WAIMAKARIRI DISTRICT COUNCIL

MEMO

FILE NO AND TRIM NO:	SEW-03-01-05 / 210723120569
DATE:	July 2021
MEMO TO:	Kelly LaValley, Project Delivery Manager
FROM:	Alicia Klos, Project Engineer
SUBJECT:	South South Kaiapoi Water and Wastewater Structure Plan

Kelly,

As requested, I have analysed the water and wastewater network capacity to allow for the potential development of the land in the South South (SS) Kaiapoi area.

The purpose of this investigation is to develop a better understanding of the infrastructure needs for any future development of SS Kaiapoi.

1. Background

The developer of the land at 162 Main North Road Kaiapoi has previously contacted the WDC about beginning development. Unfortunately the long term plan for water and wastewater in the area has never been investigated, as this area has been outside of the urban development zone. Particularly for wastewater, there isn't a lot of remaining capacity in the existing system, therefore major works would be needed to service this area. Due to costs to service this area, this could make development unaffordable if individual properties were allowed to develop in isolation, therefore it would likely require Councils assistance to co-ordinate and develop plans for future development.

SS Kaiapoi area hasn't been investigated previously, so existing physical constraints were assumed to decide the potential SS Kaiapoi full development area and the sub-areas, such as rivers, roads and railways. The following map presents the growth areas considered in this investigation (Figure 1).

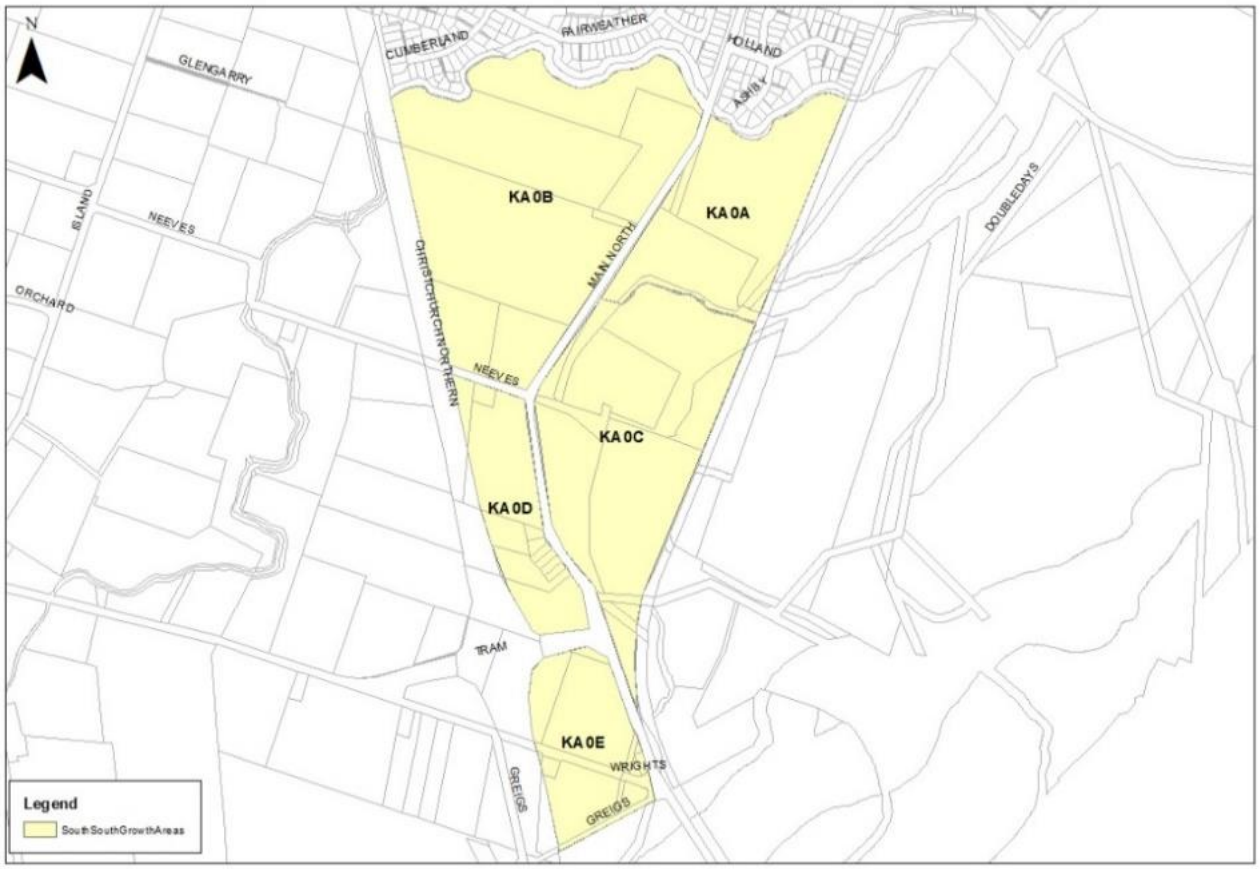


Figure 1:Growth areas assumed for South South Kaiapoi structure plan

Most of the area has been assumed to be residential, developing to 12 lots per hectare. These were modelled with the WDC future water modelling profile and engineering code of practice residential wastewater loads. The exceptions being KA0D and KA0E. KA0D is currently zoned rural, that Hellers is developed on. For this investigation it has been assumed that Hellers would remain and be serviced by the new SS Kaiapoi infrastructure. KA0E is currently zoned business, and has potential to develop further than it is now. It was assumed that both KA0D and KA0E would use full commercial development water demand and wastewater loadings, as per the standard commercial water model profile and engineering code of practice wastewater loads. Table 1 presents the projected demand for the growth areas.

Table 1: Projected demand for the South South Kaiapoi growth areas

Area	Residential Connections / Commercial Area
KA0A	159 connections *
KA0B	440 connections
KA0C	310 connections
KA0D	8.9 Ha
KA0E	9.6 Ha

**as per existing development plans (162 Main North Road)*

This investigation was split into two parts;

1. Water
    a. Establish a skeleton water network for SS Kaiapoi area.
    b. Assess the capacity of the Kaiapoi water network with the additional demand
    c. Assess fire flow capacity of the Kaiapoi water network with the additional demand, considering 25L/s for residential and 50L/s for commercial for SS Kaiapoi area.
    d. Estimate costs to service SS Kaiapoi for water

2. Wastewater
    a. Assessing the required capacity of the SS Kaiapoi rising main network
    b. Two alignment options were assessed in this exercise.
    c. Estimate costs to service SS Kaiapoi for wastewater

1.1. Kaiapoi Water

The Kaiapoi water scheme provides potable groundwater to approximately 5,400 connections, including Pines and Kairaki Beach. The scheme pumps water from six wells, at Darnley Square and Peraki Street. Then into nearby storage reservoirs at Darnley Square and Peraki Street headworks, before being pumped via surface pumps into the reticulation.

Figure 2: Existing Kaiapoi Water Network:Figure 2 presents the existing Kaiapoi water network.

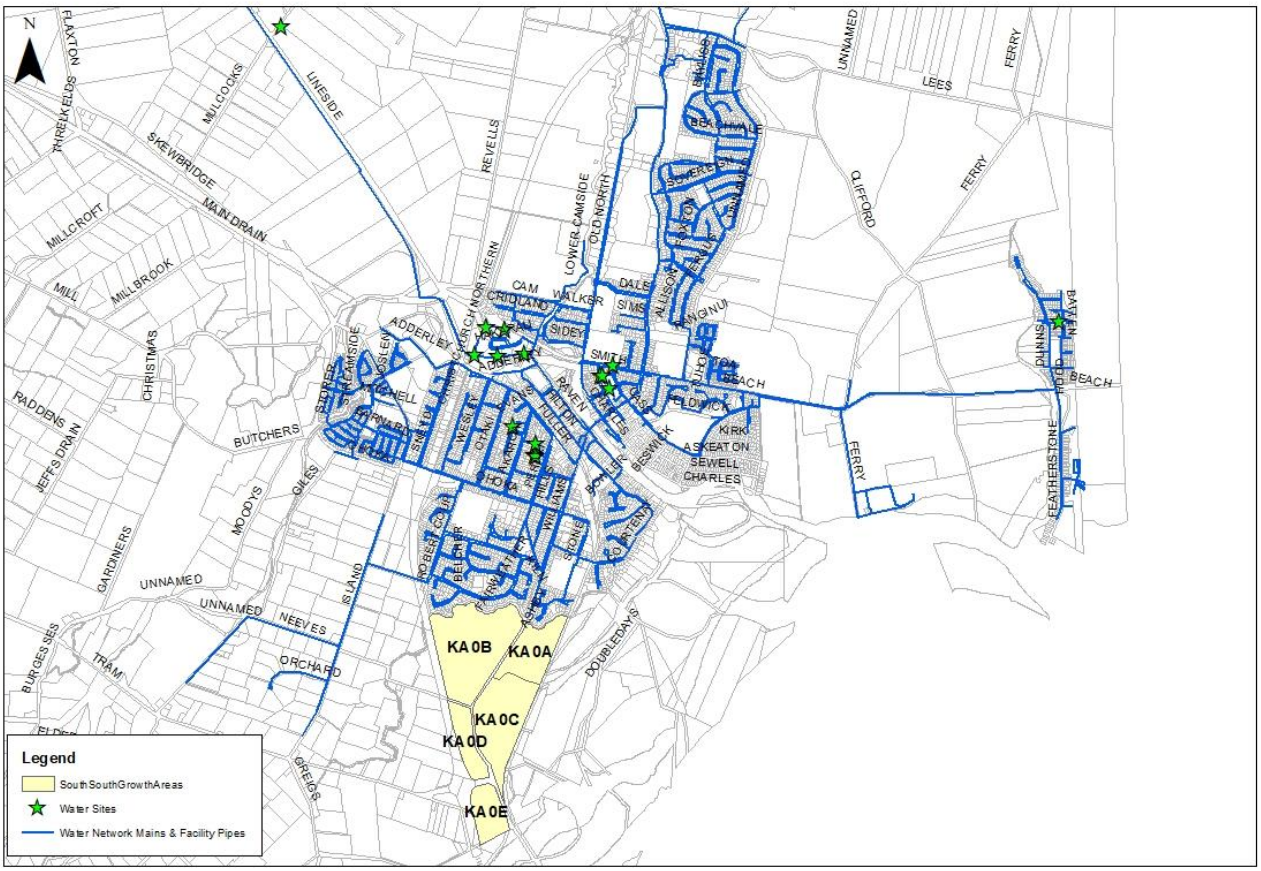


Figure 2: Existing Kaiapoi Water Network:

Firefighting requirements for the water supplies were based on the SNZ PAS 4509:2008 New Zealand Fire Service – Firefighting Water Supplies Code of Practice. It is noted that the water supply classifications for WDC supplies are no longer documented in the WDC Engineering Code of Practice. However, it is Council practice to require FW2 for all residential areas and FW3 for non-residential. All firefighting assessments for SS Kaiapoi have based on these assumptions.

1.2. Kaiapoi Wastewater

The Kaiapoi wastewater network is a shallow gravity network, with the exception of the Beach Grove Subdivision and isolated properties which are serviced by pressure wastewater. As Kaiapoi is very flat there are many pumpstations to service the network and deliver the wastewater to the Kaiapoi Wastewater Treatment Plant (Kaiapoi WWTP).

Kaiapoi's flat topography and development progression has meant that it has many wastewater pumpstations. In the south Kaiapoi network alone there are 11 pumpstations, refer to Figure 3.

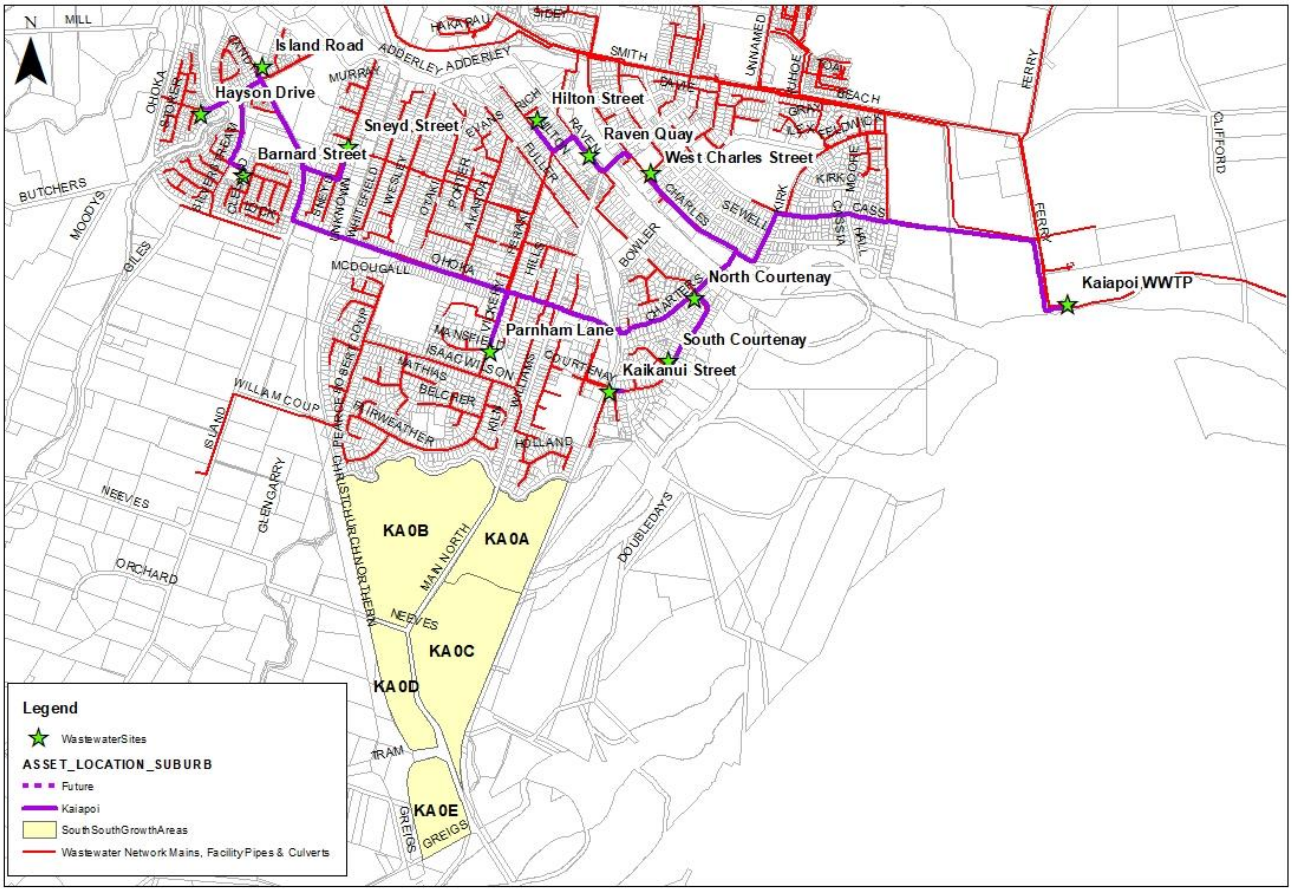


Figure 3: South Kaiapoi Wastewater Network

It is unclear whether all or some of the SS Kaiapoi structure plan area will be developed with gravity or pressure wastewater, however for the purpose of this exercise it has been assumed that gravity wastewater will be constructed in this area. It has also been assumed that there will be several pumpstations required to service the SS Kaiapoi area to ensure gravity mains are no deeper than 3.0m.

