INFRASTRUCTURE SERVICING STRATEGY REPORT

Clarkefield Development

Prepared for APD Projects Pty Ltd

01 EXECUTIVE SUMMARY

This Infrastructure Servicing Report has been prepared by Spiire for APD Projects to demonstrate to authorities how the proposed Clarkefield residential development will be serviced. For the purpose of this report the proposed development is considered to be approximately 350 residential lots within the township zoned land.

This document includes servicing strategies for water, sewer, electrical, and telecommunications. Stormwater management and integrated water management have also been investigated.

This servicing report has found that the Clarkefield development can be serviced without having a negative impact on existing networks.

This strategy has found that while there is currently no water and sewer connections directly available to Clarkefield it can be made available via the Gisborne-Macedon-Riddells Creek (GMCR) networks without having a significant impact on existing users. The strategy has also found that wastewater can be pumped and treated to Class A recycled water at the Riddells Creek WWTP with the appropriate augmentations in place.

Furthermore, stormwater runoff from the upstream rural catchment (to the north) which flow through the site can be managed and conveyed via a bypass stormwater pipe through the development and to existing culverts under the Bendigo-Melbourne Train line. Two Water Sensitive Urban Design (WSUD) asset locations are also proposed for the development to effectively treat stormwater runoff to best practice objectives.

SERVICING STRATEGY OBJECTIVES

- Minimise impact on the existing potable water network
- Wastewater as a resource
- Achieve a beneficial impact on wastewater discharges into Jacksons Creek
- Protect our waterways via and functional stormwater management
- Create a community empowered by sustainable water and energy management
- Supply electrical reticulation with augmentation works
- Supply telecommunications (NBN)

Issue Date	Rev No	Authors	Checked	Approved
-	A	Z. Irani	-	-
22/07/2021	B	B. Nevill; Z Irani	L. Holmes	L. Holmes
2/08/2021	C	B. Nevill; Z Irani	L. Holmes	L. Holmes
18/03/2022	D	B. Nevill	L. Holmes	L. Holmes

Spiire reference number: 304782

APD Projects Pty Ltd

02 VISION AND OBJECTIVES

VISION

"A self-contained urban settlement surrounding existing underutilised state infrastructure integrating the principles of transit orientated planning, low carbon living and affordable housing to meet a clear need within Macedon Ranges and Victoria"

PURPOSE OF REPORT

The purpose of this servicing report is to provide authorities and stakeholders a holistic view of servicing requirements of the site. The strategy includes general servicing for water, sewer, electrical, telecommunications, and stormwater. Whilst stormwater management and integrated water management are typically separate reports, the intention is to create a truly integrated strategy for all of the above items which inevitably carries through to the development.

AUTHORITY ENGAGEMENT

The objectives and strategy that form the basis of the servicing report were developed through authority advice and meetings with the focus on identifying and developing opportunities and acknowledging servicing constraints.

The following authorities were consulted and assisted in informing the strategy:

- Western Water;
- Macedon Ranges Shire Council;
- Melbourne Water;
- Jemena; and
- Telco

SERVICING REPORT OBJECTIVES

MINIMISE IMPACT ON THE EXISTING POTABLE NETWORK

- A diverse range of water supplies and sources
- Manage water efficiency and demand
- Safe & secure water supply
- Water available to maintain valued green community assets including for climate change (Resilience)
- Strive to achieve Western Water's Target 155 through efficient water use

WASTEWATER AS A RESOURCE

- Meets public health and environmental standards
- Reduce wastewater generated
- Effective sewerage systems to meet current and future regulations
- Maximise waste-to-resource opportunities (fit for purpose alternate water)

ACHIEVE A BENEFICIAL IMPACT ON WASTEWATER DISCHARGES INTO JACKSONS CREEK

- Reduce wastewater discharges into Jacksons Creek
- Waterway health is maintained and improved
- Appropriate levels of flood protection in new development
- Community and property resilient to local flood risk

PROTECT OUR WATERWAYS VIA APPROPRIATE AND FUNCTIONAL STORMWATER MANAGEMENT

- Safe conveyance of stormwater flows via the drainage pipe networks and road networks
- Mitigate erosion and sediment deposits in Jacksons Creek via sediment retention
- Utilisation of constructed wetlands and raingardens to treat stormwater runoff to best practice
- Reduce the magnitude and volume of post-development stormwater flows

CREATE A COMMUNITY EMPOWERED BY SUSTAINABLE WATER AND ENERGY MANAGEMENT

- Use of smart technology to monitor and control water, wastewater and stormwater networks.
- Diverse urban landscapes that reflect local conditions and community values
- Aboriginal cultural values associated with waterways are protected

03 SITE DESCRIPTION

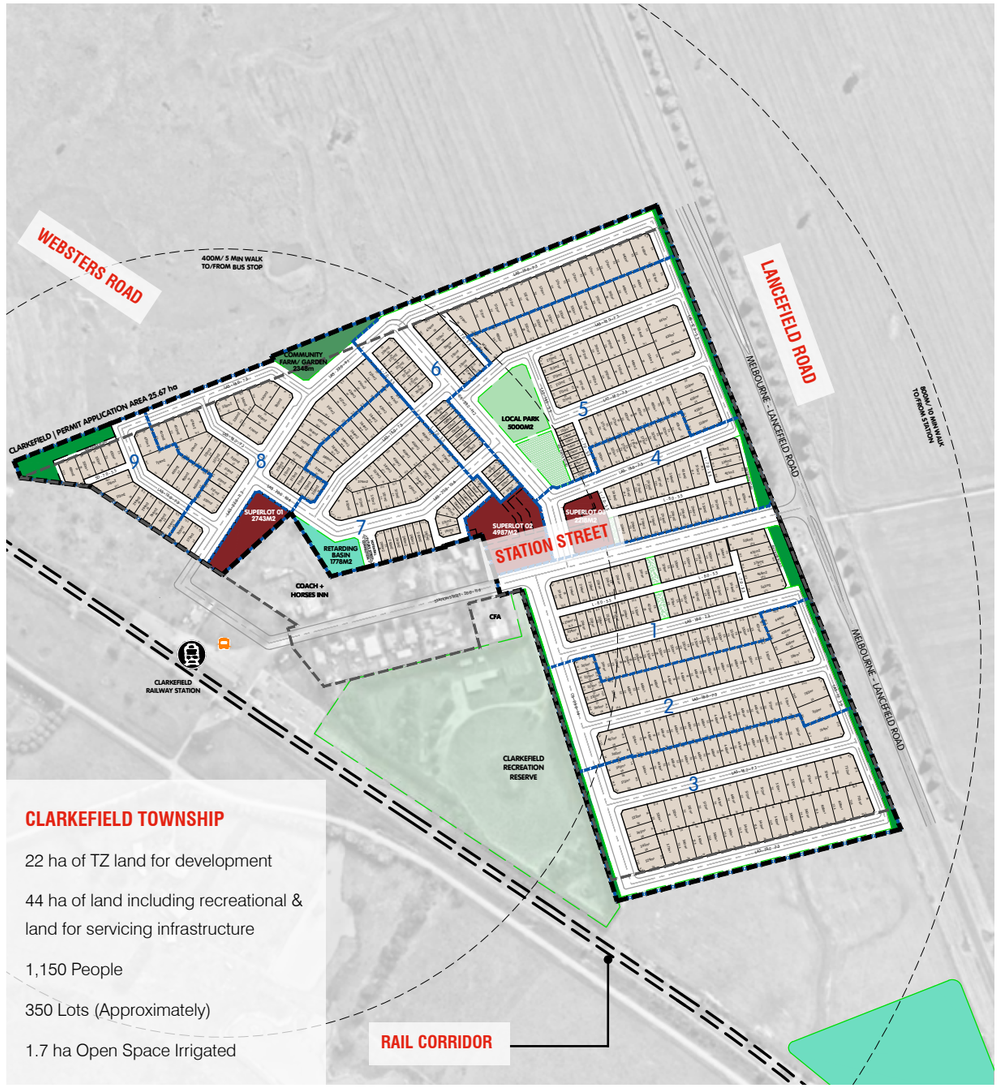
The Clarkefield development is located approximately 40km North West of Melbourne. The site is bound by Bendigo-Melbourne railway corridor to the west and Lancefield Road to the east. Station Street runs east to west through the site. There is an existing rail station 'Clarkefield Station' that is located at the heart of the township and which train alignment follows Websters Road.

The 22 hectare of Township Zone (TZ) land is proposed to consist of approximately 350 medium density and standard residential lots. In addition, the 44 ha of land is the subject of this strategy which consists of approximately 5 ha of green space in the form of an existing town oval to be upgraded and irrigated by the developer, a local park, a community garden and WSUD assets. There will also be a commercial hub.

The site grade falls to the south east with a gradient of approximately 1 in 100. The site is bounded by three major creeks: Bolinda Creek to the north, Emu Creek to the east and Jacksons Creek to the south. Runoff from the site discharges into Jacksons Creek.

The Riddells Creek Wastewater Treatment Plant (WWTP) is located north-west of the site, which currently treats wastewater prior to discharging it into Jacksons Creek.

The proposed sewer and water infrastructure for the proposed development is to be managed by Western Water.



04 WESTERN WATER'S POTABLE WATER & SEWER STRATEGY

WATER STRATEGY

Western Water had identified that the Clarkefield development can be serviced by the Gisborne-Macedon-Riddells Creek (GMRC) water network. Master Planning for GMRC has an allowance for approximately 5000 future lots over a 50 year planning period and it is expected Clarkefiled will be serviced via this additional capacity.

A future water main from Riddells Creek is expected to be constructed to Clarkefield prior to 2030 and will service the future development needs of Clarkefield. Further work has been completed by Spiire and UWS on the following page for the proposed design and alignment requirements to bring forward the timing of provision of infrastructure.

The water main earmarked along Lancefield Road is expected by 2040 based on the masterplan. No allowances for Clarkefield have been made off this network, however exploration to draw water off this main will result in minimal impact to the Sunbury network. A booster pump station will be needed in the event the Clarkefield development is required to draw off this main for land developed outside the currently zoned township centre. In saying this It is not expected that Clarkefiled would need to tap into this main as it will derive all its supply from the Riddles Creek connection.

SEWER STRATEGY

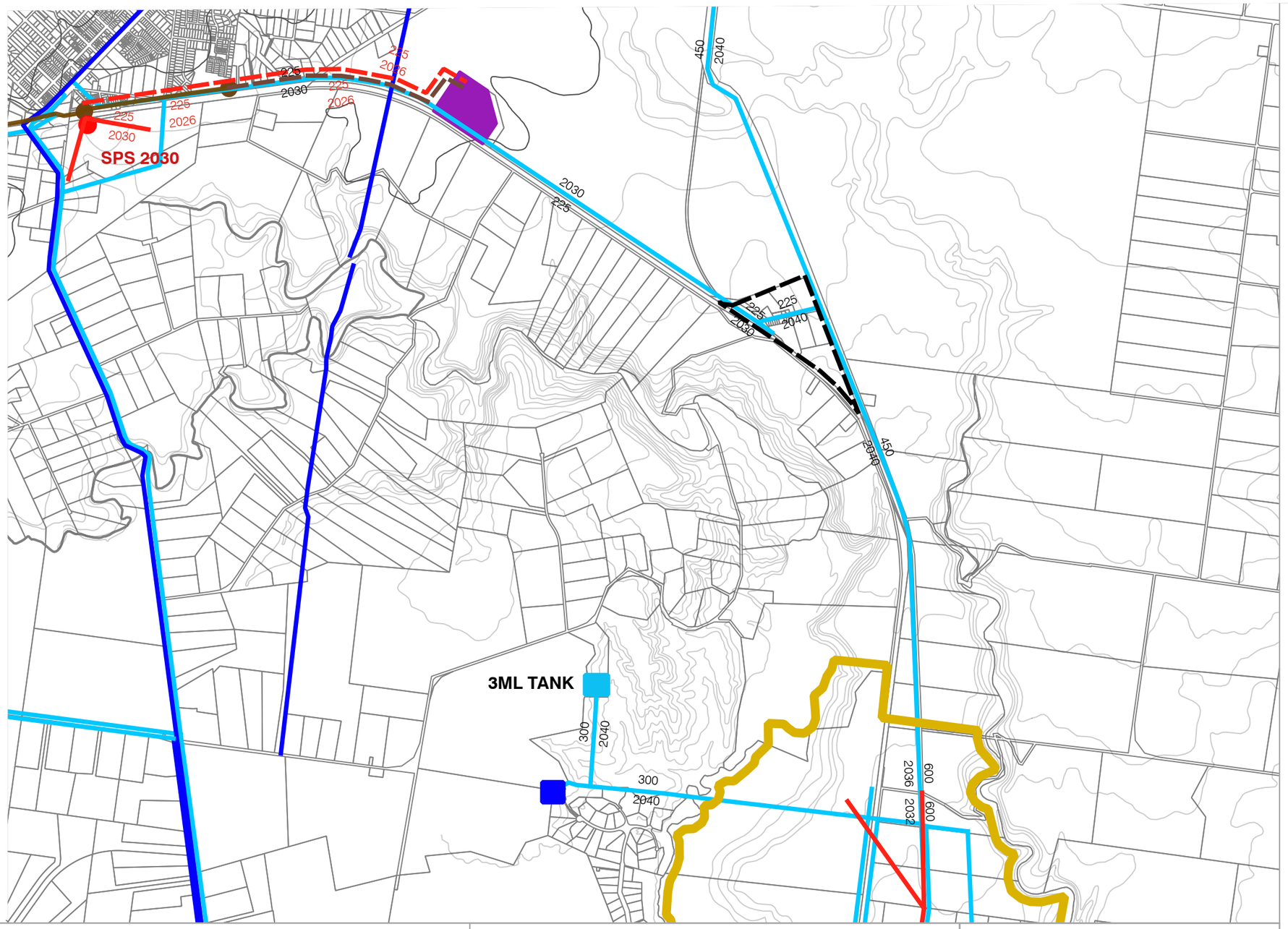
There is no planned sewer infrastructure within the current Western Water masterplan. Western Water identified that the Clarkefield development would be serviced by the GMRC sewer network, by the Riddells Creek WWTP, and has provisioned for approximately 500 lots. Western Water have indicated that they will be upgrading the Riddles Creek WWTP to deal with the future sewer demands, beyond what has already been allowed for Clarkefield and other growth areas.

A sewer pump station is proposed to be constructed which will transfer flows upstream to Riddells Creek WWTP. Modelling of the GRMC network show that the Clarkefield connection would not have a significant impact on the network. This is discussed in further detail in Section 6.

The sewer main along Lancefield Road is earmarked for construction in 2037 based on current master planning. Clarkefield has the potential to connect to this sewer main but it will require bringing forward construction of approximately 12 km of sewer. While modelling was undertaken, it has not been discussed in this report as it was deemed to be not a viable solution in this instance.

AUTHORITY RESPONSE

Spiire have developed a servicing strategy in collaboration with Western Water. Western Water have notionally supported a planning application being submitted. The following pages document the strategy that underpin the water and sewer servicing.



NOTATIONS

File Ref: 304782
Plan: W GIS WW Combined Strategy
Rev: A
Date: 19.10.2020

Designed: Z.I
Checked: L.H.
Authorised: L.H.

LEGEND

- Subject Site
- Existing Water Main
- Proposed Water Main
- Urban Growth Boundary
- Riddells Creek WWTP
- Existing Sewer Main
- Existing Sewer Rising Main
- Proposed Sewer Main
- Proposed Sewer Rising Main

1:40000

400 0 400 800 1200 m

Coordinate System: GDA 1994 MGA Zone 55
Paper size A3 Landscape

spiire
414 La Trobe Street
PO Box 16084
Melbourne Vic 8007
T 61 3 9993 7888
spiire.com.au
ABN 55 050 029 635

05 WATER RETICULATION

A Peak Day Demand scenario was used to assess the impact of the additional demand from the proposed development at Clarkefield on the water supply networks. See Figure 5.1 for the residential profile adopted. The non-residential profile adopted is shown in Figure 5.2. As the exact nature of the commercial development is unknown a generic profile with afternoon peak was adopted.

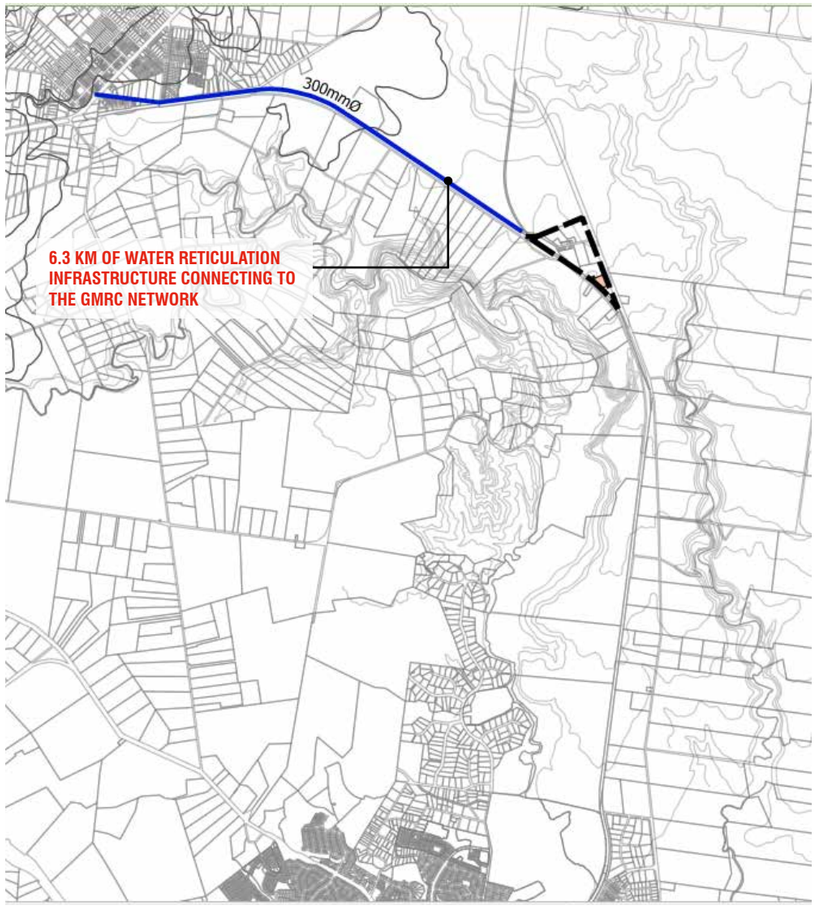
See Table 5.1 for the water design loads. Analysis of the water network has considered the following:

- Water reticulation connection to Magnet Hill zone network;
- Will supply approximately a minimum of 350 lots for Clarkefield with additional capacity if required.
- Infrastructure to consist of 6.3km of 300mm diameter pipe along Sutherlands Road.

The 2023 GMRC includes future augmentations including a new main from Gisborne to Riddell's Creek to provide approximately 5000 lots of additional supply. This augmentation is expected to be completed by 2023.

Whilst multiple options have been considered in our planning the key connection for Clarkefield will be from the the Magnet Hill Zone using the future connection at the end of Sutherlands Road. With the inclusion of the Gisborne main the Clarkefield connection will have no impact on the existing network or on the Sandy Creek zone. This option would require approximately 6.3 km of 300 mm diameter pipe. A one-way valve needs to be located to protect the Sandy Creek Zone from the demands at Clarkefield. It would also be necessary to install a PRV as the supply head from the Magnet Hill Zone is predicted to be between 420 m and 520 m on a 2067 peak day.

CLARKEFIELD WATER STRATEGY



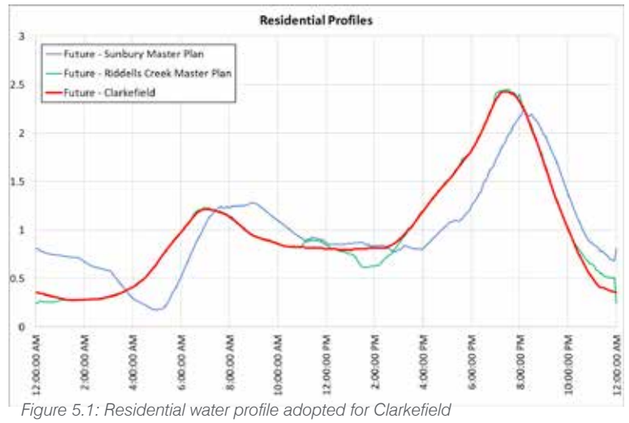


Figure 5.1: Residential water profile adopted for Clarkefield

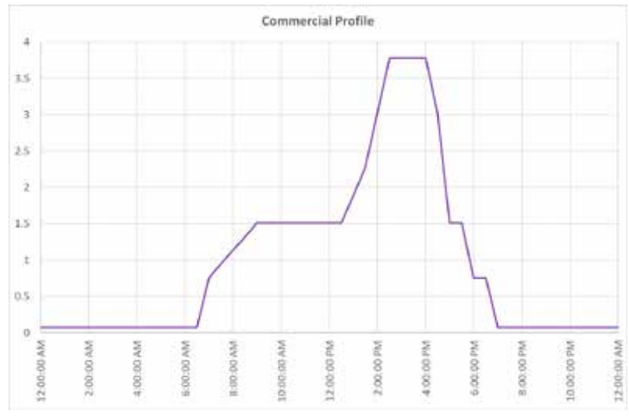


Figure 5.2: Non-residential water profile adopted for Clarkefield

Table 5.1:Water Design Loads

Residential Demand (from WW modelling)	
Max Day Demand (L/lot/day)	1,350
Max Hour/MDD Factor	2.44
Non-Residential Demand (From MWH report)	
Average Day Demand (kL/day/ha)	13.8
Peak Hour Demand (kL/h/ha)	2.16

06 SEWER NETWORK

To determine the sewer main sizing, Spiire and UWS carried out modelling to determine rising main sizes and pumping flow rates.

The modelling considers a free outfall at the Riddells Creek WWTP and does not consider the impacts on the treatment processes at the WWTP. Western Water has acknowledged they will be investigating the augmentations to the Riddells Creek WWTP later in 2020. Therefore such investigation is not required as part of these initial investigations.

The Residential Profile adopted for Clarkefield is shown in Figure 6.2. The AR&R 1987 Design Storms with wet weather peak flow timed to match dry weather peak flows were used to assess system containment.

The sewer design load for Clarkefield is shown in Table 6.1.

Pumping waste to Riddles Creek WWTP was the option adopted for servicing the proposed development at Clarkefield. The location of the pump station is to be co-located with the drainage reserve, within the Clarkfield development.

BUSINESS AS USUAL

Due to the topology of the site it is necessary to install a pump station at Clarkefield to transfer flows to the Riddells Creek WWTP. This option is classified as BAU and based on the projected number of lots will increase the wastewater discharge to Jacksons Creek.

