Caloundra South Integrated Water Cycle Management Plan

December 2011

Stockland

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1. Introduction

Parsons Brinckerhoff (PB) was commissioned by Stocklands to prepare the following water and wastewater infrastructure planning study for the Caloundra South Development. This technical report has been prepared at a master planning level to identify potential staging of this infrastructure and is representative of the work undertaken in the preparation of the water and wastewater infrastructure period planning maps.

1.1 Background - Sustainability Initiatives

Caloundra South is situated on the Sunshine Coast in Queensland and the development is expected to reach approximately 61,000 EP at ultimate development. The Caloundra South Development Scheme identifies a target of 140 litres per person per day by 2016. The scale of Caloundra South provides a unique opportunity to investigate and implement innovative water cycle management strategies that minimise demands from the water supply networks and minimise wastewater generated from the project. Due to the nature and extent of environmental receptors in proximity to the development, careful deliberation has also been given to the potential impact of the development on the Pumicestone Passage. Accordingly measures relating to the water cycle with the aim of mitigating these impacts have been considered, and opportunities exist to investigate the implementation of:

- an innovative roof water capture system that would see up to 100% of roof water captured for reuse
- a stormwater harvesting and reuse scheme;
- mandating the use of water efficient appliances within all dwellings
- the implementation of potable water and wastewater collection networks and treatment facilities;
- sealed and/or vacuumed sealed sewer systems to minimise infiltration and wet weather volumes
- low pressure and vacuum collection systems resulting in a potential hybrid solution (i.e. pressure, vacuum and conventional gravity).

These measures provide an opportunity to enhance the sustainability of the development though more efficient use and management of water. A total water cycle management strategy is currently being investigated by the Queensland Water Commission in partnership with a number of stakeholders including the Urban Land Development Authority who are considering the above opportunities. It is expected that, following the completion of these investigations that an infrastructure agreement will be agreed between a water utility and the developer in terms of the final water and waste water strategy for Caloundra South.

The following strategy outlines an initial solution for the delivery of water and waste water for Caloundra South and should be considered a base line option for which the above opportunities would be considered for inclusion within an infrastructure agreement.

1.2 Objectives

The main objectives of this investigation include:

- establishment of the applicable population and loadings applicable to water and wastewater services

- review and establishment of the applicable desired standards of service relevant to water and wastewater infrastructure
- preliminary identification of appropriate siting for major infrastructure components
- sizing of water and wastewater infrastructure throughout the development
- establishment of a staging and sequencing program
- development of a preliminary capital works program.

2. Desired Standards of Service (DSS)

The current DSS adopted for traditional water and wastewater networks relevant to the Caloundra South development is based on the Sunshine Coast Regional Council (SCRC) design standards of service. Appendix A contains further detail on the DSS used for the Caloundra South DSS. The current estimated equivalent population for the Caloundra South development is 61,288 persons.

A detached residential dwelling is considered an equivalent tenement (ET) and a person living within a detached dwelling was considered an equivalent person (EP). Therefore, an ET is considered to be equivalent to 2.7 EP.

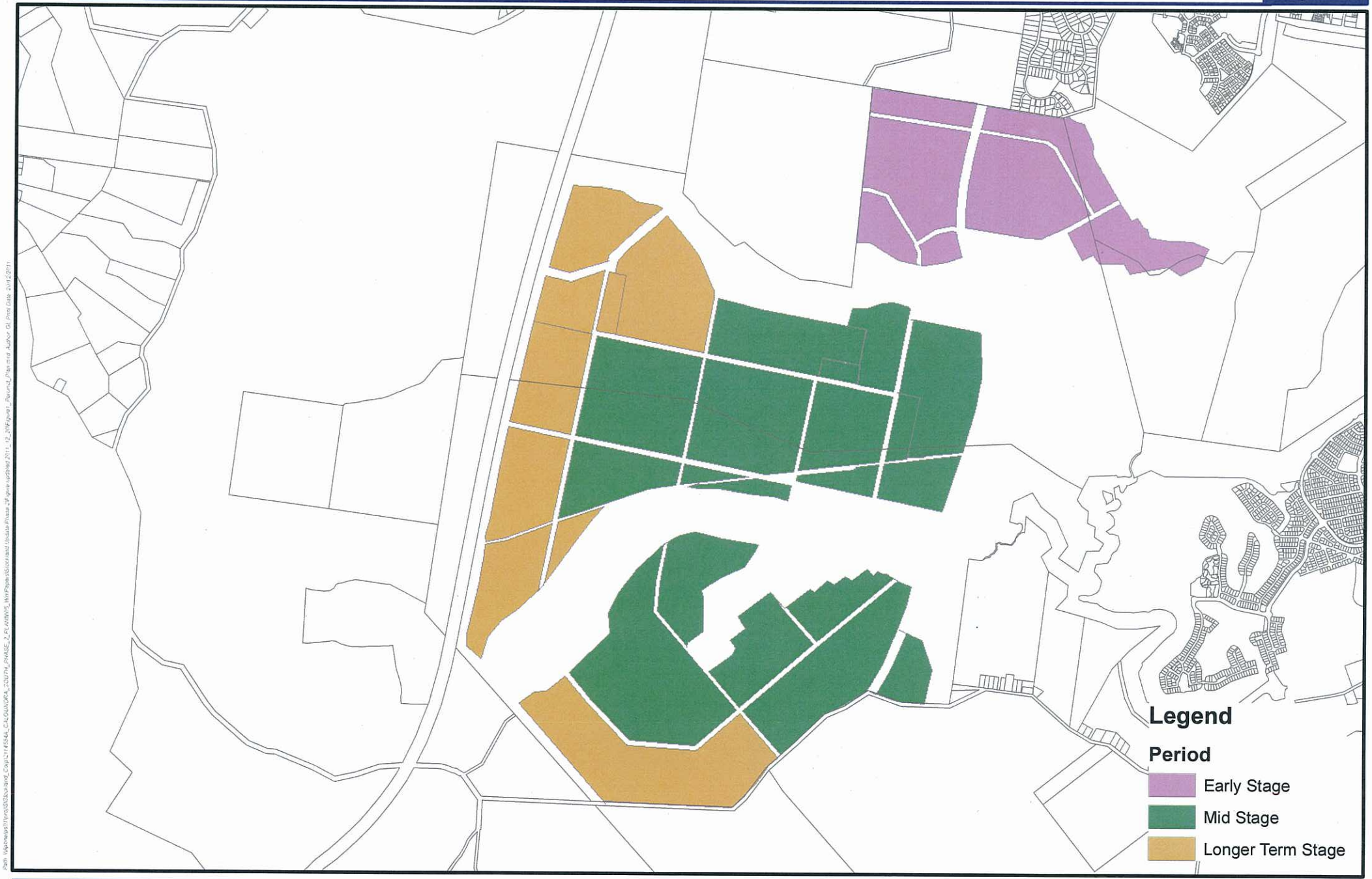
The water and wastewater networks have been based upon the following:

- Water Supply - Conventional potable water supply with the application of rainwater tanks
- Wastewater – Conventional gravity and pumped system with gravity sewers being reduced infiltration gravity sewers.

3. Caloundra South Development Staging

Figure 1 shows the modelled development sequencing program for Caloundra South. The sequencing program provides for the progressive staging of development commencing in the north eastern region of the development, then progressing to the west before progressing south. The sequencing program ensures efficient provision and utilisation of development infrastructure by developing from successive stages.

Figure 1



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Meters

Caloundra South Precinct Plan

4. Water Supply Network

The early stage development areas are proposed to connect to the existing potable water network at Bellvista Boulevard. The ability to connect to and utilise capacity from the existing network will need to be confirmed. New infrastructure will be required during the mid stage, including the first of two water supply reservoirs. Once the mid stage development occurs and the first reservoir is complete, disconnection of early stage development from the local water utilities infrastructure (or connection closure via a closed valve) can occur based on this area being serviced by the newly built Caloundra South water supply reservoir(s).

The development of the water supply network progresses based on the next staged development precinct.

Table 4.1 to Table 4.4 shows the required network infrastructure for potable water supply to service the Caloundra South development. Appendix B contains potable water infrastructure staging plans that correlate to the information contained below (refer to Appendix B for water supply details and figures).

Table 4.1 Water Supply Network Details

Section	Diameter (mm)	Length (m)	Period
PW0 - PW1	375	1,207	Early Stage
PW1 - PW2	375	469	Early Stage
PW2 - PW3	375	1,244	Early Stage
PW3 - PW4	375	824	Early Stage
PW2 - PW5	300	1,137	Early Stage
PW3 - PW5	300	758	Early Stage
PW5 - PW6	375	337	Early Stage
PW6 - PW7	375	1,192	Medium Stage
PW7 - PW8	375	829	Medium Stage
PW5 - PW9	300	2,611	Medium Stage
PW9 - PW8	375	395	Medium Stage
PW8 - PW14	375	318	Medium Stage
PW14 - PW13	450	358	Medium Stage
PW13 - PW18	600	882	Medium Stage
PW18 - PW17	900	941	Medium Stage
PW17 - PW16	900	646	Medium Stage
PW16 - PW15	900	573	Medium Stage
PW13 - PW12	375	766	Medium Stage
PW12 - PW11	300	808	Medium Stage
PW11 - PW10	300	885	Medium Stage
PW10 - PW9	375	543	Medium Stage
PW7 - PW19	300	655	Medium Stage
PW19 - PW13	300	859	Medium Stage
PW19 - PW20	200	900	Medium Stage
PW20 - PW18	200	832	Medium Stage
PW18 - PW21	300	2,240	Medium Stage
PW11 - PW21	300	790	Medium Stage
PW21 - PW22	300	1,005	Medium Stage
PW17 - PW23	450	461	Long Term Stage
PW23 - PW24	375	640	Long Term Stage
PW24 - PW22	300	1,574	Long Term Stage

Section	Diameter (mm)	Length (m)	Period
PW17 - PW25	300	857	Long Term Stage
PW25 - PW20	200	864	Long Term Stage
PW25 - PW20	200	2,502	Long Term Stage

Table 4.2 Water supply reservoir details

Reservoir	Period
Stage 1 Potable Reservoir - 27ML	Medium Stage
Stage 2 Potable Reservoir - 27ML	Medium Stage

Table 4.3 Northern Pipeline Connector

Rising Main from Northern Regional Pipeline			
Section	Diameter (mm)	Length (km)	Year Period
Northern Pipeline Connector - Pipeline to Caloundra Res.	550	9.0	Medium Stage

Table 4.4 Northern Pipeline Connector Pump Station Staging

Northern Pipeline Connector Pump Station		
Section	Flow (L/s)	Year Period
Northern Pipeline to Res. 27ML	261	Medium Stage
Northern Pipeline for 2nd Res. 27ML	509	Medium Stage

The two water supply reservoirs are staged and sized to provide Stocklands with a level of flexibility in the future. The level of reservoir storage required varies based on the DSS criteria and source substitution measures applied. Based on DSS criteria and loading a conventional potable water network with rainwater tanks will require combined reservoir storage in the order of 54ML at ultimate.

The reservoir complex is proposed to be supplied by a main (the 'Northern Regional Pipeline Connector') which sources supply through the Northern Pipeline Interconnector (NPI). The NPI is owned and operated by LinkWater. There have been assumptions made in relation to the Northern Regional Pipeline Connector to the Caloundra South development due to the lack of information on the NPI. These assumptions are:

- the NPI does not have the required pressure head to supply the Caloundra South reservoirs under gravity
- due to the lack of assumed pressure in the NPI, a pump station is required at the connection to supply the Caloundra South reservoir.

Consultation with LinkWater is required to establish the hydraulic conditions within the NPI (i.e. hydraulic grade line at connection) to determine if a pump station is required. The connection to the NPI should be made to the north of the disinfection conversion station situated along the NPI in proximity to Caloundra Street, Landsborough to ensure that the network is subject to a chlorination disinfection regime. This will be consistent with the local utility disinfection regime (i.e. Chlorinated).