2. Methodology

This investigation was a desktop exercise using Mike Urban DHI EPANET, Excel and ArcGIS. The following resources were used;

- Growth Areas - 50 year Water and Wastewater Growth Forecast 2020 (200224024348)
- May 2021 Kaiapoi Base Water EPANET Model
- 2018 Kaiapoi Wastewater MOUSE Model results
- WDC Engineering Code of Practice (ECOP)
- Existing Asset and Development Records
- 2019-20 Valuation rates
- LiDAR land elevations
- Capital Goods Price Index (CGPI) December 2020

Due to the risk of liquefaction in Kaiapoi all pipelines were assumed to be polyethylene.

2.1. Water

The May 2021 Eastern base water distribution DHI Mike Urban model was used as a base model for this investigation. SS Kaiapoi's estimated demand and a skeleton network were added to the model to determine upgrades and network layout for the SS Kaiapoi area. Excel was then used to analyse the modelling results.

A scenario was optimised to connect into the Kaiapoi network at two locations, to create a ring feed for supply resilience and redundancy for the SS Kaiapoi area. Additionally ease of construction and age of the existing reticulation were also considered.

To achieve the WDC level of service, the network pressure is required to be greater than 300kPa throughout the network. Reticulation upgrades are generally recommended when pipeline headloss exceeds 10m/1000m (WDC standard modelling practice). This was used to determine the appropriate pipe sizes to achieve peak hourly flows and fireflow requirements.

Additionally headworks upgrades were also assessed, however it is noted that these are generally based on growth of the scheme as a whole. The existing growth projections have the growth generally occurring north east of Kaiapoi, as this is currently within the Urban Limits. However if SS Kaiapoi was rezoned, then some of this growth may move south. However it is unlikely that the demand would be there for both areas, therefore the headworks upgrades are anticipated to remain the same as documented in the 2020 AMP.

Any future reservoirs were assumed to have the same ratio of operational and dead volumes. The firefighting and emergency storage requirements remained the same as existing. The emergency storage requirements for Kaiapoi are $0m^3$, as it is supplied from a reliable artesian ground water source.

2.2. Wastewater

The wastewater network capacity was calculated using excel and the design requirements from the WDC engineering code of practice. Existing asset records such as rising main, pumps and wetwell information were used to assess the remaining capacity of the existing network.

The ECOP was used to estimate long-term peaking factors for SS Kaiapoi. Standard WDC practice is to assume these long term peaking factors will take hold after 50 years with existing I&I levels trending towards these values in a linear fashion over the 50 year timeframe. Where existing catchments are already achieving the long term ECOP peaking factors it is assumed the I&I levels for these catchments will get no worse over time. Table 2 presents the WDC Engineering Code of Practice design factors.

Table 2: Peaking factors for dry and wet weather flows

	Commercial flows per Hectare	**Residential Peaking Factors**
Average Dry Weather Flow	0.2 L/s/Ha	0.0078 L/s/connection
Peak Dry Weather Flow	0.5 L/s/Ha	2.5
Peak Wet Weather Flow	1 L/s/Ha	2.0 – 4.0*

* *Dependant on the number of connections*

The future rising main design capacities were calculated based on the range of 0.8 to 1.2 m/s (as recommended in the ECOP).

When the option included discharging into the south Kaiapoi wastewater network, the capacity was assessed using an existing south Kaiapoi capacity excel model (*Reviewing the South Kaiapoi Wastewater Network System including Sneyd Street Wastewater Pump Station* (TRIM

150209017319)). This model considered all southern pumpstations pumping into the shared rising main. The existing shared rising main roughness coefficient was recently verified and was 0.55mm for this exercise. All future rising mains had a roughness coefficient of 0.3mm (which is on the rougher end of the plastic pipe roughness range).

The additional wastewater loading can affect all pumps that share rising mains with the SS Kaiapoi structure plan area (i.e. all of south Kaiapoi). The excel model calculates the headloss increase from the additional load, and modifies the system curves accordingly, to then find the duty point of the pumps. All of south Kaiapoi's pumps, Parnham Lane wetwell and the shared rising main capacities were assessed in this exercise.

2.3. Financial Estimates

The 2019-20 valuation rates were used to estimate supply and installation costs for the water and wastewater mains.

The land in the SS Kaiapoi area varies but is generally medium to poor ground conditions (deep silt over sand).

Water asset installation was projected to be relatively straight forward and standard valuation rates were applied. It was assumed that the pipeline would be installed at approximately 1m below ground level, and not require any trench stability or dewatering. It was assumed that the number of lots in the commercial areas would be 4 lots per hectare, based on other commercial areas in the Waimakariri District, which was only used when presenting the costs per lot.

To calculate the wastewater infrastructure installation costs, the following was considered;

- Installation of the pipe at 1.5m.
- 50m of rising main was used as a nominal value to connect from the SS Kaiapoi pumpstations to the shared rising main.
- It was assumed that the wastewater river crossing would be drilled. To allow for the difficult installation technique and location the rising main rate was multiplied by 7 (to align with the 2019-20 valuations).
- It was assumed that development earthworks would not change the ground level significantly (unlike in the Sovereign developments).
- Groundwater levels would be generally below 1.5m, except for KA03 and from Cass Street to the WWTP, where groundwater was assumed to be 0.5m RL.
- Urban and rural (greenfields) proportioned installation of a rising main.
- It was assumed that the number of lots in the commercial areas would be 4 lots per hectare, based on other commercial areas in the Waimakariri District.
- It was decided that the valuation gravity main extra over calculation would be used to allow for poor ground conditions in places (KA03 and from Cass Street to the WWTP).
- Capital goods price index of 4.5% (change of pipe price from mid 2019 to end 2020).
- The costs to build wastewater pumpstations was estimated using a previous exercise, undertaken as part of the 2018 Kaiapoi Wastewater Modelling project. This exercise summarised costs for seven pumpstation construction projects from the Waimakariri District. The CGPI (5%, change from 2018 to end 2020) was added to an average of these pumpstation costs, and applied to most of the structure plan pumpstations.

Additionally 12% professional fees and 40% contingency was applied, as the work is still in the planning phase.

3. Water investigation

3.1. South South Kaiapoi Infrastructure

The following table shows the predicted flows for the individual development areas on a peak day;

Table 3: Modelling flow results

	Residential Connections / Commercial Area	Peak Daily Flow	Peak Hourly Flow
KA0A	159 connections	4.6 L/s	9.5 L/s
KA0B	440 connections	12.8 L/s	26.4 L/s
KA0C	310 connections	9.0 L/s	18.6 L/s
KA0D	8.9 Ha	3.2 L/s	8.9 L/s
KA0E	9.6 Ha	3.5 L/s	9.6 L/s
Total		*** 31.9 L/s**	*** 59.2 L/s**

** Note that peak commercial and residential do not occur at the same time, therefore the total is not simply the sum of the areas.*

Refer to Appendix 6.1 for more detail capacity calculations for water.

The following skeleton network (Figure 4) was assumed for the SS Kaiapoi area. Note that the location of these pipes is indicative, and would be dependent on development road layouts.

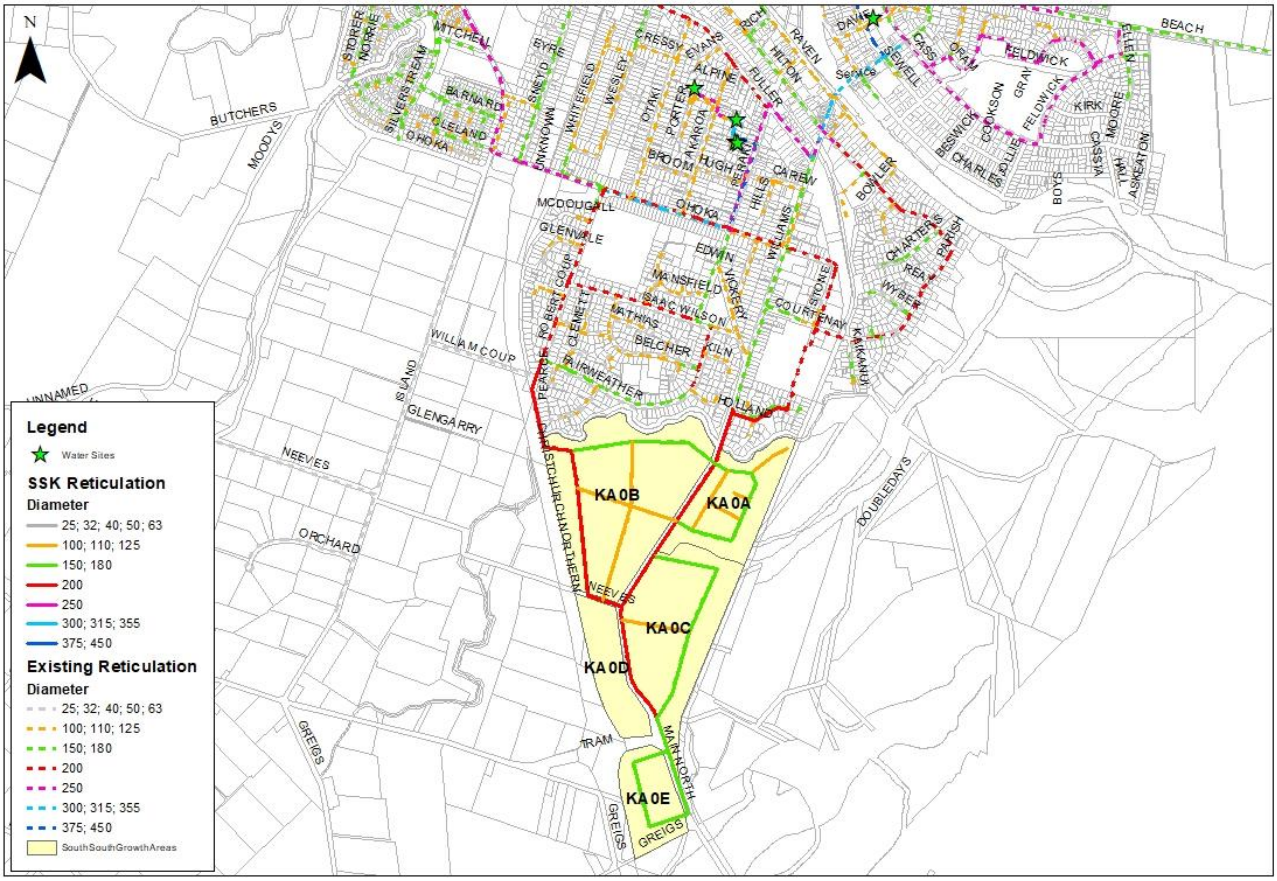


Figure 4: Basic water network for South South Kaiapoi

This scenario was optimised to connect into the Kaiapoi network at two locations, to create a ring feed for supply resilience and redundancy the SS Kaiapoi area. Connecting to the 200mm diameter main along Robert Coup Road and to the 200mm diameter main at the end of Holland Drive was found to be the best connection points into the existing network. The connection points to the Kaiapoi network were selected based on ease of construction and pipe size requirements for fire flows. It should be noted however that other network layouts could be developed, depending on final development plans.

Connecting the SS Kaiapoi area into Kaiapoi's existing network at these points means there would be no additional upgrades recommended for the existing Kaiapoi reticulation.

A 200mm diameter main is required the majority of the way along Main North Road to service the commercial firefighting requirements for KA0D and KA0E.

3.2. Kaiapoi Water Network Capacity

The effect of SS Kaiapoi on the Kaiapoi water network was assessed in this investigation, the following was analysed on a Peak Day;

1. Well Pump Capacity
2. Reservoir Capacity
3. Surface Pump Capacity

For this part of the investigation, the demand at the 10 year growth horizon has been used as a reference, but not assessed in conjunction with SS Kaiapoi demand. Scheme growth in Kaiapoi is currently projected to occur in the north, but if this area is rezoned it may occur in the south instead. It is unclear where the growth would occur if this area was to be rezoned. Regardless of the growth location the headworks upgrade requirements should remain similar to that in the AMP.

Table 4 presents the source flow requirements for the existing demand, with SS Kaiapoi demand added and the demand projected for year 2031.

Table 4: Source requirements and available capacity

	Required Source Flow *	Available Source Capacity (2021 AMP)
Existing - Combined Peraki and Darnley	129 L/s	266 L/s
With addition of SSK - Combined Peraki and Darnley	164 L/s	266 L/s
Projected Kaiapoi demand at 10 years (2021 AMP)	201 L/s	**336 L/s

** includes 10% usage safety factor*
*** Upgrade recommended at year 2023 when rating units exceed 6,000 units. Required to reduce reservoir working volume at Darnley Square*

There is sufficient source capacity to supply the existing Kaiapoi network and all of SS Kaiapoi. Although a source capacity upgrade is recommended to offset storage requirements for the additional demand for SS Kaiapoi, see further comments below.

Table 5 presents the storage requirements with and without South South Kaiapoi (SSK). When the required storage capacity exceeded the previous storage capacity an upgrade was recommended. In most circumstances an additional reservoir would be recommended, however for Kaiapoi it is recommended that source upgrades are undertaken, as there is limited land available at the headworks sites to build reservoirs and the sources are artesian.

Table 5: Storage requirements and available capacity

	Combined Peraki and Darnley Headworks
Total Storage Volume	798 m3
PDF Demand Existing	117 L/s
PDF Demand with SSK	149 L/s
Dead Volume	20%
	160 m3
Operational Volume	15%
	120 m3
Fire fighting Storage	0 m3
Emergency Storage	0 m3
Source flow Existing	266 L/s
Working Volume Existing	352 m3
Total Storage Required Existing	632 m3
Surplus Storage Existing	167 m3
Water Level Remaining on Peak Day *	41%
Source Flow with SSK	266 L/s
Working Volume with SSK	826 m3
Total Storage Required with SSK	1116 m3
Surplus Storage with SSK	-317 m3
Water Level Remaining on Peak Day *	-19%
Source Flow with SSK and more source flow **	336 L/s
Working Volume with SSK and more source flow	0 m3
Total Storage Required with SSK and more source flow	280 m3
Surplus Storage with SSK and more source flow	519 m3
Water Level Remaining on Peak Day *	85%

* *Water Level Remaining on Peak Day uses only working and operational volumes.*

** *Recommended upgrade from 2021 AMP*

Kaiapoi source capacity is currently 266L/s. To align with the 2021 AMP projects, a reservoir upgrade is predicted to be required in year 2023 (when rating units area projected to exceed 6,000 rating units), so an additional well upgrade (70L/s) is recommended to offset the need to build an additional reservoir at the Darnley Square Headworks. This would reduce the required working volume and the reservoirs would have surplus storage (85%) for the Kaiapoi scheme.

The existing surface pumps are capable of servicing SS Kaiapoi (refer to Table 6). The model predicted that the reticulation pressure level of service (300kPa) would be met with the connection of the SS Kaiapoi area, and with the reticulation network presented in Figure 4.

Table 6: Surface Pump requirements and available capacity

	Peak Hourly Flow	Required Fire Flow	Available Pump Capacity (2021 AMP)
Existing - Combined Peraki and Darnley	208 L/s	154 L/s	335 L/s
With addition of SSK - Combined Peraki and Darnley	267 L/s	184 L/s	335 L/s
Projected Kaiapoi demand at 10 years (2021 AMP)	356 L/s		*420 L/s

* *Upgrade scheduled when rating units reach 6,400, an additional 85L/s*

To achieve the firefighting level of service in Kaiapoi, 50L/s is required in the commercial areas and 25L/s in the residential areas, while maintaining 100kPa residual pressure for the remainder of the network. The firefighting requirements were met for Kaiapoi, with the additional SS Kaiapoi demand.