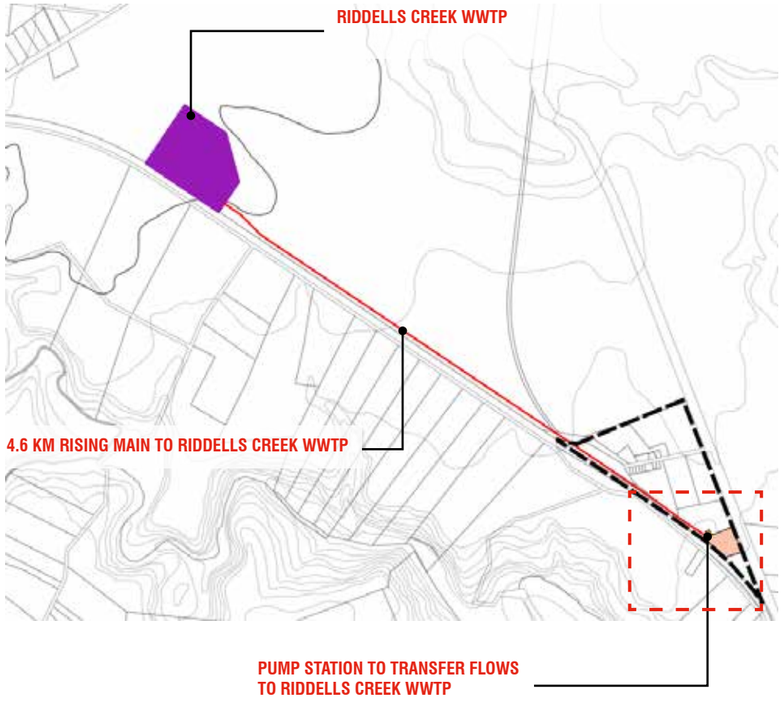


Figure 6.1: Clarkefield Sewer Strategy Layout Plan

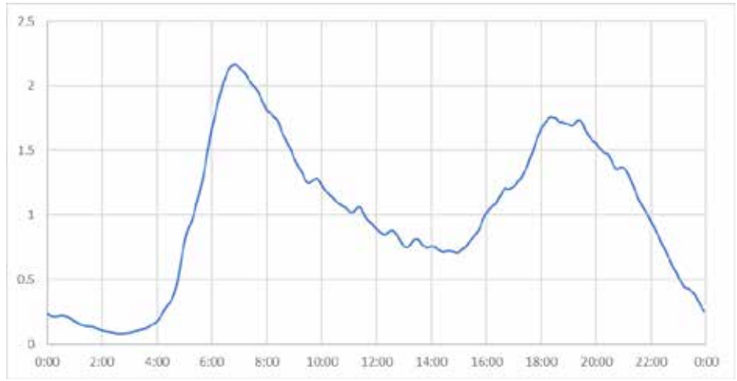


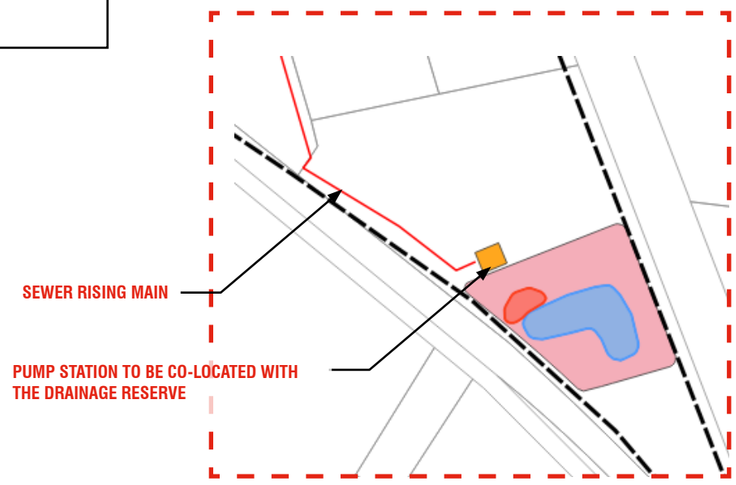
Figure 6.2: Residential sewage profile adopted for Clarkefield

Table 6.1: Sewer Design Load - Clarkefield

DRY WEATHER FLOW - RESIDENTIAL	
Residential Sewage Loading (L/day)	13.0

WET WEATHER FLOW

An inflow/infiltration (L/L) allowance of 2% runoff from 35% of the non-residential area was used to provide a notional wet weather contribution to the sewage system.



07 ELECTRICAL & TELECOMMUNICATIONS

ELECTRICITY RETICULATION

Jemena is the responsible authority for electrical reticulation in the area and the subject land. Preliminary advice indicates that supply can be made available with an upgrade to existing infrastructure. The upgrade needs to come from the nearest 3 phase supply with a suitable conductor, which is circa 5 km south on Melbourne-Lancefield Road. The development will require the overhead line to be replaced with new conductors and poles. The works are in Jemana's plans and will be undertaken, prior to stage 1 completion.

Due to the size of the development, a number of electrical substations will be required on the site each within an electrical reserve (6.2 m x 8.0 m) and vested in Jemena services.

TELECOMMUNICATIONS

The project has several high-speed internet assets within the immediate area with: Telstra, Optus, and VicTrack all maintaining connections in the area. The provision of fast speed internet is in advanced discussions with several providers. The intention is to provide a work from home hub and deliver smart community infrastructure.

It should be noted that the service providers will not provide any detailed information on costs, internal or backhaul unless a formal application is made which again is premature at this time.

However fibre networks are currently available in other surrounding developments such as Riddells Creek.

08 RECYCLED WATER

As part of the Clarkefield Servicing Strategy, the treatment of all wastewater to Class A recycled water has been explored to provide re-use for irrigation, toilet flushing and laundry use within the development. The construction of a Class A treatment system at Riddells Creek WWTP will be setup to service only the Clarkefield township zone. This is currently being explored further by Western Water, however does not effect the base case servicing of the development.

Treating wastewater and re-using it throughout the Clarkefield development for fit-for-purpose activities will reduce discharge into Jacksons Creek as per the key objective of this servicing report. Class A has been assumed throughout the development as it can be re-used for both irrigation and residential non-potable demand.

Ideally the new Class A plant will be co-located within the Riddells Creek WWTP area and the Class A main will then distribute the recycled water back into the development. Alternatively, there is an opportunity to co-locate the treatment plant within the Clarkefield township drainage reserve, and have recycled water pumped to the existing wastewater plant.

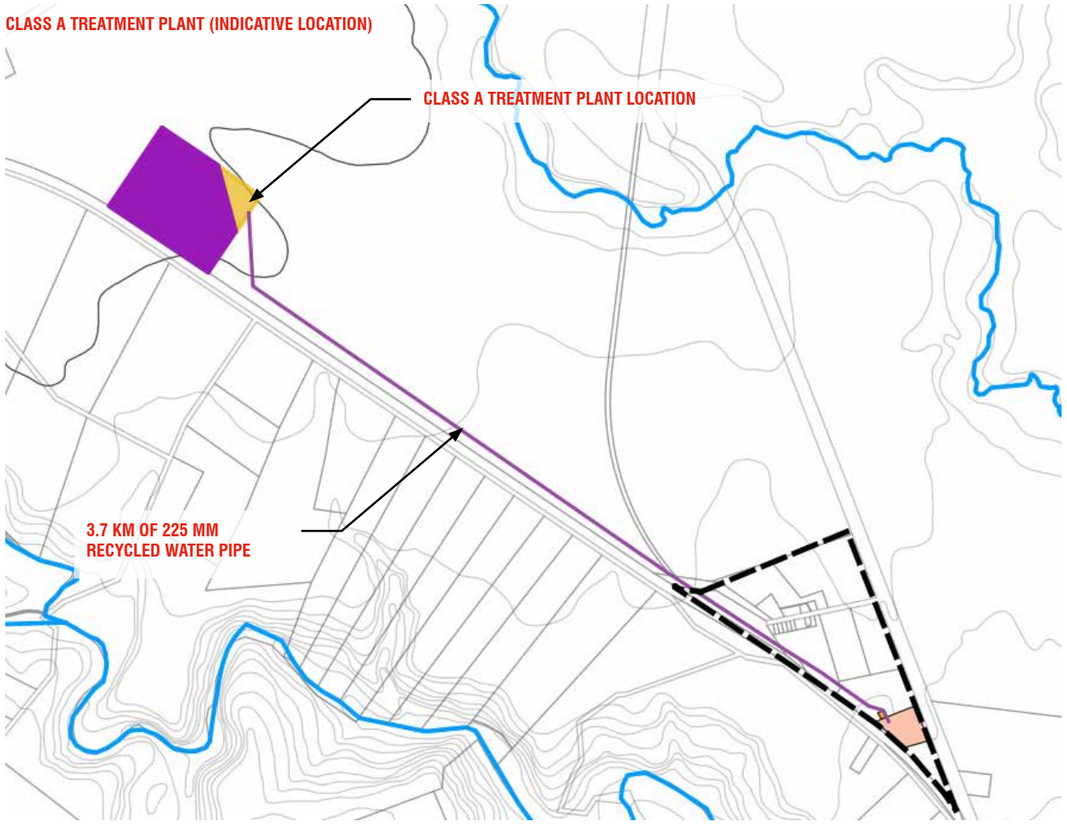
CLARKEFIELD BODY CORPORATE

It is envisaged that the Clarkefield development will include a body corporate. As part of this body corporate, an annual levy will be included that is attributed to water management and in particular the use of Class A recycled water within the development.

A levy will be implemented within the development that is expected to pay for water within the public realm that is not associated with private residential use. It is also expected that the residents will also pay for their individual domestic recycled water use.

OWNERSHIP

The ownership of the recycled water infrastructure is expected to be attributed to Western Water.



09 STORMWATER: PRE-DEVELOPMENT SCENARIO

A drainage analysis has been prepared for Clarkefield to provide strategy and framework with respect to drainage to inform the future residential development. To provide this, the specific scope of this assessment is to:

- Understand existing site and proposed site conditions;
- Undertake a hydrological assessment to represent the upstream catchment and flows;
- Determine minor and major drainage flow paths and downstream requirements;
- Confirm major infrastructure, main drains and treatment assets; and
- Provide concept layout plans of the strategy.

PRE-DEVELOPMENT SCENARIO

There are three existing culverts along the rail corridor that form the southern boundary of the Clarkefield development. These are labelled on the adjacent layout plan. The Station St and South Railway culverts will be used by the Clarkefield development. In the pre-development scenario, Catchments C and D drain to these culverts. Catchments A and B drain to the North Railway culvert which is outside the scope of this servicing report. The flow rates of Catchments C and D have been calculated using the regional flood frequency estimation (RFFE) tool and are presented in Table 9.1.

Table 9.1: RFFE pre-development flow rate estimation

LOCATION	CATCHMENT AREA (HA)	$Q_{1\%\ AEP}$ (M^3/S)
Station St Culverts	104.8	3.8
South Railway Culverts	34.5	1.6

CULVERT ASSESSMENT

A culvert assessment has been completed to ensure that the culverts can cater for post-development flow rates. Culverts details are presented in Table 9.2.

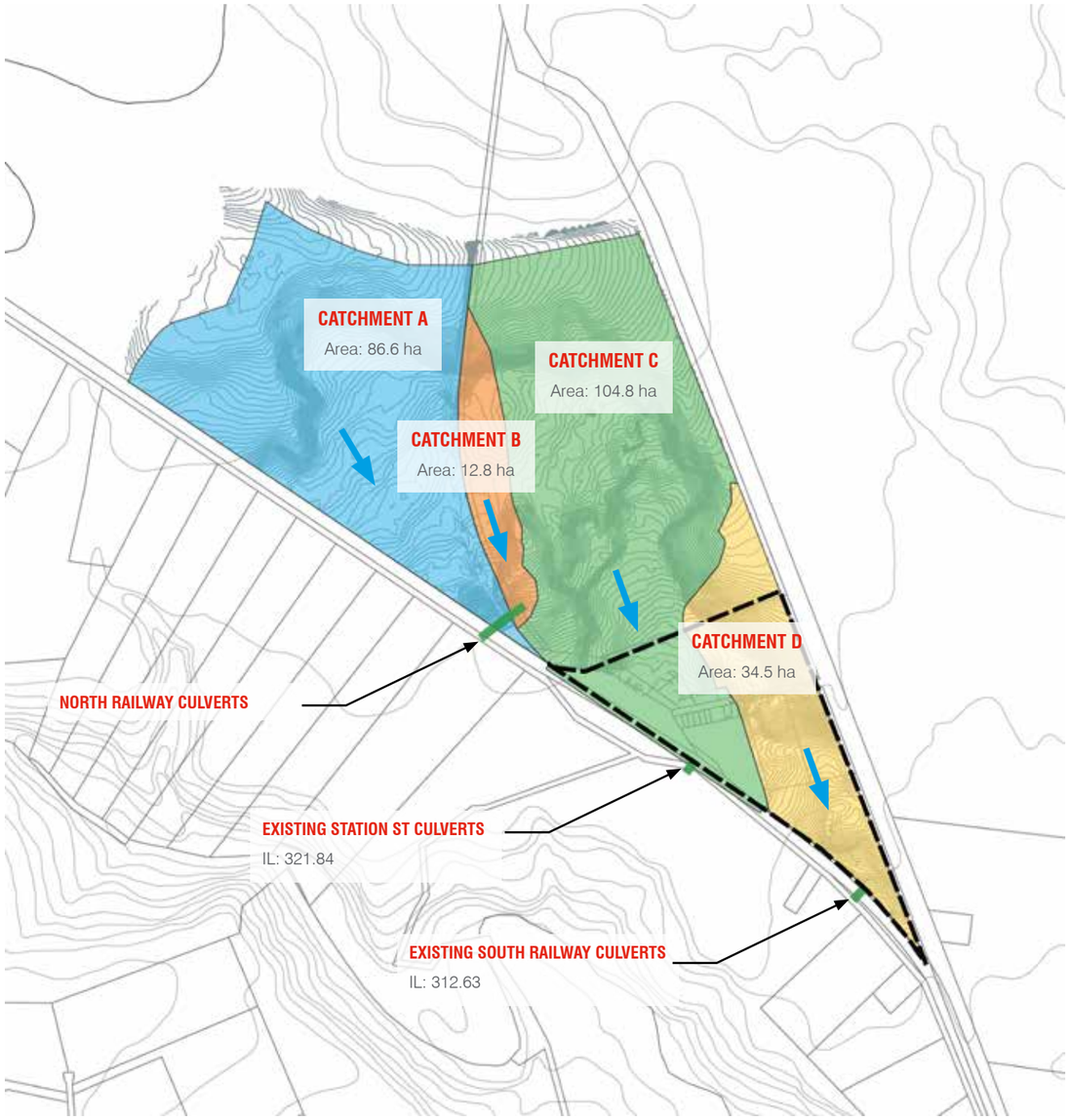
Table 9.2: Culvert Detail Summary

CULVERT	DIMENSIONS (W X H)	UPSTREAM INVERT LEVEL (M AHD)
Station St	3,000 mm x 750 mm	321.84
South Railway	2 x 600 mm x 700 mm	312.63

HY-8 is a culvert flow rate calculation tool and was used to calculate the capacities of the culverts at various headwater levels to confirm that it could cater for the pre-development flow rate and / or higher flow rates. A headwater level of one metre above the culvert obvert was assumed to be the maximum permissible headwater level based on the surrounding topography. Results are below in Table 9.3.

Table 9.3: Culvert Flow Capacity Summary

CULVERT	Q_{CAP} (M^3/S)
Station St	3.80
South Railway	1.62



09 STORMWATER: HYDROLOGY & HYDRAULICS

DEVELOPED FLOW RATES

A hydrologic model was created using RORB to estimate the developed flows and inform concept sizing of retarding basins. ARR87 guideline were adopted for the modelling. The overall catchment was broken into three sub-catchments as shown on the adjacent layout plan.

The following fraction impervious values were used:

- 0.1 for rural zones;
- 0.3 for major open space;
- 0.75 for residential zones; and
- 0.90 for commercial zones

The stormwater runoff from the upstream catchment will be conveyed to a drainage pipe within Catchment C to bypass the rural flows through the township. Both Catchment A and C will drain to the existing South Railway culverts. Catchment B will drain to the existing Station Street culverts. Refer to Table 9.4 for the flow rates.

Table 9.4: RORB 1% AEP Storm Event Developed Flow Rates

LOCATION	STORM DURATION	PEAK FLOW (M^3/S)
A	2 hrs	3.54
B	2 hrs	3.49
C	1 hrs	3.74
A & C (South Railway Culverts)	2hrs	5.05
A & B (Station St Culverts)	9 hrs	4.47

As can be seen, the incoming flow from the combined Catchment A and C exceeds the capacity of the South Railway culvert capacity (as shown on the previous page). As such, a retarding basin will be required upstream of the South Railway culvert location to mitigate flow rates. Conversely, the local flows generated from Catchment B do not exceed the capacity of the Station St culvert, and therefore, may be discharged without need for additional retardation.

09 STORMWATER: HYDROLOGY & HYDRAULICS

Incoming developed flow rates to both the South Railway and Station St Culverts have been assessed. Flows generated at the South Railway culverts will be greater than the pre-development scenario, and also exceed the capacity of the existing culverts. As such, a retarding basin will be required at this location (to the south of the site).

The retarding basin at the South Railway Culverts will retard flows from the developed Catchment C, in addition to the pre-developed flows from Catchment A. The developed flows from Catchment B will be not requre retardation, as the flow from this catchment does not exceed the pre-developed flow rate or exceed the capacity of the Station Street culverts.

RORB was used to model the catchment flows and the required retarding volumes.

Refer to Table 9.5 for RORB parameter summary and Table 9.6 for concept volumes and outfall configuration of each retarding basin.

The south railway retarding basin will be co-located with WSUD assets (discussed in Section 10). Further detailed design will be refine details such as the outlet configuration and land take.

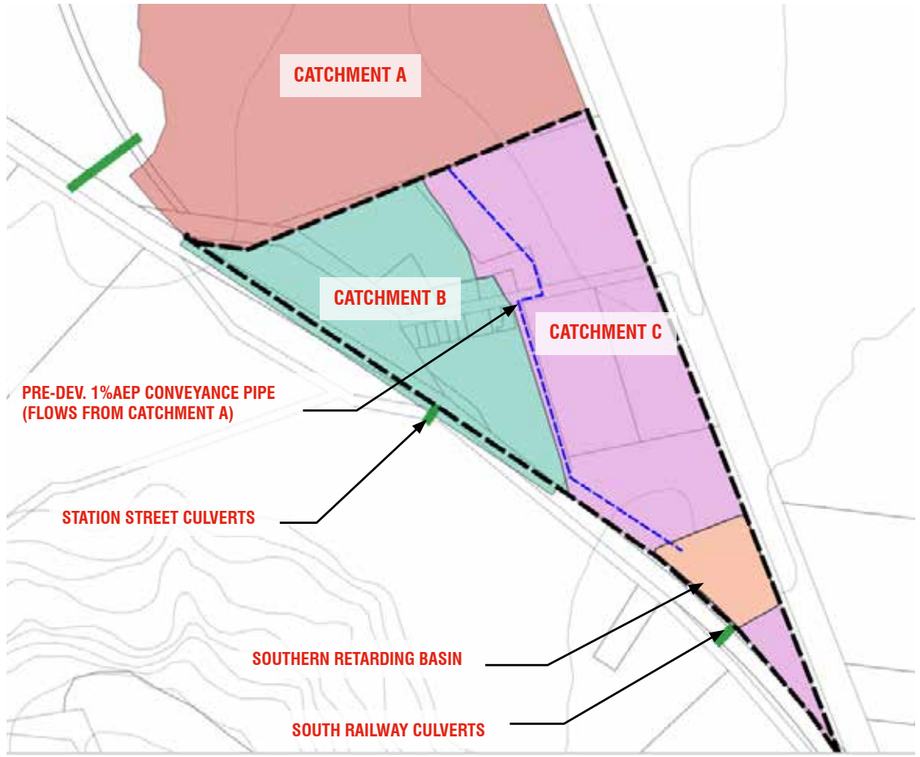


Table 9.5: RORB 1% AEP Storm Event Developed Flow Rates

PARAMETER	VALUE
Initial Loss	15 mm
RoC	0.6
m	0.8
K_c	1.67
D_{av}	1.34 km

Table 9.6: RORB 1% AEP Storm Event Developed Flow Rates

ASSET	PEAK OUTFLOW (M^3/S)	RETARDING VOLUME (M^3)	INCOMING CULVERT FLOW (M^3/S)
South Culvert RB	1.59	45,000	1.59

Table 9.5: RORB 1% AEP Storm Event Developed Flow Rates

ASSET	QDESIGN (M^3/S)	PIPE SIZE (MM)	QCAP (M^3/S)
1% AEP RURAL BYPASS PIPE	3.54	1,200	3.9

10 STORMWATER: QUALITY

WATER SENSITIVE URBAN DESIGN

Sediment Ponds, Raingardens and Wetlands have been proposed throughout the Clarkefield township to treat stormwater runoff to best practice objectives. Two treatment assets are proposed in the Clarkefield township.

Water quality assets located at the subject site are required to satisfy best practice objectives as follows:

Table 10.1: Water Quality Best Practice Objectives

POLLUTANT	BEST PRACTICE PERFORMANCE OBJECTIVES
Total Suspended Solids (TSS)	80% retention
Total Phosphorus (TP)	45% retention
Total Nitrogen (TN)	45% retention

MUSIC, an industry standard water balance tool, has been used to size the stormwater treatment assets, against the key objectives. The MUSIC modelling parameters for the nodes are shown in Table 10.3, 10.4 and 10.5, which are in line with Melbourne Water's MUSIC guidelines and Constructed Wetlands Design Manual Part A2 - Deemed to Comply (DtC).

See Table 10.2 for a summary of the WSUD assets and Table 10.6 for the treatment results.

The adjacent layout plan shows the location of WSUD assets around the Clarkefield township. Their locations are based on the topography of the site as well as preliminary minor drainage catchments. These are subject to change with the urban design and further investigation during functional design.

Table 10.3: Sediment Pond Design Parameters

DESIGN COMPONENT	SEDIMENT POND 1	SEDIMENT POND 2
Treatment Catchment (ha)	7.0	26.5
Extended Detention Depth (m)	0.35	0.35
Surface Area (m^2)	300	1,000
Permanent Pool Volume (m^2)	300	1,000
Dry Out Area (m^2)	112	424
Permanent Pool Depth (m)	1.5	1.5
Capture Efficiency (%)	99	99

Table 10.4: Raingarden Design Parameters

DESIGN COMPONENT	RAINGARDEN
Treatment Catchment (ha)	7.0
Design Treatment Flow	4EY
Extended Detention Depth (m)	0.35
Filter Area (m^2)	300

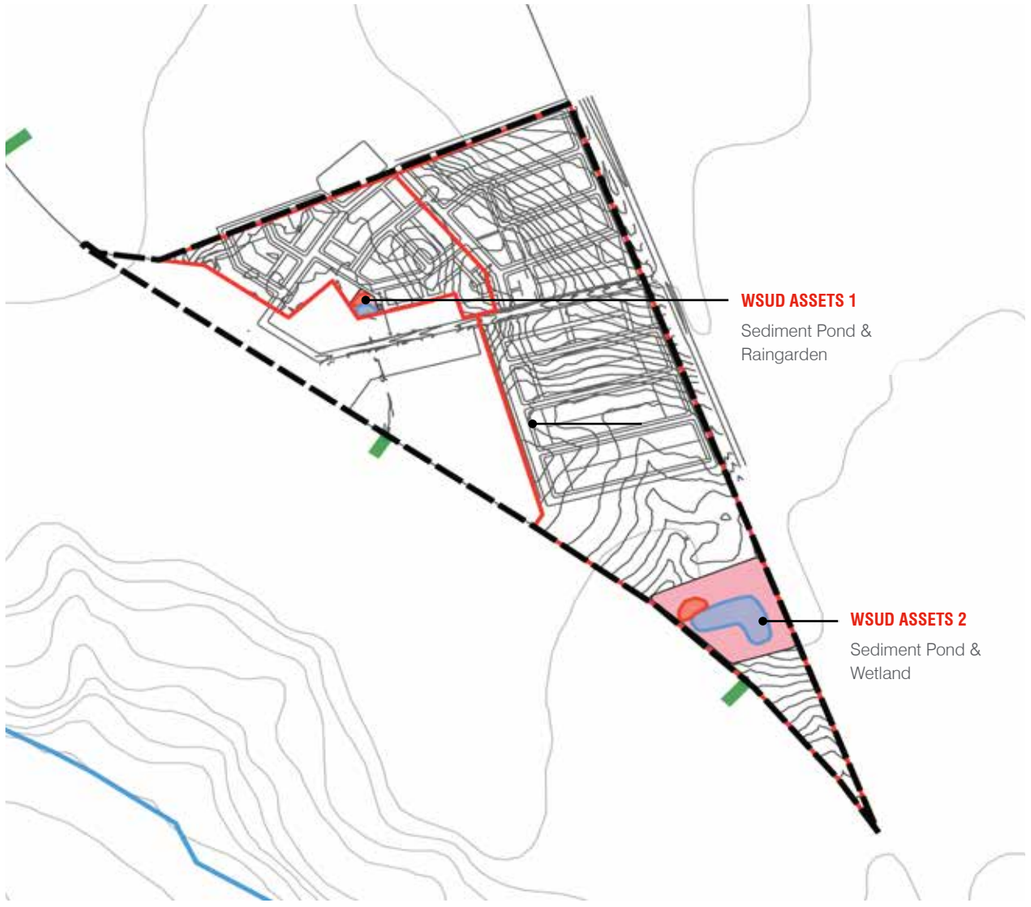


Table 10.2: WSUD asset summary

ASSETS	1	2
Sediment Pond Area (m^2)	300	1,000
Wetland Area (m^2)	N/A	5,000
Raingarden Area (m^2)	300	N/A
NWL	325.0	316.0

Table 10.5: Wetland Design Parameters

DESIGN COMPONENT	WETLAND
Treatment Catchment (ha)	26.5
Design Treatment Flow	4EY
Extended Detention Depth (m)	0.35
Surface Area (m^2)	5,000
Permanent Pool Volume (m^2)	2,000
Detention Time (hrs)	72

Table 10.6: Treatment train effectiveness

POLLUTANT	ORIGINAL LOAD	RESIDUAL LOAD	REDUCTION %
Total Suspended Solids (kg/yr)	19,900	3,630	81.8
Total Phosphorus (kg/yr)	40.6	15	63.2
Total Nitrogen (kg/yr)	284	139	51
Gross Pollutants (kg/yr)	4,150	0	100

11 IRRIGATION WATER DEMAND

Green spaces around the development will require a high volume of water for irrigation. While this may be potable water in a 'business as usual' scenario, it can be substituted with treated wastewater.