5. Wastewater Network

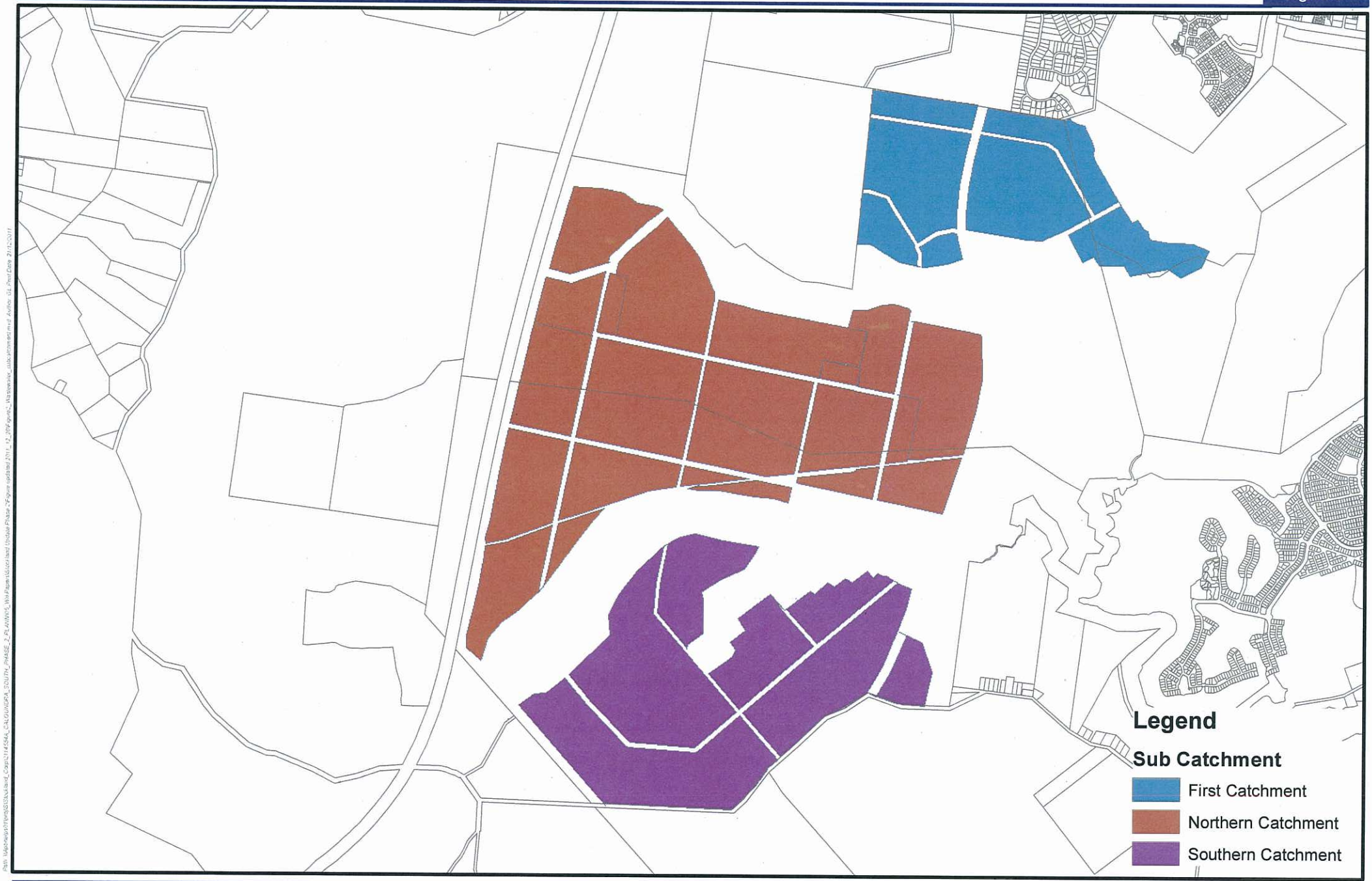
The wastewater network will consist of three wastewater catchments. The three wastewater catchments are detailed within Figure 2 and are identified as:

- First Catchment (FWW)
- North Catchment (NWW)
- South Catchment (SWW)

The South Catchment will include a major pump station that will discharge into the North Catchment. Similarly the North Catchment will include a major pump station that will discharge to the First Catchment at the wastewater treatment plant. The First Catchment will consist of a number of pump stations and discharges to the wastewater treatment plant during the mid stage development period.

The First Catchment will discharge to the existing wastewater network near Bellvista Boulevard during the early stage development. The ability to connect to and utilise capacity from the existing network will need to be confirmed with the water utility. Towards the end of the early stage development period the first stage of the wastewater treatment plant is to be operational. This will require and allow the loadings from developed areas of Caloundra South to be diverted to the Caloundra South wastewater treatment plant.

Figure 2



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Meters

Wastewater Subcatchments

Table 5.1 to Table 5.6 details the wastewater network that is required for the Caloundra South development.

Table 5.1 Ultimate Gravity Wastewater Network

Section	Diameter (mm)	Length (m)	Period
FWW1 - FWW3	225	1565	Early Stage
FWW3 - FWW4	300	133	Early Stage
FWW2 - FWW3	225	197	Early Stage
FWW7 - FWW9	225	578	Early Stage
FWW8 - FWW9	225	629	Early Stage
FWW10 - FWW9	225	1267	Early Stage
FWW5 - FWW6	150	197	Early Stage
FWW6 - FWW4	225	117	Early Stage
SWW4 - SWW3	225	391	Medium Stage
SWW3 - SWW2	300	464	Medium Stage
SWW2 - SWW1	375	453	Medium Stage
SWW6 - SWW5	225	559	Medium Stage
SWW5 - SWW3	300	313	Medium Stage
NWW10 - NWW9	750	1044	Medium Stage
NWW9 - NWW2	900	677	Medium Stage
NWW2 - NWW1	1050	1247	Medium Stage
NWW30 - NWW28	300	375	Medium Stage
NWW28 - NWW1	300	770	Medium Stage
NWW29 - NWW28	225	767	Medium Stage
SWW8 - SWW7	225	269	Medium Stage
NWW31 - NWW30	300	723	Medium Stage
NWW13 - NWW11	450	728	Medium Stage
NWW14 - NWW13	300	345	Medium Stage
NWW11 - NWW9	525	145	Medium Stage
NWW12 - NWW11	225	394	Medium Stage
NWW3 - NWW2	375	886	Medium Stage
NWW15 - NWW13	375	1020	Medium Stage
NWW19 - NWW18	225	313	Medium Stage
NWW20 - NWW18	225	325	Medium Stage
NWW18 - NWW17	300	113	Medium Stage
NWW17 - NWW16	375	685	Medium Stage
NWW16 - NWW10	450	406	Medium Stage
SWW9 - SWW1	225	970	Medium Stage
SWW16 - SWW14	300	190	Medium Stage
SWW15 - SWW14	225	275	Medium Stage
SWW14 - SWW12	375	339	Medium Stage
SWW13 - SWW12	225	394	Medium Stage
SWW12 - SWW11	375	281	Medium Stage
SWW11 - SWW10	450	286	Medium Stage
SWW19 - SWW18	225	681	Medium Stage
SWW22 - SWW21	225	428	Medium Stage
SWW21 - SWW18	300	267	Medium Stage
SWW18 - SWW10	375	405	Medium Stage
SWW10 - SWW1	525	469	Medium Stage
SWW20 - SWW19	225	242	Long Term Stage
SWW17 - SWW16	300	556	Long Term Stage

Section	Diameter (mm)	Length (m)	Period
NWW8 - NWW7	225	1065	Long Term Stage
NWW7 - NWW5	300	441	Long Term Stage
NWW5 - NWW4	300	198	Long Term Stage
NWW4 - NWW3	375	521	Long Term Stage
NWW25 - NWW17	225	1222	Long Term Stage
NWW26 - NWW20	225	370	Long Term Stage
NWW27 - NWW19	225	438	Long Term Stage
NWW24 - NWW22	225	228	Long Term Stage
NWW23 - MWW22	225	138	Long Term Stage
NWW22 - NWW15	225	251	Long Term Stage
NWW6 - NWW5	225	248	Long Term Stage
NWW21 - NWW14	225	677	Long Term Stage

Table 5.2 Wastewater Network - Rising Main Detail

Section	Diameter (mm)	Length (m)	Period
FWW11 - FWW5	100	222	Early Stage
FWW4 - EXISTING	200	2619	Early Stage
FWW9 - FWW4	200	1221	Early Stage
FWW9 - WWTP	200	723	Medium Stage
FWW4 - FWW7	200	617	Medium Stage
NWW1 - WWTP	559	986	Medium Stage
SWW1 - NWW10	356	629	Medium Stage
SWW8 - SWW7	110	1060.0	Medium Stage

Table 5.3 Wastewater Network - Pumping Station Detail

Section	Flow (L/s)	Period
FWW4	100	Early Stage
FWW9	49.6	Early Stage
FWW11	4.3	Early Stage
FWW4	50.5	Medium Stage
FWW9	49.6	Medium Stage
NWW1	539	Medium Stage
SWW1	199	Medium Stage
SWW8	10.5	Medium Stage

Table 5.4 Wastewater Network - Effluent Main Detail

Section	Diameter (mm)	Length (km)	Period
Wastewater treatment plant to start outfall	356	13.7	Medium Stage

Table 5.5 Wastewater Network - Effluent Pump Station

Section*	Flow (L/s)	Period
4.5 ML treatment	62.5	Medium Stage
4.5 ML + 5.2 ML treatment	134.7	Medium Stage
Ult 13.8 ML treatment	192	Long Term Stage

Table 5.6 Wastewater Network - Wastewater Treatment Plant Detail

Wastewater Treatment Plant Staging*	Period
4.5ML	Medium Stage
Upgrade 5.2ML	Medium Stage
Upgrade 4.0ML	Long Term Stage

* Nominated volume capacity requirements are a reference to nominal ADWF loadings.

6. Wastewater Treatment Plant and Effluent Disposal

Production of Class A treated water is proposed to be undertaken with a purpose built wastewater treatment plant (WWTP) at the Caloundra South development. It has been identified that there is capacity for the WWTP could be designed to a biological treatment capacity 3 x ADWF, and a hydraulic capacity of 5 x ADWF. At this stage, it is assumed that the approved release location will be the lagoon with the surplus treated water being supplied to the Kawana ocean outfall.

7. Conclusions

This report defines all major water supply and wastewater infrastructure requirements at Caloundra South development to assist with the development of an Infrastructure Agreement. It is concluded that:

- the total population for Caloundra South is estimated to be 61,288 EP (assumes 2269 dwellings)
- preliminary sizing of infrastructure has been completed, ultimate sizing for infrastructure is:
  - potable water reservoirs, 2 x 27ML
  - wastewater treatment plants, 4.5ML, 5.2ML and 4.0 ML (Nominal ADWF capacity)
- an indicative capital works program has been established based upon preliminary development sequencing plans and this will require further assessment once existing network capacities are confirmed
- the technical report has been based on master planning assumptions and that further investigation, analysis and design is required to identify optimum infrastructure requirements for Caloundra South.
- assessment is required to be carried out on existing water utility water or wastewater networks, including the existing ocean outfall
- assessment is required to be carried out on the Northern Pipeline Interconnector
- assessment is required at the reticulation level as detailed information is not available to make this assessment and it is deemed to be not relevant to the infrastructure agreement

This infrastructure technical report provides a master planning overview of water utility infrastructure required for the Caloundra South development. The detail supporting this report is suitable for master planning proof of concept requirements and preliminary estimates of cost only. More detailed analysis will be required to support concept and detailed design activities in the future once external infrastructure capacities are confirmed.

Appendix A

Desired Standards of Service

Appendix A

Desired Standards of Service for water supply and sewerage Infrastructure

Table 1.1: Assumed allocation of End Uses

Supply Scenario	Potable Water	Recycled Water	Rainwater	Other
Scenario 3: Case 2	Taps / Sinks Showers Hot Water Dishwashers Baths	-	Toilets External Cold Water Laundry	Demand Management, WELS and public education measures implemented
Scenario 8: Case 3	Taps / Sinks Showers Hot Water Dishwashers Baths	Toilets External	Cold water tap to washing machine	Demand Management, WELS and public education measures implemented
Other	'To Be Determined'	'To Be Determined'	'To Be Determined'	'To Be Determined'

(2) Demand assumed ultimate target values and percentage allocation have been based on the assumed allocation of end uses is listed in Table 1.2 and Table 1.3.