Note that if the growth was to occur in SS Kaiapoi, the headworks upgrades may be better suited to be assigned to Peraki Street Headworks, as this is closer to the growth area. Currently the upgrades (2021 AMP) are weighted to Darnley Square headworks as the growth is generally projected to occur north of Kaiapoi.

In 2022 when the connection growth projections are likely reassessed, this area should be discussed, and potentially included in the 2023 50 year water supply growth modelling. This would give a better picture of the headworks upgrades needed to service all of the future growth for Kaiapoi.

3.3. Financial Estimate – Water

The following presents a cost estimate for the upgrades required to service SS Kaiapoi, using 2020 valuation rates.

Table 7: Estimated costs to construct water mains for South South Kaiapoi

Sub Area	Number of lots Contributing to WW Asset	Total Structure Plan Area Development		Constructed by Developer		WDC Funded		Development Contribution	
		Total	***Per Lot***	**Total**	***Per Lot***	**Total**	***Per Lot***	**Total**	***Per Lot***
KA0A	159	$478,000	*$3,000*	$260,000	*$1,600*	$0	*$0*	$218,000	*$1,400*
KA0B	440	$904,000	*$2,100*	$300,000	*$700*	$0	*$0*	$604,000	*$1,400*
KA0C	310	$961,000	*$3,100*	$270,000	*$900*	$0	*$0*	$691,000	*$2,200*
KA0D	36	$80,000	*$2,200*	$0	*$0*	$0	*$0*	$80,000	*$2,200*
KA0E	39	$487,000	*$12,500*	$400,000	*$10,300*	$0	*$0*	$87,000	*$2,200*
Total		**$2,910,000**		**$1,230,000**				**$1,680,000**	

Refer to Appendix 6.1.1 for more details on the cost estimate for the water infrastructure.

It has been assumed that all connections would contribute (development contribution) to the 200mm diameter ring main through KA0B and along Main North Road. The 150mm and 200mm diameter extension along Main North Road would be a shared asset that would likely be funded with a development contribution, however it would only be funded by KA0C, KA0D and KA0E.

The overall cost to construct the skeleton network presented in Figure 4, was estimated to be $2.9 million. The costs include 12% fees and 40% contingency.

The estimated cost to the developer to construct the skeleton network presented in Figure 4, was estimated to be $1.2 million, ranging from $700 to $10,000 per lot, excluding Hellers (KA0D) as this is fully developed.

It was estimated that the development contribution for water would be $1.7 million, ranging from $1,400 to $2,200 per lot. There have not been any time frames projected for this development area, therefore reimbursement of these costs us unknown. If the SS Kaiapoi area develops slowly, this would be a financial risk to Council for funding the construction of a larger main to service the area.

It was assumed that the WDC would not need to fund any of the work as it would not be servicing or benefiting any existing water ratepayers.

4. Wastewater Investigation

4.1. South South Kaiapoi wastewater Infrastructure

The following presents the estimated flows from the growth areas in SS Kaiapoi for wastewater. This assumes 12 lots per hectare and flows from the WDC engineering code of practice.

Table 8: Estimated wastewater flows for south south Kaiapoi

Area	Connections	Average Dry Weather Flow	Peak Dry Weather Flow	Peak Wet Weather Flow
Section 1 - KA0E	9.7 Ha	1.9 L/s	4.9 L/s	9.7 L/s
Section 2 - KA0D	8.9 Ha	1.8 L/s	4.5 L/s	8.9 L/s
Section 3 - KA0E and KA0D		3.7 L/s	9.3 L/s	18.6 L/s
Section 3a - KA0C	310 lots	2.4 L/s	6.1 L/s	15.2 L/s
Section 3 - KA0D and KA0C		6.1 L/s	15.4 L/s	33.8 L/s
Section 4a - KA0B	440 lots	3.4 L/s	8.6 L/s	19.5 L/s
Section 4 - KA0D, KA0C and KA0B		9.6 L/s	23.9 L/s	53.2 L/s
Section 5a - KA0A	159 lots	1.2 L/s	3.1 L/s	9.2 L/s
Section 5 - KA0D, KA0C, KA0B and KA0A		10.8 L/s	27.1 L/s	62.4 L/s

Refer to Appendix 6.2 for more detail capacity calculations for wastewater.

It has been assumed that there would be either gravity or pressure wastewater infrastructure discharging into a downstream pumpstation for each area. Note that the internal reticulation would be designed by the developer, and is not included in this investigation. These individual pumpstations would pump into a shared rising main.

The following presents (Figure 5, Table 9: Shared south south Kaiapoi rising main infrastructure table

Rising main section	Combined to WWTP or Parnham Lane PS	Combined B, C, D and E	Combined C, D and E	Combined D and E
PWWF	62 L/s	53 L/s	34 L/s	19 L/s
Recommended RM ID	dia. 302	dia. 268	dia. 212	dia. 153
Recommended RM OD	dia. 355	dia. 315	dia. 250	dia. 180
Recommended RM Velocity	0.87 m/s	0.94 m/s	0.95 m/s	1.01 m/s

Table 10 and Table 9) the wastewater rising main and pump station network recommended to service the SS Kaiapoi area. Note the pumpstation locations are high-level estimations, and would be decided by each developer.

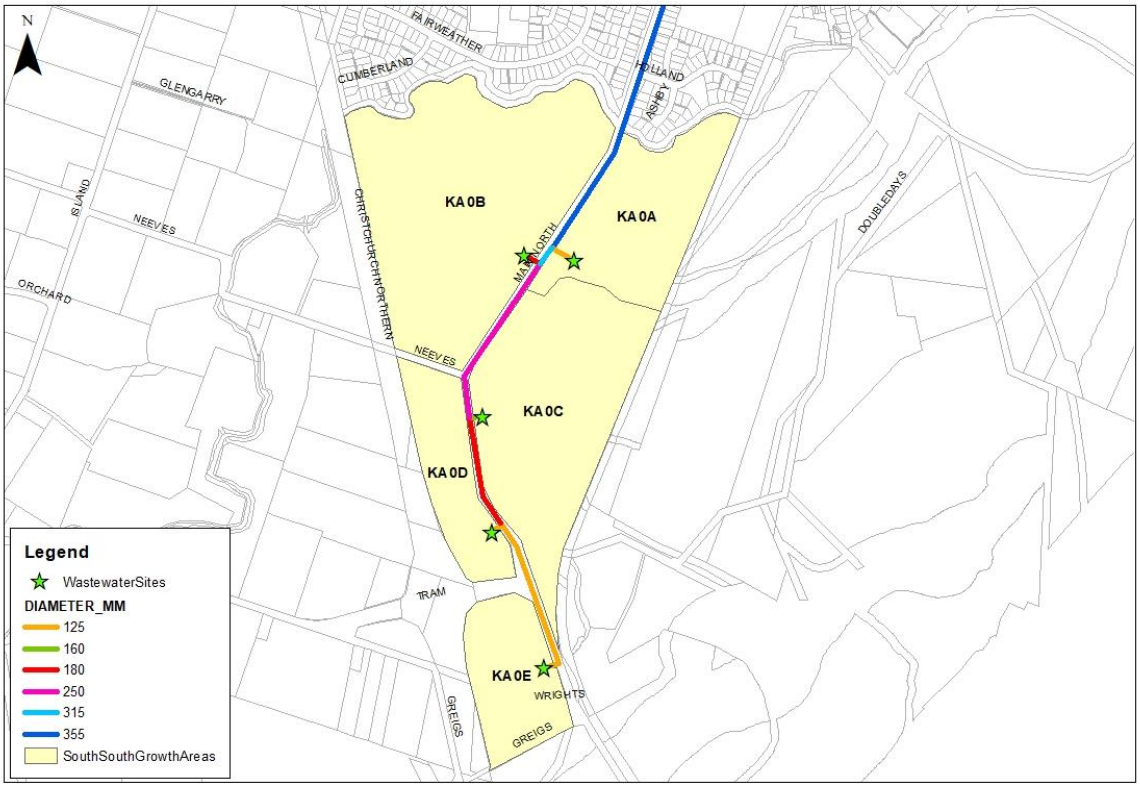


Figure 5: South South Kaiapoi Wastewater rising main (OD) and pumpstation infrastructure Map

Table 9 presents the recommended shared rising main diameters and velocities, whereas Table 10 presents the internal reticulation and pumping requirements.

Table 9: Shared south south Kaiapoi rising main infrastructure table

Rising main section	Combined to WWTP or Parnham Lane PS	Combined B, C, D and E	Combined C, D and E	Combined D and E
PWWF	62 L/s	53 L/s	34 L/s	19 L/s
Recommended RM ID	dia. 302	dia. 268	dia. 212	dia. 153
Recommended RM OD	dia. 355	dia. 315	dia. 250	dia. 180
Recommended RM Velocity	0.87 m/s	0.94 m/s	0.95 m/s	1.01 m/s

Table 10: South South Kaiapoi Wastewater rising main and pumpstation infrastructure table

Rising main section	KA0A	KA0B	KA0C	KA0D	KA0E
PWWF	9 L/s	19 L/s	15 L/s	9 L/s	10 L/s
Recommended RM PS to shared RM - ID	dia. 106	dia. 153	dia. 136	dia. 106	dia. 106
Recommended RM PS to shared RM - OD	dia. 125	dia. 180	dia. 160	dia. 125	dia. 125
Recommended RM Velocity	1.04 m/s	1.06 m/s	1.05 m/s	1.01 m/s	1.10 m/s
Recommended PS Operating Pressure - Direct discharge to WWTP (O1)	17 m	17 m	21 m	24 m	29 m
Recommended PS Operating Pressure - Discharge to Parnham Lane PS (O2 and O3)	7 m	7 m	11 m	14 m	19 m

Table 10 presents the required duty points for the pumps for each of the growth areas (e.g. KA0A would require a pump capable of 9L/s at 17m or 7m depending on the discharge option selected). This table also presents the recommended sized rising main to discharge wastewater from the development to the shared SS Kaiapoi rising main.

4.2. South Kaiapoi Wastewater Network

The south Kaiapoi wastewater network is technically at capacity, therefore simply connecting SS Kaiapoi is not an option.

Three options were therefore investigated to service the SS Kaiapoi structure plan area. Although it is noted that there are many other options for discharging wastewater from this area, these three options are presented to give an indication of costs, pumpstations and rising main sizing requirements.

The options investigated are as follows;

1. SS Kaiapoi has a dedicated rising main to the Kaiapoi WWTP, around Courtenay Drive, across the river to the WWTP.
2. SS Kaiapoi discharges into Parnham Lane Pumpstation, then upgrade the shared rising main to increase capacity in the south Kaiapoi network.
3. SS Kaiapoi discharges into Parnham Lane Pumpstation, then construct a dual rising main to increase capacity in the south Kaiapoi network.

To show the capacity of the south Kaiapoi wastewater system, design and existing system flows were modelled. Table 11 and Table 12 present the modelled results, which are explained further below the tables.

Table 11: Design and Existing Simultaneous pump operation (excluding SS Kaiapoi)

Simultaneous Pump Operation	Design		Existing	
	Pressure	Flow	Pressure	Flow
Island Road PS	62 m	45 L/s	38 m	30 L/s
Sneyd St PS	56 m	10 L/s	37 m	10 L/s
Parnham Ln PS	36 m	91 L/s	25 m	67 L/s
Courtenay Dv North PS (South + North)	31 m	10 L/s	25 m	16 L/s
Charles West PS	34 m	33 L/s	28 m	33 L/s

Red highlights show upgrades needed (which could be pump or rising main upgrades)

Table 12: Shared rising main velocities with all pumps running simultaneously (excluding SS Kaiapoi)

		Shared Rising Main Velocity	
	Rising Main Size	**Design**	**Existing**
Silverstream to Vickery St	250 mm	1.27 m/s	0.85 m/s
Parnham Lane PS to Vickery St	335 mm	1.27 m/s	0.94 m/s
Vickery St to Courtenay Dv	450 mm	1.27 m/s	0.93 m/s
North Courtenay PS to Courtenay Dv	180 mm	0.55 m/s	0.88 m/s
Courtenay Dv to River	450 mm	1.36 m/s	1.07 m/s
River Crossing*	355 mm	2.18 m/s	*1.72 m/s
New Charles/Jones St to Charles St	200 mm	1.36 m/s	1.36 m/s
to end of Cass St	375 mm	1.71 m/s	1.41 m/s
to WWTP	450 mm	1.65 m/s	1.36 m/s

Red highlights show calculated rising main velocities above the ECOP recommendations on maximum wastewater rising main velocity of 1.5m/s.

**The river crossing rising main is an inverted syphon, so it benefits from flushing at higher velocities. Therefore velocities below 2.0m/s have not been highlighted for this section of rising main.*

4.2.1. Design flows

This scenario was run to show the ultimate state of the current south Kaiapoi wastewater network (i.e. the level of service the WDC has committed to). It was found that either all pumps would need to be upgraded or parts of the shared rising main would need to be upsized to accommodate the design flows. Note that the design flows include the Island Road Pumpstation discharging 45L/s, which would be when Silverstream is fully developed, and when it is discharging at ECOP flows (upgrade predicted to be required in more than 13 years' time). This scenario also allows

for Parnham Lane pumps to be running at full speed, 91L/s, which would only be the case if additional connections were added to the Parnham catchment.

The section of rising main between Sneyd Street and Parnham Lane is beyond the scope of this work, but would also be operating at capacity when the full development flows begin from the Island Road pumpstation.

The long term deficiencies associated with this scenario have all been addressed as part of the Council's long term planning through a combination of planned pump replacements and I&I reduction work in some catchments.

4.2.2. Existing system

This scenario represents the current operating scenario, with all pumps operating simultaneously at their regular operational set points. There are some key features of the South Kaiapoi wastewater network that relate to this exercise, these are as follows:

1. The Kaikanui catchment was recently diverted to the Courtenay Drive pumpstation. The Courtenay Drive pumpstation was originally designed to operate at 10L/s and is now projected to run at 16.1L/s.
2. As the Kaikanui discharge was diverted from Parnham Lane catchment, the Parnham Lane pumps are now set to operate at 67L/s rather than the design flow of 91L/s.
3. Currently the Island Road pumps run at 30L/s and should not require upgrading for at least another 13 years (assuming growth projections hold true), when they would get upgraded to 45L/s.

It was found that under the existing operating conditions, the Courtenay Drive pumps would need upgrading, regardless of any additional connections. This upgrade hasn't been undertaken yet as the pumps are only marginally undersized, and these capacity calculations are conservative.

4.2.3. Option 1 – Dedicated Rising Main

It was calculated that a 300mm diameter main (355mm diameter PE) would be required to service SS Kaiapoi in isolation. The following figure (Figure 6) presents the alignment selected, which was selected based on a high level assessment of services along existing road corridors.