This strategy proposes to:

- Increase irrigation demand to incorporate the green living principles; and
- Offset wastewater generation in a positive manner by finding additional irrigation area for the development.

The areas to be irrigated are highlighted pink in the adjacent layout plan. They are:

- Active open space within the development;
- Portion of the education precinct;
- Space directly east of the education precinct;
- 100 m buffer strip north west of the development; and
- The verge on Lancefield Road,

The total area to be irrigated is 18.7 ha. This would require approximately 66 ML/year to irrigate, not including residential irrigation demands. When including residential demand, the total demand increases to 75 ML/year.

12 IWM OPPORTUNITIES

Development of the infrastructure servicing report is a result of ongoing discussions with Western Water around reducing the volume of Class C recycled water discharged from Riddells Creek WWTP into Jacksons Creek.

The report has been prepared to align with the Western Water Integrated Water Management Developer Guidance Report (Western Water 2018).

The following IWM options explored are based on the servicing strategy objectives outlined in Section 2. This has lead to the following options being explored:

- Reduction in water use by the installation of water efficient appliances at a lot scale
- Upgrade of the WWTP to produce Class A recycled water supply for reuse within the development for irrigation, toilet flushing and laundry.
- Water Sensitive Urban Design (WSUD) solutions such as sedimentation basins and wetlands.

Table 12.1 assesses how each of the explored options addresses the five IWM objectives.

Urban Water Solutions (UWS) have been engaged to complete modelling of the sewer network and water reticulation network. The modelling analyses the impact the Clarkefield township has on Western Water's strategy. Refer to Appendix A for the report.

The following options have not been investigated in this servicing report:

- Indirect potable water use
- Rainwater harvesting
- Smart tanks
- Rainwater to hot water
- Stormwater to potable substitution
- Aquifer storage & recharge
- Water reuse for urban farm/community gardens

WESTERN WATER TARGET 155

Target 155 is a voluntary water conservation program that encourage residents in greater Melbourne to use 155 litres of water or less per person per day (Western Water, 2020).

Ways of achieving this target can be largely attributed to better community awareness and their own water use and as such the Clarkefield development can further enhance this via promotion and implementation of the following initiatives:

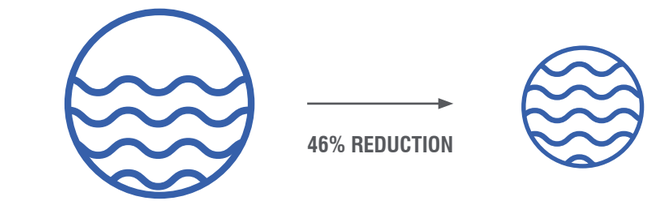
- Assisting with community water education and awareness;
- Mandating water efficient appliances for all new homes (WELS);
- Enabling alternative water within the community; and
- Digital metering to better detect and repair leaking water mains

See adjacent graph for Western Water's progress since 2017 in achieving Target 155.

Table 12.1: Options assessment based on Key objectives of the Clarkefield IWM Strategy

IWM OBJECTIVES		MINIMISE IMPACT ON THE EXISTING POTABLE NETWORK	WASTEWATER AS A RESOURCE	ACHIEVE A BENEFICIAL IMPACT ON WASTEWATER DISCHARGES INTO JACKSONS CREEK	CREATE A COOL, GREEN AND WATER SENSITIVE URBAN DESIGN	PROTECT OUR WATERWAYS VIA APPROPRIATE AND FUNCTION STORMWATER MANAGEMENT
	OPTIONS					
1	Water Efficient Appliances	✓				
2	Class A Recycled Water Supply	✓	✓	✓		
3	Water Sensitive Urban Design				✓	✓

12 IWM OPPORTUNITIES



522 L / Household / Day

HOUSEHOLD WATER USE WITH CONVENTIONAL APPLIANCES

282 L / Household / Day

HOUSEHOLD WATER USE WITH WATER EFFICIENT APPLIANCES

CLASS A RECYCLED WATER SUPPLY

The Clarkefield township is located near the Riddells Creek WWTP which currently provides Class C recycled water for irrigation. Augmenting the existing WWTP to provide Class A recycled water can provide a water substitute for non-potable water demands. Implementation of a development scale Class A WWTP provides the following lot scale opportunities for reuse:

- Lot scale Irrigation
- Toilet flushing
- Laundry use

WATER SENSITIVE URBAN DESIGN

WSUD assets contribute to reducing pollutant loads entering Jacksons Creek. There is potential to design WSUD assets such as wetlands and raingardens in the Public Open Spaces around the Clarkefield development, improving amenity and creating an opportunity to educate residents on the water cycle.

Sedimentation basins, wetlands, and raingardens have been proposed to treat stormwater runoff to meet best practice water quality targets.

Water sensitive urban design has the following benefits:

- Reduce pollutant loads of stormwater entering Jacksons Creek
- Bring water to the surface to enable the community's visual connection to the water cycle
- Urban greening
- Improve amenity

WATER EFFICIENT APPLIANCES

Spiire have analysed and created a conventional profile of the household water use within the Clarkefield township, based on local existing data. This conventional water profile was compared against a water efficient profile and found that there is potential for 46% in water use.

These profiles have informed the water balance modelling to demonstrate the potential of IWM opportunities explored throughout this servicing report.

Spiire have analysed and created a conventional profile of the household water use within the Clarkefield township, based on local existing data. This conventional water profile was compared against a water efficient profile and found that there is potential for 46% in water use.

These profiles have informed the water balance modelling to demonstrate the potential of impact of recycled water reuse.

Water Efficient Appliances have been utilised to reduce potable water use and thus reduction in wastewater discharged into Jacksons Creek. The following household appliances have been considered:

- Hot water recirculation
- Bathroom taps, shower & toilet
- Kitchen taps
- Dishwasher
- Laundry taps & washing machines

2.6 people per household has been adopted (Australian Bureau of Statistics ABS) for the suburb of Clarkefield.

13 WATER BALANCE CONVENTIONAL

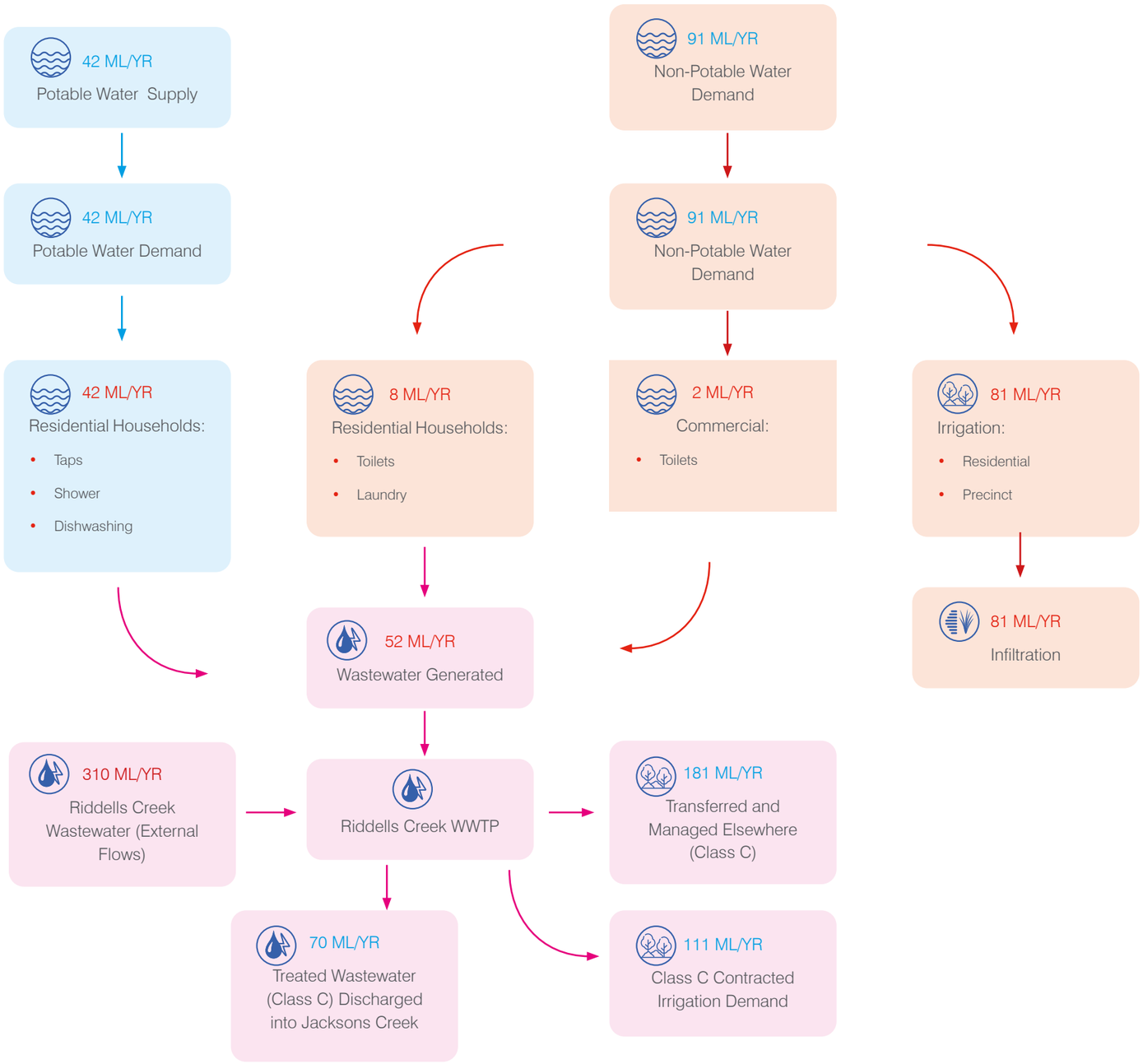
Water balance modelling has been completed for two scenarios to demonstrate the impact recycled water reuse has on Riddells Creek WWTP and Jacksons Creek.

CONVENTIONAL SCENARIO

The objective of this scenario is to illustrate the water balance and the impact on discharge into Jacksons Creek if no recycled water reuse was adopted.

The conventional scenario adopts the following:

- Water Efficient Appliances



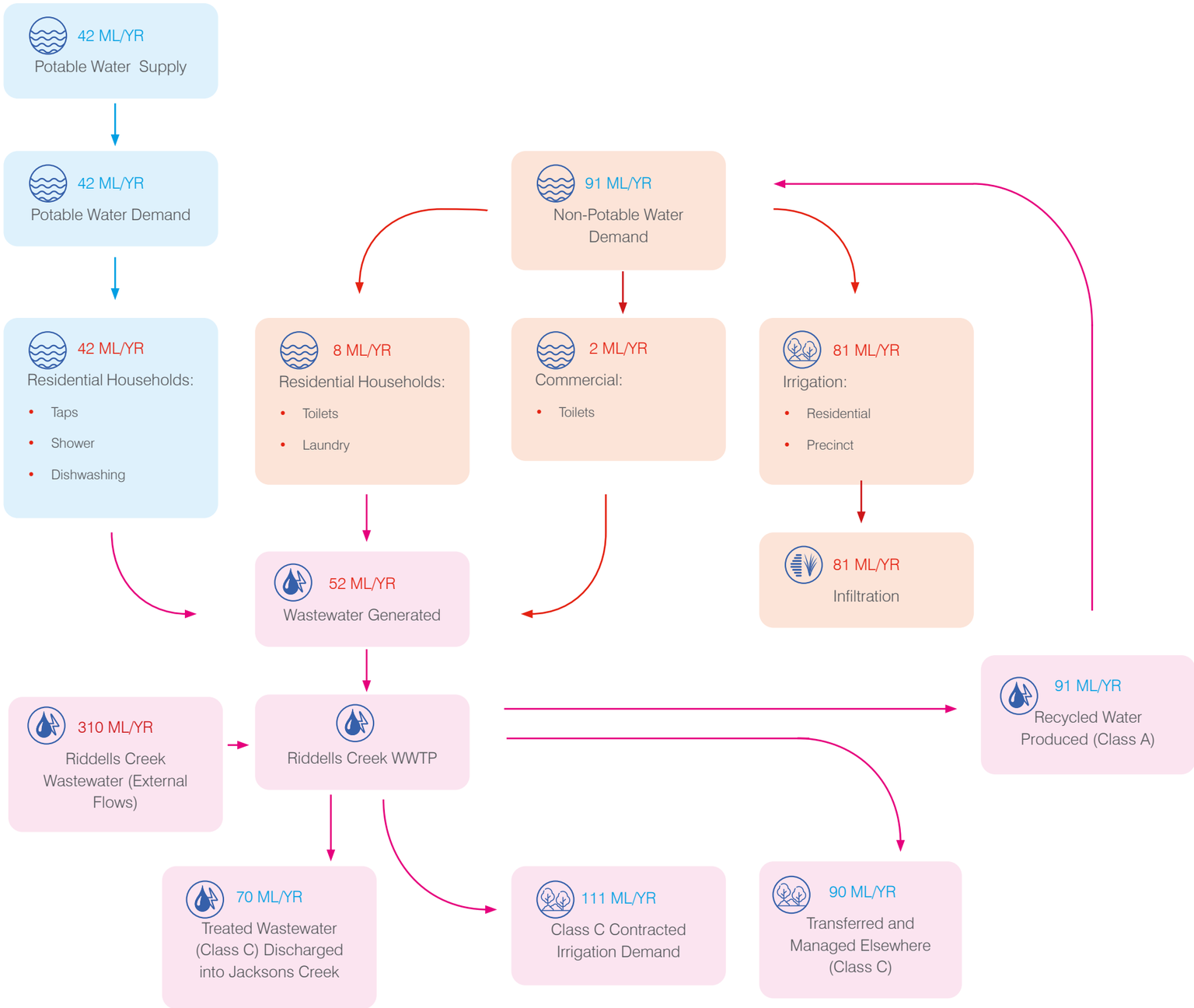
13 WATER BALANCE RECYCLED WATER REUSE

RECYCLED WATER REUSE SCENARIO

The objective of this scenario is to illustrate the water balance and the impact on discharge into Jacksons Creek if recycled water reuse was adopted throughout the Clarkefield township.

The conventional scenario adopts the following:

- Water Efficient Appliances
- Class A Recycled Water reuse within the Clarkefield township



14 RECOMMENDATIONS

This Infrastructure Servicing Report is to support the Clarkefield Township zoned land whereby approximately 350 lots is anticipated.

Overall the key Initiatives the Clarkefield Township identified are as follows:

- A site that can feasibly be serviced by potable water and sewer without impacting the broader region.
- Recycled Water Class A scheme that will initially be funded by the developer and co-contributed to by the Clarkefield body corporate;
- Water Efficient Appliances mandated for all new homes;
- Water Sensitive Urban Design;
- Electricity supply to the development can be adequately provided with electricity augmentation works; and
- Telecommunications (NBN) can be made available.

Whilst it is not shown that the Clarkefield development will be serviced within Western Water's current sewer masterplan, it is expected that up to 500 lots will be serviced by the Riddells Creek Wastewater Treatment Plant. It is understood that the Riddells Creek Treatment Plant is under review by Western Water and irrespective of Clarkefield the sewer servicing and treatment strategy will need upgrades to meet current growth expectations in the next 50 years. Our strategy has provisioned for Class A treatment either at the existing RC WWTP or within the development itself, however, this will be worked together with Western Water during the post permit design. This has been discussed with Western Water to date.

This development provides Western Water with a unique situation to utilize the development to assist in improving discharges to Jackson Creek through the wastewater re-use objective of this Servicing Report. Maximising the water re-use within the site via Class A recycled water has been identified as the only applicable option to achieve a water balance on site that reduces discharges to Jackson's Creek.

The development has included WSUD to ensure clause 56.07 has been met whilst flood mitigation has been allowed for on-site to ensure pre-development flow rates are maintained downstream. All drainage flows need to pass through existing railway culverts, which are not expected to be upgraded and received by Jacksons Creek. The development has allowed for the passing of existing upstream rural land flows through the site. No stormwater harvesting has been provisioned for given the ability to utilise Class A treated water for the development. The alternative water is planned on being used within the households and within open space to contribute to reduced potable water consumption and urban greening / cooling of the area.

APPENDIX A URBANWATER SOLUTIONS REPORT

SPIIRE

CLARKEFIELD
WATER AND SEWERAGE MODELLING TO SUPPORT IWM

urbanwater solutions

DECEMBER 2019

CONTENTS AMENDMENT RECORD

This report has been issued and amended as follows:

Issue	Revision	Description	Date	Prepared:	Checked:	Authorised:
1	A	Draft Water	11/11/2019	AP	KK	AP
	B	Draft Sewer	12/11/2019	AP	AP	AP
	C	Draft Both	14/11/2019	AP	AP	AP
	D	Updated Draft	18/11/2019	AP		AP
	E	Final	13/12/2019			AP

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1 Introduction

Urban Water Solutions (UWS) was commissioned by Spiire to assess the impact on the existing water and sewerage systems from a proposed 2,500 lot residential and 14.0 ha commercial development at Clarkefield.

Western Water (WW) are the local water authority that provides potable water supply and reticulated sewerage services.

This report details the impact of the proposed development on the existing WW water and sewerage systems and is subject to approval by WW.

1.1 Location

The development site is located approximately 40 km north west of Melbourne.

This report addresses the impact of the currently proposed development which covers an area of approximately 30.5 ha. A locality plan is presented in Figure 1-1 and a site plan is provided in Figure 1-2 showing the area considered in this assessment.

Figure 1-1: Development Location

Figure 1-2: Site Plan (Spiire document)

2 Sewerage System

2.1 Introduction

Western Water had identified that the Clarkefield development would be serviced by the Gisborne-Macedon-Riddells Creek (GMRC) sewer model, specifically the Riddells Creek wastewater treatment plant (WWTP).

The modelling considers a free outfall at the Riddells Creek WWTP and does not consider the impacts on the treatment processes at the WWTP.

2.1.1 Base Case network

The current master planning for GMRC has an allowance for 537 Future lots at Clarkefield in the 2067 design horizon.

Table 1: Master Plan Allowance for Clarkefield development (Lots)

2017	2023	2028	2033	2038	2067
0	0	67	142	217	537

In the master planning model, the pump station at Clarkefield (15 L/s) and rising main (150 mm diameter) to Riddells Creek WWTP are constructed prior to 2028 but are not required in the 2023 model.

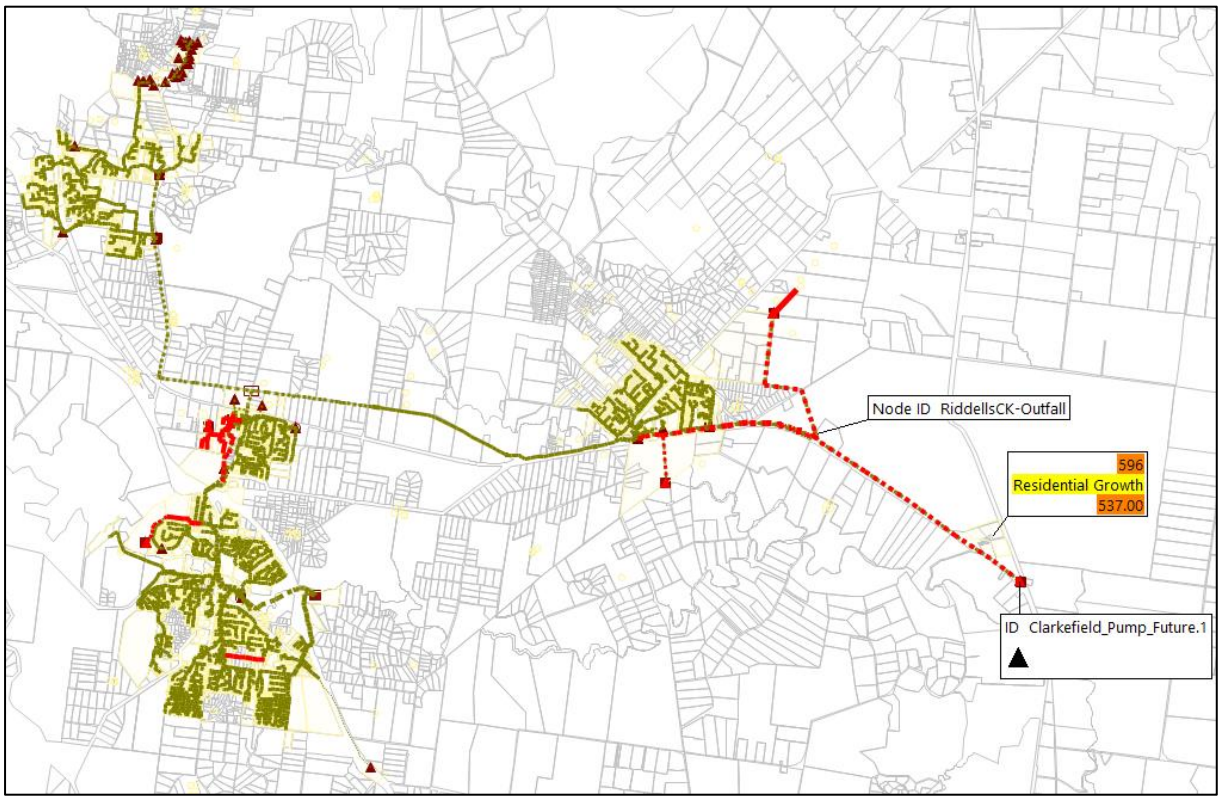
The master planning flows to the Riddells Creek WWTP are shown below

Table 2: Summary of Flows at Riddells Creek WWTP

Source of Flow	Maximum Flow Volume (L/s) 12 hr storm	24 hour Volume (kL) 2 hr	12 hr
2023			
RC WWTP Inlet	118	1,657	3,671
From Clarkefield	0	0	0
2067 (Master Plan)			
RC WWTP Inlet	190	4,515	7,904
From Clarkefield	16	421	560

The 2067 design horizon, with preferred planned augmentations (shown in red in Figure 2-1) was used as the base case for analysing the impact of the 2,500 lot Clarkefield development.