Table 1.2: Target Percentage Demands of End Uses

Scenario	Current total Consumption (L/person/day)	Ultimate potable residential consumption (L/person/day)	Ultimate Recycled Water (RCW) consumption (L/person/day)	Ultimate Rainwater Tanks (RWT) consumption (l/person/day)	Reduction in consumption due to DM and market (L/person/day)	% reduction in potable water
Detached Greenfield Dwellings						
Scenario 3 - Case 2	230	112.1	0	84.8	33.1	51%
Scenario 8 - Case 3	230	102.9	64	32	33.1	56%
Attached Greenfield Dwellings						
Scenario 3 - Case 2	200	145.1	0	27	27.9	27%
Scenario 8 - Case 3	200	111.1	34	27	27.9	44%

Table 1.3: End Use Percentage Breakdown

End Use	Existing Consumption Per User (L/d)	% Use
Residential Internal		
Toilets	17.9	10.7%
Baths	32	1.9%
Showers	57.8	34.6%
Taps/Sinks	27	16.2%
Dishwashers	2.7	1.6%
Washing Machines	42.2	25.3%
Internal Leakage	16	9.6%
Total Internal	*166.8*	*100%*
Residential External		
Irrigation		80%
Other		15%
External Leakage		5%
Total External		100%

Further water conservation opportunities may be achieved through the reallocation of end uses to alternative water sources i.e. additional source substitution opportunities.

(3) Demand Unit per dwelling type is listed below and in Table 1.5:

- 2.7 EP / 1 ET for detached residential dwellings

Table 1.5: Adopted Consumption Figures

Average Consumption per Dwelling (L/day)		Average Consumption per Person (L/day)	
Detached Residential	Attached Residential	Detached Residential (2.7 persons / dwelling)	Attached Residential (1.8 persons / dwelling)
621	360	230	200

(4) Achievement of the Desired Standards of Service for potable water and recycled water supply is to be demonstrated under the minimum performance testing scenarios specified in **Table 1.6** (Minimum Performance Testing Scenarios for Water Networks).

Table 1.6: Minimum Performance Testing Scenarios for Water Networks

Scenario	Details
1. 3days at MDMM demand	This scenario is necessary for demonstration of compliance to bulk supply, storage and pumping requirements. Reservoir levels are to commence at 90% full at midnight on the 1st day (i.e. at the start of the analysis). All reservoirs are to have a positive net flow at the end of each day.
2. Scenario 1 to be followed by three consecutive days of MD demand	This scenario is necessary for demonstration of compliance to storage, MH pressure, velocity and pumping requirements. No reservoir should fail according to standards P13, P14 and P15 below during the analysis.
3. 7days at AD demand	This scenario is necessary for demonstration of compliance to maximum pressure criteria and is useful for testing of water quality parameters such as reservoir turnover. Longer runs (e.g. 30 days x AD demand) may be required to test water quality parameters such as water age and chlorine decay.
4. Fire Flow	This scenario is necessary for assessment of the water supply network capacity to deliver fire flow demands. Refer to standards P19, P20 and P21 for details to the water supply network's required fire flow performance capacity.

(5) The Desired Standards of Service for potable water supply Infrastructure are specified in Table 1.7. Only Case 2 and Case 3 are considered (Potable Water Standards of Service Summary Table).

Table 1.7: Potable Water Standards of Service Summary

Standard	Reference	Criteria						
Demand Unit	P01	2.7 EP / ET						
Average Day Potable Water Demand per Equivalent Tenement (L/ET/day)	P02-3	Scenario 3: Case 2						
		Land Use Group*	Existing	2011	2016	2021	2031	Ult
		Single Family Residential (SFR)	405	390	366	353	340	336
		Multiple Family Residential (MFR)	493	476	451	436	425	421

Standard	Reference	Criteria

Rural Residential (RUR)	405	390	366	353	340	336
Commercial (COM)	804	785	767	758	754	750
Industrial (IND)	804	785	767	758	754	750

*Land Use Group – As defined in population model or equivalent

P02-3

Scenario 8: Case 3

Land Use Group*	Existing	2011	2016	2021	2031	Ult
Single Family Residential (SFR)	367	353	331	318	306	303
Multiple Family Residential (MFR)	377	364	343	332	325	322
Rural Residential (RUR)	367	353	331	318	306	303
Commercial (COM)	603	589	575	569	566	563
Industrial (IND)	603	589	575	569	566	563

*Land Use Group – As defined in population model or equivalent

Potable Water Peaking Factors (x AD)

P03-2

Case 2 Dwellings

Land Use Group	MDMM	MD	MH
Single Family Residential (SFR)	2.6	3.7	7.8
Multiple Family Residential (MFR)	1.8	2.5	4.6
Rural Residential (RUR)	2.6	3.7	7.8
Commerical (COM)	1.5	1.9	2.85
Industrial (IND)	1.5	1.9	2.66

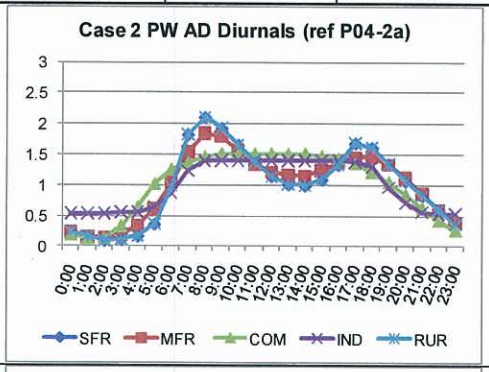
P03-3

Case 3 Dwellings

Land Use Group	MDMM	MD	MH
Single Family Residential (SFR)	2.0	2.5	4.2
Multiple Family Residential (MFR)	1.9	2.4	4.1
Rural Residential (RUR)	2.0	2.5	4.2
Commerical (COM)	1.5	1.8	2.7
Industrial (IND)	1.5	1.8	2.5

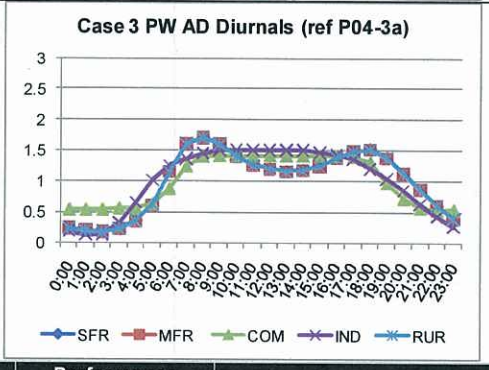
Case 2 Properties – AD Diurnal Profiles

P04-2a



Case 3 Properties – AD Diurnal Profiles

P04-3a



Pressure Performance Criteria	Reference	Criteria	Performance Specification (m)	Details
	P06	Minimum Pressure	20	Minimum pressure of 20m at the street level is to be maintained at all times. Compliance should be demonstrated under maximum hour demand conditions with zonal reservoirs at their minimum operating level.

Standard	Reference	Criteria		
	P07	Minimum Pressure for small, remote and isolated area	16	Any use of this relaxed minimum service pressure criteria for areas considered small, remote and elevated by external professionals in network analysis activities must be justified.
	P08	Maximum Pressure*	80	Compliance should be demonstrated during minimum demand periods with reservoirs at their maximum operating level.
	* It is a prefence to minimise the maximum pressure where possible to reduce the level of potential leakage in the network.			

Water Pipeline Sizing Criteria	Reference	Criteria	Performance Specification
	P09	Bulk supply pipeline operating under gravity	Capacity to transport MDMM demand over 24 hours
	P10	Bulk supply pipeline operating under pumped supply	Capacity to transport MDMM demand over 20 hours
	P11	Zonal and reticulation water supply mains	Sized for the mainentance of pressure meeting both maximum hour and fire flow performance criteria
	P12	Maximum velocity in all mains	2.5m/s

Potable Reservoir Sizing Criteria	Reference	Criteria	Performance Specification
	P13	Potable ground level reservoir in traditional network	1 x MD + 30% contingency storage
	P14	Potable ground level reservoir in dual reticulation network	1.8 x MD
	P15	Elevated Reservoirs	6 x (MH – 1/12 MDMM) + 150kL fire storage (statical analysis); OR Maintenance of storage to a minimum of 30% full is demonstrated at existing elevated reservoirs through dynmaic modelling where the operation of the supply pumping station is acceptable and the pumping station contains adequate security against power failure.

Potable Water Pumping Station Sizing Criteria	Reference	Criteria	Duty Pump Specification	Standby Pump Specification	Other
	P16	Pumping Stations servicing ground level reservoirs	MDMM demand over 20 hours per day	Equivalent to largest duty pump	-
	P17	Pumping stations servicing elevated reservoirs	((6 x MH – operating volume) / (6 x 3600)) (L/s unit)	Equivalent to largest duty pump	-
	P18	Booster pumping stations – direct supply to customers	MH Demand	Equivalent to largest duty pump	FF pump set required if duty pumps cannot provide fire flow.^
	^ See P19, P20 and P21 for fire flow standards.				

Fire Flow Demand and Supply Requirements	P19	Fire Flow Assessment Background Demand = 2/3 MH			
	Reference	Property Type	Total FF Demand (L/s)	Flow Sourced from Number of Adjacent Hydrants	Duration (Hours)
	P20a	Detached Residential	15	2 (7.5L/s each)	2
	P20b	Multiple Level Residential <4 Storeys	15	2 (7.5L/s each)	2
	P20c	Multiple Level Residential ≥4 Storeys	30	3 (10L/s each)	4
	P20d	Commerical / Industrail	30	3 (10L/s each)	4

Fire Flow Performance Pressure Requirements	Reference	Location	Minimum Residual Pressure Requirement (m)
	P21a	At hydrants in use	12
	P21b	To all of network other than hydrant in use	6

Water Main Friction Coefficients	P22	Hydraulic Equation for Water Supply Modelling = Hazen Williams Hazen Williams Roughness Coefficients (C Values)

Material	Diameter (mm)				
	100	150-200	250-300	375-600	>600
Mild Steel Concrete Lined (MSCL)	110	120	125	130	135
Ductile Iron Concrete Lined (DICL)	100	110	120	125	130
Ductile Iron (DI)	100	110	115	120	125
Cast Iron Concrete Lined (CICL)	100	110	120	125	130

Standard	Reference	Criteria					
		Cast Iron (CI)	100	110	115	120	125
		UPVC	110	120	125	130	135
		Abestos Cement (AC)	100	110	115	120	125
		Other	100	110	115	120	125
Fire Flow Demand and Supply Requirements	R18	Fire Flow Assessment Background Demand = 2/3 MH					
	Reference	Property Type	Total FF Demand (L/s)	Flow sourced from number of adjacent hydrants	Duration (hours)		
	R19a	Detached Residential	15	2 (7.5L/s each)	2		
	R19b	Multiple Level Residential <4 Storeys	15	2 (7.5L/s each)	2		
	R19c	Multiple Level Residential ≥4 Storeys	30	3 (10L/s each)	4		
	R19d	Commerical / Industrail	30	3 (10L/s each)	4		
Fire Flow Performance Pressure Requirements	Reference	Location		Minimum Pressure Requirement (m)			
	R20a	At hydrants in use		12			
	R20b	To all of network other than hydrants in use		6			