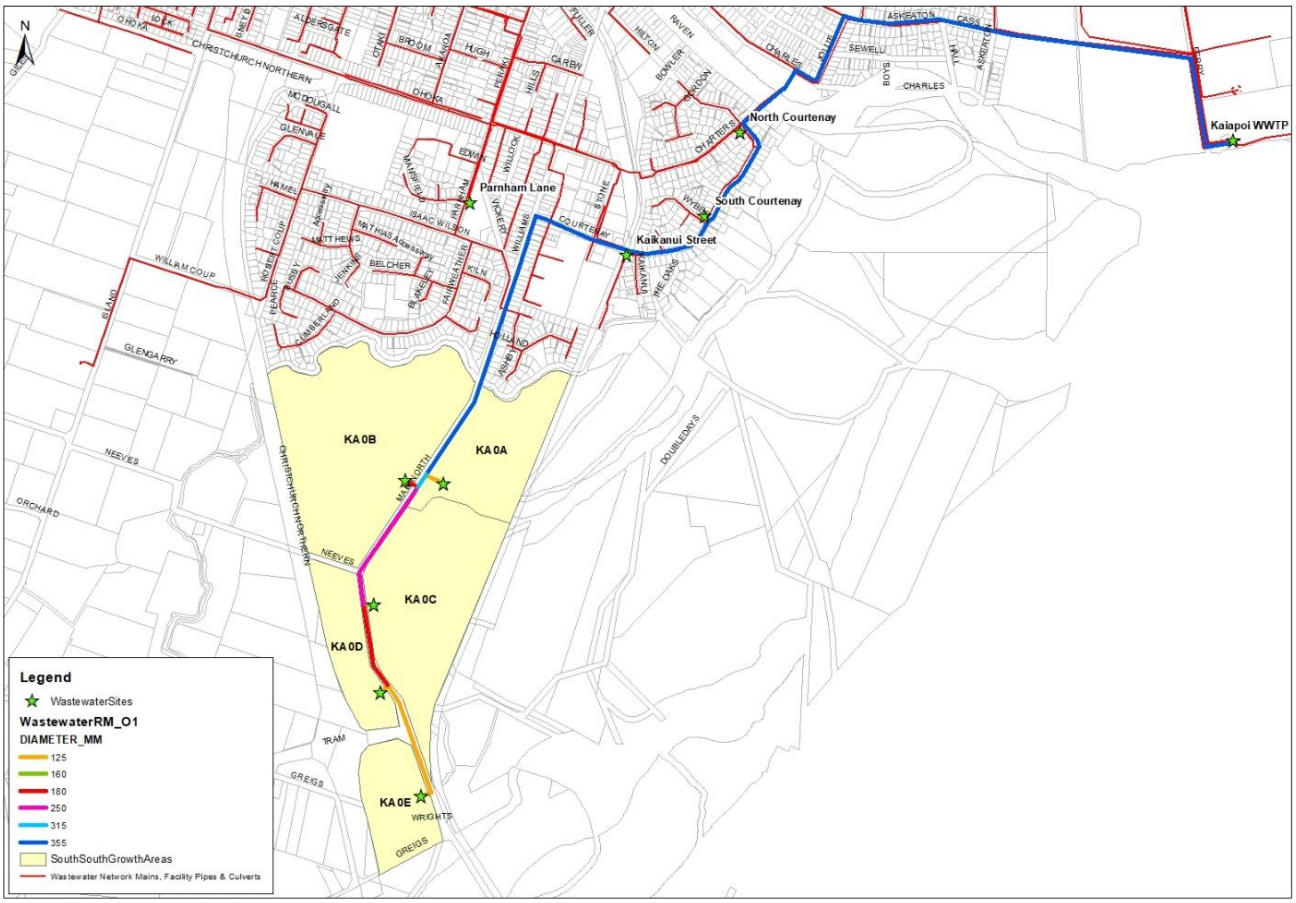


Figure 6: Option 1 map of rising main alignment and sizing

This option has the benefit of not affecting the existing SS Kaiapoi network, which could mean less operational changes in the level of service. However it may be a better solution to have a larger diameter pipe discharging into the WWTP, to reduce the total number of pipes discharging to the WWTP in the long term. Additionally this option doesn't provide as much resilience as the others, as it would bypass South Kaiapoi.

The pump operation requirements were estimated to be as follows, Table 13.

Table 13: Option 1 pump duty points

Pumpstation location	KA0A	KA0B	KA0C	KA0D	KA0E
PWWF	9 L/s	19 L/s	15 L/s	9 L/s	10 L/s
Recommended PS Operating Pressure - Direct discharge to WWTP	17 m	17 m	21 m	24 m	29 m

4.2.4. Option 2 – Upsize Rising Main

Option 2 is to replace the existing rising main from the Parnham Lane Pumpstation to the Kaiapoi WWTP. The following table and map (Table 14 and Figure 7) present the recommended pipe sizes for this option.

Table 14: Existing and Option 2 rising main sizes and velocities

	Existing Rising Main Size (OD)	Option 2 rising main size (OD)	Shared Rising Main Velocity	
			Existing **	With SSK connected and Upgraded Rising Main *
Snyed Street to Parnham Lane	dia. 250	Not upgraded	0.85 m/s	1.55 m/s

Parnham Lane PS to Vickery St	dia. 335	dia. 500	0.94 m/s	0.91 m/s
Vickery St to Courtenay Dv	dia. 450	dia. 560	0.93 m/s	1.04 m/s
Courtenay Dv to River	dia. 450	dia. 560	1.07 m/s	1.13 m/s
River Crossing*	dia. 355	dia. 560	1.72 m/s	1.13 m/s
New Charles/Jones St to Charles St	dia. 200	Not upgraded	1.36 m/s	1.04 m/s
to end of Cass St	dia. 375	dia. 630	1.41 m/s	1.04 m/s
to WWTP	dia. 450	dia. 630	1.36 m/s	1.04 m/s

Red highlights show calculated rising main velocities above the ECOP recommendations on maximum wastewater rising main velocity of 1.5m/s.

**includes full development design flows into the island road pumpstation of 45L/s.*

***does not include full development design flows into the island road pumpstation of 45L/s.*

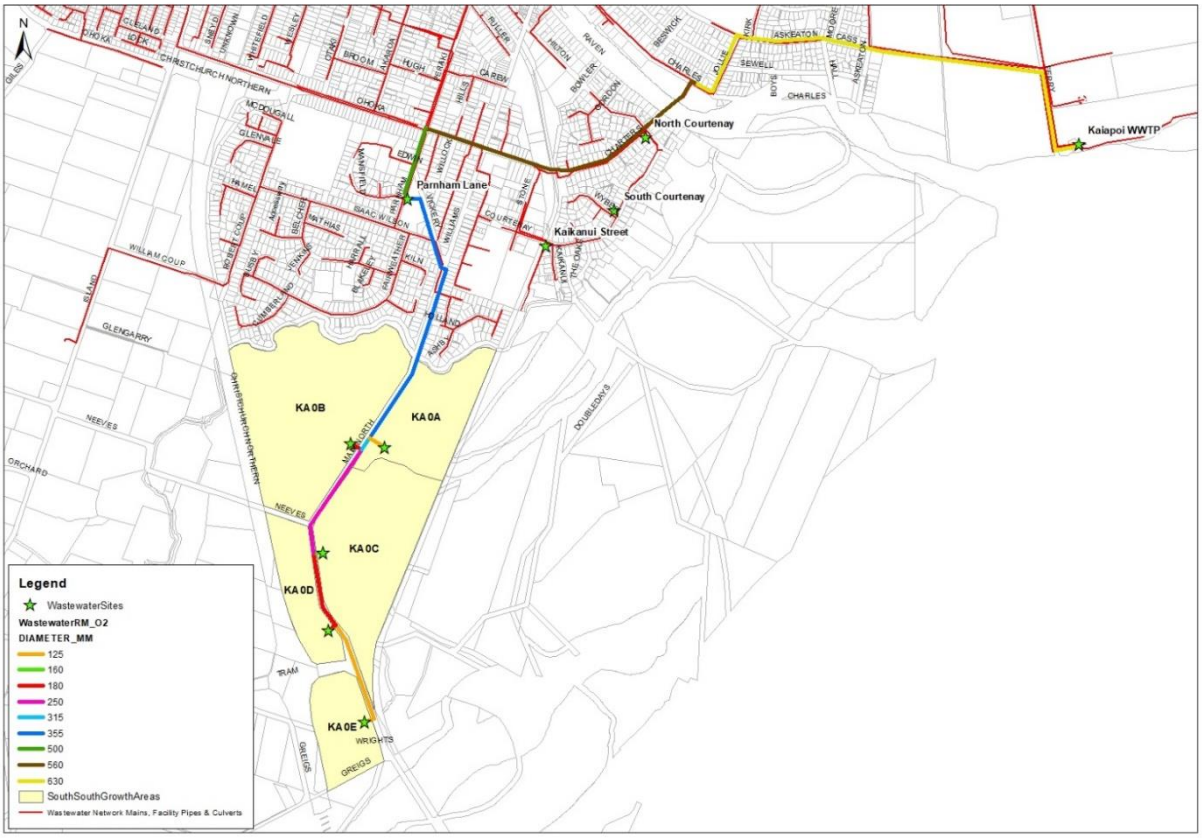


Figure 7: Option 2 map of rising main alignment and sizing

The rising main sizes were selected based on having a velocity within the recommended range of 0.8m/s to 1.2m/s, from the WDC ECOP.

Table 14 shows that the replacement rising main would relieve the existing system by reducing the rising main velocities to within the recommended ECOP range.

The pump operation requirements were estimated to be as follows, Table 13.

Table 15: Option 2 pump duty points

Simultaneous Pump Operation	**Original Design**		**Existing**		**With SSK connected and Upgraded Rising Main**	
	Pressure	Flow	Pressure	Flow	Pressure	Flow
Island Road PS	62 m	45 L/s	38 m	30 L/s	42 m	45 L/s
Sneyd St PS	56 m	10 L/s	37 m	10 L/s	36 m	10 L/s
Parnham Ln PS	36 m	91 L/s	25 m	67 L/s	19 m	152 L/s
Courtenay Dv North PS (South + North)	31 m	10 L/s	25 m	16 L/s	15 m	16 L/s
Charles West PS	34 m	33 L/s	28 m	33 L/s	20 m	33 L/s

Red highlights show upgrades needed (which could be pump or rising main upgrades)

It was found that the operating pressures would be lower than they are now, but all are within the capabilities of the existing pumps. Note that Island Road's pressure is higher due to the increase in flow when it is fully developed.

Table 15 shows that Island Road Pumps would need to be upgraded, and this is scheduled when development in the catchment reaches a threshold. When upgrading the Island Road Pumps it may be worth considering selecting pumps to operate in a range which would also work if the rising main network was upgraded.

Courtenay Drive pumps are currently operating outside of their recommended range, however the pumps are only marginally undersized, and these capacity calculations are conservative.

This option has the advantage of upgrading some rising mains that are at capacity in the South Kaiapoi network (i.e. the river crossing), which option 1 would not provide. However it does not increase the redundancy of the network, whereas having dual mains would.

A key disadvantage of this option is it would require replacement of key infrastructure that is generally between 1 to 10 years in age.

4.2.5. Option 3 – Dual Rising Main

Option 3 is to install a dual rising main from Parnham Lane pumpstation to the Kaiapoi WWTP. The following table and map (Table 16 and Figure 8) present the recommended pipe sizes for this option.

Table 16: Existing and Option 3 rising main sizes and velocities

	Existing Rising Main Size (OD)	Option 3 rising main size (OD)	Shared Rising Main Velocity	
			Existing **	With SSK connected and Upgraded Rising Main *
Snyed Street to Parnham Lane	dia. 250	Not upgraded	0.85 m/s	1.55 m/s
Parnham Lane PS to Vickery St	dia. 335	dia. 315	0.94 m/s	1.08 m/s
Vickery St to Courtenay Dv	dia. 450	dia. 400	0.93 m/s	0.96 m/s
Courtenay Dv to River	dia. 450	dia. 450	1.07 m/s	0.87 m/s
River Crossing*	dia. 355	dia. 400	1.72 m/s	1.17 m/s
New Charles/Jones St to Charles St	dia. 200	Not upgraded	1.36 m/s	1.04 m/s
to end of Cass St	dia. 375	dia. 450	1.41 m/s	1.02 m/s
to WWTP	dia. 450	dia. 450	1.36 m/s	1.02 m/s

Red highlights show calculated rising main velocities above the ECOP recommendations on maximum wastewater rising main velocity of 1.5m/s.

**includes full development design flows into the island road pumpstation of 45L/s.*

***does not include full development design flows into the island road pumpstation of 45L/s.*

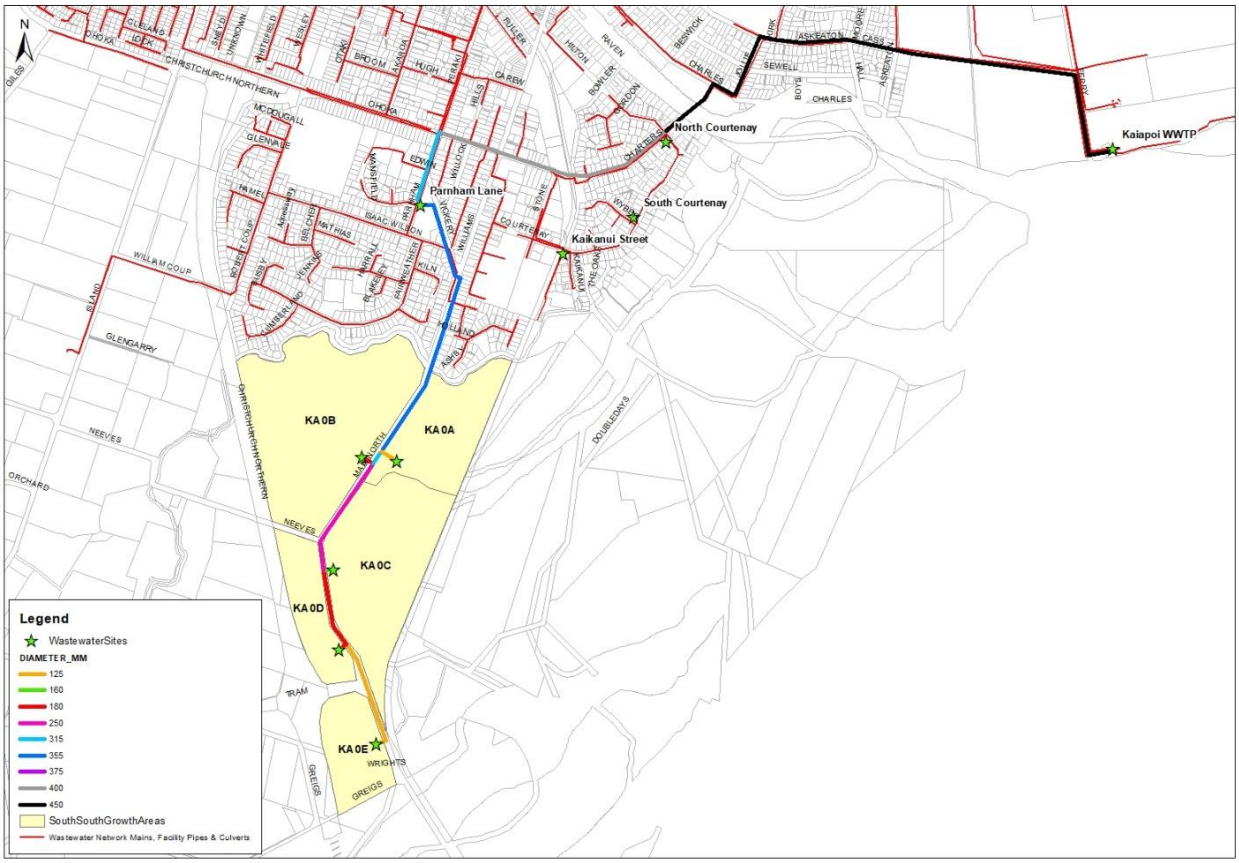


Figure 8: Option 3 map of rising main alignment and sizing

The rising main sizes were selected based on having a velocity within the recommended range of 0.8m/s to 1.2m/s, from the WDC ECOP. Table 16 shows that the dual rising main would relieve existing system by reducing the rising main velocities to within the recommended ECOP range.

