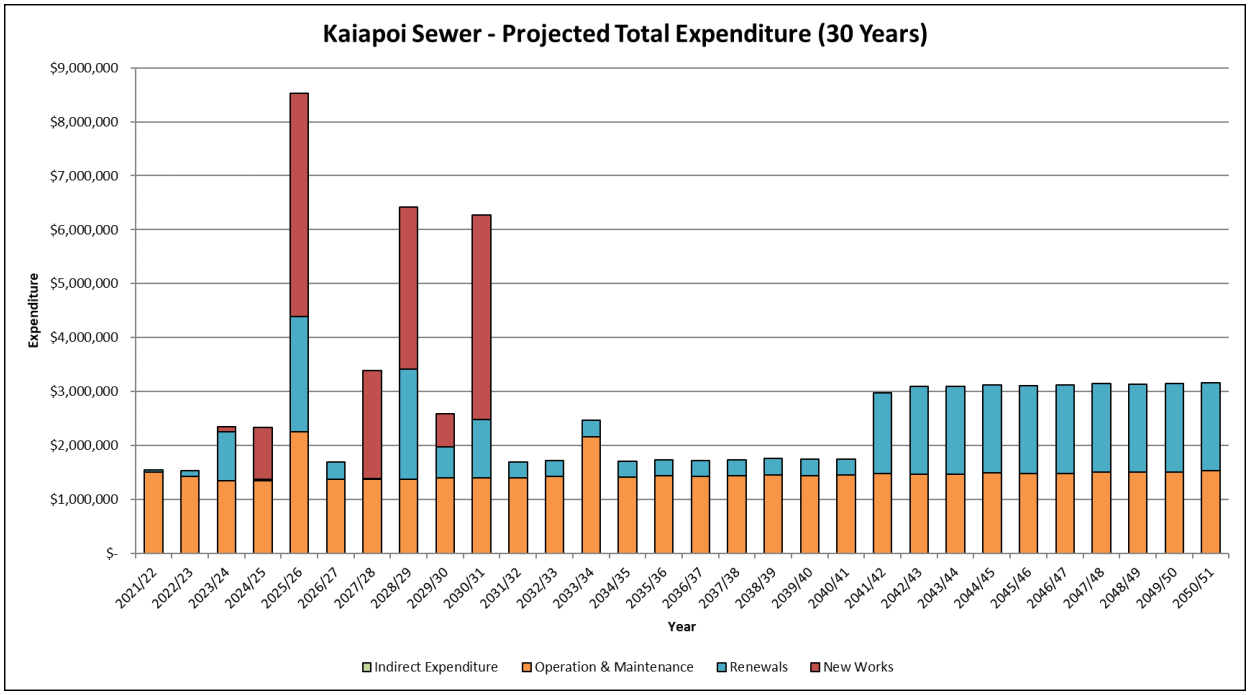
6.4 Financial Projections

The following graph summarises the breakdown of projected total expenditure over a 30 year time horizon. It includes both operational and capital expenditure. Operational costs include operations and maintenance, but not indirect expenditure.

Indirect expenditure includes interest, rating collection costs, costs associated with maintaining the Asset Register, and other internal overhead costs. For systems connected to the Eastern District Wastewater Scheme, these costs are aggregated within the Eastern District Scheme budget.

Capital includes expenditure for growth, levels of service and renewals.

Figure 13: Projected Expenditure



6.5 Valuation

A full peer reviewed valuation of assets is carried out on a three yearly cycle, using the asset data in our asset management information system. Table 15 below provides a summary of the replacement cost, depreciated replacement cost and annual depreciation for this scheme

Table 15: Asset Valuation

Asset Type	Unit	Quantity	Replacement Cost	Depreciated Replacement Cost	Annual Depreciation
Manhole	No.	1,075	$12,670,327	$9,867,563	$102,265
Valve	No.	221	$660,994	$602,837	$7,573
Main	m	78,370	$64,789,217	$48,132,795	$703,885
Service Line	properties	3,987	$16,025,571	$12,019,520	$171,621
Facilities			**$12,704,293**	**$9,786,035**	**$284,963**
Total			**$106,850,403**	**$80,408,750**	**$1,270,307**

6.6 Revenue Sources

Revenue is provided from two key sources; targeted rates and Development Contributions. Development contributions are calculated in accordance with Council's Development Contributions Policy (TRIM 191129168016), while targeted rates are charged in accordance with Council's Revenue and Financing Policy (TRIM 180522056008).