Figure 2-1: Gisborne-Macedon-Riddells Creek 2067 Sewer Network Base Case



2.2 Western Water Design Standards

The design standards applied in the assessment are as follows:

Sewer Design Standards		
Sewer Loading		
Average residential sewer loading	450	L/property/day
Average non-residential sewer loading	0.16	L/s/ha
Pumping Station		
Emergency storage detention time	8 hr ADWF as per WSA 02 code	

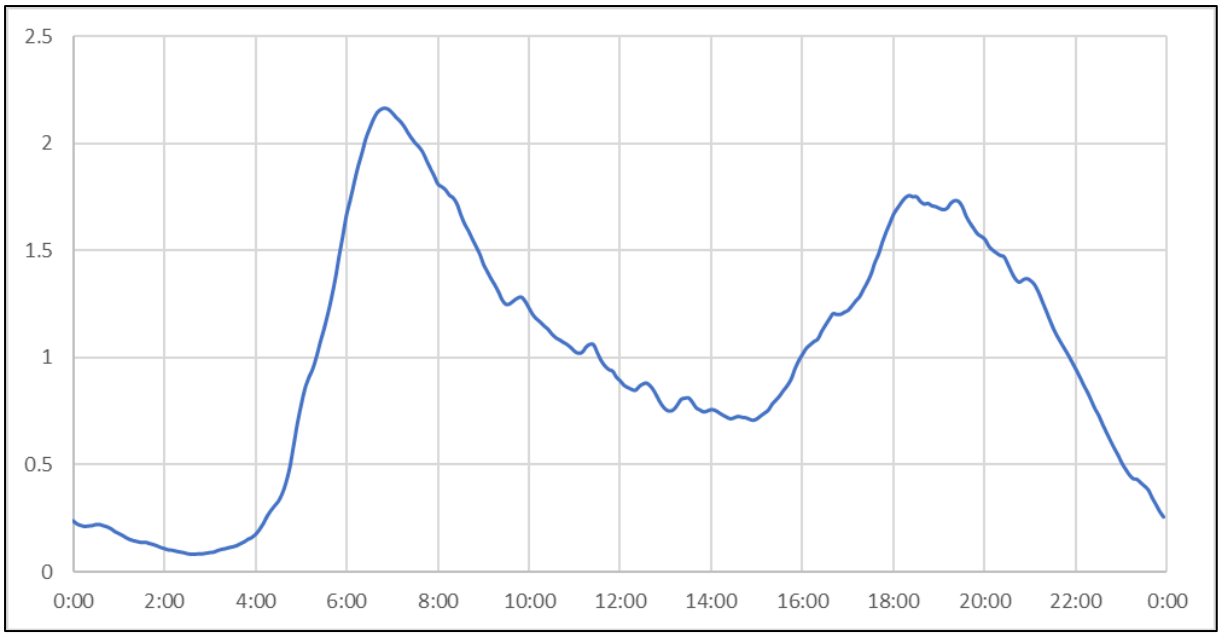
Other Requirements

1. There should be no dry weather overflow from the system
2. There should be no dry or wet weather overflow from a pumping station
3. Refer S64 Determination of ET Guidelines for loading estimate for commercial and industrial developments
4. Wet weather allowance - Inflow/infiltration (I/I): Provide 2% of the total area as a notional wet weather contribution to the sewerage system.
5. The level of service standard is that sewerage infrastructure must have the hydraulic capacity to contain all flows associated with a 1 in 5-year rainfall event

The Residential Profile adopted for Clarkefield is shown in Figure 2-2.

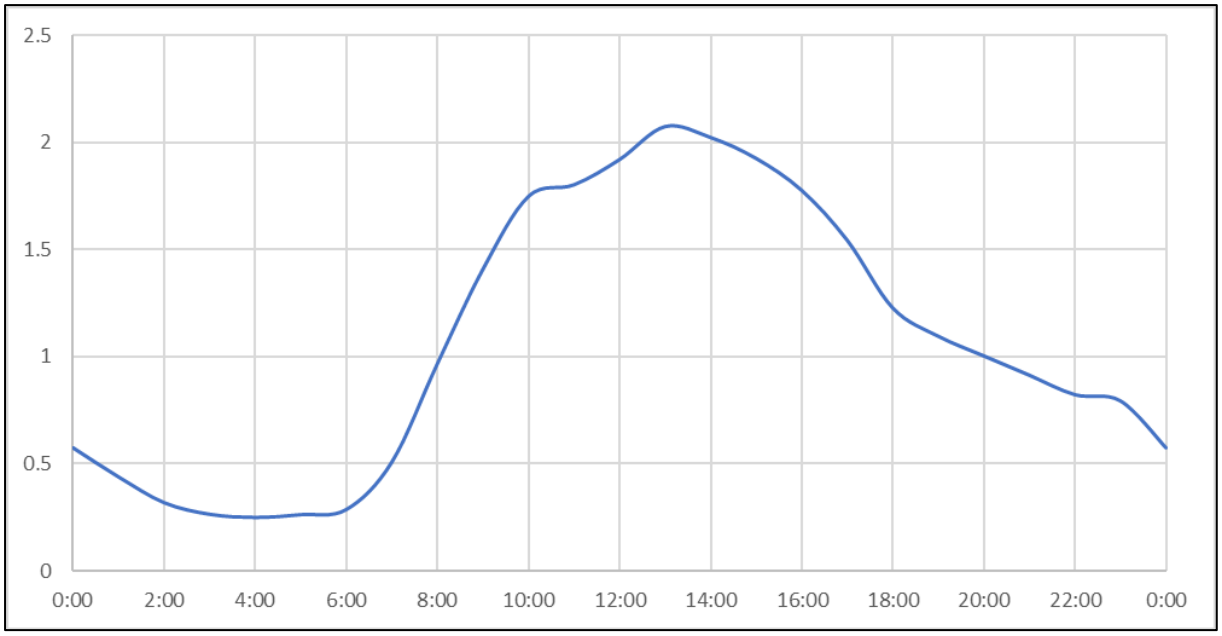
The AR&R 1987 Design Storms with wet weather peak flow timed to match dry weather peak flows were used to assess system containment.

Figure 2-2: Residential sewage profile adopted for Clarkefield



For the commercial sections of the development a generic commercial development profile was adopted as shown in Figure 2-3. An average flow of 2.1 L/s is attributed to the total commercial area.

Figure 2-3: Non-residential sewage profile adopted for Clarkefield



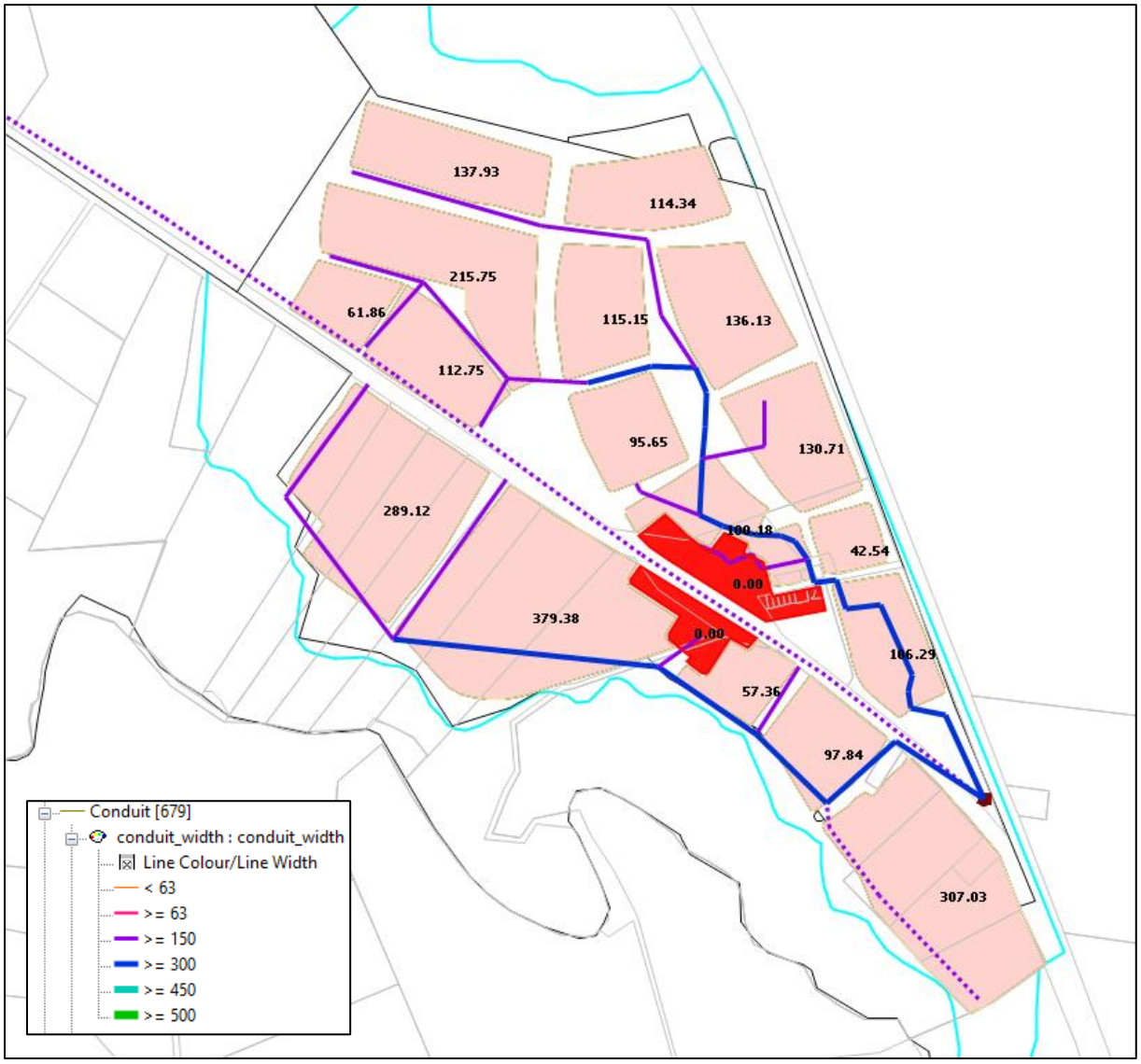
Sewer Design Load - Clarkefield	
Dry Weather Flow – Residential	
Number of Properties	2500
Estimated Sewage Loading (kL/d) (2500 * 0.45)	1,125
Residential Sewage Loading (L/s)	13.0
Dry Weather Flow - Non-residential	
Commercial Area (ha)	13.17
Average daily sewage (kL/d)	182.1
Dry Weather Flow Total Average daily sewage (kL/d)	1307.1
Wet Weather Flow An inflow/infiltration (I/I) allowance of 2% runoff from 35% of the non-residential area was used to provide a notional wet weather contribution to the sewerage system.	

2.3 Sewerage modelling (Conceptual)

The internal pipework for the Clarkefield development was not modelled in detail. Trunk assets were located and sized according to WSAA guidelines. Figure 2-4 shows the number of properties assigned and the asset sizes. One a lot layout is available more detailed alignment can be developed.

There is a pump station located in the south east corner (to the north of Settlement Road) of the development. This will not be able to command the land parcel south of Settlement Road and will require the construction of a second pump station. It may be possible to relocate this pump station and avoid the construction of two pump stations.

Figure 2-4: Indicative Clarkefield sewer servicing arrangement



Using the loadings discussed previously the pump and storage size at Clarkefield can be determined. The peak wet weather flow from the development into the discharge pump station is 158 L/s.

The following options were considered for servicing the proposed development at Clarkefield:

- Pump to Riddells Creek wastewater treatment plant
- Gravitate to Sunbury wastewater treatment plant

2.3.1 Pump to Riddells Creek Wastewater Treatment Plant

Due to the topology of the site it is necessary to install a pump station at Clarkefield to transfer flows to the Riddells Creek WWTP (located to the north west).

Due to limitations at the Riddells Creek WWTP it may be necessary to retard flows and store volume locally at Clarkefield.

Table 3: Comparison of Pump and Storage Sizing

Maximum Pump Size	Rising Main Indicative Internal Diameter (mm)	Volume of Wet Weather Storage required to contain 1 in 5-yr 12-hr storm (kL)
158 L/s @ 45m	500	80
100 L/s @ 53m	375	150
50 L/s @ 68m	250	1,000
40 L/s @ 72m	225	1,250
25 L/s	Too small to service development in wet weather	

Regardless of the option chosen above it will be necessary to provide an emergency dry weather storage volume of at least 436 kL at Clarkefield.

The average dry weather flow rate is 15.1 L/s.

A summary of the flows at Riddells Creek WWTP for the 2067 scenario with 2,500 lots developed at Clarkefield is shown in Table 4. To determine the impact of the proposed development on what has been currently planned please compare this table with Table 2 on page 8.

Table 4: Summary of Flows at Riddells Creek WWTP (2067)

Source of Flow	Maximum Flow Volume (L/s) 12 hr storm	24 hour Volume (kL) 2 hr	12 hr
RC WWTP Inlet	226.7	6,042	11,490
From Clarkefield	50 limited by pumps	1,960	3,676

2.3.2 Gravitate sewage to Sunbury Sewer Network

The Sunbury Sewerage Master Plan is scheduled to be updated in 2020, and the sewerage model is currently uncalibrated.

A preliminary option was investigated where flows gravitate from the Clarkefield development to the Sunbury reticulation network.

This option would require the construction of approximately 10.3km of sewer and would require a storage and maximum flow discharge of 35 L/s to avoid flooding the downstream network. This is shown in Figure 2-5.

It should be noted that the Sunbury sewer network is not calibrated and does not include any allowance for future growth.

Figure 2-5: 2067 Clarkefield to Sunbury gravity connection

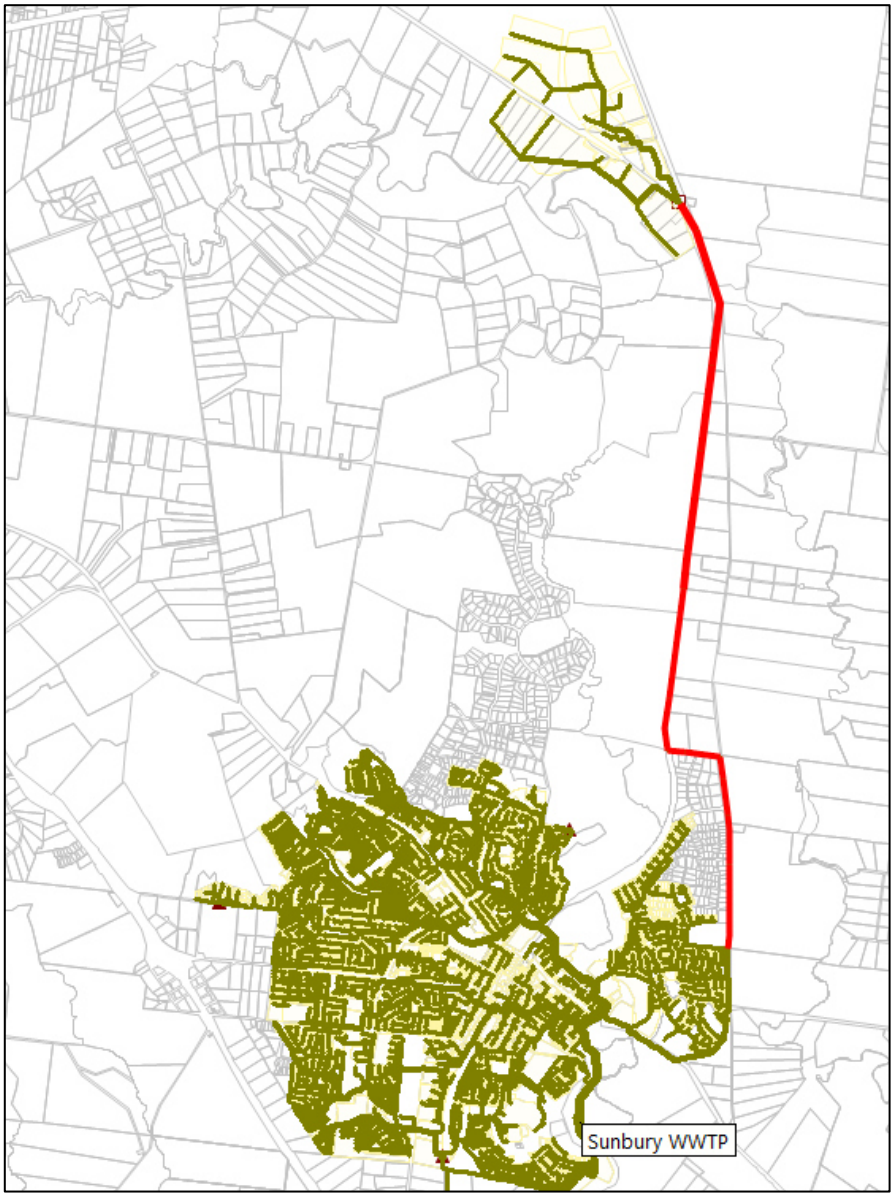
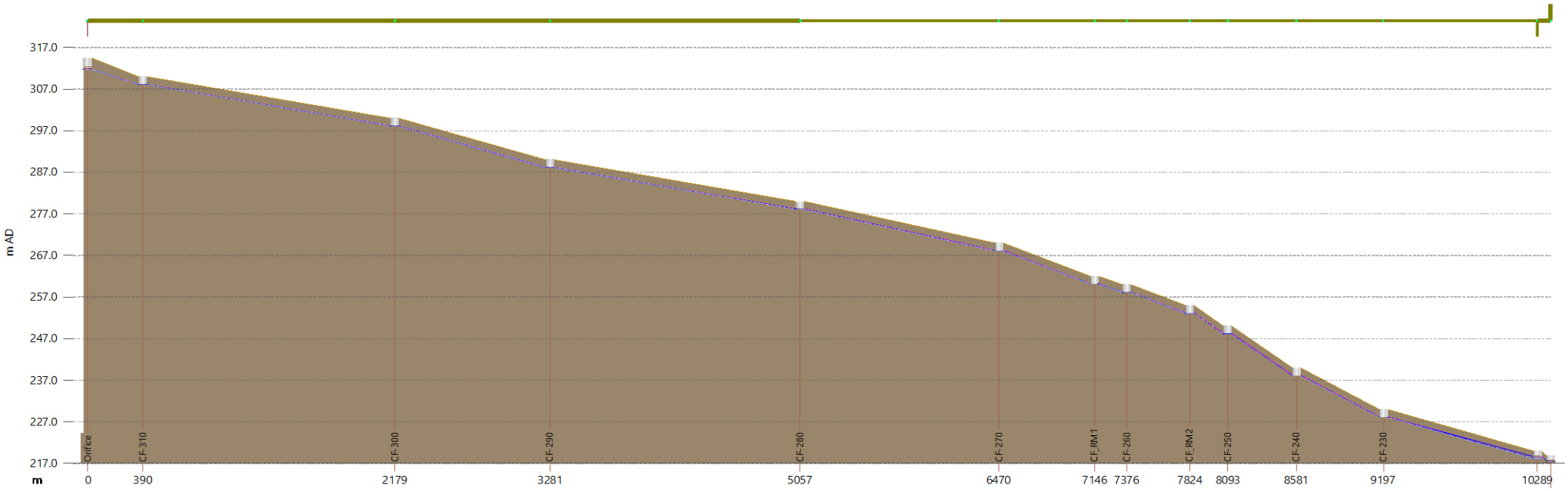


Figure 2-6: 2067 Clarkefield to Sunbury gravity connection – Long Section



Link	Orifice.1	CF-310.1	CF-300.1	CF-290.1	CF-280.1	CF-270.1	-	CF-260.1	-	CF-250.1	CF-240.1	CF-230.1	-
height (mm)	300	300	300	300	225	225	225	225	225	225	225	225	-
us inv (m AD)	311.601	308.000	298.000	288.000	278.000	268.000	-	258.000	-	248.000	238.000	228.000	-
ds inv (m AD)	308.000	298.000	288.000	278.000	268.000	260.000	-	253.000	-	238.000	228.000	218.000	-

Node	-	CF-310	CF-300	CF-290	CF-280	CF-270	CF_RM1	-	-	CF-250	CF-240	CF-230	14685
ground (m AD)	-	310.000	300.000	290.000	280.000	270.000	262.000	-	-	250.000	240.000	230.000	220.022
level (m AD)	-	308.148	298.129	288.147	278.175	268.145	260.161	-	-	248.121	238.130	228.158	218.662

2.4 Sewer Summary

The conceptual modelling has shown that there are broadly two options available for servicing the proposed development:

- Discharging to Riddells Creek WWTP, and
- Discharging to Sunbury WWTP.

A summary of assets required is provided below, however consideration of the timing of Western Water upgrades is required.

Table 5: Summary of Sewer servicing options

Connection Option	Assets linear	Assets non-linear	Additional works required in WW system ?	Risks
Riddells Creek WWTP	4.6km of 250mm (ID) rising main	50 L/s pump and 1,000 kL storage	Only at Riddells Creek WWTP	
Sunbury WWTP	10.3km of 300/225mm gravity main	Storage and flow control at Clarkefield	Potentially	Sunbury model is uncalibrated, and master planning has not been completed

3 Water Supply System

3.1 Introduction

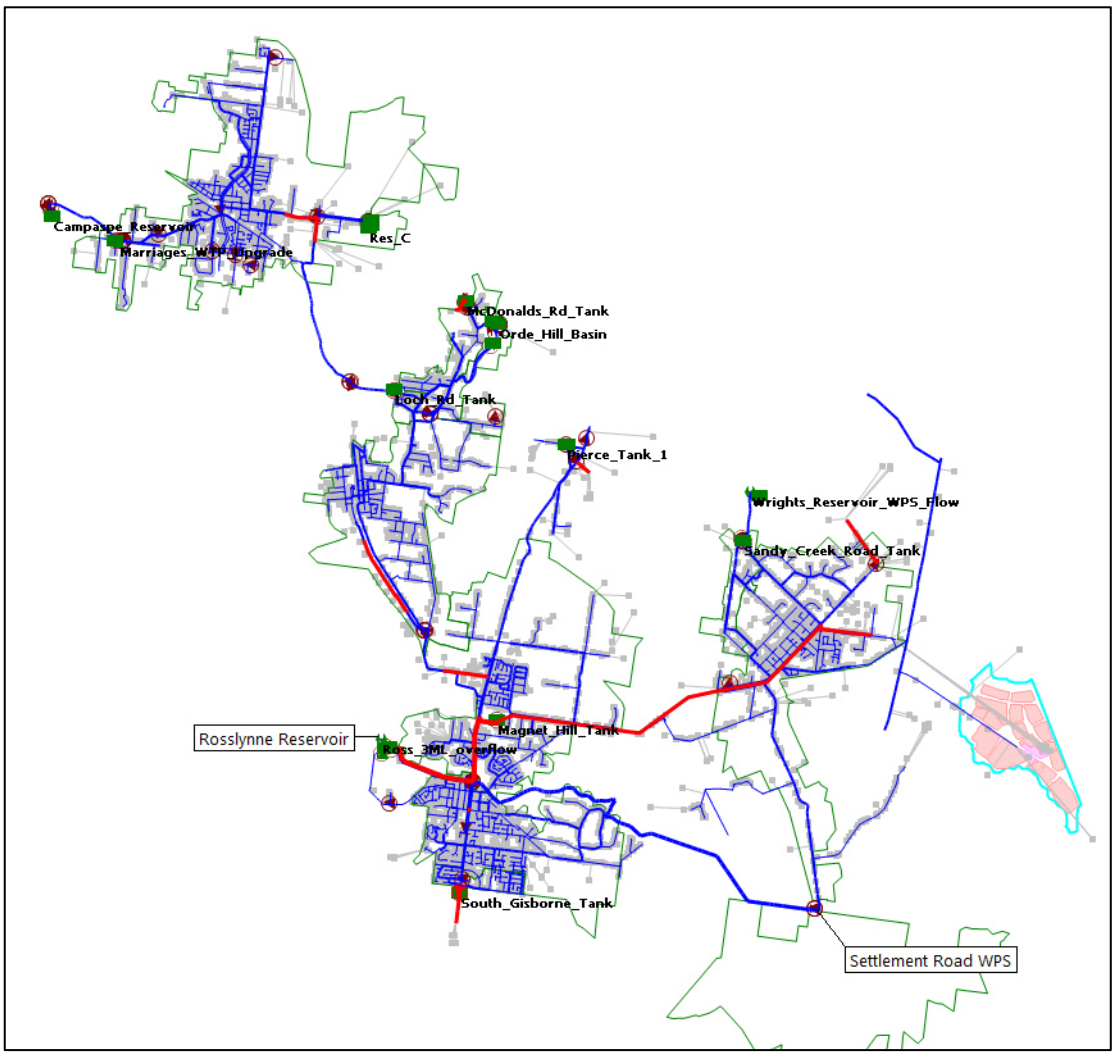
Western Water had identified that the Clarkefield development would be serviced by the Gisborne-Macedon-Riddells Creek-Woodend water network. The Master Planning for GMRC has an allowance for 537 Future lots at Clarkefield.