It is assumed that the operating pressure would need to be the same as option 2. Refer to Table 15: Option 2 pump duty pointsTable 15. It was found that the operating pressures would be lower than they are now, but all are within the capabilities of the existing pumps.

This option would operate in a similar fashion to option 2, however it would theoretically provide more redundancy to the system and be a better configuration for undertaking maintenance. It would also mean that the relatively new infrastructure installed in the South Kaiapoi area could continue to be utilised. Note that the alignment is indicative, and may be better suited to crossing the river at a location further up or down stream to improve the systems resilience even further.

4.3. Financial Wastewater Estimate

This section presents the estimated costs to supply and install wastewater pumpstations and rising mains for the SS Kaiapoi structure plan servicing options.

To ensure costs are spread equitably between developers it will be necessary for Council to partially fund the development of the wastewater scheme extension and recoup costs through development contributions. Infrastructure that is shared across multiple developments should be funded through development contributions paid to the Council.

The existing infrastructure for the South Kaiapoi wastewater network is at capacity and adequately services the existing connections. However if this area develops in 50 years' time the rising mains may be better replaced while construction is occurring in the area. Therefore it has been assumed that this work would be completely developer funded for options 1 and 3 (whether

it be development contribution or constructed by the developer), however for the option (option 2) the extra over cost to upsize the shared rising main has been separated and allocated as a WDC cost.

Table 17, Table 18 and Table 19 present cost estimates assuming the WDC would undertake the work for all shared assets and receive development contributions as development occurs. Refer to the methodology section for cost estimate assumptions, and see the appendix 6.2.4, 6.2.5 and 6.2.6 for the cost full calculations.

Table 17: Option 1 dedicated rising main, estimated costs to construct rising mains and pumpstations for South South Kaiapoi

Sub Area	Lots	Total Structure Plan Area Development		Constructed by Developer		WDC Funded		Development Contribution*	
		Total	Per Lot	Total	Per Lot	Total	Per Lot	Total	Per Lot
KA0A	159	$1,780,000	*$11,000*	$930,000	*$6,000*	$0	*$0*	$850,000	*$5,000*
KA0B	440	$3,500,000	*$8,000*	$1,100,000	*$3,000*	$0	*$0*	$2,400,000	*$5,000*
KA0C	310	$3,070,000	*$10,000*	$1,120,000	*$4,000*	$0	*$0*	$1,960,000	*$6,000*
KA0D	36	$1,250,000	*$35,000*	$930,000	*$26,000*	$0	*$0*	$320,000	*$9,000*
KA0E	39	$1,480,000	*$38,000*	$1,130,000	*$29,000*	$0	*$0*	$350,000	*$9,000*
Total		**$11,080,000**		**$5,210,000**		**$0**		**$5,880,000**	

Table 18: Option 2 upsize rising main, estimated costs to construct rising mains and pumpstations for South South Kaiapoi

Sub Area	Lots	Total Structure Plan Area Development		Constructed by Developer		WDC Funded *		Development Contribution*	
		Total	*Per Lot*	Total	*Per Lot*	Total	*Per Lot*	Total	*Per Lot*
KA0A	159	$2,320,000	*$15,000*	$930,000	*$6,000*	$370,000	*$2,000*	$1,030,000	*$6,000*
KA0B	440	$5,020,000	*$11,000*	$1,100,000	*$3,000*	$1,020,000	*$2,000*	$2,890,000	*$7,000*
KA0C	310	$4,140,000	*$13,000*	$1,120,000	*$4,000*	$720,000	*$2,000*	$2,300,000	*$7,000*
KA0D	36	$1,370,000	*$38,000*	$930,000	*$26,000*	$80,000	*$2,000*	$360,000	*$10,000*
KA0E	39	$1,620,000	*$42,000*	$1,130,000	*$29,000*	$90,000	*$2,000*	$390,000	*$10,000*
Total		**$14,470,000**		**$5,210,000**		**$2,280,000**		**$6,970,000**	

** This is the extra over to enlarge the existing pipeline. It has been calculated as the difference between the cost to construct option 2 and option 3.*

Table 19: Option 3 dual rising main, estimated costs to construct rising mains and pumpstations for South South Kaiapoi

Sub Area	Lots	Total Structure Plan Area Development		Constructed by Developer		WDC Funded		Development Contribution*	
		Total	*Per Lot*	Total	*Per Lot*	Total	*Per Lot*	Total	*Per Lot*
KA0A	159	$1,950,000	*$12,000*	$930,000	*$6,000*	$0	*$0*	$1,030,000	*$6,000*
KA0B	440	$4,000,000	*$9,000*	$1,100,000	*$3,000*	$0	*$0*	$2,890,000	*$7,000*
KA0C	310	$3,420,000	*$11,000*	$1,120,000	*$4,000*	$0	*$0*	$2,300,000	*$7,000*
KA0D	36	$1,290,000	*$36,000*	$930,000	*$26,000*	$0	*$0*	$360,000	*$10,000*
KA0E	39	$1,530,000	*$39,000*	$1,130,000	*$29,000*	$0	*$0*	$390,000	*$10,000*
Total		**$12,190,000**		**$5,210,000**		**$0**		**$6,970,000**	

It has been calculated that the SS Kaiapoi area would cost approximately $11-12 million to service for wastewater. However if option 2 is preferred, there would be an additional cost to upgrade the existing main of $2.3 million.

These options mainly differ by the alignment and size of the rising main. There were two areas that were considered to be constructed in poor ground conditions, KA0C and the section of main to from Cass Street to the WWTP, additional cost were added to the pipe rates to account for dewatering and trench stability for these pipelines. Additionally the pipe rate was multiplied by 7 to estimate the cost to install the pipeline under the Kaiapoi River, which was based on rates used for the 2019/20 valuations.

The proportion of the costs attributed solely to the developer was estimated to be $5.2 million, ranging from $9,000 to $39,000 per lot. This included the cost to construct the pumpstation and 50m of rising main to discharge into the shared rising main.

It was estimated that the development contribution for wastewater would be $6-7 million, ranging from $6,000 to $10,000 per lot. There have not been any time frames projected for this development area, therefore reimbursement of these costs us unknown.

It was also estimated that for option 3 that Councils share of the replacement of the existing south Kaiapoi shared rising main from Parnham Lane to the WWTP would be $2.3 million.

If the SS Kaiapoi area develops slowly, this would be a financial risk to Council for funding the construction of a larger main to service the area. Therefore option 2 or 3 would be recommended as the upgrades could be staged, and new development wastewater flows (lower I&I) could be considered. It is noted however that option 3 would have a lower cost to Council and also provide more resilience to the system, making this the recommended option overall.

5. Conclusion

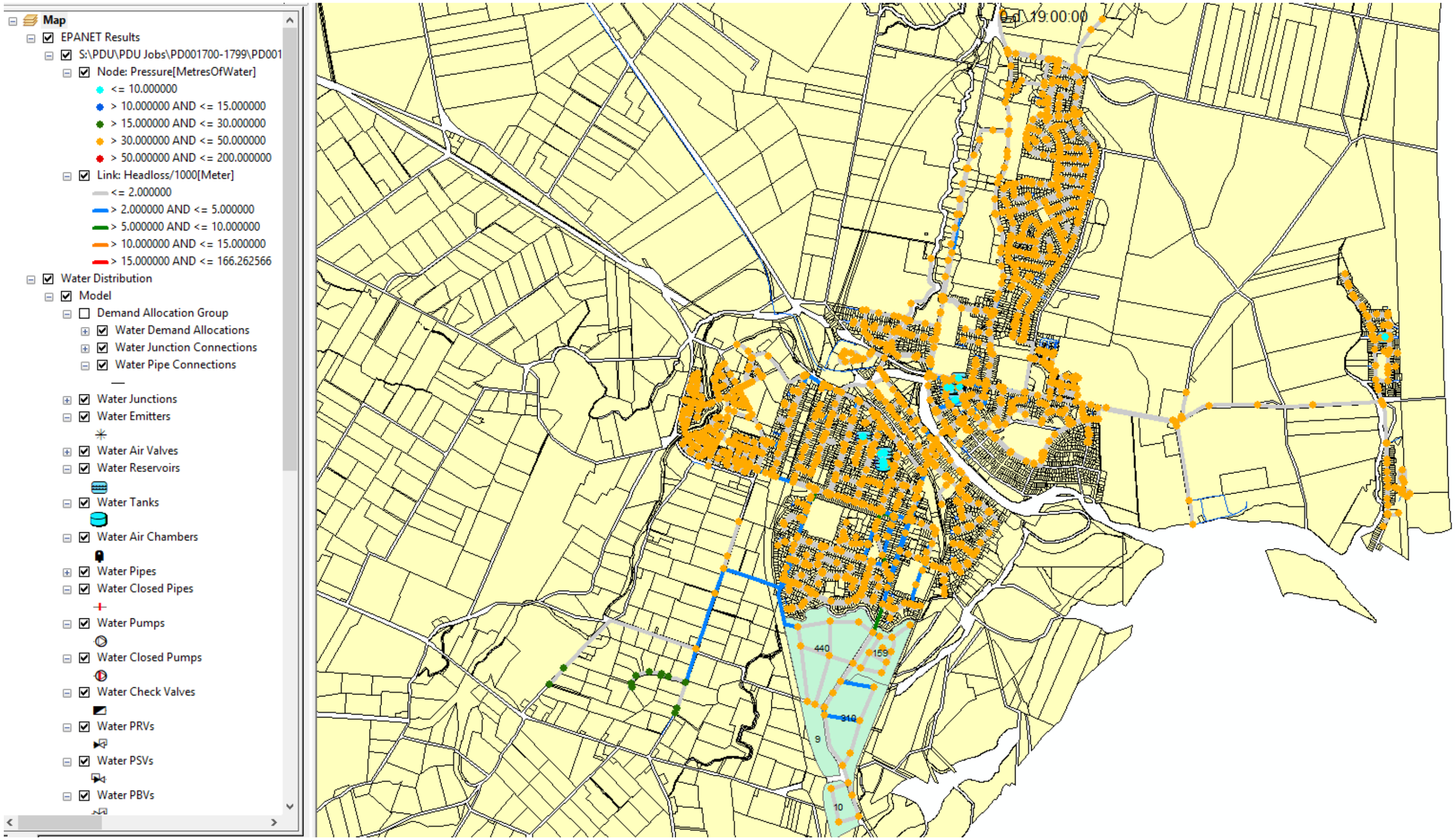
This investigation assessed the water and wastewater network capacity to allow for the potential development of the land in the SS Kaiapoi area. The following was concluded;

- SS Kaiapoi is projected to be 983 connections, made up of mostly residential and some commercial.
- Water supply
  - The existing reticulation has capacity to service SS Kaiapoi without any upgrades.
  - A skeleton reticulation network was optimised and recommended to be supplied from the 200mm diameter main along Robert Coup Road and to the 200mm diameter main at the end of Holland Drive.
  - A 200mm diameter ring main is recommended and it would need to extend past Hellers (KA0D) to provide firefighting flows to the commercial land south of Hellers (KA0E).
  - It is estimated to cost $2.9M to service SS Kaiapoi for water, with $1.7M projected to be funded by WDC and be collected as development contributions. Note that this was a skeleton network layout, and would be expected to cost more than this estimate.
- Wastewater Network
  - Three options were investigated,
    1. A dedicated main from SS Kaiapoi to the WWTP.
    2. Discharging into Parnham Lane PS and upgrading the rising main to accommodate SS Kaiapoi, from Parnham Lane PS to the Kaiapoi WWTP.
    3. Discharging into Parnham Lane PS and installing a dual rising main to operate with the existing rising main, from Parnham Lane PS to the Kaiapoi WWTP.
  - The existing/design South Kaiapoi rising main network is at capacity and can therefore not receive long term discharges from SS Kaiapoi developments.
  - The recommended option is to construct a dual rising main to the WWTP from Parnham Lane pumpstation (option 3). It was found that the dual rising main would basically need to be the same size as the existing rising main (duplicating the existing system).
  - It was estimated that this would cost $12.1M, with $7M projected to be funded by WDC and be collected as development contributions. This excludes the internal reticulation network but includes all cost from the pumpstations to the WWTP.
  - Option 3 was seen to be the best option as having an additional Kaiapoi river crossing would improve the system redundancy, and there are additional operational benefits with having a dual rising main for the south Kaiapoi network. Additionally connecting into the existing networks means that the upgrades required to service SS Kaiapoi can be staged and even delayed while I&I levels are low.