Average Day Diurnal Profiles in Tabular Form

	Case 1 Potable Water AD Diurnal (ref P04-1a)					Case 2 Potable Water AD Diurnals (ref P04-2a)				
Time	SFR	MFR	COM	IND	RUR	SFR	MFR	COM	IND	RUR
0:00	0.24	0.23	0.18	0.53	0.24	0.24	0.23	0.18	0.53	0.24
1:00	0.16	0.15	0.12	0.53	0.16	0.16	0.15	0.12	0.53	0.16
2:00	0.09	0.14	0.13	0.53	0.09	0.09	0.14	0.13	0.53	0.09
3:00	0.1	0.19	0.32	0.55	0.1	0.1	0.19	0.32	0.55	0.1
4:00	0.16	0.33	0.64	0.55	0.16	0.16	0.33	0.64	0.55	0.16
5:00	0.36	0.61	1.01	0.63	0.36	0.36	0.61	1.01	0.63	0.36
6:00	0.98	1.04	1.25	0.87	0.98	0.98	1.04	1.25	0.87	0.98
7:00	1.82	1.54	1.36	1.23	1.82	1.82	1.54	1.36	1.23	1.82
8:00	2.1	1.84	1.45	1.39	2.1	2.1	1.84	1.45	1.39	2.1
9:00	1.92	1.79	1.5	1.4	1.92	1.92	1.79	1.5	1.4	1.92
10:00	1.65	1.56	1.5	1.4	1.65	1.65	1.56	1.5	1.4	1.65
11:00	1.38	1.34	1.5	1.4	1.38	1.38	1.34	1.5	1.4	1.38
12:00	1.14	1.21	1.5	1.4	1.14	1.14	1.21	1.5	1.4	1.14
13:00	1.01	1.16	1.5	1.4	1.01	1.01	1.16	1.5	1.4	1.01
14:00	0.99	1.15	1.5	1.4	0.99	0.99	1.15	1.5	1.4	0.99
15:00	1.09	1.24	1.46	1.4	1.09	1.09	1.24	1.46	1.4	1.09
16:00	1.33	1.38	1.42	1.4	1.33	1.33	1.38	1.42	1.4	1.33
17:00	1.68	1.45	1.35	1.38	1.68	1.68	1.45	1.35	1.38	1.68
18:00	1.61	1.46	1.2	1.3	1.61	1.61	1.46	1.2	1.3	1.61
19:00	1.34	1.33	1.04	0.96	1.34	1.34	1.33	1.04	0.96	1.34
20:00	1.07	1.12	0.84	0.71	1.07	1.07	1.12	0.84	0.71	1.07
21:00	0.83	0.86	0.62	0.56	0.83	0.83	0.86	0.62	0.56	0.83
22:00	0.6	0.6	0.42	0.53	0.6	0.6	0.6	0.42	0.53	0.6
23:00	0.36	0.39	0.26	0.53	0.36	0.36	0.39	0.26	0.53	0.36
Average	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

	Case 3 Potable Water AD Diurnal (ref P04-3a)				
Time	SFR	MFR	COM	IND	RUR
0:00	0.23	0.23	0.53	0.18	0.23
1:00	0.2	0.2	0.53	0.12	0.2
2:00	0.17	0.17	0.53	0.13	0.17
3:00	0.22	0.22	0.55	0.32	0.22
4:00	0.35	0.35	0.55	0.64	0.35
5:00	0.61	0.61	0.63	1.01	0.61
6:00	1.15	1.15	0.87	1.25	1.15
7:00	1.6	1.6	1.23	1.36	1.6
8:00	1.7	1.7	1.39	1.45	1.7
9:00	1.6	1.6	1.4	1.5	1.6
10:00	1.4	1.4	1.4	1.5	1.4
11:00	1.25	1.25	1.4	1.5	1.25
12:00	1.19	1.19	1.4	1.5	1.19
13:00	1.15	1.15	1.4	1.5	1.15
14:00	1.17	1.17	1.4	1.5	1.17
15:00	1.24	1.24	1.4	1.46	1.24
16:00	1.38	1.38	1.4	1.42	1.38
17:00	1.48	1.48	1.38	1.35	1.48
18:00	1.51	1.51	1.3	1.2	1.51
19:00	1.37	1.37	0.96	1.04	1.37
20:00	1.12	1.12	0.71	0.84	1.12
21:00	0.86	0.86	0.56	0.62	0.86
22:00	0.6	0.6	0.53	0.42	0.6
23:00	0.39	0.39	0.53	0.26	0.39
Average	1.00	1.00	1.00	1.00	1.00

6. Desired Standards of Service for Sewerage Infrastructure

(1) The Desired Standards of Service for sewerage Infrastructure are specified in **Table 1.5** (Waste Water Standards of Service Summary Table).

Standard	Reference	Criteria
Demand Unit	S01	2.7EP/ET
ADWF	S02	600L/ET/day
PWWF	S03	Conventional Gravity 5 x ADWF
	S04	Reduced Infiltration Gravity Sewers (RIGS) 4 x ADWF
PDWF	S06	PDWF = C_2 x ADWF Where, $C_2 = 4.7 \times (2.7 \times ET)^{-0.105}$
Gravity Sewer Performance Criteria		
Minimum Size	S07	150mm
Maximum depth of flow at PWWF (new pipes)	S08	≤ 0.75 x pipe diameter
Maximum	S09	Pipe full and surcharge of manholes to a maximum of 1m below manhole lid

Standard	Reference	Criteria		
depth of flow at PWWF (existing pipes)				
Minimum velocity at PDWF	S10	0.7m/s		
Minimum Grades for Gravity Sewers	Reference	Diameter (mm)	Grade %	
	S11	150*	0.55	
		225	0.33	
		300	0.25	
		375	0.17	
		450	0.14	
		525	0.12	
		600	0.10	
		750	0.08	
		* For ETs <2 the minimum grade for a 150mm diameter main = 1.25% * For ETs 2-5 the minimum grade for a 150mm diameter main = 1.00%		
Pressure Main Performance Criteria				
Maximum velocity under single pump operation (new mains)	S12	2 m/s (1.5m/s target)		
Maximum velocity under all pump operations (new mains)	S13	2.5 m/s		
Maximum velocity criteria (existing mains)	S14	2.5m/s (single pump) and 3m/s (all pumps)		
Wet Well Performance Criteria				
Wet Well Performance Criteria	Reference	Criteria	Performance Specification	Other
	S15	Wet well operating storage	(0.9 x single pump capacity)/N	N = Number of pump Starts N = 12 starts motors < 50kW N = 5 starts motors > 50kW Operational storage is between pump start / stop levels
	S16	Minimum wet well diameter	2.4	-
Wastewater Pumping Station Performance Criteria				
Pumping station performance criteria	Reference	Criteria	Performance Specification	Other
	S17	Minimum duty pump capacity for existing pumping stations	C_1 x ADWF	C_1 = 15 x (2.7 x ET) -0.1587 Minimum value of C_1 = 3.5
	S18	All pump capacity for existing infrastructure	PWWF (i.e. 5 x ADWF)	
	S19	Duty pump capacity for new pumping stations in areas with coventional sewer networks	PWWF (i.e. 5 x ADWF)	Standby pump of equivalent duty is to be provided.
	S20	Duty pump capacity for new pumping stations in areas with RIGS	PWWF (i.e. 4 x ADWF)	Standby pump of equivalent duty is to be provided.
Emergency Storage Performance Criteria				
Emergency Storage Performance Criteria	Reference	Sewer Technology	Performance Specifications	Other
	S21	Conventional Sewers	6hrs x ADWF	Can include system storage below the wet well overflow level
	S22	Reduced Infiltration Sewers	12hrs x ADWF	Can include system storage below the wet well overflow level
Septicity and Odour				
Septicity and Odour Control Criteria	S23	Criteria for the control of septicity and odour will be identified through a risk evaluation process. The risk identification process is provided below in Table D7 of this Appendix. The actions for odour control that are triggered for each of the risk categories as follows: • Low Risk – No additional treatment required • Medium (Single) Risk – No additional treatment required • Medium (Multiple) Risk - Further investigation maybe required including investigation into Septicity / Odour control facilities. • High Risk – Septicity / Odour control facilities will be required		

Standard	Reference	Criteria			
		Risk Category	Buffer Distance	Odour Parameter Retention Time	Sewerage Characteristics
			Distance between source and receptor	Amount of time that sewage is in a pressure main based on ADWF	Quality of Sewerage
		Low	Greater than 50m	Less than 1 hr	Domestic Only
		Medium	Between 20 and 50m	Between 1 and 2hrs	Mostly domestic with minor commercial quantities
		High	Less than 20m	Greater than 2hrs	Higher strength sewage e.g. industrial cleaners, food/beverage process effluents, tanneries etc.

Hydraulic Equations

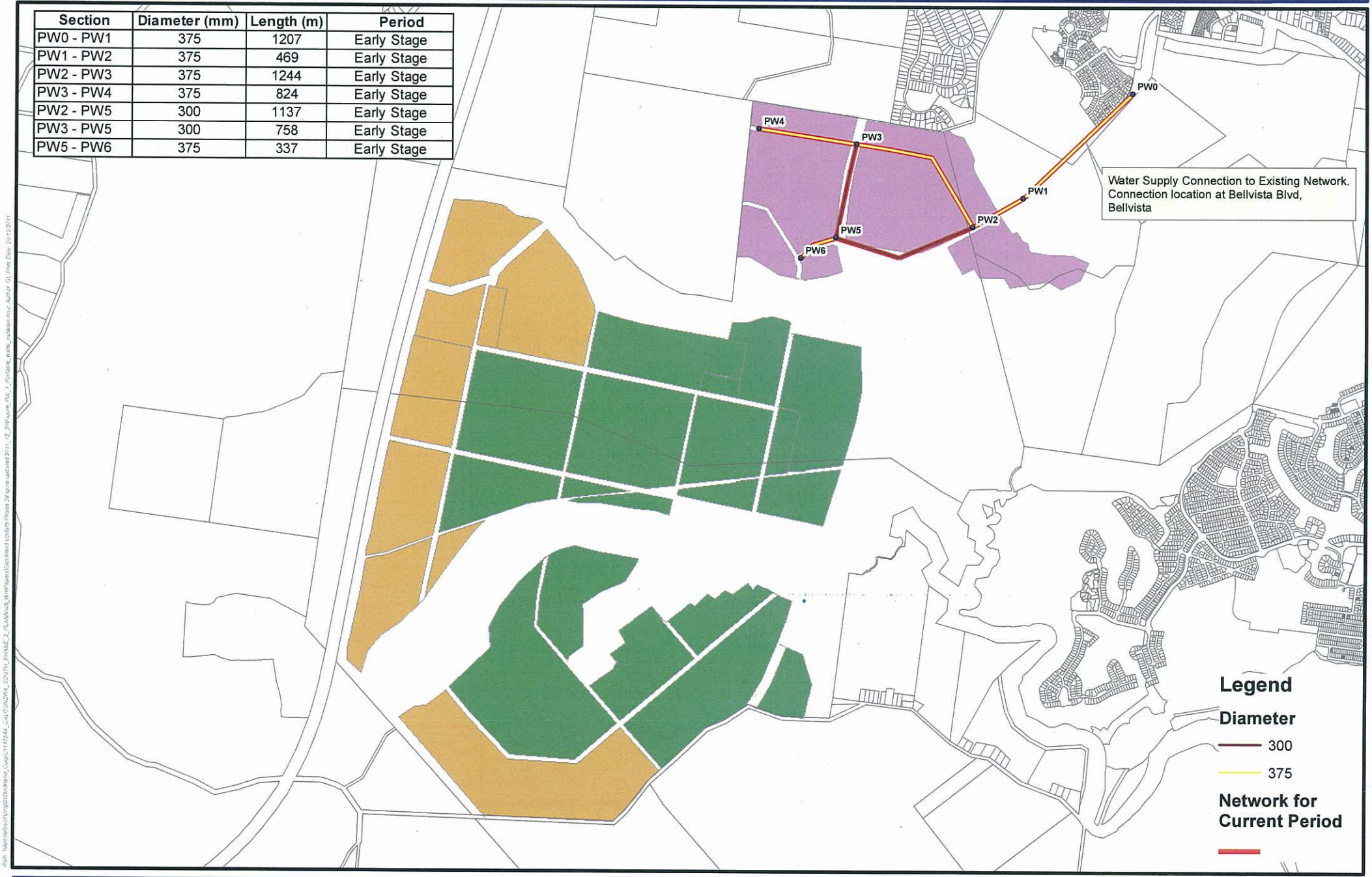
Gavity Sewer Flow Equations	Reference	Flow Equation for Gravity Sewers = Mannings Mannings Hydraulic Roughness Coefficient (n Values)	
		Material	Manning's n
	S24	Cement Motar	0.013
		Ceramics	0.014
		Smooth Concrete	0.012
		Normal Concrete	0.013
		Rough Concrete	0.015
		Iron (Cast)	0.014
		Iron (wrought)	0.015
		PVC / Plastics / PE	0.013
		Stone	0.013
		Vitrified Clay	0.014
Pressure Main Flow Equation	Reference	Flow Equation for Gravity Sewers = Hazen Williams Hazen Williams Roughness Coefficients (C Value)	
		Material	Roughness (C Value)
	S25	Cement Mortar	130
		Ceramics	110
		Smooth Concrete	140
		Normal Concrete	130
		Rough Concrete	100
		Iron (Cast)	110
		Iron (wrought)	100
		PVC / Plastic / PE	130
		Stone	130
		Vitrified Clay	110