Due to the location and size of the proposed development and the proximity to future Master Plan assets identified in the Sunbury network the impact was also assessed on that network.

3.1.1 Gisborne-Macedon-Riddells Creek-Woodend

The Gisborne-Macedon-Riddells Creek-Woodend (GMRCW) Water Master Plan model was used for this analysis. The 2067 design horizon, with preferred augmentations (shown in Red in Figure 3-1) was used as the base case for this analysis.

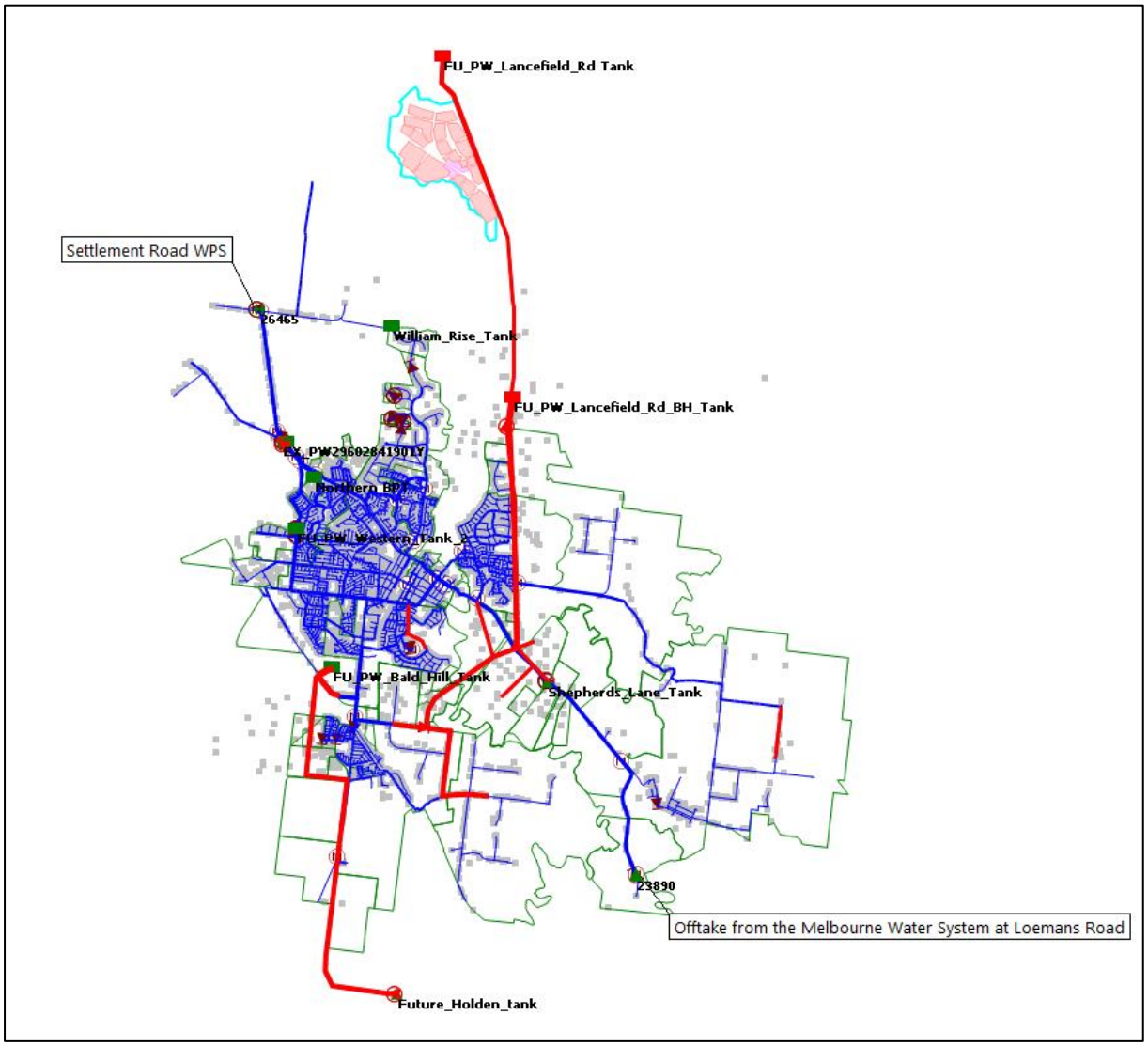
Figure 3-1: Gisborne-Macedon-Riddells Creek-Woodend 2067 Water Network Base Case



3.1.2 **Sunbury**

Sunbury Master Plan model of the 2067 design horizon, with preferred augmentation shown in red is shown in Figure 3-2. No allowance for Clarkefield is currently included in the Sunbury Master Plan.

Figure 3-2: Sunbury 2067 Water Network Base Case



It should be noted that the augmentations shown in the previous figures include assets that are yet to be constructed.

3.2 Western Water Design Standards

The following design loads were applied in this assessment:

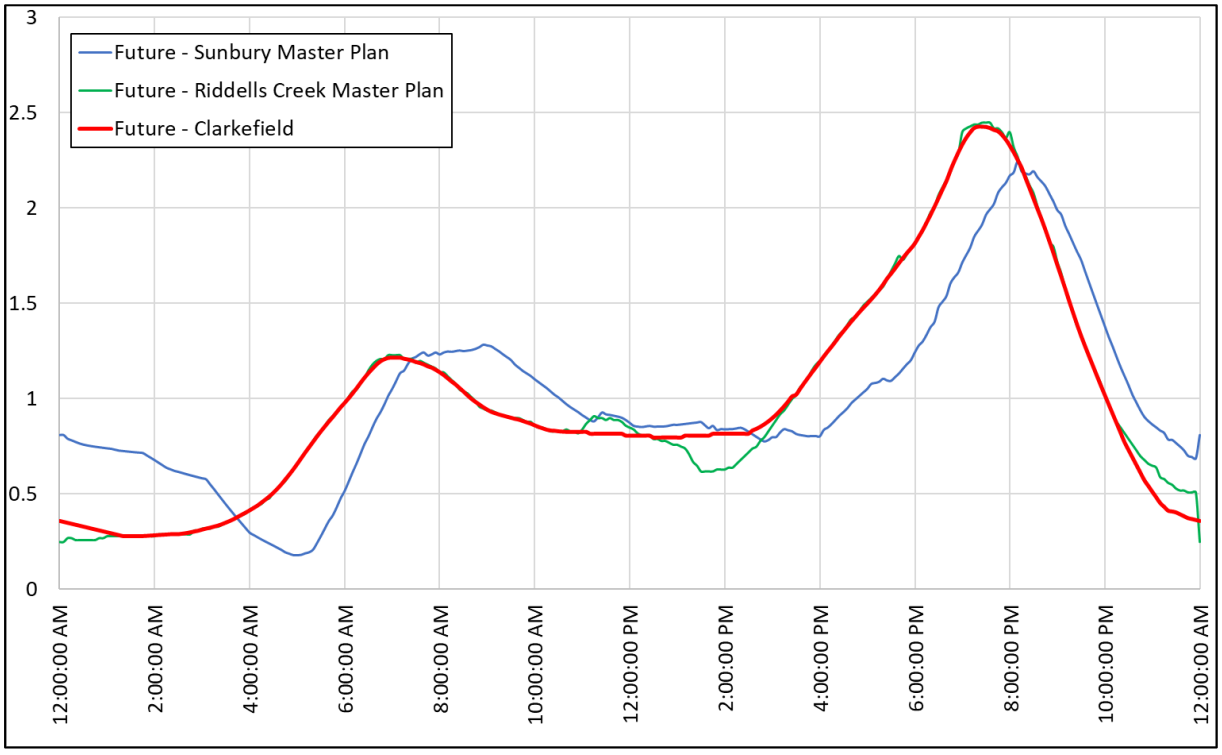
Water Design Loads		
Residential Demand (from WW modelling)		
Max Day Demand per Lot	1350	L/Lot/day
Max Hour / MDD Factor	2.44	
Non-residential Demand (From MWH Report[1])		
Average Day Demand	0.16	L/sec/ha
	13.8	kL/day/ha
Peak hour demand	0.6	L/s/ha
	2.16	kL/h/ha

The Residential Profile adopted for Clarkefield is shown in red in Figure 3-3.

It has been assumed that the elevation of the entire Clarkefield site is 330m AHD.

A Peak Day Demand scenario was used to assess the impact of the additional demand from the proposed development at Clarkefield on the water supply networks.

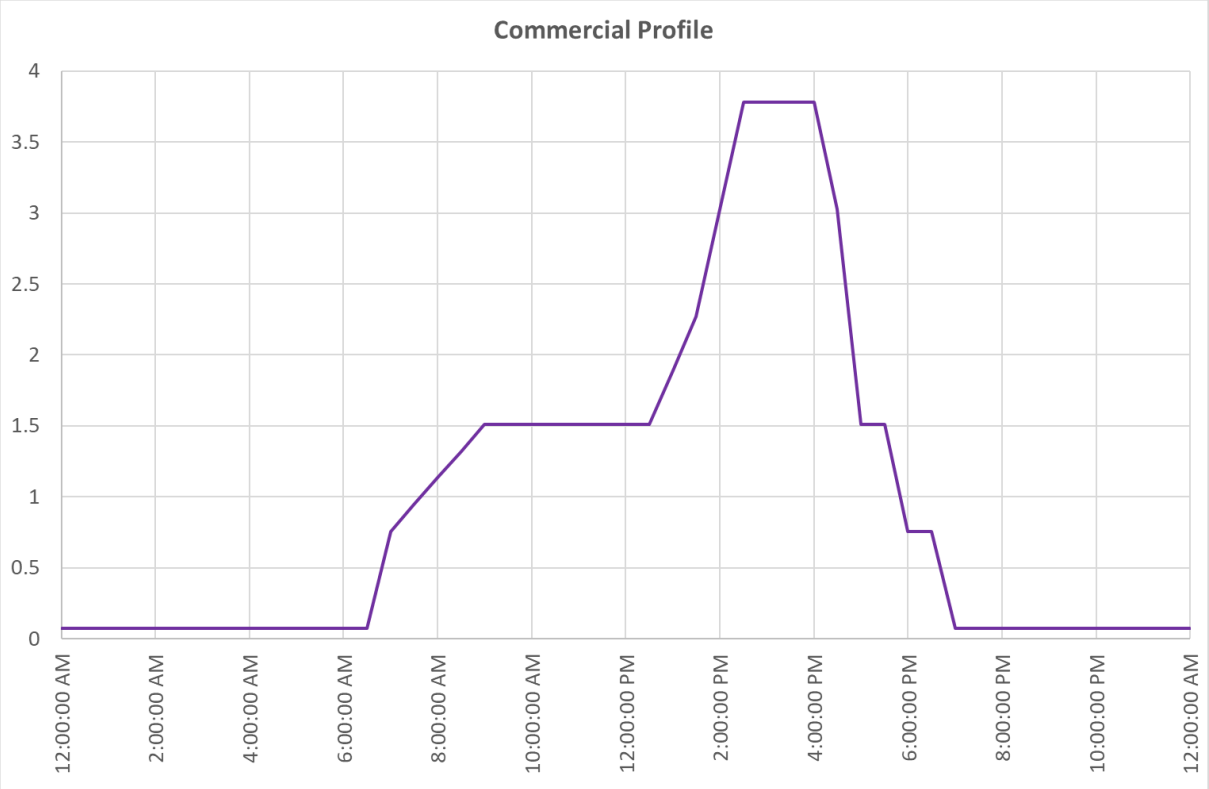
Figure 3-3: Residential water profile adopted for Clarkefield



[1] MWH, 26/05/2016, Clarkefield Township Feasibility Study

The non-residential profile adopted is shown in in Figure 3-4. As the exact nature of the commercial development is unknown a generic profile with afternoon peak was adopted.

Figure 3-4: Non-residential Profile adopted for Clarkefield

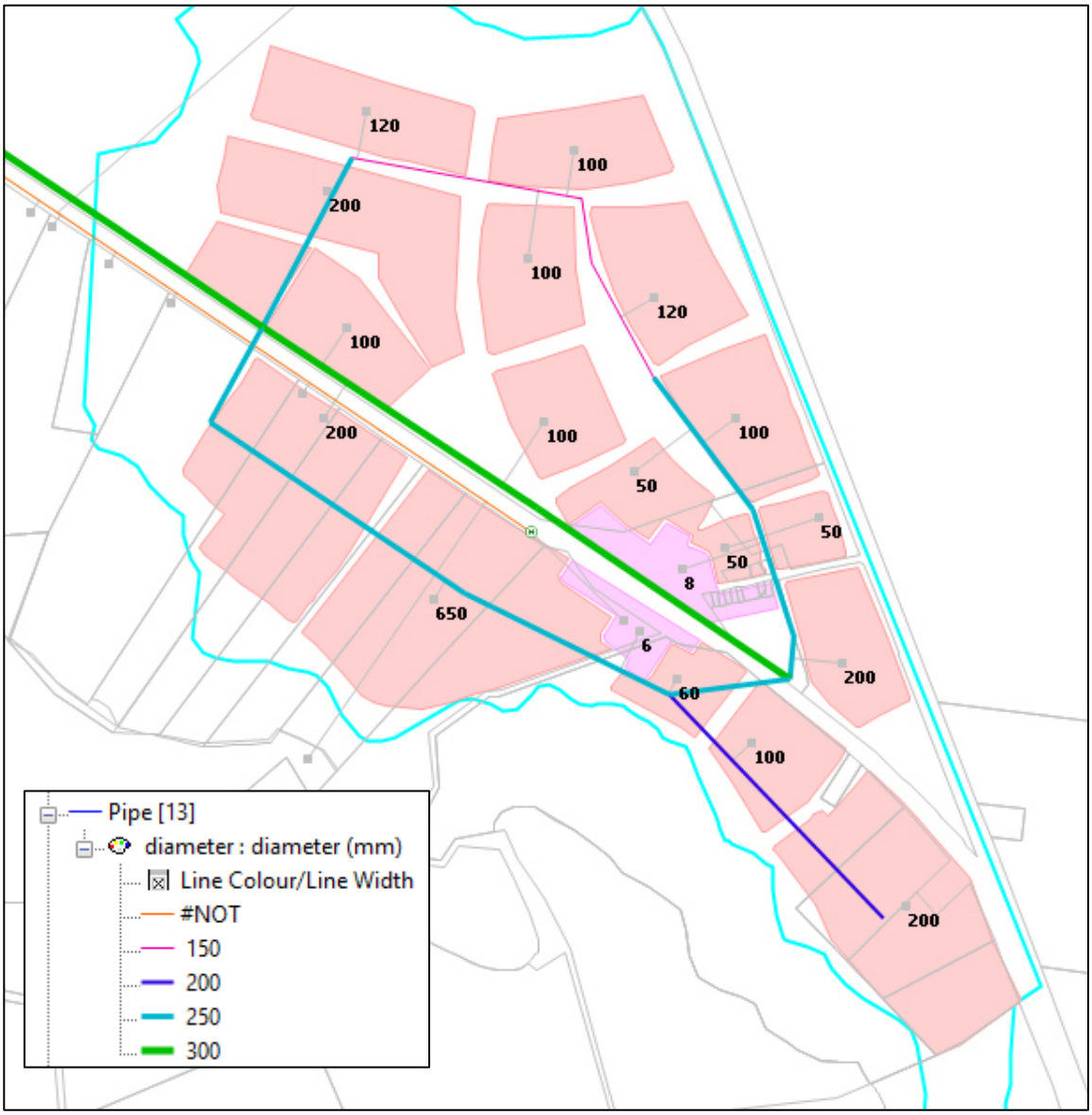


Water Demand Estimate Clarkefield	
Number of Dwellings	2500
Max Day Demand (MDD) Total (kL/d)	3,375
Max Hour Demand (MHD) (L/s)	95.3
Commercial Area	14.0 ha
Average Day Demand Total (kL/d)	193.5
Max Hour Demand (L/s)	8.4

3.3 Hydraulic Modelling (Conceptual 2067)

The internal pipework for the Clarkefield development was not modelled in detail. A ring-main was developed. Figure 3-5 shows the number of properties assigned and the asset sizes. Once a lot layout is available more detailed alignment can be developed.

Figure 3-5: Indicative Clarkefield servicing arrangement



The following three options were considered for supplying the proposed Clarkefield Development:

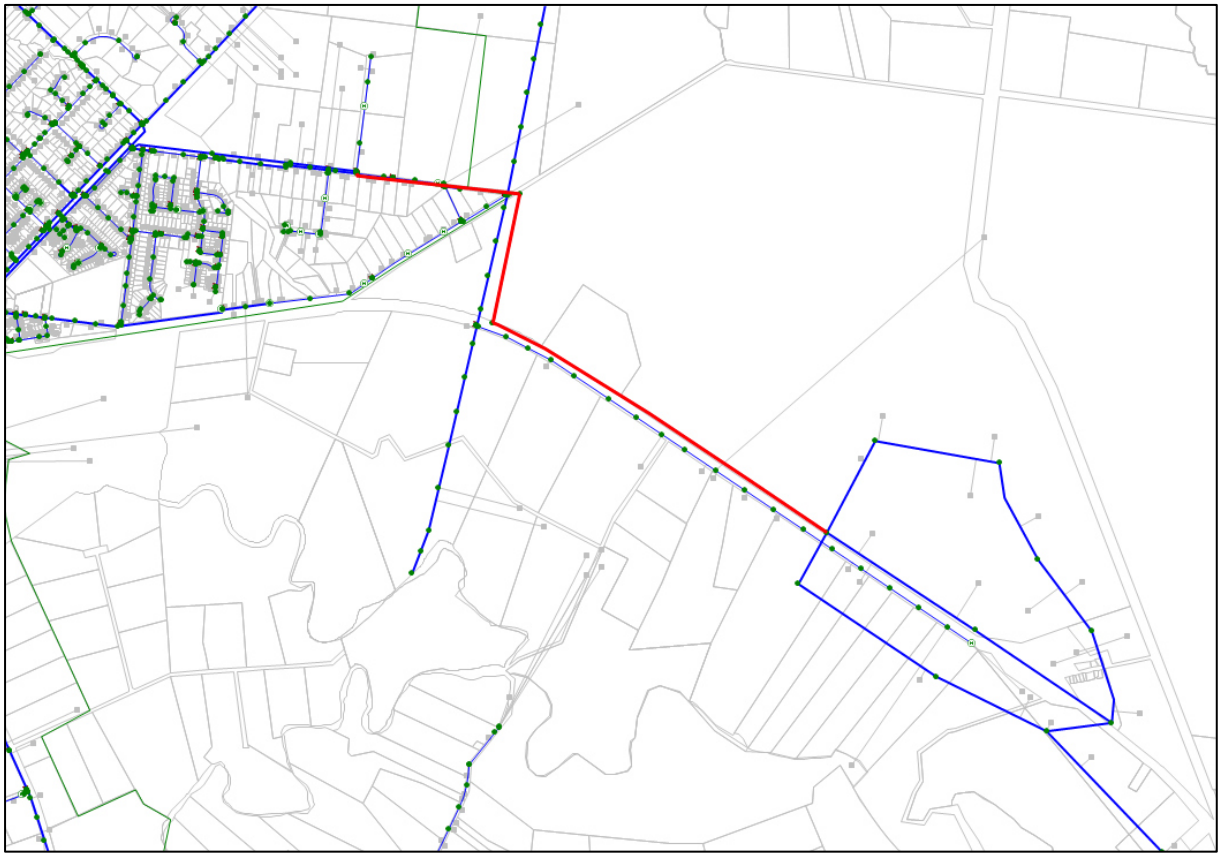
- Supply via Sandy Creek Zone
- Supply from Magnet Hill Tank
- Supply from future Sunbury assets

3.3.1 Supply from Sandy Creek Zone

The ultimate Clarkefield development cannot be supplied from the Sandy Creek Zone (GMRCW model) without causing pressure issues in the 2067 augmented network scenario. This option also results in the drawdown of the Sandy Creek Road Tank and would require further augmentations in WW's network.

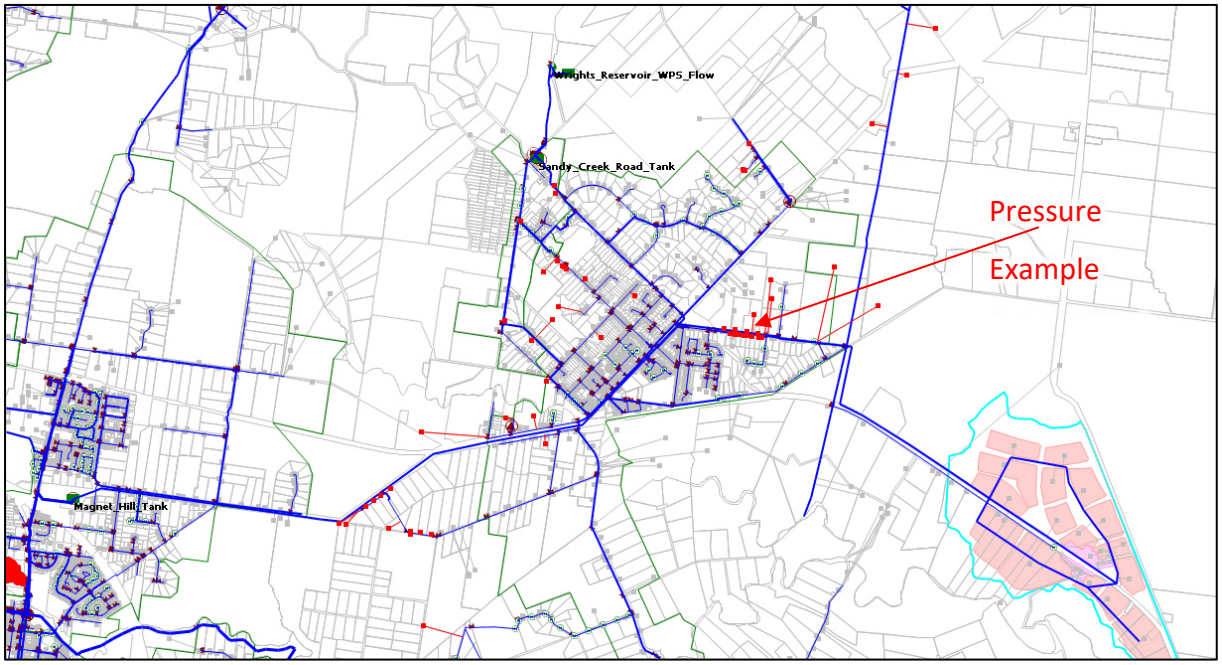
This would require construction of approximately 4km of 300mm diameter pipe as shown below in Figure 3-6.