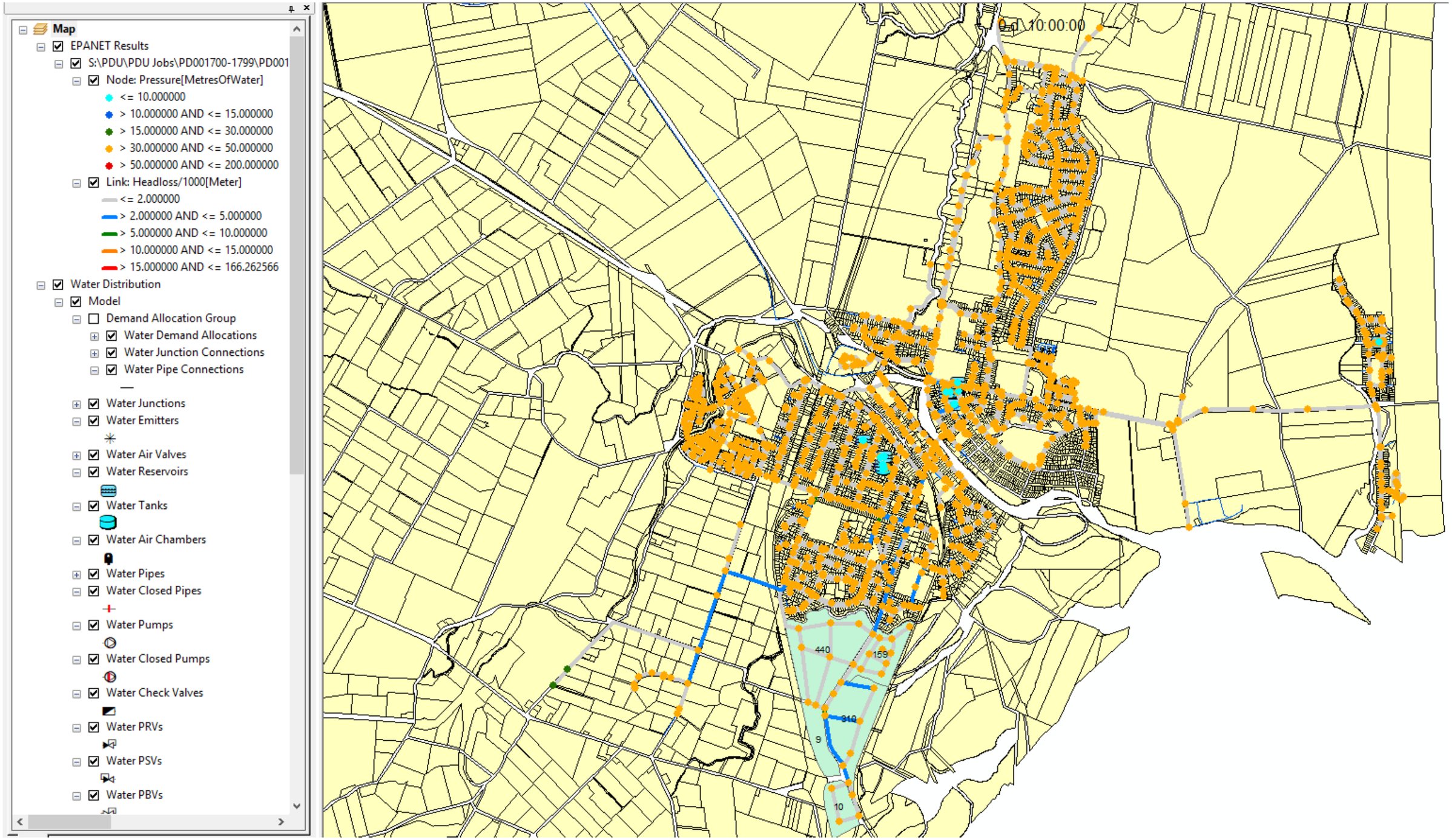
6. Appendix

6.1. Appendix – water model results

6.1.1. Residential Peak



6.1.2. Commercial Peak



6.1.3. Fire flow residential

6.1.4. Fireflow Commercial

6.1.5. Existing Flows

Peraki			Darnley			Combined
	Value	0986 [l/s]		Value	0978 [l/s]	
1	0	9.073829	1	0	2.595178	11.66901
2	1	-0.00808	2	1	44.25669	44.24862
3	2	-0.00707	3	2	38.83769	38.83061
4	3	-0.00708	4	3	38.83768	38.8306
5	4	-0.00707	5	4	38.83774	38.83066
6	5	-0.00708	6	5	38.8377	38.83062
7	6	-0.00908	7	6	49.67577	49.66669
8	7	-0.01207	8	7	65.93277	65.9207
9	8	-0.01907	9	8	103.8657	103.8466
10	9	44.96416	10	9	119.7078	164.672
11	10	92.67999	11	10	76.24361	168.9236
12	11	37.58417	12	11	111.1796	148.7638
13	12	130.9926	13	12	7.958955	138.9516
14	13	35.92295	14	13	108.4467	144.3697
15	14	-0.02008	15	14	145.9019	145.8819
16	15	36.34578	16	15	116.4663	152.8121
17	16	37.6192	17	16	126.0288	163.648
18	17	67.08331	18	17	108.4247	175.508
19	18	92.11052	19	18	113.0235	205.134
20	19	-0.03605	20	19	208.1944	208.1584
21	20	71.94271	21	20	117.0798	189.0225
22	21	65.23135	22	21	92.7953	158.0266
23	22	70.58523	23	22	60.35141	130.9366
24	23	93.01077	24	23	-0.00011	93.01066
25	24	-0.00704	25	24	38.8377	38.83066

Flows with SS Kaiapoi

Eastern 200mm feed			Western 200mm feed			Combined	
	Value	WLINK_1754 [l/s]		Value	WLINK_1801 [l/s]	Time	Flow
1	0	9.415026665	1	0	7.043019772	1	16.45805
2	1	5.964164257	2	1	3.125829697	2	9.089994
3	2	5.839192867	3	2	3.250816107	3	9.090009
4	3	5.839199066	4	3	3.250818253	4	9.090017
5	4	5.839205742	5	4	3.250823498	5	9.090029
6	5	10.74131775	6	5	7.438691616	6	18.18001
7	6	10.93819904	7	6	7.241801262	7	18.18
8	7	16.17361832	8	7	11.09639835	8	27.27002
9	8	26.74862099	9	8	18.70139313	9	45.45001
10	9	22.38472366	10	9	15.67328358	10	38.05801
11	10	26.15024757	11	10	19.71975899	11	45.87001
12	11	25.01754951	12	11	19.36446762	12	44.38202

13	12	19.31780434	13	12	14.30020809	13	33.61801
14	13	20.50496101	14	13	13.1130476	14	33.61801
15	14	18.6579361	15	14	13.47208595	15	32.13002
16	15	24.09136009	16	15	15.64064789	16	39.73201
17	16	28.00369072	17	16	20.81830788	17	48.822
18	17	32.76904297	18	17	23.46895599	18	56.238
19	18	31.06692314	19	18	22.00908852	19	53.07601
20	19	34.57183075	20	19	24.61816788	20	59.19
21	20	27.90821075	21	20	19.02979469	21	46.93801
22	21	21.85560417	22	21	14.50441837	22	36.36002
23	22	11.98474503	23	22	6.1952672	23	18.18001
24	23	11.18706322	24	23	6.992956161	24	18.18002
25	24	10.74132347	25	24	7.438695908		

Peraki

	Value	0986 [l/s]
1	0	15.94798088
2	1	-0.008078178
3	2	-0.007079546
4	3	-0.007077203
5	4	-0.007072967
6	5	-0.007076865
7	6	-0.00907683
8	7	-0.012075561
9	8	-0.019038692
10	9	80.11213684
11	10	85.04897308
12	11	96.59389496
13	12	68.9720993
14	13	-0.019045644
15	14	80.22180939
16	15	-0.022048045
17	16	86.19615936
18	17	50.05793762
19	18	120.6736221
20	19	119.0907288
21	20	109.4739532
22	21	97.83550262
23	22	69.30597687
24	23	60.76868439
25	24	-0.007055209

Darnley

	Value	0978 [l/s]
1	0	3.419670343
2	1	53.34672928
3	2	47.92777634
4	3	47.92771149
5	4	47.92776871
6	5	57.01773834
7	6	67.85571289
8	7	93.20278168
9	8	149.3156738
10	9	122.6178207
11	10	129.7446594
12	11	96.55191803
13	12	103.5976639
14	13	178.0068207
15	14	97.79011536
16	15	192.5660706
17	16	126.27388
18	17	181.6880341
19	18	137.536438
20	19	148.2576294
21	20	126.4864731
22	21	96.55115509
23	22	79.8107605
24	23	50.42196274
25	24	57.01768875

Combined

Time	Flow
1	19.36765
2	53.33865
3	47.9207
4	47.92063
5	47.9207
6	57.01066
7	67.84664
8	93.19071
9	149.2966
10	202.73
11	214.7936
12	193.1458
13	172.5698
14	177.9878
15	178.0119
16	192.544
17	212.47
18	231.746
19	258.2101
20	267.3484
21	235.9604
22	194.3867
23	149.1167
24	111.1906

6.1.6. Headwork with SS Kaiapoi

2020 AMP work

2020 AMP growth projections

Component	Existing	First 10 Years Works (2020 - 2029)	Second 10 Year Works (2030 - 2039)	Third 10 Year Works (2040 - 2049)
Darnley Square Pressure	420 kPa	464 kPa	470 kPa	479 kPa
Peraki Street Pressure	440 kPa	439 kPa	444 kPa	454 kPa
Darnley Well Capacity	121 L/s	83 L/s	99 L/s	103 L/s
Peraki Well Capacity	145 L/s	118 L/s	127 L/s	133 L/s
Darnley Square Surface Pump Capacity	168 L/s	178 L/s	198 L/s	208 L/s
Peraki Street Surface Pump Capacity	168 L/s	178 L/s	195 L/s	203 L/s
Darnley Square Storage	600 m3	600 m3	600 m3	600 m3
Peraki Street Storage	198 m3	643 m3	319 m3	-185 m3

Surface Pumps

Max Peraki	121 L/s	
Max Darnley	193 L/s	These need balancing - but outside of scope
Required Peak Flow	267 L/s	
Required FF Peak	184 L/s	Average daily flow + 50L/s
Pump Capacity	335 L/s	
		OK

Source

Source Requirement	164 L/s	Additional 10% added for operation
Source capacity	266 L/s	
		OK

Upgrade needed to offset storage requirements

Storage

Scheme	Peraki		Darnley		Combined
Emergency Storage Hours	0		0.00		Artesian water supply
Fire Hazard Category	W4		W4		100 L/s CBD
Fire Fighting Storage Volume	0		0		Artesian water supply
Peak Day Flow Profile					
1	15.9 L/s		3.4 L/s		19.4 L/s
2	0.0 L/s	0 m3	53.3 L/s	0 m3	53.3 L/s
3	0.0 L/s	0 m3	47.9 L/s	0 m3	47.9 L/s
4	0.0 L/s	0 m3	47.9 L/s	0 m3	47.9 L/s
5	0.0 L/s	0 m3	47.9 L/s	0 m3	47.9 L/s
6	0.0 L/s	0 m3	57.0 L/s	0 m3	57.0 L/s
7	0.0 L/s	0 m3	67.9 L/s	0 m3	67.8 L/s
8	0.0 L/s	0 m3	93.2 L/s	0 m3	93.2 L/s
9	0.0 L/s	0 m3	149.3 L/s	1 m3	149.3 L/s

	10	80.1 L/s	0 m3	122.6 L/s	54 m3	202.7 L/s
	11	85.0 L/s	0 m3	129.7 L/s	19 m3	214.8 L/s
	12	96.6 L/s	0 m3	96.6 L/s	0 m3	193.1 L/s
	13	69.0 L/s	0 m3	103.6 L/s	0 m3	172.6 L/s
	14	0.0 L/s	0 m3	178.0 L/s	71 m3	178.0 L/s
	15	80.2 L/s	0 m3	97.8 L/s	61 m3	178.0 L/s
	16	0.0 L/s	0 m3	192.6 L/s	87 m3	192.5 L/s
	17	86.2 L/s	0 m3	126.3 L/s	138 m3	212.5 L/s
	18	50.1 L/s	0 m3	181.7 L/s	119 m3	231.7 L/s
	19	120.7 L/s	0 m3	137.5 L/s	139 m3	258.2 L/s
	20	119.1 L/s	0 m3	148.3 L/s	79 m3	267.3 L/s
	21	109.5 L/s	0 m3	126.5 L/s	59 m3	236.0 L/s
	22	97.8 L/s	0 m3	96.6 L/s	0 m3	194.4 L/s
	23	69.3 L/s	0 m3	79.8 L/s	0 m3	149.1 L/s
	24	60.8 L/s	0 m3	50.4 L/s	0 m3	111.2 L/s
PDF		47.5 L/s		101.5 L/s		149.0 L/s
ADF		19.0 L/s		40.6 L/s		
Source Flow		145.0 L/s		121.0 L/s		266.0 L/s
Working Volume			0 m3		826 m3	826 m3
Emergency Storage						0 m3
Fire Fighting Storage						0 m3
Required Storage						826 m3
Full Storage Capacity						798 m3
+ Operating Allowance						124 m3
+ Dead Volume						166 m3
Total Storage Required						1116 m3
Surplus						-317 m3

ADF = PDF/2.5

Use Pegasus and Woodend reservoirs at Pegasus WTP working volume

Greatest of the Emergency and Firefighting Storage gets used to calculated the Required Storage

Assuming the operating percentage remains the same, TRIM reference 200121007544

Assuming the dead volume percentage remains the same, TRIM reference 200121007544

NOT OK

Peak Day Flow Profile

	Peraki		**Darnley**		**Combined**
1	15.9 L/s		3.4 L/s		19.4 L/s
2	0.0 L/s	0 m3	53.3 L/s	0 m3	53.3 L/s
3	0.0 L/s	0 m3	47.9 L/s	0 m3	47.9 L/s
4	0.0 L/s	0 m3	47.9 L/s	0 m3	47.9 L/s
5	0.0 L/s	0 m3	47.9 L/s	0 m3	47.9 L/s
6	0.0 L/s	0 m3	57.0 L/s	0 m3	57.0 L/s
7	0.0 L/s	0 m3	67.9 L/s	0 m3	67.8 L/s
8	0.0 L/s	0 m3	93.2 L/s	0 m3	93.2 L/s
9	0.0 L/s	0 m3	149.3 L/s	0 m3	149.3 L/s
10	80.1 L/s	0 m3	122.6 L/s	0 m3	202.7 L/s
11	85.0 L/s	0 m3	129.7 L/s	0 m3	214.8 L/s
12	96.6 L/s	0 m3	96.6 L/s	0 m3	193.1 L/s
13	69.0 L/s	0 m3	103.6 L/s	0 m3	172.6 L/s
14	0.0 L/s	0 m3	178.0 L/s	0 m3	178.0 L/s
15	80.2 L/s	0 m3	97.8 L/s	0 m3	178.0 L/s
16	0.0 L/s	0 m3	192.6 L/s	0 m3	192.5 L/s
17	86.2 L/s	0 m3	126.3 L/s	0 m3	212.5 L/s
18	50.1 L/s	0 m3	181.7 L/s	0 m3	231.7 L/s
19	120.7 L/s	0 m3	137.5 L/s	0 m3	258.2 L/s
20	119.1 L/s	0 m3	148.3 L/s	0 m3	267.3 L/s
21	109.5 L/s	0 m3	126.5 L/s	0 m3	236.0 L/s
22	97.8 L/s	0 m3	96.6 L/s	0 m3	194.4 L/s

	23	69.3 L/s	0 m3	79.8 L/s	0 m3	149.1 L/s		
	24	60.8 L/s	0 m3	50.4 L/s	0 m3	111.2 L/s		
PDF		47.5 L/s		101.5 L/s		149.0 L/s		
ADF		19.0 L/s		40.6 L/s				ADF = PDF/2.5
Source Flow		145.0 L/s		191.0 L/s			336.0 L/s	Darnley Source upgrade in 2023 - Develop an additional 70L/s well and associated pipework at Darnley Square to bring the total flow to 366 L/s (including N+1) 2020 AMP
Working Volume			0 m3		0 m3		0 m3	Use Pegasus and Woodend reservoirs at Pegasus WTP working volume
Emergency Storage							0 m3	Greatest of the Emergency and Firefighting Storage gets used to calculated the Required Storage
Fire Fighting Storage							0 m3	
Required Storage							0 m3	
Full Storage Capacity							798 m3	
+ Operating Allowance							120 m3	Assuming the operating percentage remains the same, TRIM reference 200121007544
+ Dead Volume							160 m3	Assuming the dead volume percentage remains the same, TRIM reference 200121007544
Total Storage Required							280 m3	
Surplus							519 m3	**OK**

6.1.1. Extended cost estimate Water

Name	Quantity	Proposed Main dia	Proposed Main Material	2020 Rate pipe, Valve and Hydrant	Upgrade cost	Fees and Contingency	Total Capital Cost (excluding residual value of existing main)
KA0E Internal Reticulation	610 m	150	PE	$233	$141,868	$6,810	$150,000
KA0E External	435 m	150	PE	$552	$240,038	$11,522	$250,000
KA0C, D, E External	516 m	200	PE	$603	$311,350	$14,945	$330,000
KA0C internal	293 m	100	PE	$113	$33,040	$1,586	$30,000
	972 m	150	PE	$233	$226,098	$10,853	$240,000
KA0B internal	1144 m	100	PE	$113	$128,999	$6,192	$140,000
	648 m	150	PE	$233	$150,603	$7,229	$160,000
KA0A internal	714 m	100	PE	$113	$80,475	$3,863	$80,000
	736 m	150	PE	$233	$171,035	$8,210	$180,000
All Internal	772 m	200	PE	$303	$233,751	$11,220	$240,000
All External	1752 m	200	PE	$603	$1,056,948	$50,734	$1,110,000
Total	8592 m				$2,774,205	$133,162	$2,910,000