Appendix B

Water Supply Network Details and Figures

Figure PW-1

Section	Diameter (mm)	Length (m)	Period
PW0 - PW1	375	1207	Early Stage
PW1 - PW2	375	469	Early Stage
PW2 - PW3	375	1244	Early Stage
PW3 - PW4	375	824	Early Stage
PW2 - PW5	300	1137	Early Stage
PW3 - PW5	300	758	Early Stage
PW5 - PW6	375	337	Early Stage



Potable Water Network - Early Stage

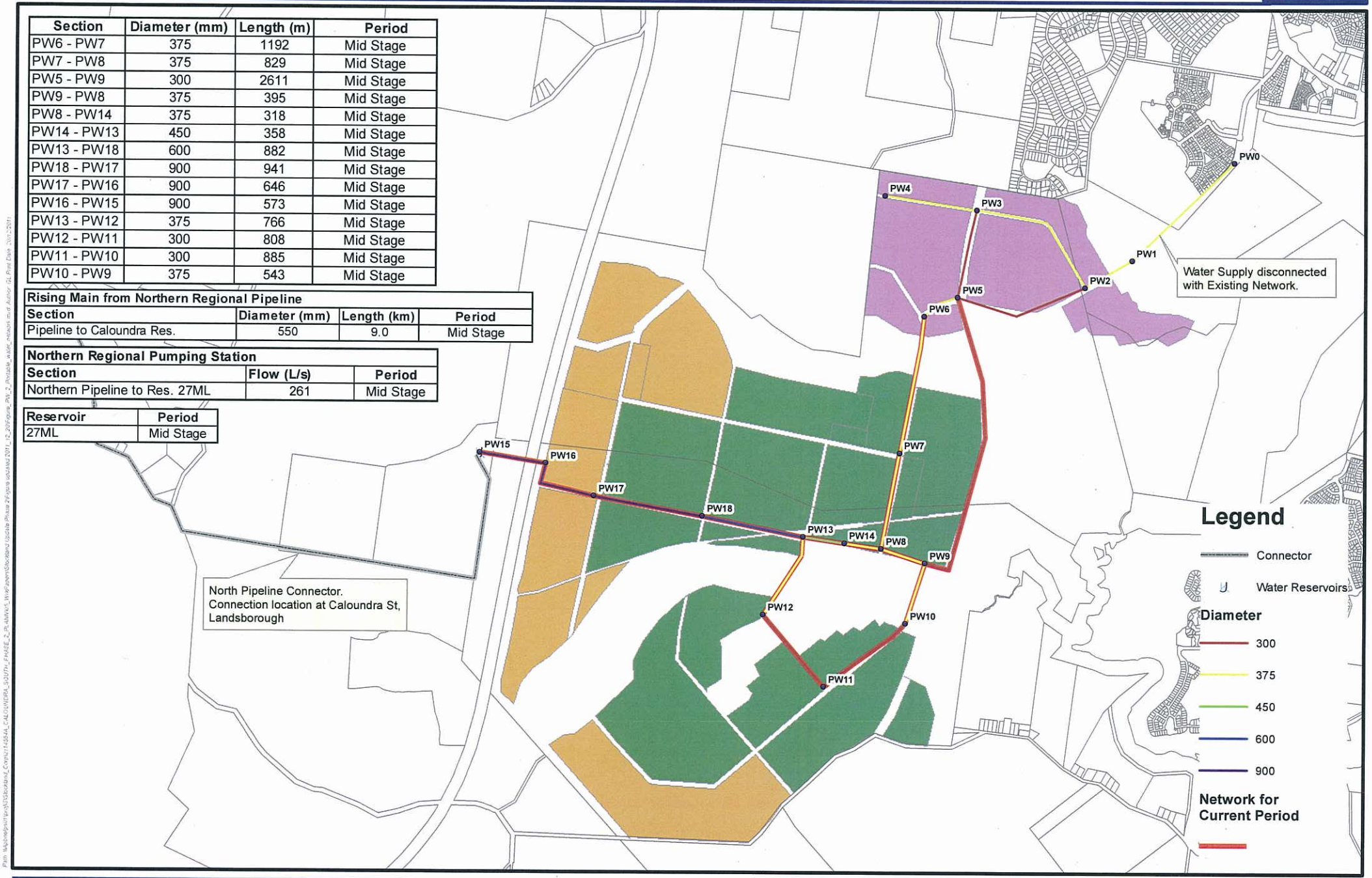
Figure PW-2

Section	Diameter (mm)	Length (m)	Period
PW6 - PW7	375	1192	Mid Stage
PW7 - PW8	375	829	Mid Stage
PW5 - PW9	300	2611	Mid Stage
PW9 - PW8	375	395	Mid Stage
PW8 - PW14	375	318	Mid Stage
PW14 - PW13	450	358	Mid Stage
PW13 - PW18	600	882	Mid Stage
PW18 - PW17	900	941	Mid Stage
PW17 - PW16	900	646	Mid Stage
PW16 - PW15	900	573	Mid Stage
PW13 - PW12	375	766	Mid Stage
PW12 - PW11	300	808	Mid Stage
PW11 - PW10	300	885	Mid Stage
PW10 - PW9	375	543	Mid Stage

Rising Main from Northern Regional Pipeline			
Section	Diameter (mm)	Length (km)	Period
Pipeline to Caloundra Res.	550	9.0	Mid Stage

Northern Regional Pumping Station		
Section	Flow (L/s)	Period
Northern Pipeline to Res. 27ML	261	Mid Stage

Reservoir	Period
27ML	Mid Stage



N

0 500 1,000 2,000 Meters

Potable Water Network - Mid Stage

Figure PW-3

Section	Diameter (mm)	Length (m)	Period
PW7 - PW19	300	655	Mid Stage
PW19 - PW13	300	859	Mid Stage

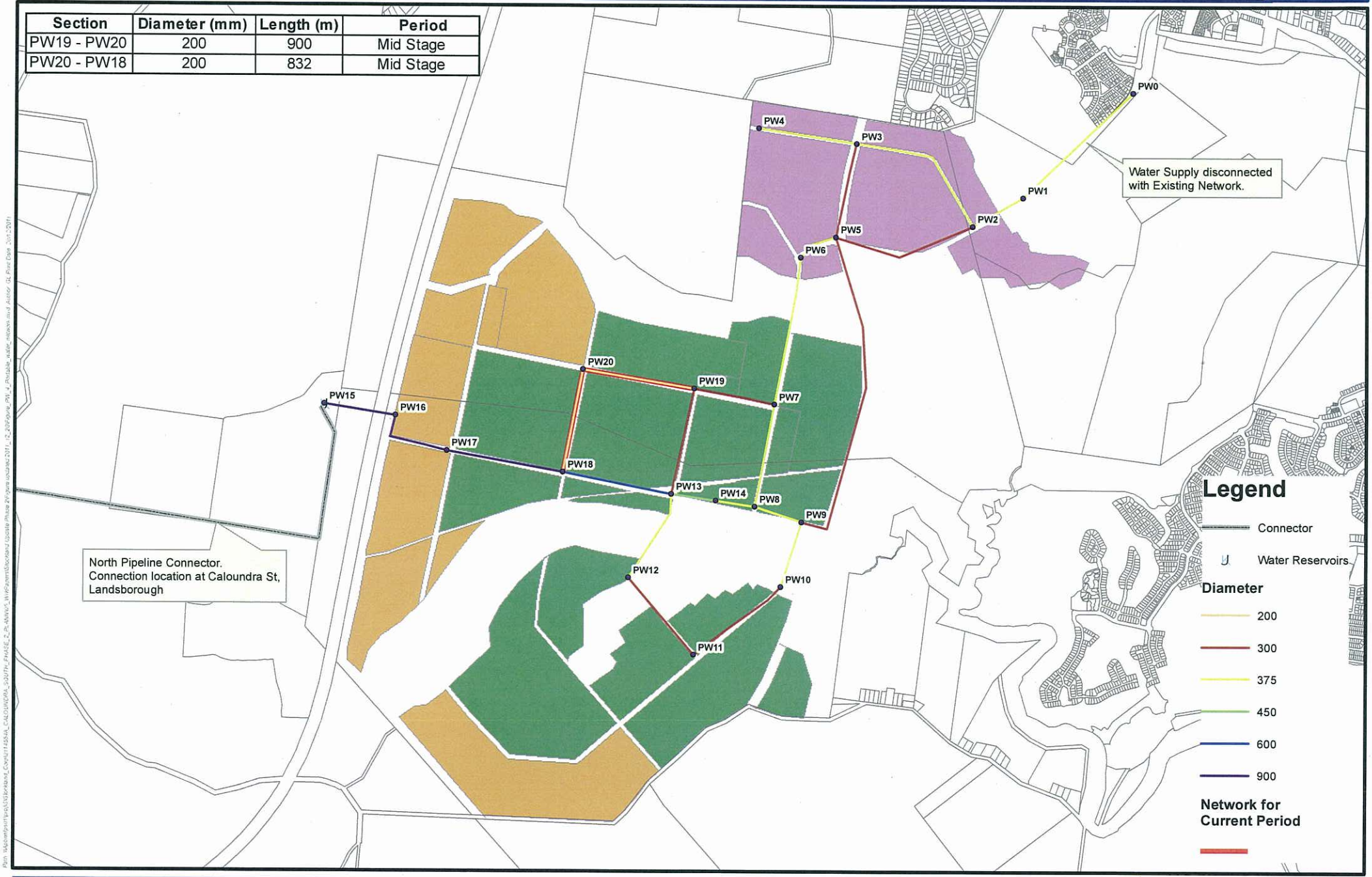
N

0 500 1,000 2,000 Meters

Potable Water Network - Mid Stage

Figure PW-4

Section	Diameter (mm)	Length (m)	Period
PW19 - PW20	200	900	Mid Stage
PW20 - PW18	200	832	Mid Stage