Figure 3-6: Overview of the Sandy Creek Zone connection



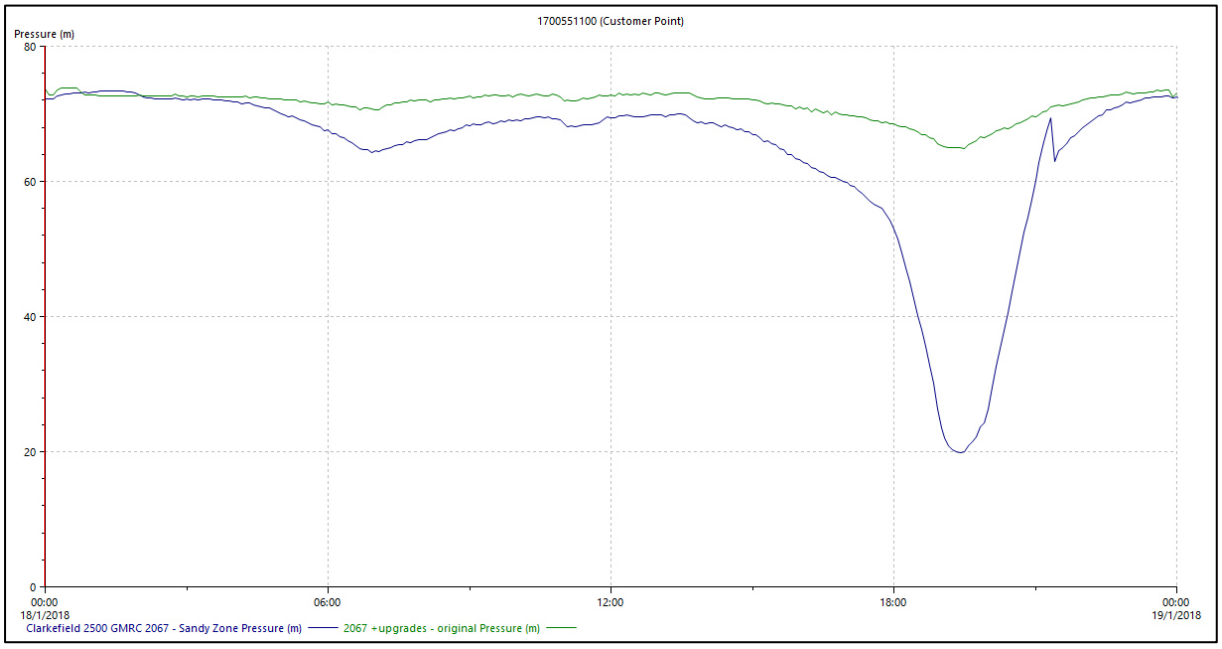
Thirty four customers are predicted to be impacted by the Clarkefield development. These are shown in Figure 3-7.

Figure 3-7: Properties experiencing a minimum pressure <20m with the Sandy Creek connection



An example of pressure differential on Amess Road is shown in Figure 3-8. The green line represents the future network, the blue line shows the impact of adding Clarkefield with no additional network upgrades. There is a significant pressure decrease (>40m) at peak demand at this location.

Figure 3-8: 2067 Pressure impact of Clarkefield development at Amess Road



It will be necessary to change the supply from Magnet Hill Tank to ensure that the tank level in Sandy Creek is sustained during peak hours. Local network upgrades (such as along Amess Road) will also be required.

A Pressure Reducing Valve (PRV) may be required for the Clarkefield development as the supply head from the Sandy Creek Zone is predicted to be between 375m and 445m on a 2067 peak day.

3.3.2 Supply from Magnet Hill Tank Zone

An alternate option is to connect Clarkefield to the Magnet Hill Zone using the future connection between Magnet Hill and Sandy Creek Rd tanks. This results in minimal impact on the Sandy Creek Zone.

A conceptual supply route is shown below. This option would require the construction of approximately 5.6km of 300mm diameter pipe. A one-way valve needs to be located to protect the Sandy Creek Zone from the demands at Clarkefield. The valve location is shown in yellow in Figure 3-9

Figure 3-9:Overview of the Magnet Hill Tank Zone connection

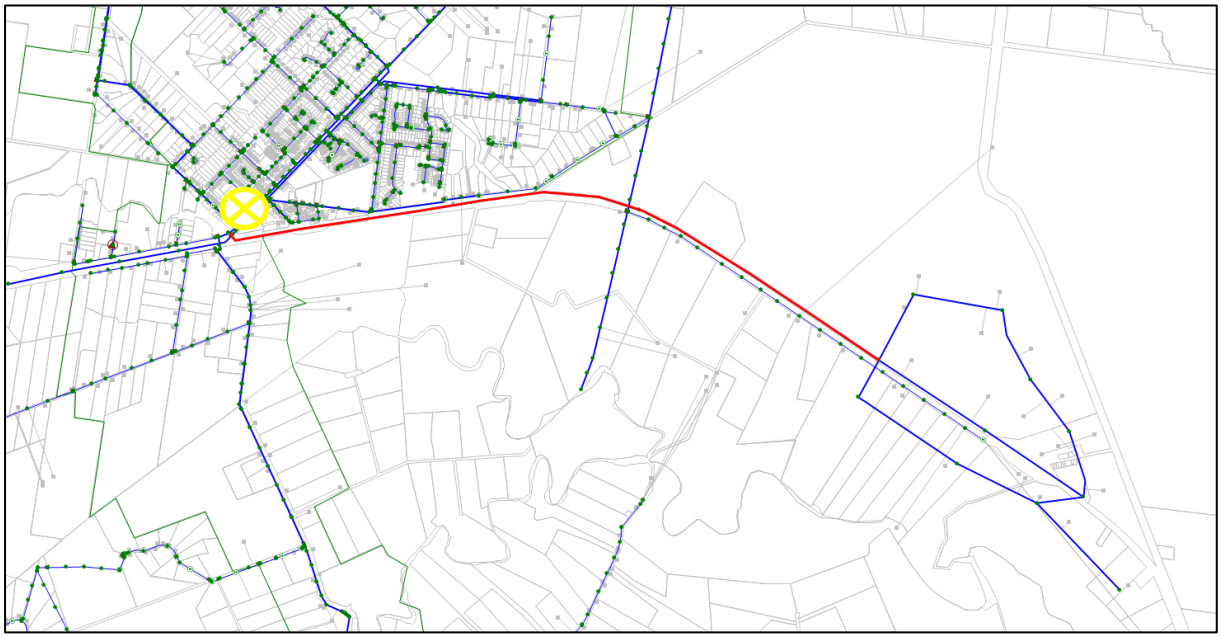
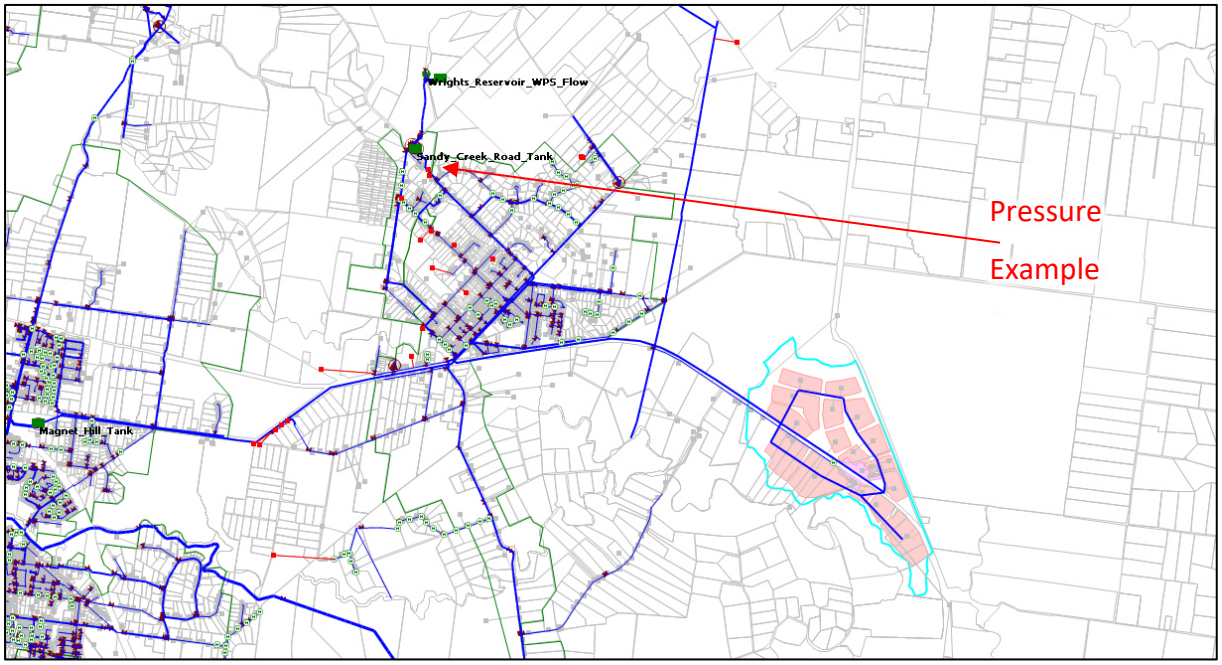
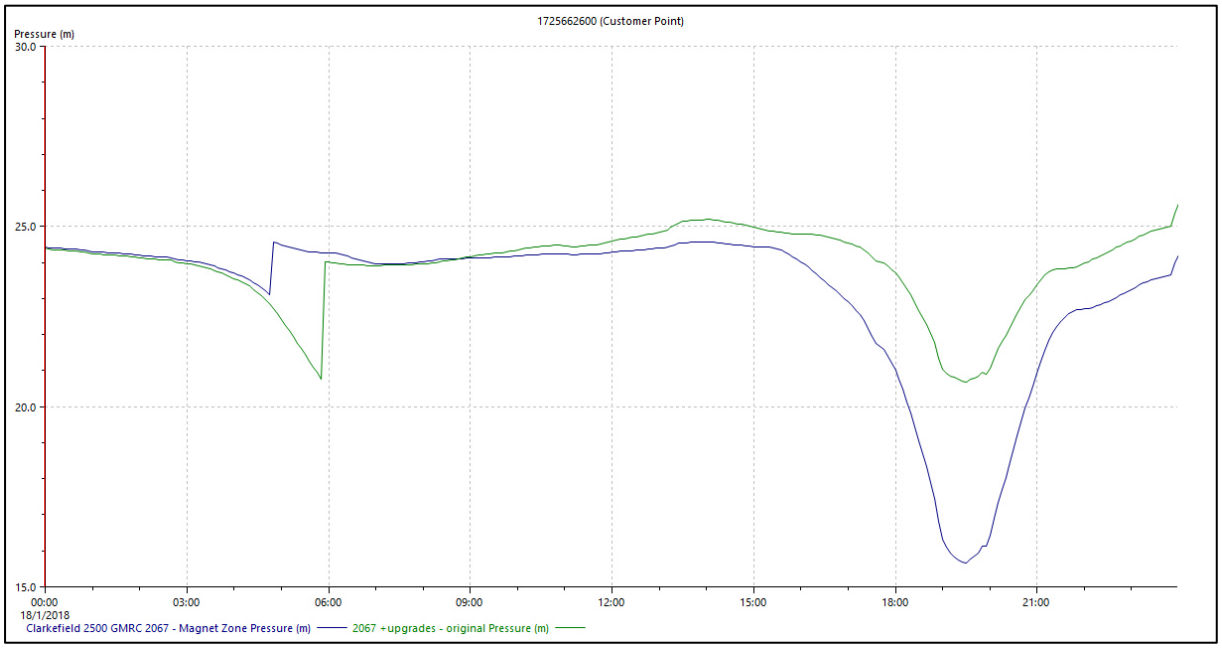


Figure 3-10: Properties experiencing a minimum pressure <20m with Magnet Hill connection



An example of pressure differential on Sandy Creek Road is shown in Figure 3-11Figure 3-8. The green line represents the future network, the blue line shows the impact of adding Clarkefield with no additional network upgrades. There is a pressure decrease (approximately 5m) at peak demand at this location. There is no impact at Amess Road due to the network connectivity.

Figure 3-11: 2067 Pressure impact of Clarkefield development at Sandy Creek Road



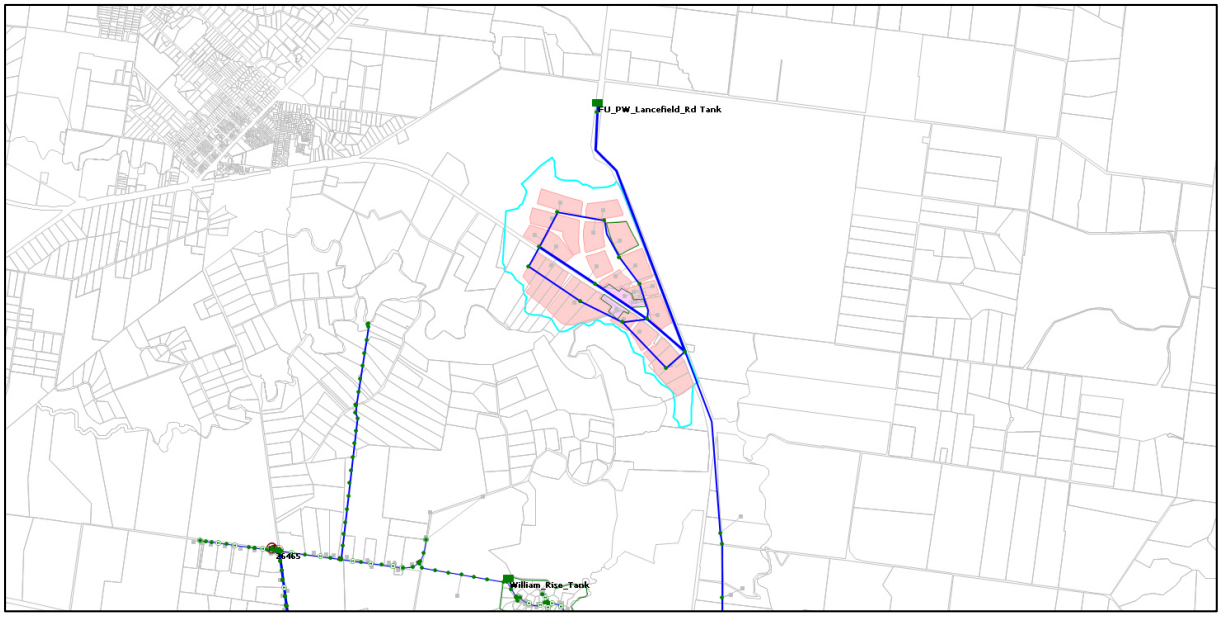
It would be necessary to install a PRV as the supply head from the Magnet Hill Zone is predicted to be between 420m and 520m on a 2067 peak day.

3.3.3 Supply from Sunbury Zone

The Clarkefield development was not considered within the scope of the Sunbury network Master Plan. The preferred option for Sunbury shows the future construction of a 4.5ML storage to the north of the Clarkefield development.

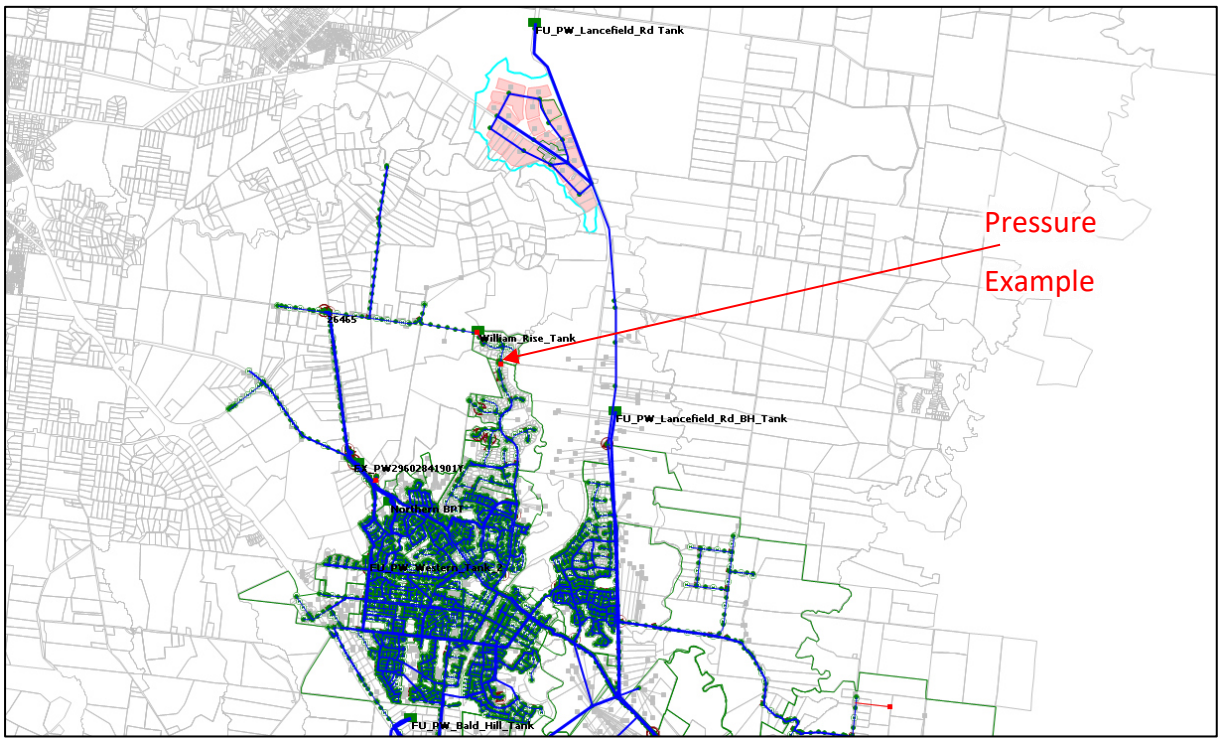
This would require minimal additional network construction as shown in Figure 3-12.

Figure 3-12: Overview of the Sandy Creek Zone connection



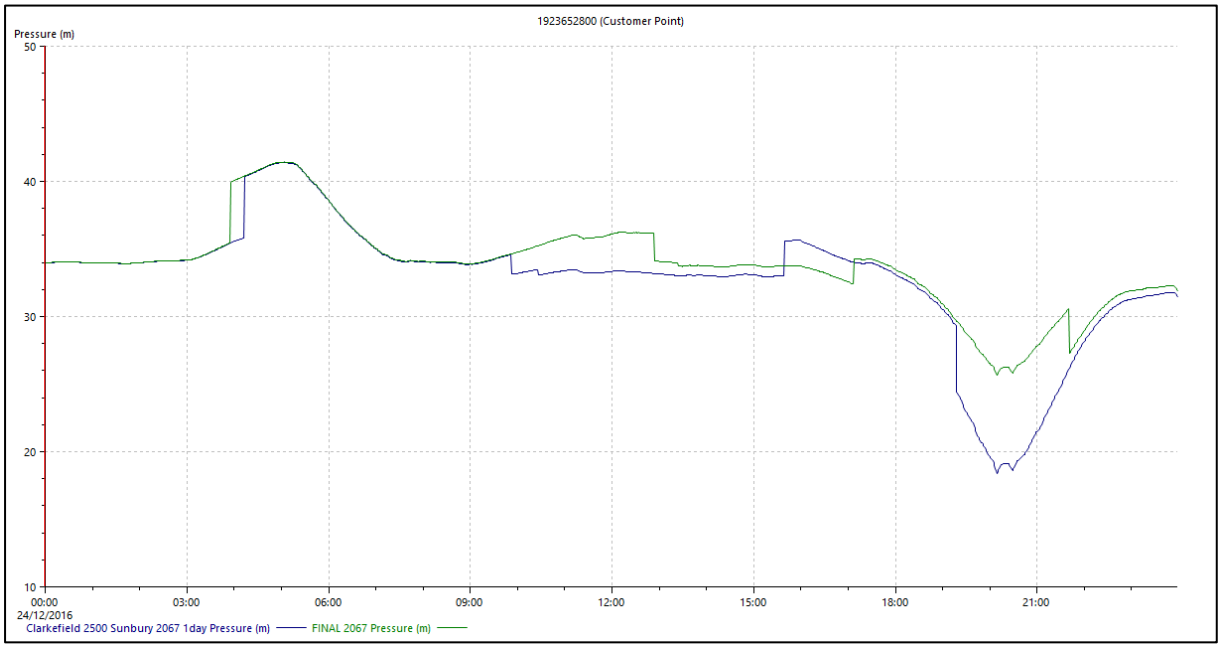
The demand from Clarkefield does not appear to have a detrimental impact on the Sunbury reticulation network. There are larger transfer issues to be considered, however these are currently being developed by WW.

Figure 3-13: Properties experiencing a minimum pressure <20m with Sunbury connection



An example of pressure differential on Racecourse Road is shown in Figure 3-8. The green line represents the future network, the blue line shows the impact of adding Clarkefield with no additional network upgrades. There is a pressure decrease (approximately 7.2m) at peak demand at this location.

Figure 3-14: 2067 Pressure impact of Clarkefield development at Racecourse Road



The solution to this in the Western Water network would be to change the planned operation of the future pump supplying the Lancefield Rd Tank to ensure that the tank level is not impacted during peak hour. Additional storage may be required at Lancefield Rd Tank and the quantity of this has not been assessed at this stage.

It would be necessary to install a pump to supply the Clarkefield Development as the supply head from the Sunbury Zone is predicted to be between 333m and 357m on a 2067 peak day.

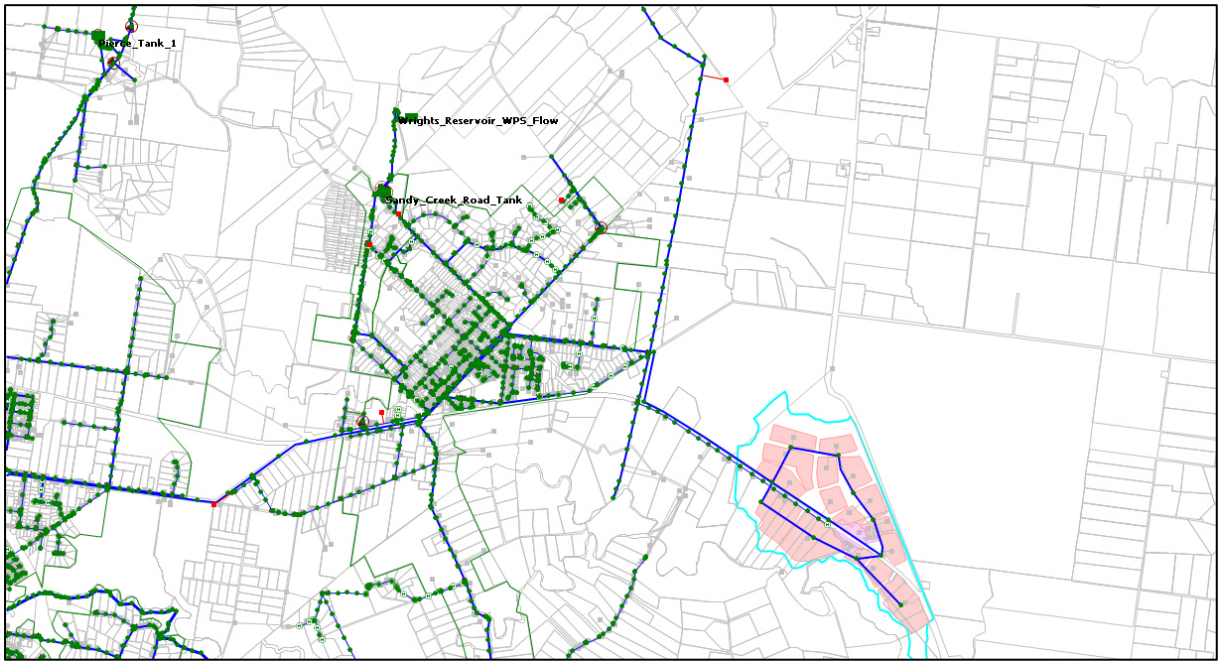
3.4 Hydraulic Modelling (Conceptual 2067, 50% Demand)

The same three options were considered for supplying the proposed Clarkefield Development. To investigate the impact of non-potable substitution the potable demand was scaled to 50% of the original value, or 675 L/lot/day.

3.4.1 Supply from Sandy Creek Zone

Five properties are predicted to experience less than 20m pressure within the Sandy Creek zone with a 50% reduction in potable demand. Potentially changing the operation of the pump station at Magnet Hill to avoid the system drawdown during peak hour could overcome these issues.