Sub Area	Number of lots Contributing to WW Asset	Total Structure Plan Area Development		Constructed by Developer		WDC Funded		Development Contribution	
		Total	*Per Lot*	Total	*Per Lot*	Total	*Per Lot*	Total	*Per Lot*
KA0A	159	*$478,140*	$3,007	$260,000	*$1,635.22*	$0	*$0*	$218,140	*$1,372*
KA0B	440	*$903,659*	$2,054	$300,000	*$681.82*	$0	*$0*	$603,659	*$1,372*
KA0C	310	*$961,019*	$3,100	$270,000	*$870.97*	$0	*$0*	$691,019	*$2,229*
KA0D	36	*$80,247*	$2,229	$0	*$0.00*	$0	*$0*	$80,247	*$2,229*
KA0E	39	*$486,935*	$12,486	$400,000	*$10,256.41*	$0	*$0*	$86,935	*$2,229*
Total		***$2,910,000***		***$1,230,000***				***$1,680,000***	

Sub Area	Number of lots Contributing to WW Asset	Total Structure Plan Area Development		Constructed by Developer		WDC Funded		Development Contribution	
		Total	*Per Lot*	Total	*Per Lot*	Total	*Per Lot*	Total	*Per Lot*
KA0A	159	*$478,000*	$3,000	$260,000	*$1,600*	$0	*$0*	$218,000	*$1,400*
KA0B	440	*$904,000*	$2,100	$300,000	*$700*	$0	*$0*	$604,000	*$1,400*
KA0C	310	*$961,000*	$3,100	$270,000	*$900*	$0	*$0*	$691,000	*$2,200*
KA0D	36	*$80,000*	$2,200	$0	*$0*	$0	*$0*	$80,000	*$2,200*
KA0E	39	*$487,000*	$12,500	$400,000	*$10,300*	$0	*$0*	$87,000	*$2,200*
Total		***$2,910,000***		***$1,230,000***				***$1,680,000***	

6.2. Appendix – Wastewater analysis results

6.2.1. Flow estimates

Area	Lots	Average Dry Weather Flow	Peak Dry Weather Flow	Peak Wet Weather Flow
Section 1 - KA0E	9.7	1.9 L/s	4.9 L/s	9.7 L/s
Section 2 - KA0D	8.9	1.8 L/s	4.5 L/s	8.9 L/s
Section 3 - KA0E and KA0D		3.7 L/s	9.3 L/s	18.6 L/s
Section 3a - KA0C	310	2.4 L/s	6.1 L/s	15.2 L/s
Section 3 - KA0D and KA0C		6.1 L/s	15.4 L/s	33.8 L/s
Section 4a - KA0B	440	3.4 L/s	8.6 L/s	19.5 L/s
Section 4 - KA0D, KA0C and KA0B		9.6 L/s	23.9 L/s	53.2 L/s
Section 5a - KA0A	159	1.2 L/s	3.1 L/s	9.2 L/s
Section 5 - KA0D, KA0C, KA0B and KA0A		10.8 L/s	27.1 L/s	62.4 L/s

Section 1 - KA0E

Area	Commercial	9.7	*Ha*	
ADWF	ECOP	0.2	L/s/ha	from the Code of Practice, Commercial
PDWF	ECOP	0.5	L/s/ha	from the Code of Practice, Commercial
PWWF	ECOP	1	L/s/ha	from the Code of Practice, Commercial
ADWF	Average Dry Weather Flow	1.94	L/s	
PDWF	Peak Dry Weather Flow	4.85	L/s	
PWWF	Peak Wet Weather Flow	9.70	L/s	

Section 2 - KA0D

Area	Commercial	8.9	*Ha*	
ADWF	ECOP	0.2	L/s/ha	from the Code of Practice, Commercial
PDWF	ECOP	0.5	L/s/ha	from the Code of Practice, Commercial
PWWF	ECOP	1	L/s/ha	from the Code of Practice, Commercial
ADWF	Average Dry Weather Flow	1.78	L/s	
PDWF	Peak Dry Weather Flow	4.45	L/s	
PWWF	Peak Wet Weather Flow	8.90	L/s	

Section 3a - KA0C

Dwell	Number of dwellings	310	*Lots*	
Dpop	Population Density	2.7	people/dwelling	from the Code of Practice, Fixed Value
PFdwf	Peaking Factor (Dry Weather Flow)	2.50		from the Code of Practice, Fixed Value
PFwwf	Peaking Factor (Dpop < 50)	4.00		from the Graph, in the Sheet "CoP Graph"
	Peaking Factor (51 < Dpop < 550)	2.50		from the Graph, in the Sheet "CoP Graph"
	Peaking Factor (Dpop > 551)	2.10		from the Graph, in the Sheet "CoP Graph"
	Finalised PFwwf	2.50		
Qres	Residential Flow Rate	250	L/person/day	from the Code of Practice
ADWF	Average Dry Weather Flow	209.3	m3/d	ADWF = Dpop x Qres x Dwell
PDWF	Peak Dry Weather Flow	523.1	m3/d	PDWF = ADWF x PFdwf
PWWF	Peak Wet Weather Flow	1310.0	m3/d	PWWF = PDWF x PFwwf

ADWF	Average Dry Weather Flow	2.42	L/s	
PDWF	Peak Dry Weather Flow	6.05	L/s	
PWWF	Peak Wet Weather Flow	15.16	L/s	

Section 4a - KA0B

Dwell	Number of dwellings	440	*Lots*	
Dpop	Population Density	2.7	people/dwelling	from the Code of Practice, Fixed Value
PFdwf	Peaking Factor (Dry Weather Flow)	2.50		from the Code of Practice, Fixed Value
PFwwf	Peaking Factor (Dpop < 50)	4.00		from the Graph, in the Sheet "CoP Graph"
	Peaking Factor (51 < Dpop < 550)	2.27		from the Graph, in the Sheet "CoP Graph"
	Peaking Factor (Dpop > 551)	2.09		from the Graph, in the Sheet "CoP Graph"
	Finalised PFwwf	2.27		
Qres	Residential Flow Rate	250	L/person/day	from the Code of Practice
ADWF	Average Dry Weather Flow	297.0	m3/d	ADWF = Dpop x Qres x Dwell
PDWF	Peak Dry Weather Flow	742.5	m3/d	PDWF = ADWF x PFdwf
PWWF	Peak Wet Weather Flow	1683.3	m3/d	PWWF = PDWF x PFwwf
ADWF	Average Dry Weather Flow	3.44	L/s	
PDWF	Peak Dry Weather Flow	8.59	L/s	
PWWF	Peak Wet Weather Flow	19.48	L/s	

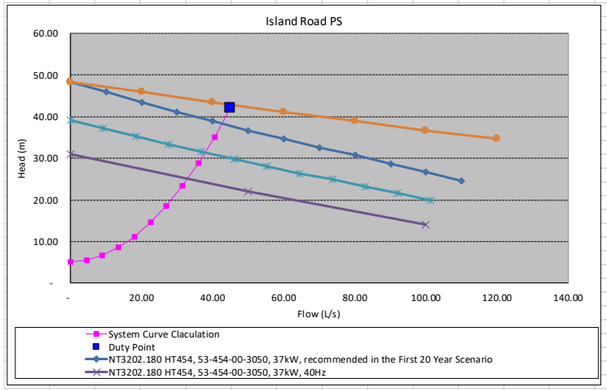
Section 5a - KA0A

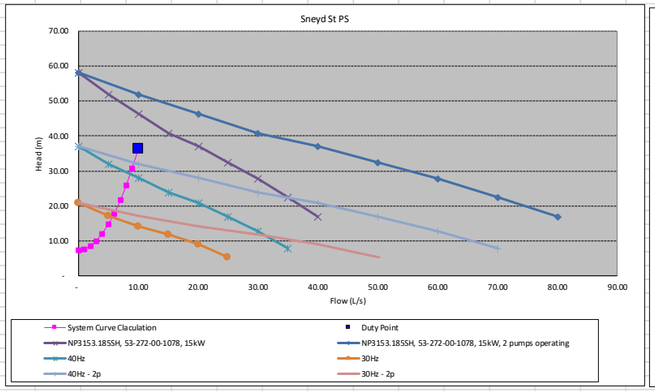
Dwell	Number of dwellings	159	*Lots*	
Dpop	Population Density	2.7	people/dwelling	from the Code of Practice, Fixed Value
PFdwf	Peaking Factor (Dry Weather Flow)	2.50		from the Code of Practice, Fixed Value
PFwwf	Peaking Factor (Dpop < 50)	4.00		from the Graph, in the Sheet "CoP Graph"
	Peaking Factor (51 < Dpop < 550)	2.96		from the Graph, in the Sheet "CoP Graph"
	Peaking Factor (Dpop > 551)	2.11		from the Graph, in the Sheet "CoP Graph"
	Finalised PFwwf	2.96		
Qres	Residential Flow Rate	250	L/person/day	from the Code of Practice
ADWF	Average Dry Weather Flow	107.3	m3/d	ADWF = Dpop x Qres x Dwell
PDWF	Peak Dry Weather Flow	268.3	m3/d	PDWF = ADWF x PFdwf
PWWF	Peak Wet Weather Flow	793.3	m3/d	PWWF = PDWF x PFwwf
ADWF	Average Dry Weather Flow	1.24	L/s	
PDWF	Peak Dry Weather Flow	3.11	L/s	
PWWF	Peak Wet Weather Flow	9.18	L/s	

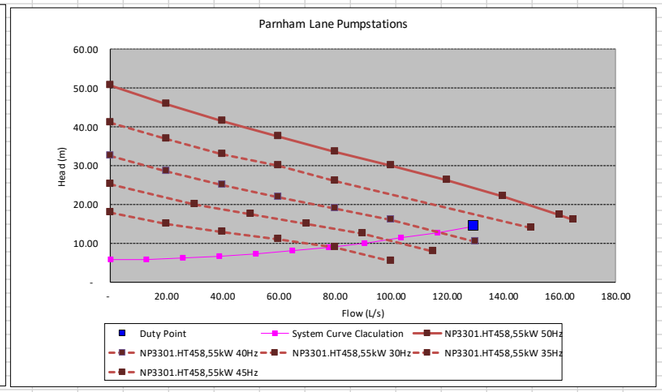
6.2.2. Wastewater Option 2 and 3 pumpstation flow assumptions

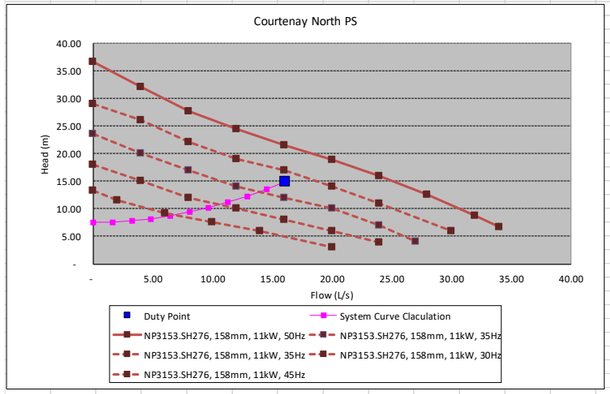
Pipeline Names	Input Flow (L/s)
Island Road PS	45.0
Sneyd St PS	10.0
Parnham Ln PS	129.4
Courtenay Dv North PS (Courtenay South + North)	16.1
Charles West PS	33.0
	233.5

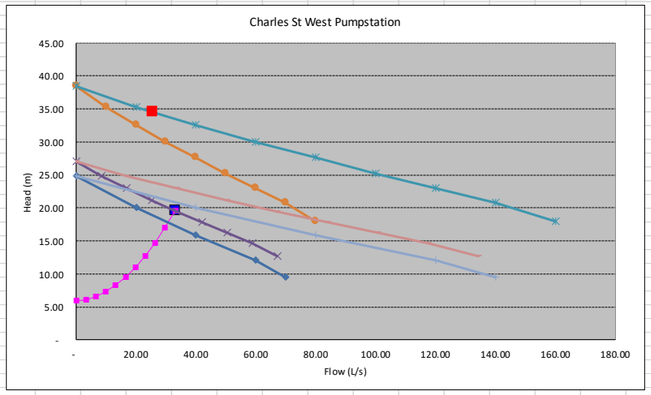
6.2.3. Wastewater Option 2 and 3 simultaneous pump operation











6.2.4. Extended cost estimate Wastewater – Option 1

Structure Plan Area	Rising Main Section	Sub Area	Number of lots Contributing WW Asset	Ground Condition	Costs														Cost per Connection
					Required PE Pipe (OD)	Length	Valuation Rates 2019-20 Urban / Rural split	Adjustment for poor ground conditions	Additional for CGPI	Base Rate incl. Extra Over and CGPI($)	Pipe Installation Cost	Pumpstation Base Rate	Additional for CGPI	Pumpstation Cost	Professional Fees 12%	Funding Contingency 40%	Total Cost		
South Kaiapoi - Shared Assets	KA0E	KA0E	39	Medium - 3	125	405	$312.00	$312.00	4.50%	$326.04	$132,046				$15,846	$59,157	$207,048		$5,336.30
	Combined D and E	KA0E and KA0D	74	Medium - 3	180	310	$386.50	$386.50	4.50%	$403.89	$125,207				$15,025	$56,093	$196,324		$2,638.76
	Combined C, D and E	KA0E, KA0D and KA0C	384	Medium - 3	250	435	$463.80	$463.80	4.50%	$484.67	$210,832				$25,300	$94,453	$330,584		$860.00
	Combined B, C, D and E	KA0E, KA0D, KA0C and KA0B	824	Medium - 3	315	110	$546.60	$546.60	4.50%	$571.20	$62,832				$7,540	$28,149	$98,520		$119.51
	Combined to River	All	983	Medium - 3	355	2144	$585.20	$585.20	4.50%	$611.53	$1,311,129				$157,335	$587,386	$2,055,850		$2,090.55
	River Crossing	All	983	Medium - 3	315	140	$546.60	$3,826.20	4.50%	$3,998.38	$559,773				$67,173	$250,778	$877,724		$892.54
	Combined River to WWTP	All	983	Low - 2	355	2145	$455.60	$657.10	4.50%	$686.67	$1,472,906				$176,749	$659,862	$2,309,517		$2,348.50
South Kaiapoi - Development Assets	KA0E	KA0E 50m of RM and Pump Station	39	Medium - 3	125	50	$70.00	$70.00	4.50%	$73.15	$3,658	$560,000	5.00%	$588,000	$70,999	$265,063	$927,719		$23,910.28
	KA0D	KA0D 50m of RM and Pump Station	36	Medium - 3	125	50	$70.00	$70.00	4.50%	$73.15	$3,658	$560,000	5.00%	$588,000	$70,999	$265,063	$927,719		$26,059.52
	KA0C	KA0C 50m of RM and Pump Station	310	Low - 2	160	50	$170.00	$371.50	4.50%	$388.22	$19,411	$660,000	5.00%	$693,000	$85,489	$319,160	$1,117,060		$3,603.42
	KA0B	KA0B 50m of RM and Pump Station	440	Medium - 3	180	50	$197.70	$197.70	4.50%	$206.60	$10,330	$660,000	5.00%	$693,000	$84,400	$315,092	$1,102,821		$2,506.41
	KA0A	KA0A 50m of RM and Pump Station	159	Medium - 3	125	50	$70.00	$70.00	4.50%	$73.15	$3,658	$560,000	5.00%	$588,000	$70,999	$265,063	$927,719		$5,834.71
Sub Total																	***$11,078,606***		