0 500 1,000 2,000 Meters

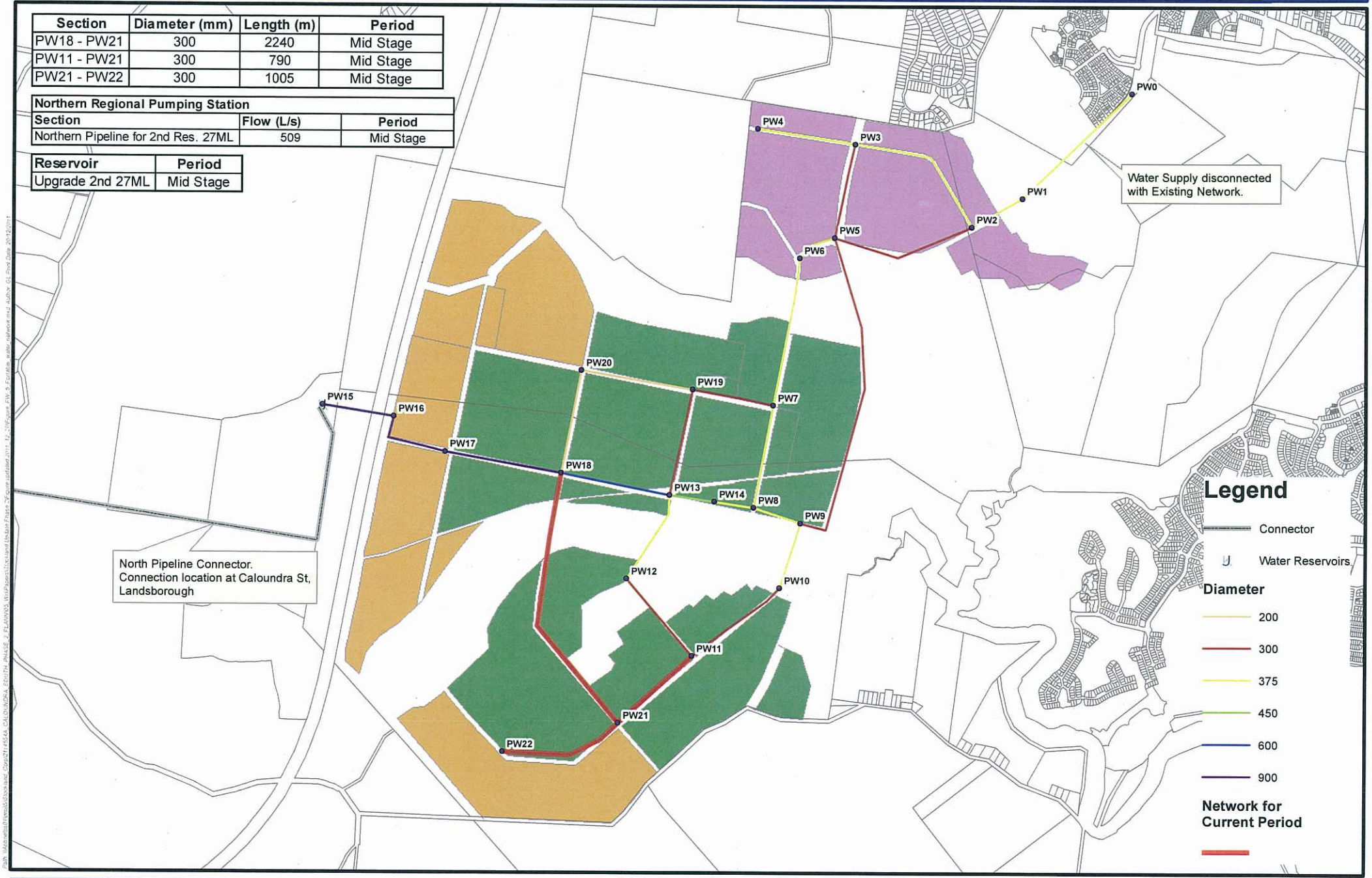
Potable Water Network - Mid Stage

Figure PW-5

Section	Diameter (mm)	Length (m)	Period
PW18 - PW21	300	2240	Mid Stage
PW11 - PW21	300	790	Mid Stage
PW21 - PW22	300	1005	Mid Stage

Northern Regional Pumping Station		
Section	Flow (L/s)	Period
Northern Pipeline for 2nd Res. 27ML	509	Mid Stage

Reservoir	Period
Upgrade 2nd 27ML	Mid Stage



0 500 1,000 2,000 Meters

Potable Water Network - Mid Stage

Figure PW-6

Section	Diameter (mm)	Length (m)	Period
PW17 - PW23	450	461	Longer Term Stage
PW23 - PW24	375	640	Longer Term Stage
PW24 - PW22	300	1574	Longer Term Stage

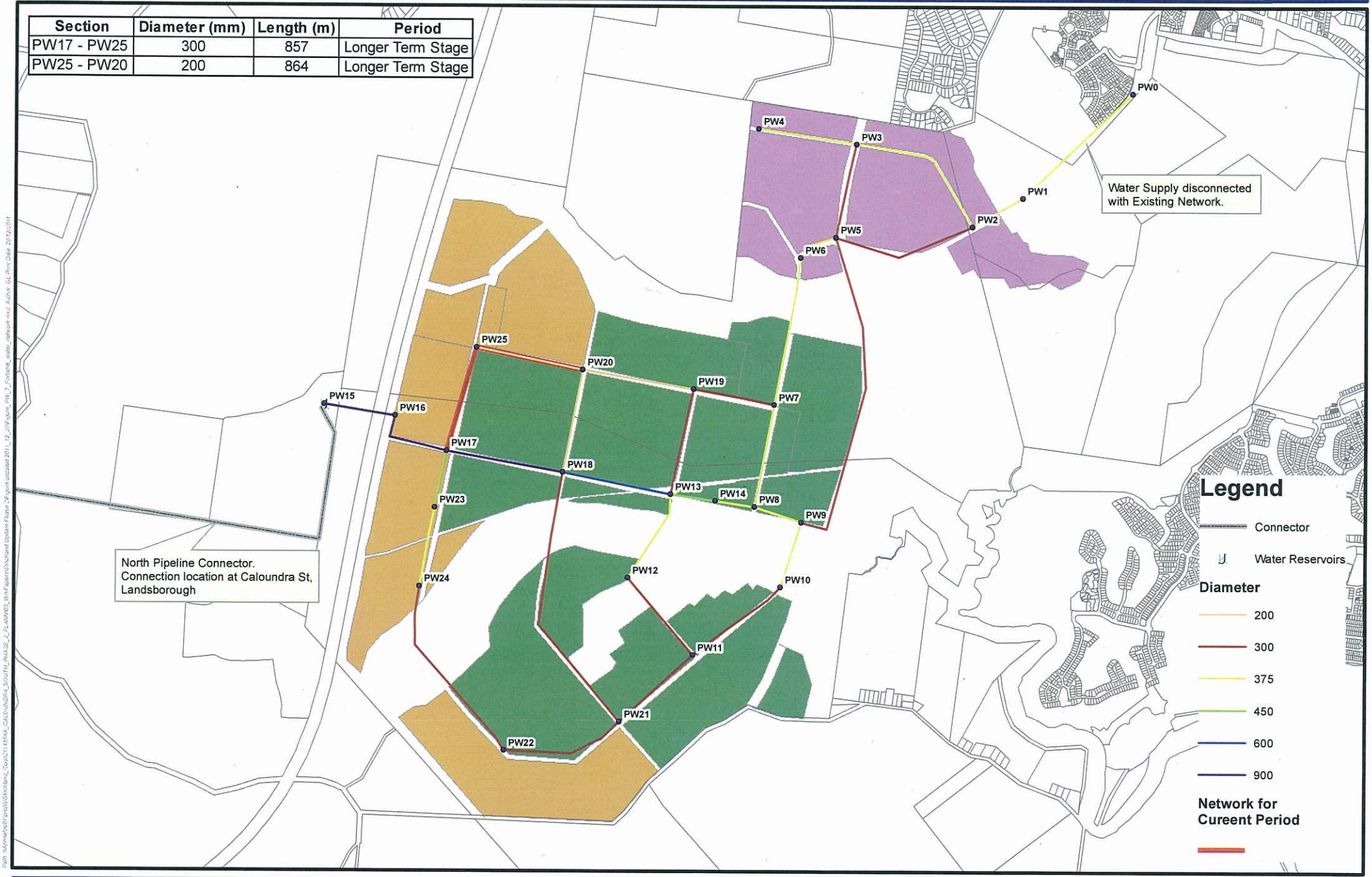
N

0 500 1,000 2,000 Meters

Potable Water Network - Longer Term Stage

Figure PW-7

Section	Diameter (mm)	Length (m)	Period
PW17 - PW25	300	857	Longer Term Stage
PW25 - PW20	200	864	Longer Term Stage



0 500 1,000 2,000 Meters

Potable Water Network - Longer Term Stage

Figure PW-8

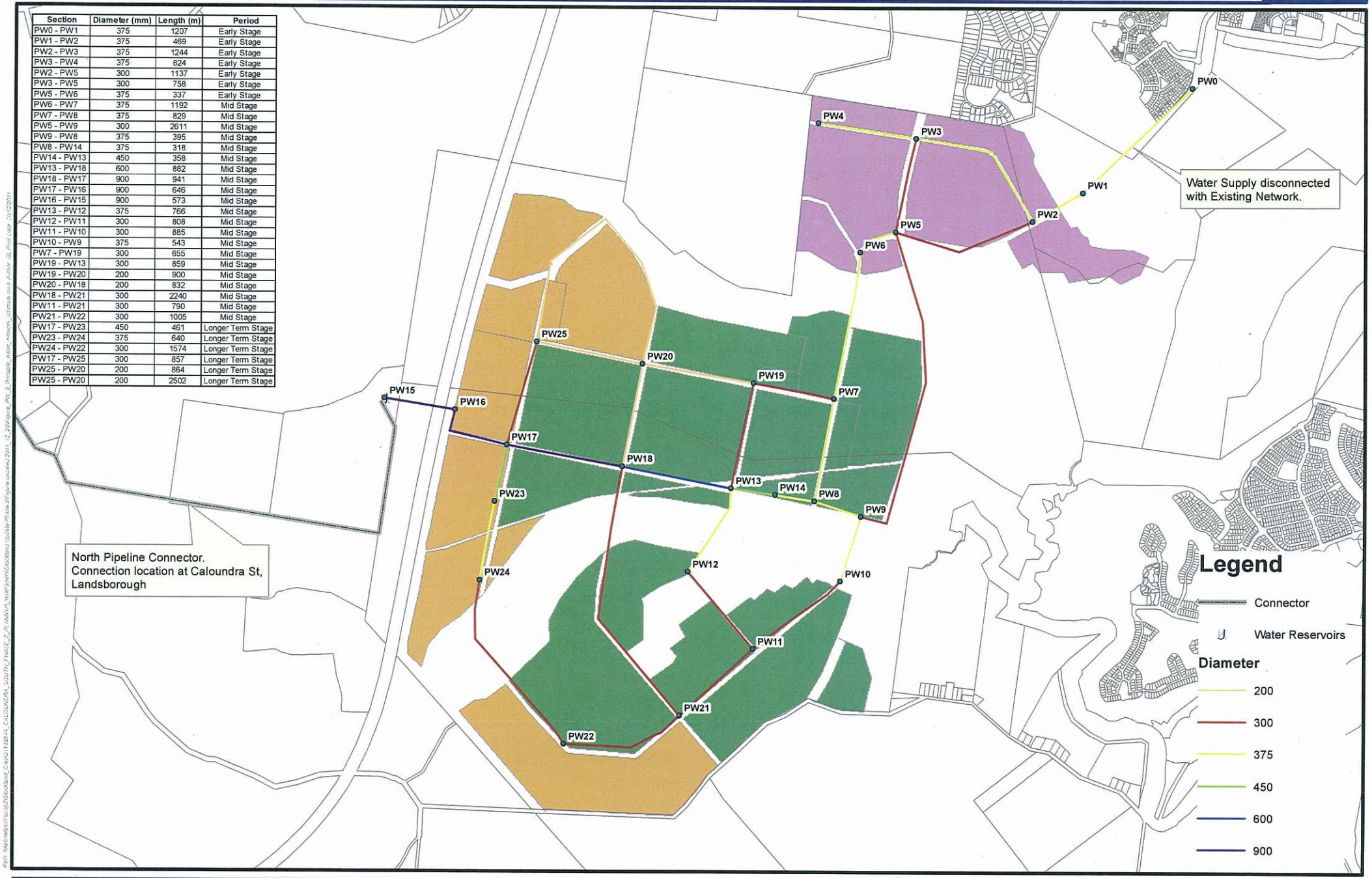
Section	Diameter (mm)	Length (m)	Period
PW25 - PW20	200	2502	Longer Term Stage

0 500 1,000 2,000 Meters

Potable Water Network - Period FY31-Ult

Figure PW-9

Section	Diameter (mm)	Length (m)	Period
PW0 - PW1	375	1207	Early Stage
PW1 - PW2	375	469	Early Stage
PW2 - PW3	375	1244	Early Stage
PW3 - PW4	375	824	Early Stage
PW2 - PW5	300	1137	Early Stage
PW3 - PW5	300	758	Early Stage
PW5 - PW6	375	337	Early Stage
PW6 - PW7	375	1192	Mid Stage
PW7 - PW8	375	829	Mid Stage
PW5 - PW9	300	2611	Mid Stage
PW9 - PW8	375	395	Mid Stage
PW8 - PW14	375	318	Mid Stage
PW14 - PW13	450	358	Mid Stage
PW13 - PW18	600	882	Mid Stage
PW18 - PW17	900	941	Mid Stage
PW17 - PW16	900	646	Mid Stage
PW16 - PW15	900	573	Mid Stage
PW13 - PW12	375	766	Mid Stage
PW12 - PW11	300	808	Mid Stage
PW11 - PW10	300	885	Mid Stage
PW10 - PW9	375	543	Mid Stage
PW7 - PW19	300	655	Mid Stage
PW19 - PW13	300	859	Mid Stage
PW19 - PW20	200	900	Mid Stage
PW20 - PW18	200	832	Mid Stage
PW18 - PW21	300	2240	Mid Stage
PW11 - PW21	300	790	Mid Stage
PW21 - PW22	300	1005	Mid Stage
PW17 - PW23	450	461	Longer Term Stage
PW23 - PW24	375	640	Longer Term Stage
PW24 - PW22	300	1574	Longer Term Stage
PW17 - PW25	300	857	Longer Term Stage
PW25 - PW20	200	864	Longer Term Stage
PW25 - PW20	200	2502	Longer Term Stage