Figure 3-15: Properties experiencing a minimum pressure <20m with the Sandy Creek connection (50% potable demand)



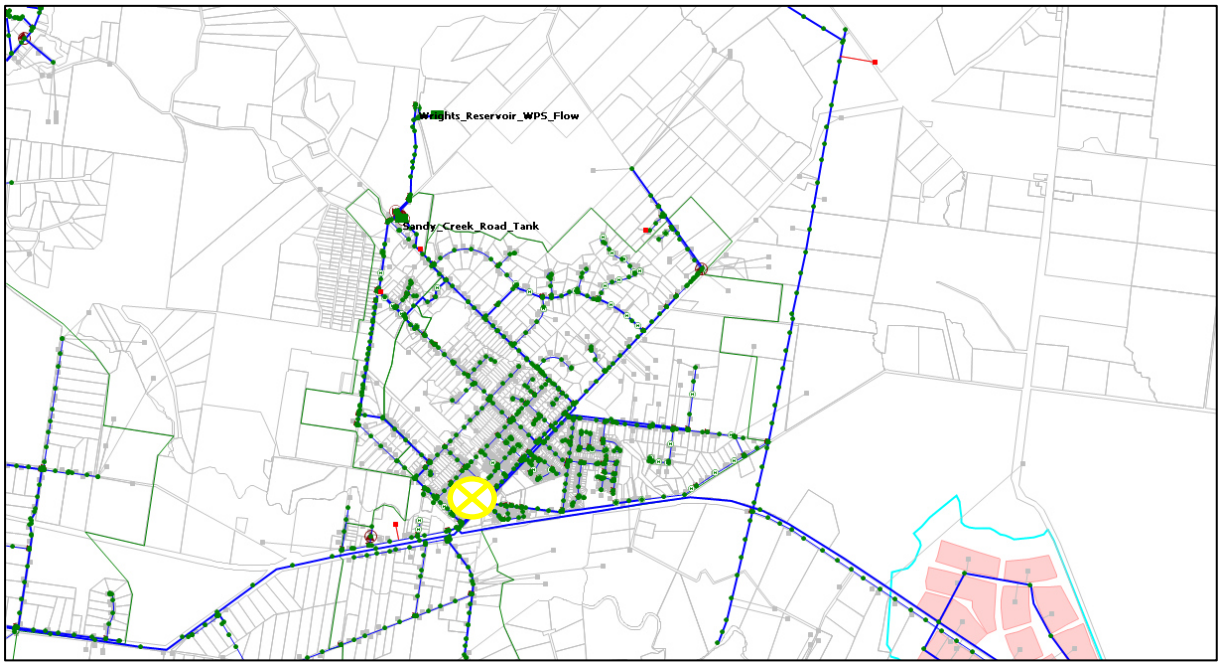
A Pressure Reducing Valve (PRV) will be required for the Clarkefield development as the supply head from the Sandy Creek Zone is predicted to be between 420m and 445m on a 2067 peak day.

3.4.2 Supply from Magnet Hill Tank Zone

An alternate option is to connect Clarkefield to the Magnet Hill Zone using the future connection between Magnet Hill and Sandy Creek Rd tanks. This results in minimal impact on the Sandy Creek Zone.

The same properties as identified in Figure 3-15 are impacted in this scenario.

Figure 3-16: Properties experiencing a minimum pressure <20m with Magnet Hill connection (50% potable demand)



It would be necessary to install a PRV as the supply head from the Magnet Hill Zone is predicted to be between 450m and 520m on a 2067 peak day. The one-way valve is also required to protect the Sandy Creek Zone.

3.4.3 Supply from Sunbury Zone

The reduction in potable demand from Clarkefield does not change the number of customers experiencing low pressures. The two customers experiencing low pressure in the 100% potable demand scenario are still negatively impacted in this scenario.

3.5 Hydraulic Modelling (Conceptual Staging)

3.5.1 2023 supply from Sandy Creek Zone

The 2023 master plan model includes future augmentations to the network supplying the Sandy Creek Road Tank. These augmentations have not currently been undertaken.

When using the 2023 master plan model three properties shown in red in Figure 3-17 are predicted to receive pressures below 20m in 2023. None of these are of concern as explained in Table 6.

Figure 3-17: Properties failing minimum pressure requirements - Sandy Creek connection

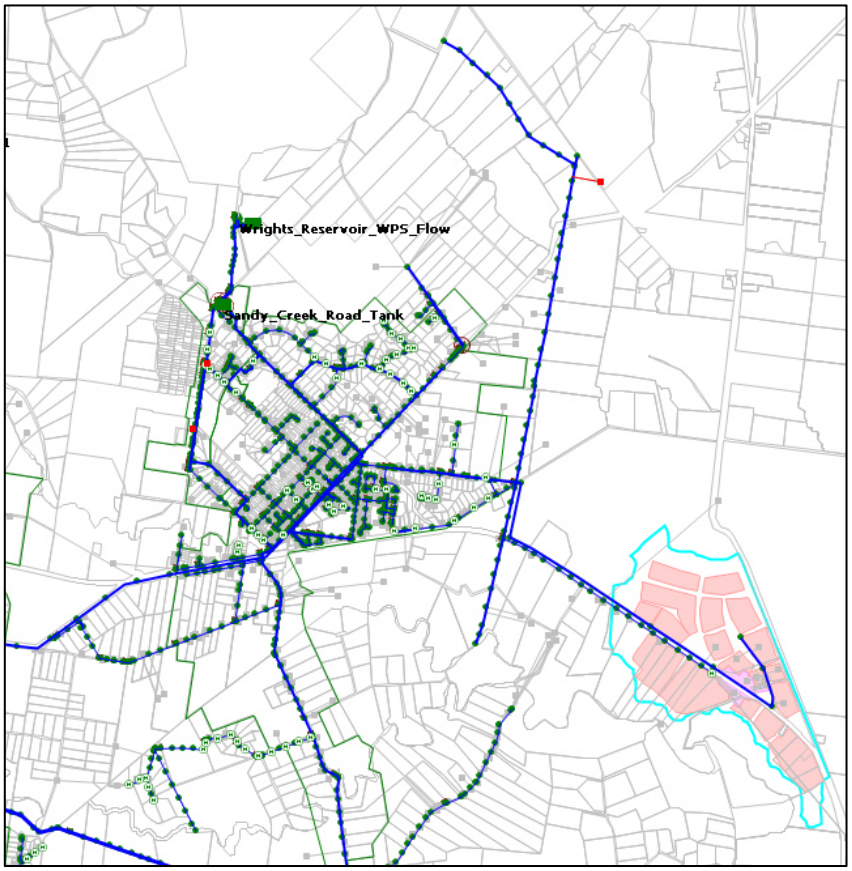


Table 6: 2023 Customers failing minimum pressure requirements – Sandy Creek connection

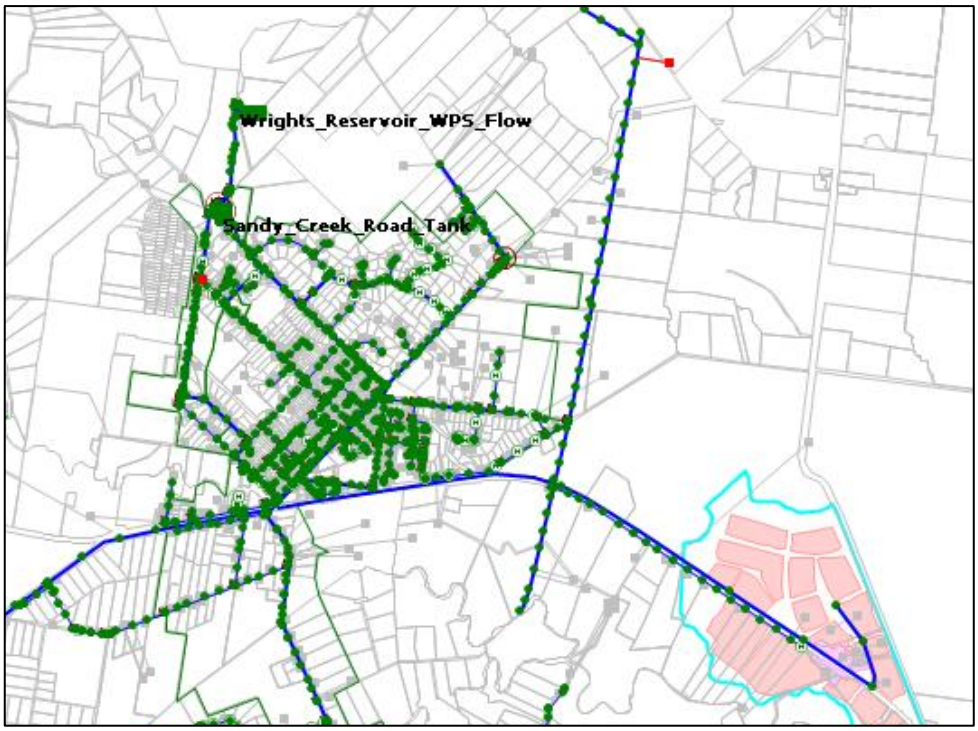
Reference	Predicted Minimum Pressure	Demand Category	Comments
1710503700	13.36	Residential_Riddells Ck LL	Could be connected to High Level Zone
1719880050	1.93	Farm	Water usage in 2016/17 is zero so may not be connected.
1725170450	19.30	Residential_Riddells Ck LL	Could be connected to High Level Zone

3.5.2 2023 supply from Magnet Hill Tank Zone

The 2023 master plan model includes future augmentations to the network supplying the Sandy Creek Road Tank, specifically the new transfer main from Magnet Hill to Sandy Creek Tank which this option is proposing to utilise. These augmentations have not currently been undertaken.

When using the 2023 master plan model two properties shown in red in Figure 3-18 are predicted to receive pressures below 20m in 2023. These properties are also highlighted in the previous option (Table 6).

Figure 3-18: Properties failing minimum pressure requirements – Magnet Hill Transfer Main connection



Two properties are modelled with pressures below 20m in 2023. None of these are of concern as explained in Table 7.

Table 7: 2023 Customers failing minimum pressure requirements – Magnet Hill connection

Reference	Predicted Minimum Pressure	Demand Category	Comments
1710503700	18.40	Residential_Riddells Ck LL	As previous
1719880050	8.87	Farm	Significant improvement when compared to Sandy Creek connection

3.5.3 2028 supply from Sandy Creek Zone

The 2028 master plan model includes future augmentations to the network supplying the Sandy Creek Road Tank. These augmentations have not currently been undertaken.

Ninety-eight properties are modelled with minimum pressures below 20m in 2028. These are shown in Figure 3-19 and a summary is provided in Table 8.

As a minimum the augmentation of the water main in Amess Road would be required to address these low pressures.

Figure 3-19: Properties failing minimum pressure requirements - Sandy Creek connection

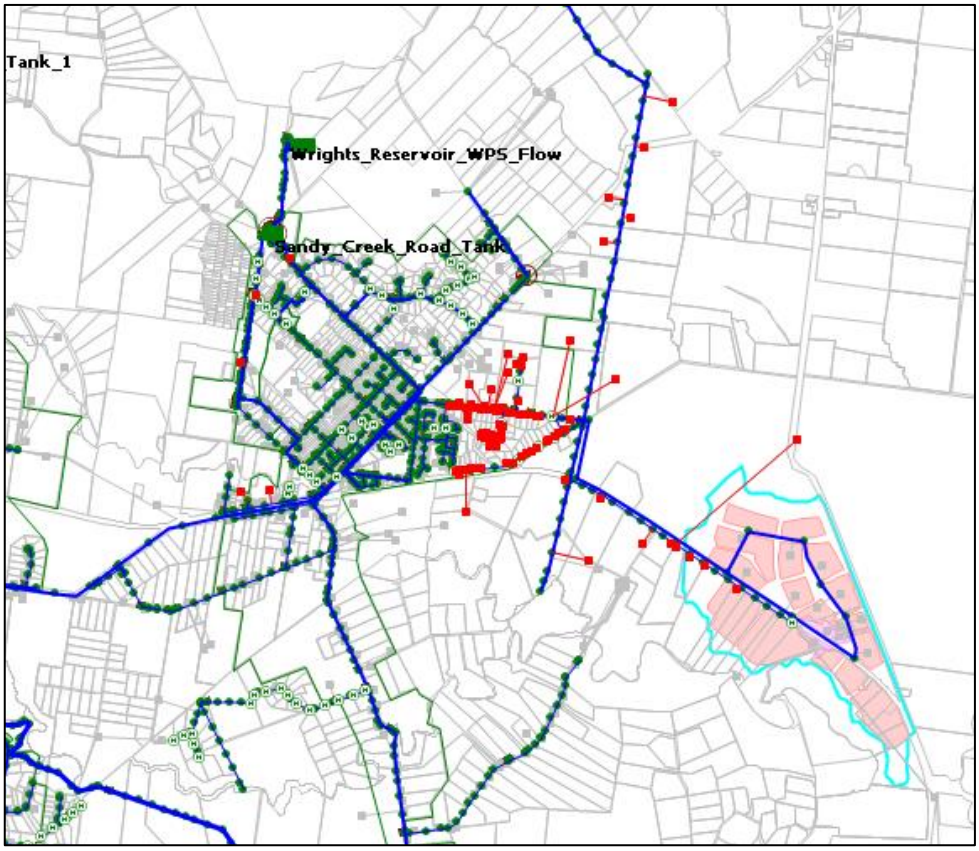


Table 8: 2028 Customers failing minimum pressure requirements – Sandy Creek connection

Demand Category	Number of customers
Residential_Riddells Ck LL	79
Non Residential	4
Future Residential	15

3.5.4 2028 supply from Magnet Hill Tank Zone

The 2028 master plan model includes future augmentations to the network supplying the Sandy Creek Road Tank, specifically the new transfer main from Magnet Hill to Sandy Creek Tank which this option is proposing to utilise. These augmentations have not currently been undertaken.

When using the 2028 master plan model two properties shown in red in Figure 3-20 are predicted to receive pressures below 20m in 2028. A summary is shown in Table 9.

Figure 3-20: Properties failing minimum pressure requirements – Magnet Hill Transfer Main connection

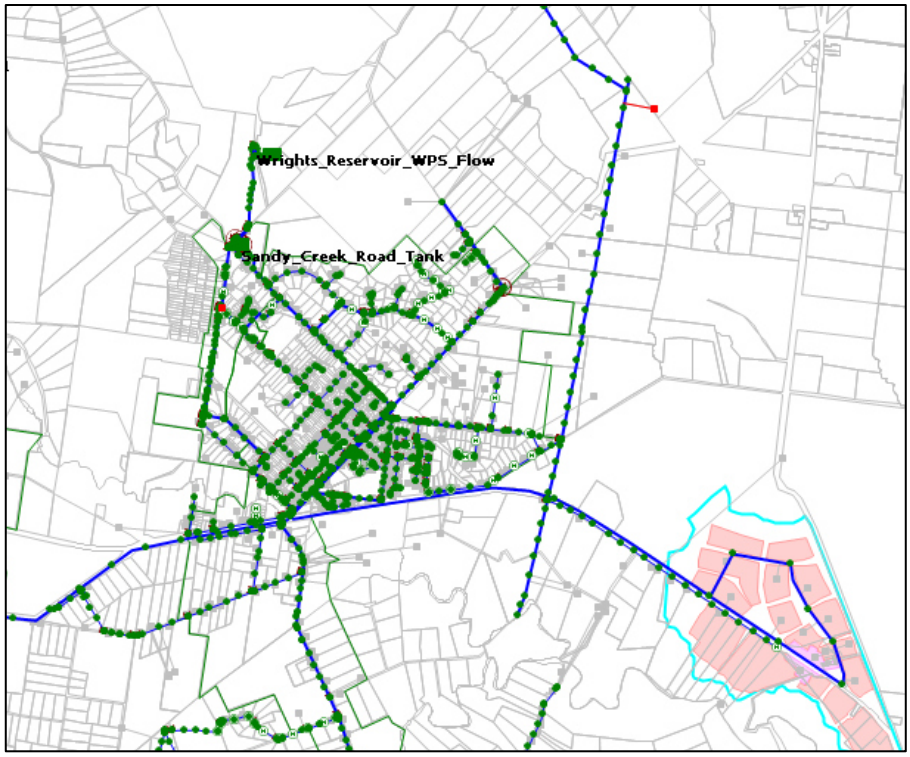


Table 9: 2028 Customers failing minimum pressure requirements – Magnet Hill connection

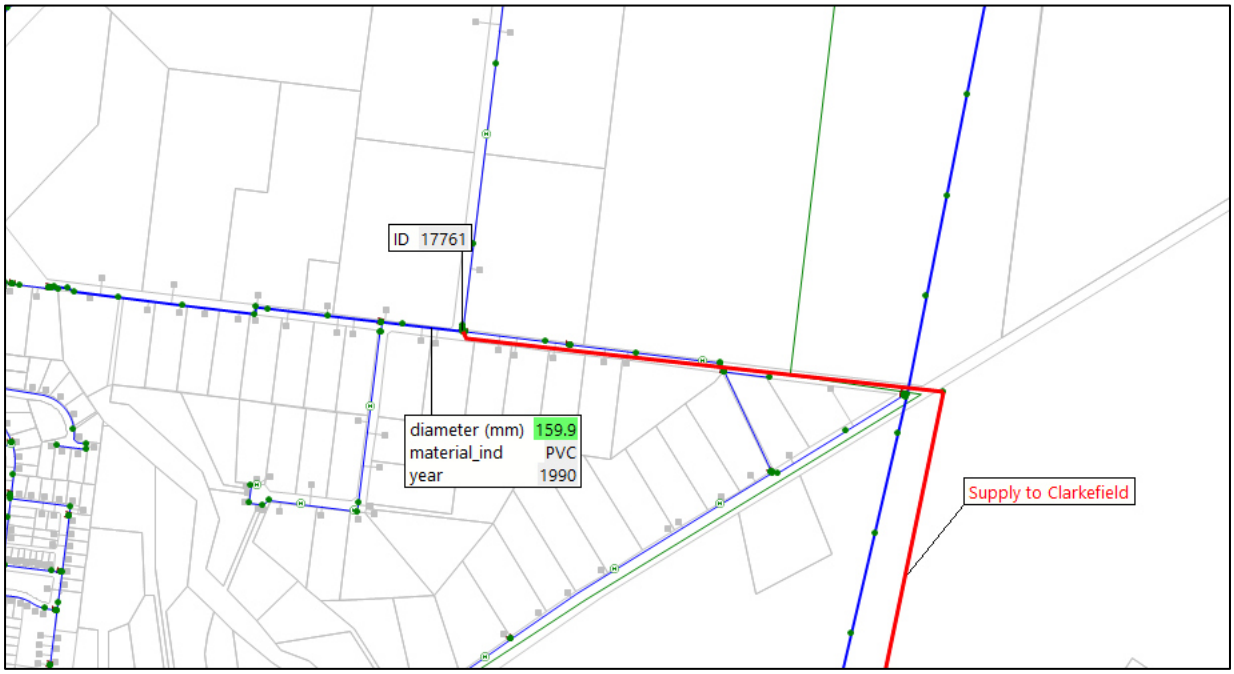
Reference	Predicted Minimum Pressure	Demand Category	Comments
1710503700	18.28	Residential_Riddells Ck LL	As previous
1719880050	13.26	Farm	As previous

3.5.5 500 Lots supplied from current network

As all of the previous analysis relied on the construction of future assets the connection of 500 lots into the current network was reviewed.

The Clarkefield development (of 500 Lots) was connected into the existing PVC main located in Amess Street as shown in Figure 3-21.

Figure 3-21: Clarkefield connection to 2019 network



Under this scenario three properties in the local area are predicted to receive less than 20m pressure. These are summarised in Table 10 and shown in Figure 3-22.

Table 10: 2028 Customers failing minimum pressure requirements – Magnet Hill connection

Reference	Predicted Minimum Pressure	Demand Category	Comments
1710503650	19.34	Residential_Riddells Ck LL	Could be connected to High Level Zone
1710503700	16.09	Residential_Riddells Ck LL	As previous
1719880050	11.60	Farm	As previous

Figure 3-22: Properties predicted to receive less than 20m pressure

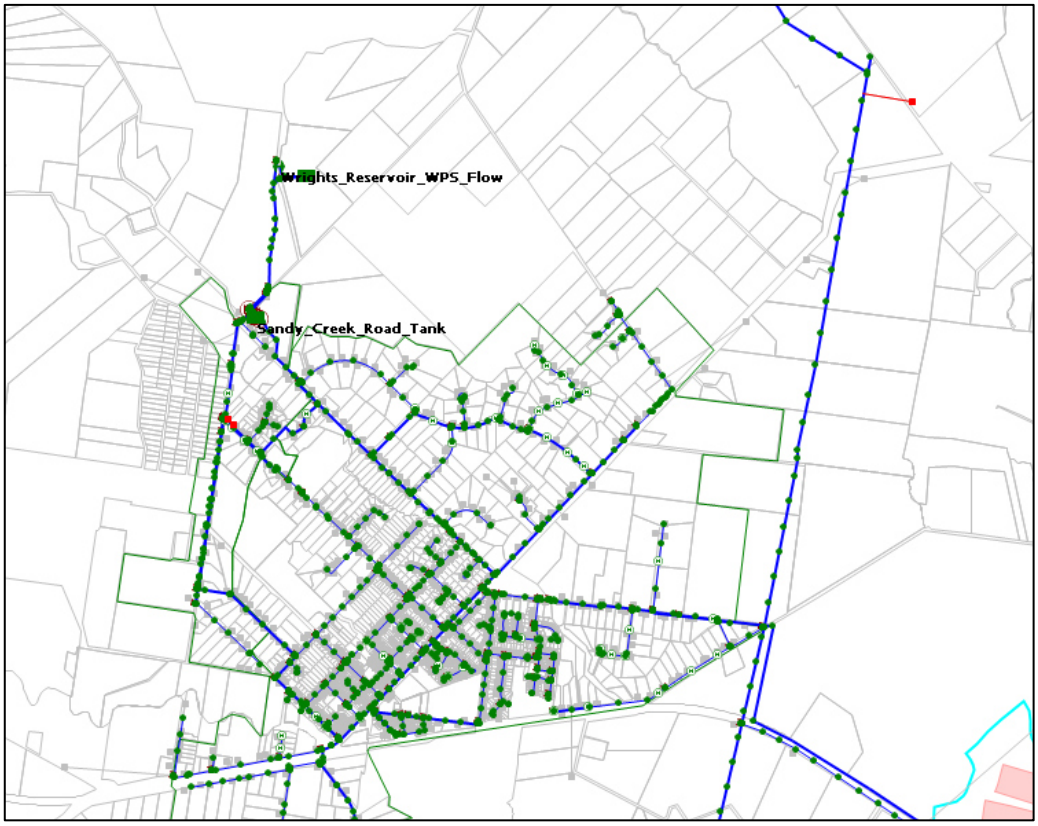


Figure 3-23 shows the volume in Sandy Creek Tank is predicted (blue) to drawdown further than experienced currently (green), however can be replenished overnight.

At this stage Western Water's minimum storage requirements have not been assessed in detail.

Of more concern is the impact of the Clarkefield demand on the 10ML tank at Rosslynne Reservoir. Figure 3-24 shows that the 10ML tank is not able to refill during prolonged peak demand periods.