Sub Area	Number of lots Contributing to WW Asset	Total Structure Plan Area Development		Constructed by Developer		WDC Funded		Development Contribution	
		Total	*Per Lot*	Total	*Per Lot*	Total	*Per Lot*	Total	*Per Lot*
KA0A	159	*$1,775,442.64*	$11,166	$927,719	*$5,835*	$0	*$0*	$847,724	*$5,332*
KA0B	440	*$3,501,305.45*	$7,958	$1,102,821	*$2,506*	$0	*$0*	$2,398,484	*$5,451*
KA0C	310	*$3,073,501.77*	$9,915	$1,117,060	*$3,603*	$0	*$0*	$1,956,442	*$6,311*
KA0D	36	*$1,246,334.19*	$35,009	$927,719	*$26,060*	$0	*$0*	$318,615	*$8,950*
KA0E	39	*$1,482,022.20*	$38,196	$1,134,767	*$29,247*	$0	*$0*	$347,255	*$8,950*
		$11,078,606		***$5,210,087***		***$0***		***$5,868,520***	

Sub Area	Lots	Total Structure Plan Area Development		Constructed by Developer		WDC Funded		Development Contribution	
		Total	*Per Lot*	Total	*Per Lot*	Total	*Per Lot*	Total	*Per Lot*
KA0A	159	$1,780,000	*$11,000*	$930,000	*$6,000*	$0	*$0*	$850,000	*$5,000*
KA0B	440	$3,500,000	*$8,000*	$1,100,000	*$3,000*	$0	*$0*	$2,400,000	*$5,000*
KA0C	310	$3,070,000	*$10,000*	$1,120,000	*$4,000*	$0	*$0*	$1,960,000	*$6,000*
KA0D	36	$1,250,000	*$35,000*	$930,000	*$26,000*	$0	*$0*	$320,000	*$9,000*
KA0E	39	$1,480,000	*$38,000*	$1,130,000	*$29,000*	$0	*$0*	$350,000	*$9,000*
Total		***$11,080,000***		***$5,210,000***		***$0***		***$5,880,000***	

6.2.5. Extended cost estimate Wastewater – Option 2

Structure Plan Area	Rising Main Section	Sub Area	Number of lots Contributing WW Asset	Ground Condition	Costs													Cost per Connection
					Required PE Pipe (OD)	Length	Valuation Rates 2019-20 Urban / Rural split	Adjustment for poor ground conditions	Additional for CGPI	Base Rate incl. Extra Over and CGPI($)	Pipe Installation Cost	Pumpstation Base Rate	Additional for CGPI	Pumpstation Cost	Professional Fees 12%	Funding Contingency 40%	Total Cost	
South Kaiapoi - Shared Assets	KA0E	KA0E	39	Medium - 3	125	405	$312.00	$312.00	4.50%	$326.04	$132,046				$15,846	$59,157	$207,048	$5,336.30
	Combined D and E	KA0E and KA0D	74	Medium - 3	180	310	$386.50	$386.50	4.50%	$403.89	$125,207				$15,025	$56,093	$196,324	$2,638.76
	Combined C, D and E	KA0E, KA0D and KA0C	384	Medium - 3	250	435	$463.80	$463.80	4.50%	$484.67	$210,832				$25,300	$94,453	$330,584	$860.00
	Combined B, C, D and E	KA0E, KA0D, KA0C and KA0B	824	Medium - 3	315	110	$546.60	$546.60	4.50%	$571.20	$62,832				$7,540	$28,149	$98,520	$119.51
	KA0A to Parnham	All	983	Medium - 3	355	1130	$585.20	$585.20	4.50%	$611.53	$691,033				$82,924	$309,583	$1,083,540	$1,101.83
	Parnham to Vickory	All	983	Medium - 3	500	298	$717.80	$717.80	4.50%	$750.10	$223,530				$26,824	$100,141	$350,495	$356.41
	Parnham to Courtenay	All	983	Medium - 3	560	982	$866.65	$866.65	4.50%	$905.65	$889,348				$106,722	$398,428	$1,394,497	$1,418.04
	Courtney to North of River	All	983	Medium - 3	560	76	$866.65	$866.65	4.50%	$905.65	$68,829				$8,260	$30,836	$107,924	$109.75
	River Crossing	All	983	Low - 2	560	140	$6,066.55	$6,066.55	4.50%	$6,339.54	$887,536				$106,504	$397,616	$1,391,657	$1,415.15
	North of River to WWTP	All	983	Low - 2	630	2158	$1,015.50	$1,216.50	4.50%	$1,271.24	$2,743,341				$329,201	$1,229,017	$4,301,559	$4,374.17
South Kaiapoi - Development Assets	KA0E	KA0E 50m of RM and Pump Station	39	Medium - 3	125	50	$70.00	$70.00	4.50%	$73.15	$3,658	$560,000	5.00%	$588,000	$70,999	$265,063	$927,719	$23,910.28
	KA0D	KA0D 50m of RM and Pump Station	36	Medium - 3	125	50	$70.00	$70.00	4.50%	$73.15	$3,658	$560,000	5.00%	$588,000	$70,999	$265,063	$927,719	$26,059.52
	KA0C	KA0C 50m of RM and Pump Station	310	Low - 2	160	50	$170.00	$371.50	4.50%	$388.22	$19,411	$660,000	5.00%	$693,000	$85,489	$319,160	$1,117,060	$3,603.42
	KA0B	KA0B 50m of	440	Medium - 3	180	50	$197.70	$197.70	4.50%	$206.60	$10,330	$660,000	5.00%	$693,000	$84,400	$315,092	$1,102,821	$2,506.41

		RM and Pump Station																
	KA0A	KA0A 50m of RM and Pump Station	159	Medium - 3	125	50	$70.00	$70.00	4.50%	$73.15	$3,658	$560,000	5.00%	$588,000	$70,999	$265,063	$927,719	$5,834.71
Sub Total																	***$14,465,188***	
																	$5,210,087	
Structure Plan Area	**Rising Main Section**	**Sub Area**	**Number of lots Contributing WW Asset**	**Ground Condition**	**Costs**													
					Required PE Pipe (OD)	**Length**	**Valuation Rates 2019-20 Urban / Rural split**	**Adjustment for poor ground conditions**	**Additional for CGPI**	**Base Rate incl. Extra Over and CGPI($)**	**Pipe Installation Cost**	**Pumpstation Base Rate**	**Additional for CGPI**	**Pumpstation Cost**	**Professional Fees 12%**	**Funding Contingency 40%**	**Total Cost**	
Cost to replace the existing main	Parnham to Vickory	Existing South Kaiapoi		Medium - 3	335	298	$585.20	$585.20	4.50%	$611.53	$182,237				$21,868	$81,642	$285,748	
	Parnham to Courtenay	Existing South Kaiapoi		Medium - 3	450	982	$717.80	$717.80	4.50%	$750.10	$736,599				$88,392	$329,996	$1,154,988	
	Courtney to North of River	Existing South Kaiapoi		Medium - 3	450	76	$717.80	$717.80	4.50%	$750.10	$57,008				$6,841	$25,539	$89,388	
	River Crossing	Existing South Kaiapoi		Medium - 3	355	140	$585.20	$4,096.40	4.50%	$4,280.74	$599,303				$71,916	$268,488	$939,708	
	North of River to WWTP	Existing South Kaiapoi		Medium - 3	450	2158	$602.24	$803.50	4.50%	$839.66	$1,811,981				$217,438	$811,767	$2,841,186	
Sub Total																	***$5,311,017***	

Sub Area	Number of lots Contributing to WW Asset	Total Structure Plan Area Development		Constructed by Developer		WDC Funded		Development Contribution	
		Total	*Per Lot*	Total	*Per Lot*	Total	*Per Lot*	Total	*Per Lot*
KA0A	159	*$2,322,998.61*	$14,610	$927,719	*$5,835*	$369,039	*$2,321*	$1,026,241	*$6,454*
KA0B	440	*$5,016,554.68*	$11,401	$1,102,821	*$2,506*	$1,021,240	*$2,321*	$2,892,493	*$6,574*
KA0C	310	*$4,141,063.73*	$13,358	$1,117,060	*$3,603*	$719,510	*$2,321*	$2,304,493	*$7,434*
KA0D	36	*$1,368,931.63*	$38,453	$927,719	*$26,060*	$82,628	*$2,321*	$358,585	*$10,073*
KA0E	39	*$1,615,639.64*	$41,640	$1,134,767	*$29,247*	$90,055	*$2,321*	$390,817	*$10,073*
		$14,465,188		***$5,210,087***		***$2,282,472***		***$6,972,630***	

Sub Area	Lots	Total Structure Plan Area Development		Constructed by Developer		WDC Funded		Development Contribution	
		Total	*Per Lot*	Total	*Per Lot*	Total	*Per Lot*	Total	*Per Lot*
KA0A	159	$2,320,000	*$15,000*	$930,000	*$6,000*	$370,000	*$2,000*	$1,030,000	*$6,000*
KA0B	440	$5,020,000	*$11,000*	$1,100,000	*$3,000*	$1,020,000	*$2,000*	$2,890,000	*$7,000*
KA0C	310	$4,140,000	*$13,000*	$1,120,000	*$4,000*	$720,000	*$2,000*	$2,300,000	*$7,000*
KA0D	36	$1,370,000	*$38,000*	$930,000	*$26,000*	$80,000	*$2,000*	$360,000	*$10,000*
KA0E	39	$1,620,000	*$42,000*	$1,130,000	*$29,000*	$90,000	*$2,000*	$390,000	*$10,000*
Total		***$14,470,000***		***$5,210,000***		***$2,280,000***		***$6,970,000***	

6.2.6. Extended cost estimate Wastewater – Option 3

Structure Plan Area	Rising Main Section	Sub Area	Number of lots Contributing WW Asset	Ground Condition	Costs													Cost per Connection
					Required PE Pipe (OD)	Length	Valuation Rates 2019-20 Urban / Rural split	Valuation Rates 2019-21 with extraover - deep silt in high groundwater	Additional for CGPI	Base Rate incl. Extra Over and CGPI($)	Pipe Installation Cost	Pumpstation Base Rate	Additional for CGPI	Pumpstation Cost	Professional Fees 12%	Funding Contingency 40%	Total Cost	
South Kaiapoi - Shared Assets	**KA0E**	KA0E	39	Medium - 3	125	405	$312.00	$312.00	4.50%	$326.04	$132,046				$15,846	$59,157	$207,048	$5,336.30
	Combined D and E	KA0E and KA0D	74	Medium - 3	180	310	$386.50	$386.50	4.50%	$403.89	$125,207				$15,025	$56,093	$196,324	$2,638.76
	Combined C, D and E	KA0E, KA0D and KA0C	384	Medium - 3	250	435	$463.80	$463.80	4.50%	$484.67	$210,832				$25,300	$94,453	$330,584	$860.00
	Combined B, C, D and E	KA0E, KA0D, KA0C and KA0B	824	Medium - 3	315	110	$546.60	$546.60	4.50%	$571.20	$62,832				$7,540	$28,149	$98,520	$119.51
	KA0A to Parnham	All	983	Medium - 3	355	1130	$585.20	$585.20	4.50%	$611.53	$691,033				$82,924	$309,583	$1,083,540	$1,101.83
	Parnham to Vickory	All	983	Medium - 3	315	298	$546.60	$546.60	4.50%	$571.20	$170,217				$20,426	$76,257	$266,900	$271.41
	Parnham to Courtenay	All	983	Medium - 3	400	982	$642.70	$642.70	4.50%	$671.62	$659,532				$79,144	$295,470	$1,034,147	$1,051.60
	Courtney to North of River	All	983	Medium - 3	450	76	$717.80	$717.80	4.50%	$750.10	$57,008				$6,841	$25,539	$89,388	$90.90
	River Crossing	All	983	Low - 2	400	140	$4,498.90	$4,498.90	4.50%	$4,701.35	$658,189				$78,983	$294,869	$1,032,040	$1,049.46
	North of River to WWTP	All	983	Low - 2	450	2158	$602.24	$803.50	4.50%	$839.66	$1,811,981				$217,438	$811,767	$2,841,186	$2,889.15
South Kaiapoi - Development Assets	**KA0E**	KA0E 50m of RM and Pump Station	39	Medium - 3	125	50	$70.00	$70.00	4.50%	$73.15	$3,658	$560,000	5.00%	$588,000	$70,999	$265,063	$927,719	$23,910.28
	KA0D	KA0D 50m of RM and Pump Station	36	Medium - 3	125	50	$70.00	$70.00	4.50%	$73.15	$3,658	$560,000	5.00%	$588,000	$70,999	$265,063	$927,719	$26,059.52
	KA0C	KA0C 50m of RM and Pump Station	310	Low - 2	160	50	$170.00	$371.50	4.50%	$388.22	$19,411	$660,000	5.00%	$693,000	$85,489	$319,160	$1,117,060	$3,603.42
	KA0B	KA0B 50m of RM and Pump Station	440	Medium - 3	180	50	$197.70	$197.70	4.50%	$206.60	$10,330	$660,000	5.00%	$693,000	$84,400	$315,092	$1,102,821	$2,506.41
	KA0A	KA0A 50m of RM and Pump Station	159	Medium - 3	125	50	$70.00	$70.00	4.50%	$73.15	$3,658	$560,000	5.00%	$588,000	$70,999	$265,063	$927,719	$5,834.71
Sub Total																	***$12,182,717***	

Sub Area	Number of lots Contributing to WW Asset	Total Structure Plan Area Development		Constructed by Developer		WDC Funded		Development Contribution	
		Total	*Per Lot*	Total	*Per Lot*	Total	*Per Lot*	Total	*Per Lot*
KA0A	159	*$1,953,959.58*	$12,289	$927,719	*$5,835*	$0	*$0*	$1,026,241	*$6,454*
KA0B	440	*$3,995,314.57*	$9,080	$1,102,821	*$2,506*	$0	*$0*	$2,892,493	*$6,574*
KA0C	310	*$3,421,553.65*	$11,037	$1,117,060	*$3,603*	$0	*$0*	$2,304,493	*$7,434*
KA0D	36	*$1,286,304.02*	$36,132	$927,719	*$26,060*	$0	*$0*	$358,585	*$10,073*
KA0E	39	*$1,525,584.83*	$39,319	$1,134,767	*$29,247*	$0	*$0*	$390,817	*$10,073*
		$12,182,717		***$5,210,087***		***$0***		***$6,972,630***	

Sub Area	Lots	Total Structure Plan Area Development		Constructed by Developer		WDC Funded		Development Contribution	
		Total	*Per Lot*	Total	*Per Lot*	Total	*Per Lot*	Total	*Per Lot*
KA0A	159	$1,950,000	*$12,000*	$930,000	*$6,000*	$0	*$0*	$1,030,000	*$6,000*
KA0B	440	$4,000,000	*$9,000*	$1,100,000	*$3,000*	$0	*$0*	$2,890,000	*$7,000*
KA0C	310	$3,420,000	*$11,000*	$1,120,000	*$4,000*	$0	*$0*	$2,300,000	*$7,000*
KA0D	36	$1,290,000	*$36,000*	$930,000	*$26,000*	$0	*$0*	$360,000	*$10,000*
KA0E	39	$1,530,000	*$39,000*	$1,130,000	*$29,000*	$0	*$0*	$390,000	*$10,000*
Total		***$12,190,000***		***$5,210,000***		***$0***		***$6,970,000***	