7 Improvement Plan

7.1 2021 Improvement Plan

Error! Reference source not found. details the scheme specific improvements and relevant district wide improvements recommended to address the management issues identified in Section 3. Each improvement item has been tagged to either a capital project or, a process improvement project to help manage and track Councils response. Short term indicates within the first three years of the LTP, long term, out beyond 2021.

If the table is empty, this indicates that all improvements required are either district wide improvements (covered by the Overview AMP), or covered by a capital project or projects, covered in the Capital Works section.

Table 16: 2021 AMP Improvement Plan

Project Ref	AMP Section	Project Description	Priority	Status	Estimated Cost
NA	NA	NA	NA	NA	NA

8 Change to AMP as a result of Long Term Plan consultation

Some changes to budgets have arisen as a consequence of a staff submission report to Council during LTP hearings 25-26 May (TRIM 210506072970). For the Kaiapoi scheme Council

- Approved bringing forward $50,000 from 2022/23 and $500,000 from 2023/24, plus an additional new budget of $300,000, to give a revised budget of $850,000 in 2021/22 for the Chapman Place wastewater rising main replacement under the Kaiapoi wastewater account. As a renewal this does not directly affect rates for the 2021/22 year
- Approved a new budget of $50,000 in the 2022/23 year for landscape planting at the Kaiapoi WWTP. This increases the Eastern Districts sewer rate by $0.15 or 0.03% from 2023/24.