N

0 500 1,000 2,000 Meters

Potable Water Network - Ultimate

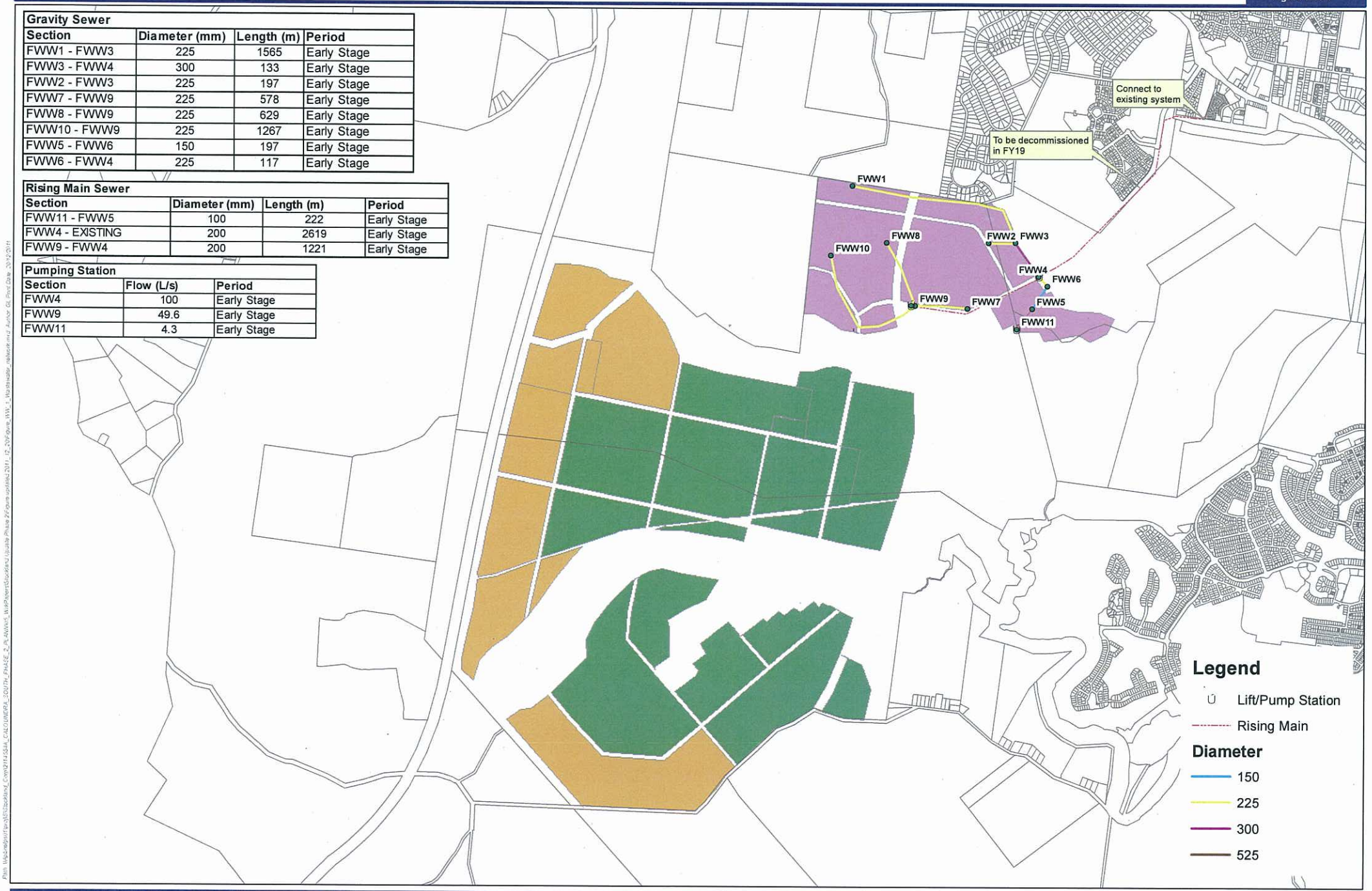
Appendix C

Wastewater Supply Network Details and Figures

Gravity Sewer			
Section	Diameter (mm)	Length (m)	Period
FWW1 - FWW3	225	1565	Early Stage
FWW3 - FWW4	300	133	Early Stage
FWW2 - FWW3	225	197	Early Stage
FWW7 - FWW9	225	578	Early Stage
FWW8 - FWW9	225	629	Early Stage
FWW10 - FWW9	225	1267	Early Stage
FWW5 - FWW6	150	197	Early Stage
FWW6 - FWW4	225	117	Early Stage

Rising Main Sewer			
Section	Diameter (mm)	Length (m)	Period
FWW11 - FWW5	100	222	Early Stage
FWW4 - EXISTING	200	2619	Early Stage
FWW9 - FWW4	200	1221	Early Stage

Pumping Station		
Section	Flow (L/s)	Period
FWW4	100	Early Stage
FWW9	49.6	Early Stage
FWW11	4.3	Early Stage



N

0 500 1,000 2,000 meters

Wastewater Network -Early Stage

Gravity Sewer			
Section	Diameter (mm)	Length (m)	Period
SWW4 - SWW3	225	391	Mid Stage
SWW3 - SWW2	300	464	Mid Stage
SWW2 - SWW1	375	453	Mid Stage
SWW6 - SWW5	225	559	Mid Stage
SWW5 - SWW3	300	313	Mid Stage
NWW10 - NWW9	750	1044	Mid Stage
NWW9 - NWW2	900	677	Mid Stage
NWW2 - NWW1	1050	1247	Mid Stage
NWW30 - NWW28	300	375	Mid Stage
NWW28 - NWW1	300	770	Mid Stage
NWW29 - NWW28	225	767	Mid Stage

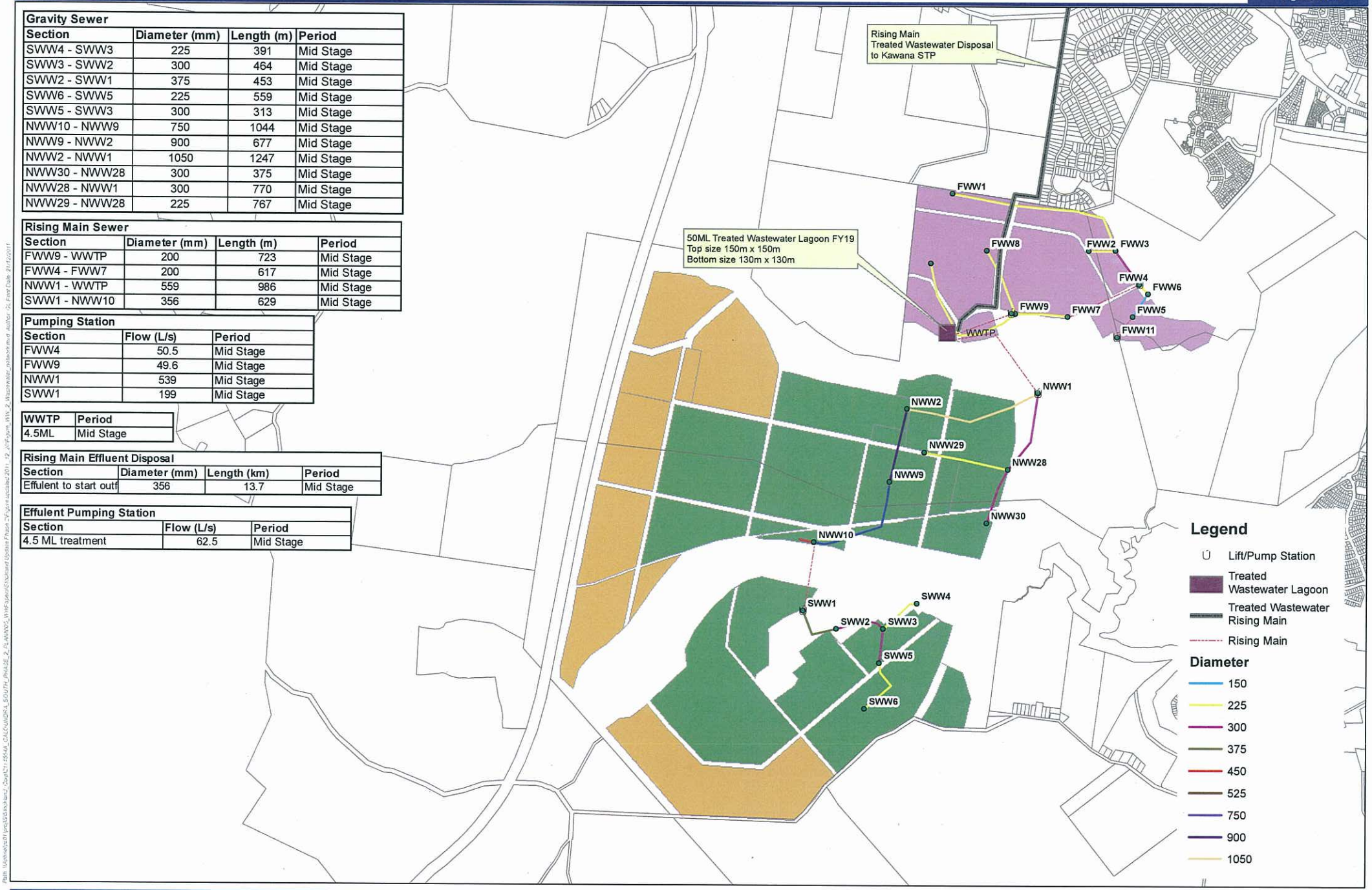
Rising Main Sewer			
Section	Diameter (mm)	Length (m)	Period
FWW9 - WWTP	200	723	Mid Stage
FWW4 - FWW7	200	617	Mid Stage
NWW1 - WWTP	559	986	Mid Stage
SWW1 - NWW10	356	629	Mid Stage

Pumping Station		
Section	Flow (L/s)	Period
FWW4	50.5	Mid Stage
FWW9	49.6	Mid Stage
NWW1	539	Mid Stage
SWW1	199	Mid Stage

WWTP	Period
4.5ML	Mid Stage

Rising Main Effluent Disposal			
Section	Diameter (mm)	Length (km)	Period
Effulent to start outf	356	13.7	Mid Stage

Effulent Pumping Station		
Section	Flow (L/s)	Period
4.5 ML treatment	62.5	Mid Stage