Figure 3-23: Volume in Sandy Creek Tank

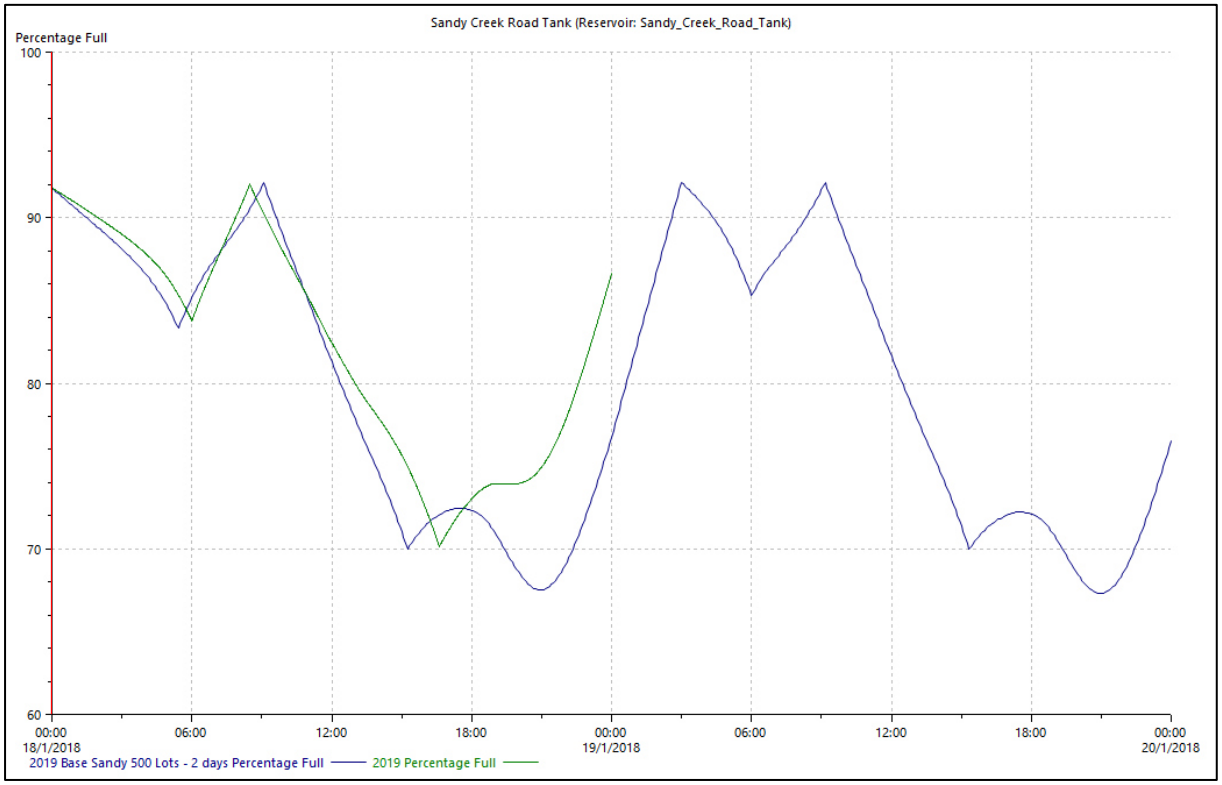
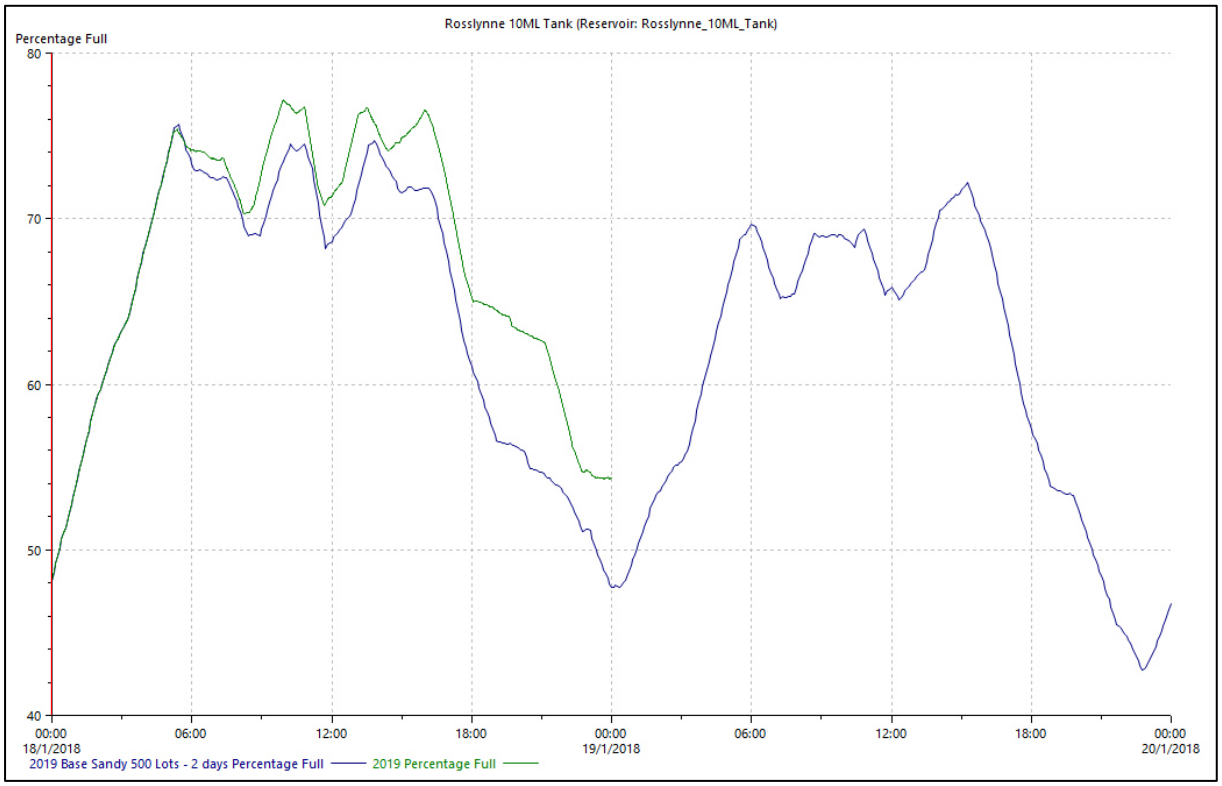


Figure 3-24: Volume in 10ML tank at Rosslynne Reservoir



3.6 Water Summary

The conceptual modelling has shown that the Clarkefield development could be serviced from three separate sources. These are:

- Supply via Sandy Creek Zone
- Supply from Magnet Hill Tank
- Supply from future Sunbury assets

Different assets would be required for each option as summarised in Table 11. Some of the options require Western Water to construct/augment the network, and further augmentations of the Western Water network may be required to ensure supply for current and future users of the water supply network.

Table 11: Summary of Ultimate water servicing options

Connection Option	Indicative Assets linear	Indicative Assets non-linear	Additional works required in WW system?	Risks
Sandy Creek Zone	4.0km of 300mm	PRV maybe	Some	Requires future augmentation of WW network.
Magnet Hill Tank	5.6km of 300mm	PRV & one-way valve	Some	Connection to future asset
Sunbury	Minimal	Booster Pump	Minimal	Connection to future asset

For the initial stages of development supply from the transfer main from the Magnet Hill Tank provides the best overall network impact however it should be noted that this connection relies on assets that are currently unconstructed.

Further analysis is required for connection to the current network, as while customer pressures are not significantly affected by the connection of Clarkefield to the Sandy Creek Zone there may be storage implications.

Longer term the supply from Sunbury should be considered, and this could potentially be utilised by Western Water to provide additional supply resilience to the Sandy Creek and Magnet Hill Tanks.

APPENDIX B RECYCLED CLASS A WATER TREATMENT MEMO

MEMO

To:	APD
From:	Shanli Zhang
Date:	15 December 2019
Reference:	304782
Project name:	Clarkefield
Subject:	Class A Water Quality Treatment – Capital and Operational Costs

As part of the Clarkefield Integrated Water Management Plan, the treatment of Class C recycled water to Class A recycled water has been explored to provide reuse for irrigation, toilet flushing and laundry uses within the development. A preliminary feasibility assessment of a Class A treatment system including capital cost, land take and operation and maintenance cost of required infrastructure has been undertaken.

1. CLASS A WATER FACILITY PROCESS ANALYSIS

Based on the biological treatment lagoon effluent being the feed water, and treated water quality targets will be based on Class A standards to be used for dual pipe supply and unrestricted irrigation purpose. The indicative Log Removal Value (LRV) targets are tabulated in Table 1 to indicate the required LRV for each category of pathogen, to improve water quality from Class C to Class A for Third Pipe Supply and the Riddell Creek RWP onsite internal use. Please be noted this is a typically indicative target, actual target should be quantified by Quantitative Microbiological Risk Assessment (QMRA) specific to this project in later stage of the project.

Table 1: Indicative Required LRV Target for Each Category of Pathogen

Treatment LRV Targets	Protozoa	Virus	Bacteria
Third Pipe Supply	5	6.4	5.2
Riddell Creek on site use	4.8	6.2	5
Total required	**5**	**6.4**	**5.2**

Considering the process equipment available on the market, following Membrane Filtration, UV and Chlorination are selected to achieve to total LRV target on the pathogen. Expected LRV of each process and total LRV is calculated and listed in Table 2 below.

Table 2: Expected LRV from the Proposed Treatment Process Units

	Protozoa	Virus	Bacteria	Process Parameters Requirement
Membrane Filtration	4	2.5	4	Using UF or coagulation MF
UV	2	0	2	UV dose at 5.8 mJ/cm^2
Chlorination	0	4	4	CT= 12min*mg/L at pH<8, Turb<0.2
Total LRV Achievable	**6**	**6.5**	**10**	
Total LRV Required	**5**	**6.4**	**5.2**	

2. CLASS A WATER TREATMENT COST ANALYSIS

The following influent conditions have been put into consideration:

- Proposed 2500 Lots development ~ 7500 EP (263ML/Year)
- Wastewater to be transferred via ~3850m sewage pipeline to Riddells Creek RWP. At Riddells Creek RWP, wastewater is treated to Class C, then pumped to the Class A water facility at Riddells Creek RWP and treated to Class A prior to pump back and reuse within the development for irrigation and domestic toilet flushing and laundry purpose. The treatment to class A is based on UF membranes followed by U.V. disinfection and final chlorination.
- The Class C effluent from Riddells Creek RWP is assumed always sufficient to feed the new Class A facility.
- The scope is focus to analyse the new Class A facility with Riddells Creek RWP.

2.1 Treatment Infrastructure

2.1.1 Landtake

The total estimated landtake is 25m*19m= 475m^2, schematic diagram and an estimated layout has been provided in Appendix A.

2.1.2 Treatment Process selection

2.1.2.1 Class A water production using UF+UV+Chlorination process

After the domestic sewage is properly treated to Class C quality at the Riddell's Creek RWP, it will be suitable to feed into a UF membrane system for further pathogen reduction. Typically UV membrane will provide 4, 2.5 and 4 LRV on protozoa, virus and bacteria respectively. The treatment plant should provide a recovery rate of approximately 85-90% of the feed water. The waste water of 10-15% will be sent to waste water pit, then pump to the Riddell's Creek RWP's inlet work.

The UF filtrate will then enter the UV system, which utilise the UV radiation to deactivate pathogen, with UV dose at 5.8 mJ/cm^2.The UV system produces an LRV of 2, 0 and 2 on protozoa, virus and bacteria can be achieved respectively. It is possible to achieve higher LRV from UV process, but it will require about 10 time of UV dose to achieve 1 LRV on the virus, which makes UV not economic to achieve LRV on virus. Achieving a 1 LRV on viruses can be used as fall-back position if a LRV of 2.5 for an on market UF membrane is not available in the future or QMRA result requires a higher target LRV target on virus.

The chlorination is a common process in water and wastewater treatment, with a chlorine CT at 12 min*mg/L, with pH<8.0 and turbidity<0.2 NTU, we can achieve 0, 4 and 4 LRV on protozoa, virus and bacteria. The chlorination can utilise the recycled water tank, by maintaining a minimum level of 20%.

3. COST ESTIMATE

3.1 Capital Cost Estimate

A preliminary capital cost estimate in Table is shown below.

Table 3: Capital Cost Estimate for 2500 Lots development

Description	Amount
Development Scale Class A Treatment Facility Capital	
Total Class A Treatment Infrastructure Capital Cost	$1,096,000.00
Nominal Allowance for engineering scope development 10%	$ 110,000.00
Contingency 25%	$ 274,000.00
Total Class A Recycled Water Treatment Facility Works (Capital Ex. GST)	**$1,480,000.00**

3.2 Operational Cost Estimate

The operational cost per annum for each options has been estimated and is provided in Table . This operational cost estimate includes sampling cost, chemical cost, power cost, disposal cost, labour cost and renewal costs. This Further direction from Western Water around incorporating labour costs into price per kL is needed to determine the effect of labour on potable and recycled water source market pricing.

Table 4: Operational Cost Estimate for the Proposed Class A Water Treatment Plant

Option OPEX - Summary	Cost Per Annum
Labour Cost, 1.3 FTE	$ 132,600,00
Sampling Cost	$ 12,000.00
Chemical Cost	$ 9,200.00
Power Cost	$ 22,100.00
Disposal Cost	$-
Renewal Cost	$ 50,000.00
Total	$ 225,900.00
Contingency (5%)	$ 11,295.00
Grand Total	**$ 237,195.00**
Calculated $/KL	**$ 0.9**

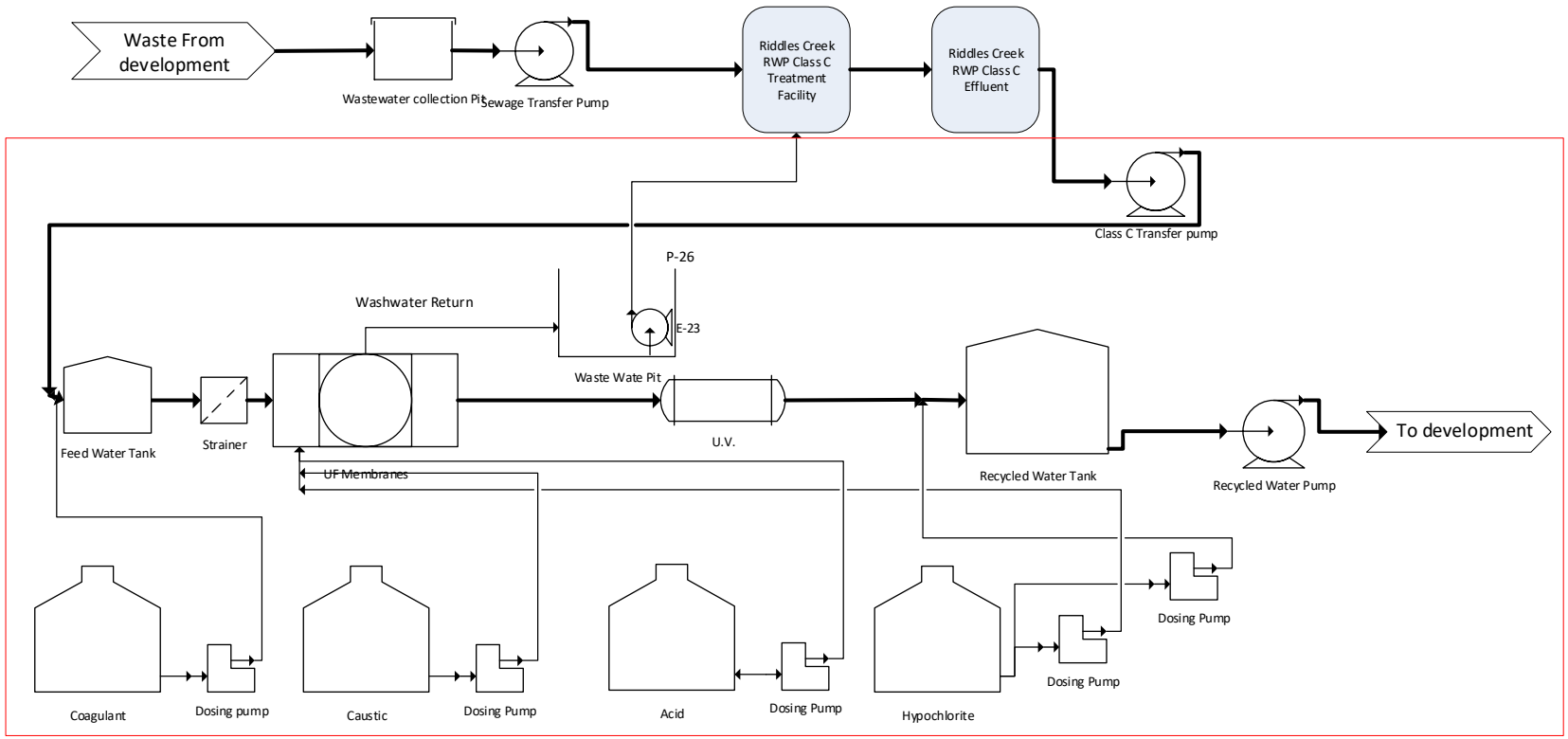
4. SUMMARY

In regard to the capital cost of the proposed Class A water treatment facility for the proposed 2500 lots development at Clarkefield, the capital cost is estimated $1,480,000.00, the land take will be 25m*19m and Annual OPEX is estimated at $237,195.00.

A detailed NPV can be calculated including the treatment plant CAPEX, OPEX and the 3rd pipeline distribution costs to estimate a leveislised cost in terms of $/kL.

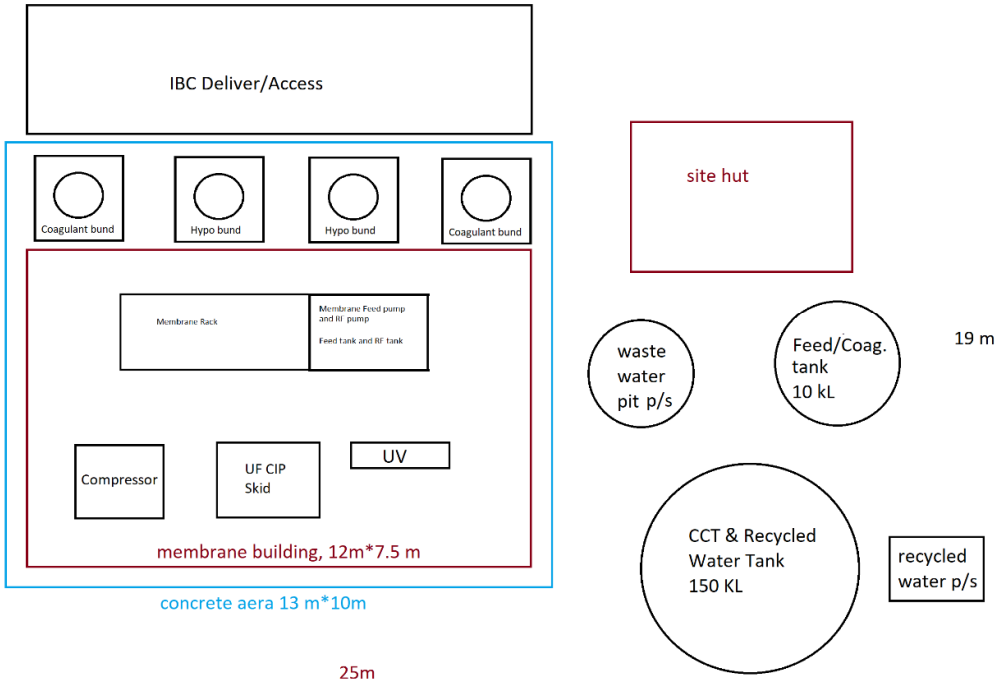
APPENDIX A

Figure 1: Class A Facility Schematic Plan

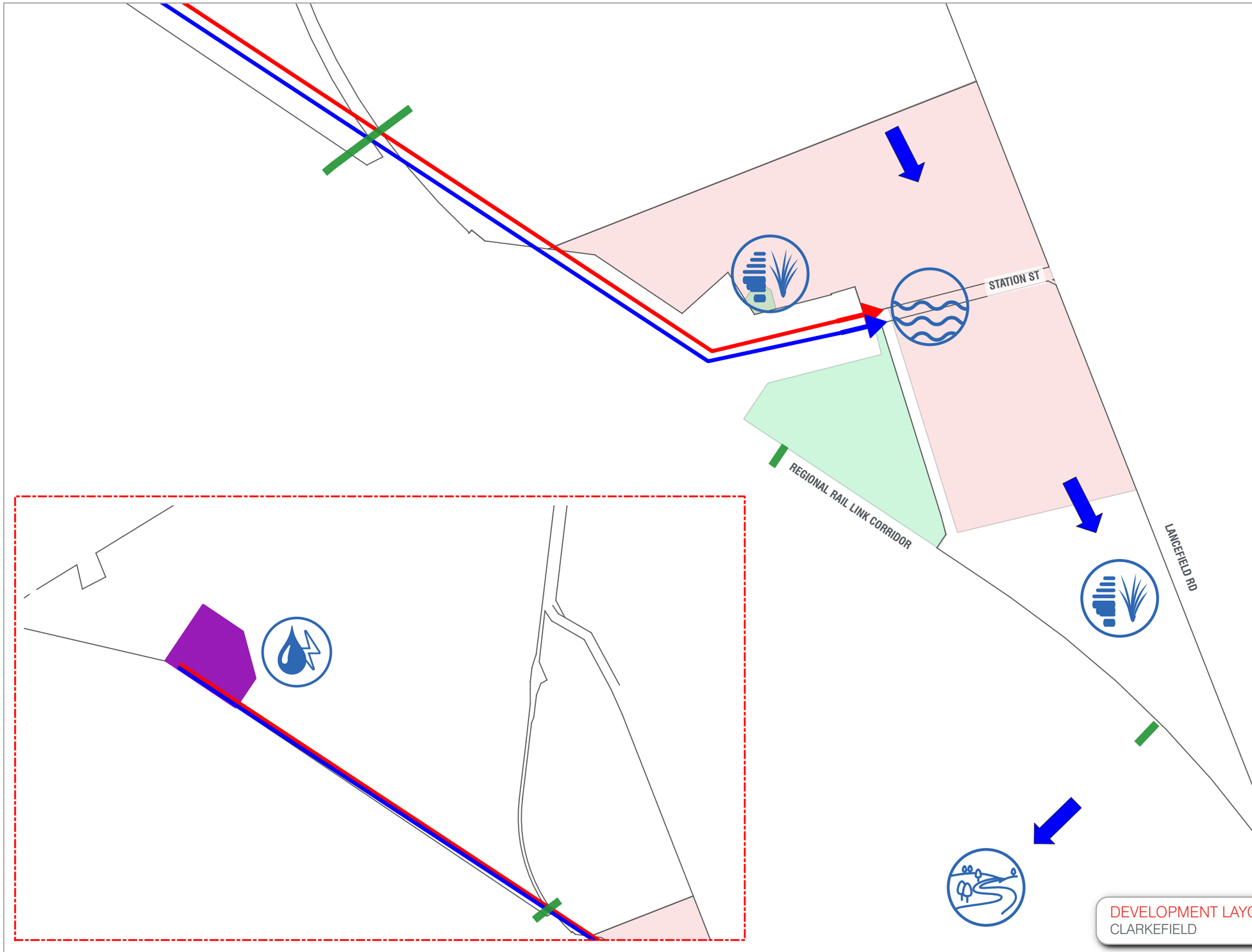


New Class A treatment Facility

Figure 2: Class A Facility Layout



APPENDIX C SERVICING STRATEGY LAYOUT PLAN



WATER ASPECTS

FIT FOR PURPOSE RECYCLED WATER

The Clarkefield Town Centre will be a net importer of recycled water and this principle will incorporated into the wider vision for the township. The utilisation of the Riddells Creek Recycled Water Plant will see Clarkefield have a net positive impact on the water balance at the treatment plant. Recycled water will be used throughout the development for lot and public open space irrigation, toilet flushing and other uses.

WORKING WITH SUNBURY INFRASTRUCTURE

Currently there are no reticulated water or sewer services in Clarkefield. Our plans aim is to minimise Clarkefield's impact on any existing networks. Working with Western Water, we have found that Clarkefield can be serviced by the Riddells Creek Recycled Water Plant and the Gisborne-Macedon-Riddles Creek water network.

BENEFITING OUR WATERWAYS

Water Sensitive Urban Design (WSUD) in the form of wetlands and raingardens will be implemented throughout the public open spaces throughout Clarkefield. WSUD improves visual amenity while reducing pollutant loads entering Jacksons Creek.

JACKSONS CREEK

Stormwater runoff from the site and upstream of the site will drain to the culverts under the Regional Rail Link corridor where they will discharge in a controlled manner into Jacksons Creek.

DEVELOPMENT LAYOUT PLAN
CLARKEFIELD

NOTATIONS

File Ref: 304782
Plan: W GIS Servicing Strategy Layout Plan
Rev: B
Date: 24.02.2021

Designed: Z.I
Checked: L.H.
Authorised: L.H.

APD Projects Pty Ltd

LEGEND

- Residential
- Green Spaces
- Existing Culverts
- Water Reticulation
- Sewer Rising Main
- Development Plan Area Township Zone

1:6,000

60 0 60 120 180 m

Coordinate System: GDA 1994 MGA Zone 55
Paper size A3 Landscape

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ALBURY | BENDIGO | CANBERRA | GEELONG | MELBOURNE | SHEPPARTON