APPENDIX 'A'. PLANS

Figure 14: A1 - Plan of Serviced Area

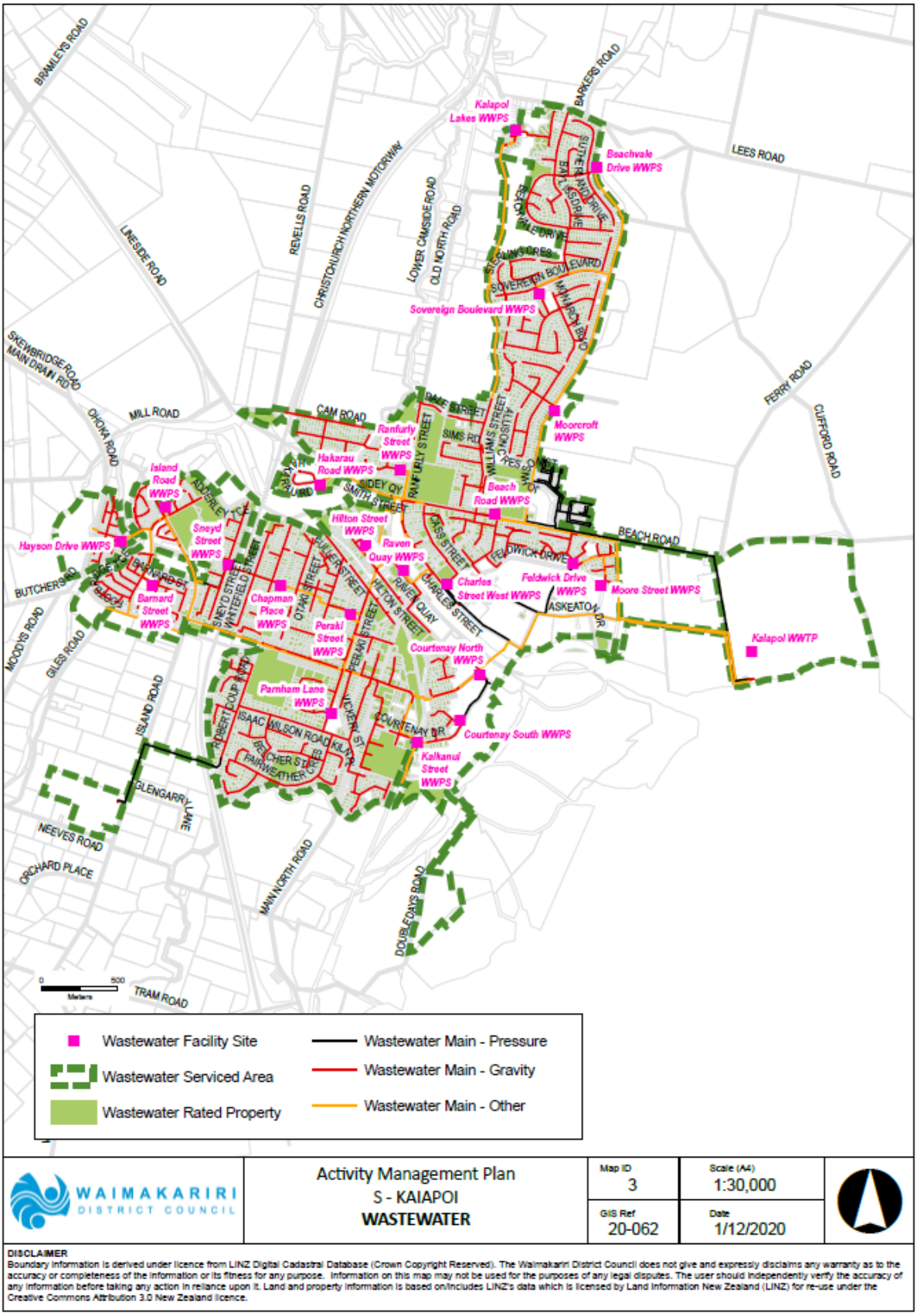


Figure 15: Kaiapoi Wastewater Supply Statistics

Kaiapoi Wastewater Statistics

Kaiapoi | 19/20 | Updated: Jun-20

Note that shading indicates the relative quantity measured for the ten year period (i.e. the lowest value has no shading, the highest has complete shading.)

		July '09 - June '10	July '10 - June '11	July '11 - June '12	July '12 - June '13	July '13 - June '14	July '14 - June '15	July '15 - June '16	July '16 - June '17	July '17 - June '18	July '18 - June '19	July '19 - June '20	5 yr Average	10 yr Average
Average Daily Flow	m^3/day	3,523	4,632	4,361	5,116	4,966	3,881	3,997	4,133	5,305	3,937	2,783	4,031	4,311
Average Dry Weather Flow	m^3/day	3,243	4,196	4,062	4,547	3,880	3,631	3,710	3,586	4,120	3,579	2,481	3,495	3,779
Peak Daily Flow	m^3/day	11,602	11,880	10,614	24,409	21,020	6,664	7,723	16,939	16,748	23,916	6,641	14,393	14,655
Peak Weekly Flow	m^3/day	6,941	7,081	7,583	14,254	11,162	5,114	5,315	8,293	9,279	8,579	4,813	7,256	8,147
Peak Monthly Flow	m^3/day	5,008	5,232	5,313	8,759	7,711	4,667	4,551	6,004	6,346	5,105	3,442	5,089	5,713
Peak Instantaneous Flow	L/s	-	-	-	-	-	-	-	-	-	-	-	-	-
Peak Month		Jun	Aug	Aug	Jun	Apr	Jul	Jan	Apr	Jul	Jun	Jul		
Peak Week		Week 23	Week 33	Week 34	Week 26	Week 17	Week 26	Week 34	Week 16	Week 30	Week 23	Week 30		
Peak Day		28/05/2010	24/07/2010	18/08/2011	17/06/2013	10/06/2014	19/06/2015	28/05/2016	14/04/2017	21/07/2017	1/06/2019	20/07/2019		
Peak Day Rainfall	mm	4.8	0	0	64.6	68.2	10.4	23.2	39	60.8	95.4	22.4		
Peak Day Weather		Wet	Wet	Wet	Storm	Storm	Storm	Storm	Storm	Storm	Storm	Storm		
Total Annual Volume	m^3	1,292,874	1,699,841	1,600,560	1,877,610	1,822,469	1,424,388	1,466,944	1,516,842	1,946,818	1,444,988	1,021,389	1,479,396	1,582,185
Rating Connections		4,226	4,224	4,234	3,584	3,853	4,169	4,420	4,611	4,745	4,884	4,977		
Rating Charges		4,856	4,832	4,858	-	4,486	4,819	5,091	5,348	5,500	5,692	5,810		
Average Daily Flow per Connection	L/con/day	834	1,097	1,030	1,427	1,289	931	904	896	1,118	806	559	857	1,006
Peak Daily Flow per Connection	L/con/day	2,745	2,812	2,507	6,811	5,455	1,598	1,747	3,674	3,530	4,897	1,334	3,036	3,437
Data Quality		very high	very high	very high	very high	very high	very high	very high	very high	very high	very high	high		