N

0 500 1,000 2,000 meters

Wastewater Network - Mid Stage

Gravity Sewer

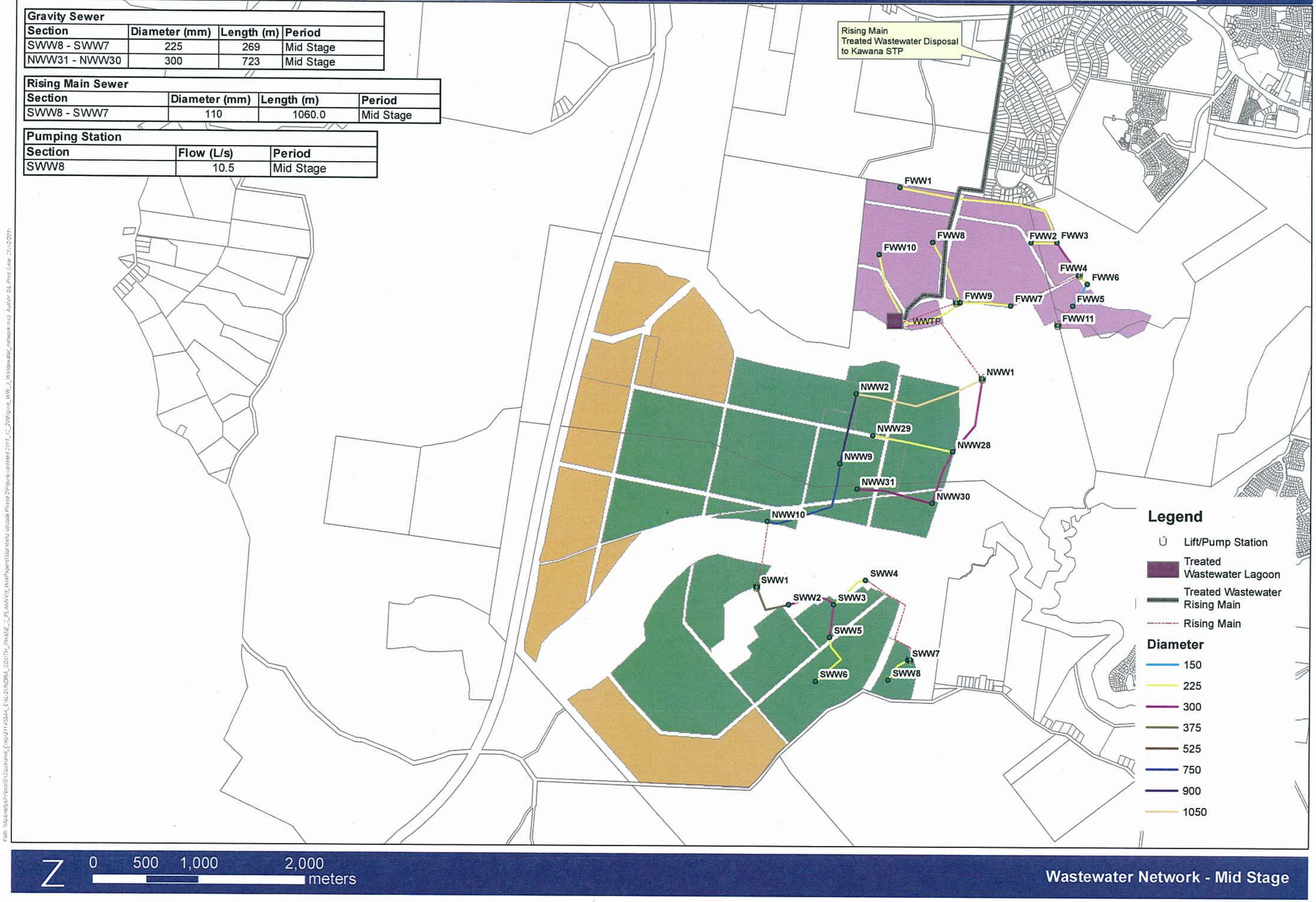
Section	Diameter (mm)	Length (m)	Period
SWW8 - SWW7	225	269	Mid Stage
NWW31 - NWW30	300	723	Mid Stage

Rising Main Sewer

Section	Diameter (mm)	Length (m)	Period
SWW8 - SWW7	110	1060.0	Mid Stage

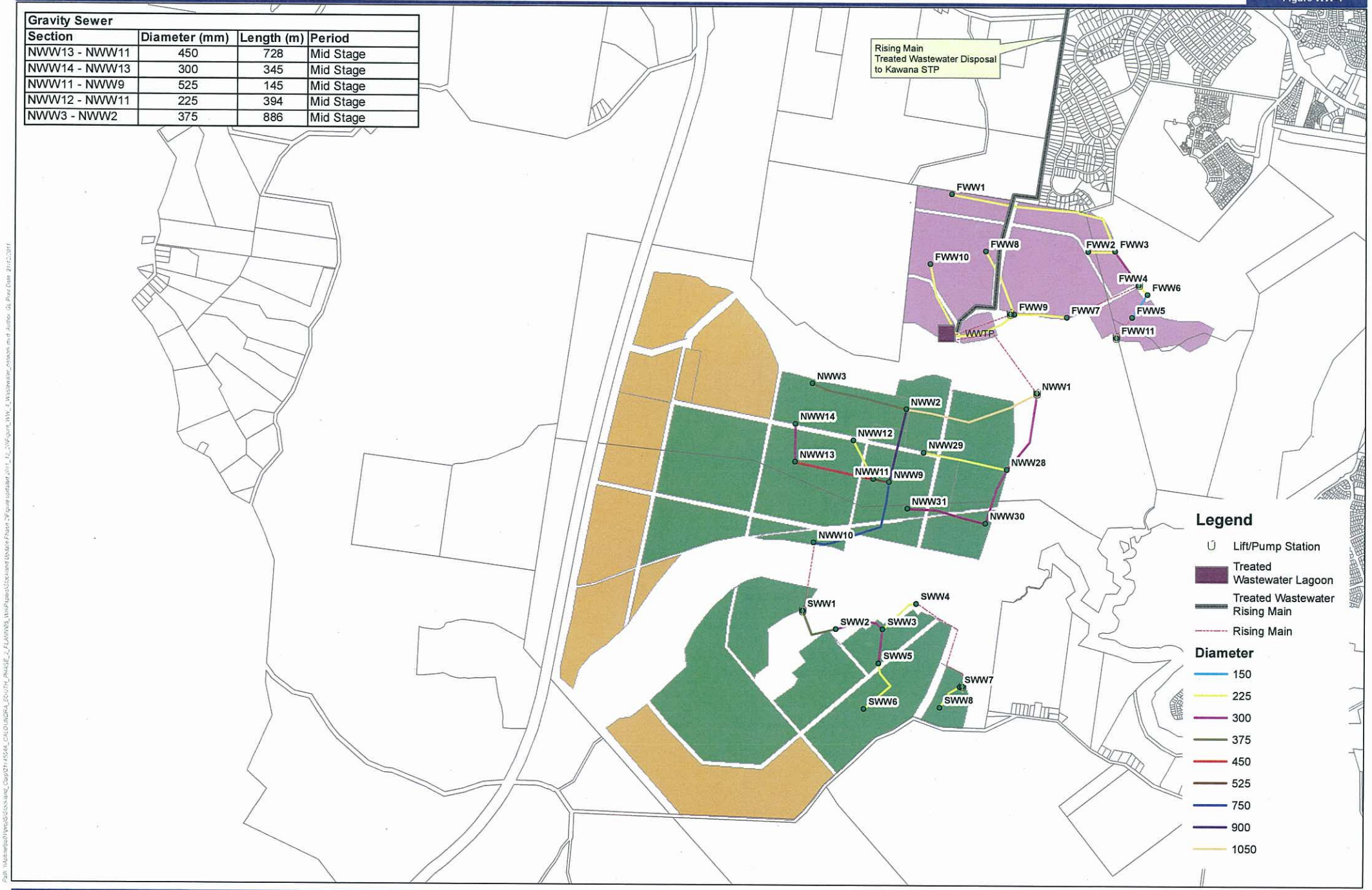
Pumping Station

Section	Flow (L/s)	Period
SWW8	10.5	Mid Stage



Wastewater Network - Mid Stage

Gravity Sewer			
Section	Diameter (mm)	Length (m)	Period
NWW13 - NWW11	450	728	Mid Stage
NWW14 - NWW13	300	345	Mid Stage
NWW11 - NWW9	525	145	Mid Stage
NWW12 - NWW11	225	394	Mid Stage
NWW3 - NWW2	375	886	Mid Stage



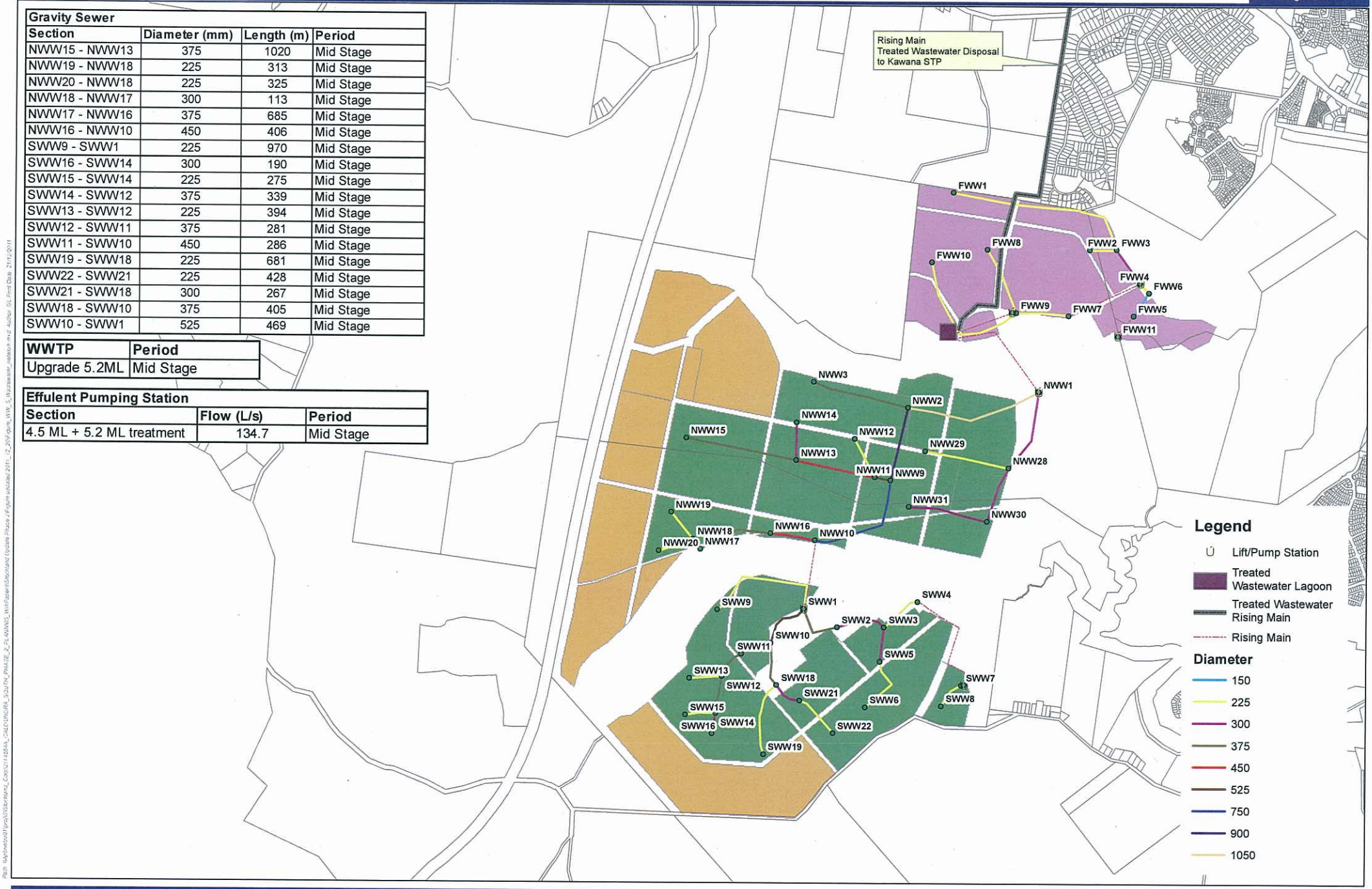
N 0 500 1,000 2,000 meters

Wastewater Network - Mid Stage

Gravity Sewer			
Section	**Diameter (mm)**	**Length (m)**	**Period**
NWW15 - NWW13	375	1020	Mid Stage
NWW19 - NWW18	225	313	Mid Stage
NWW20 - NWW18	225	325	Mid Stage
NWW18 - NWW17	300	113	Mid Stage
NWW17 - NWW16	375	685	Mid Stage
NWW16 - NWW10	450	406	Mid Stage
SWW9 - SWW1	225	970	Mid Stage
SWW16 - SWW14	300	190	Mid Stage
SWW15 - SWW14	225	275	Mid Stage
SWW14 - SWW12	375	339	Mid Stage
SWW13 - SWW12	225	394	Mid Stage
SWW12 - SWW11	375	281	Mid Stage
SWW11 - SWW10	450	286	Mid Stage
SWW19 - SWW18	225	681	Mid Stage
SWW22 - SWW21	225	428	Mid Stage
SWW21 - SWW18	300	267	Mid Stage
SWW18 - SWW10	375	405	Mid Stage
SWW10 - SWW1	525	469	Mid Stage

WWTP	Period
Upgrade 5.2ML	Mid Stage

Effluent Pumping Station		
Section	**Flow (L/s)**	**Period**
4.5 ML + 5.2 ML treatment	134.7	Mid Stage

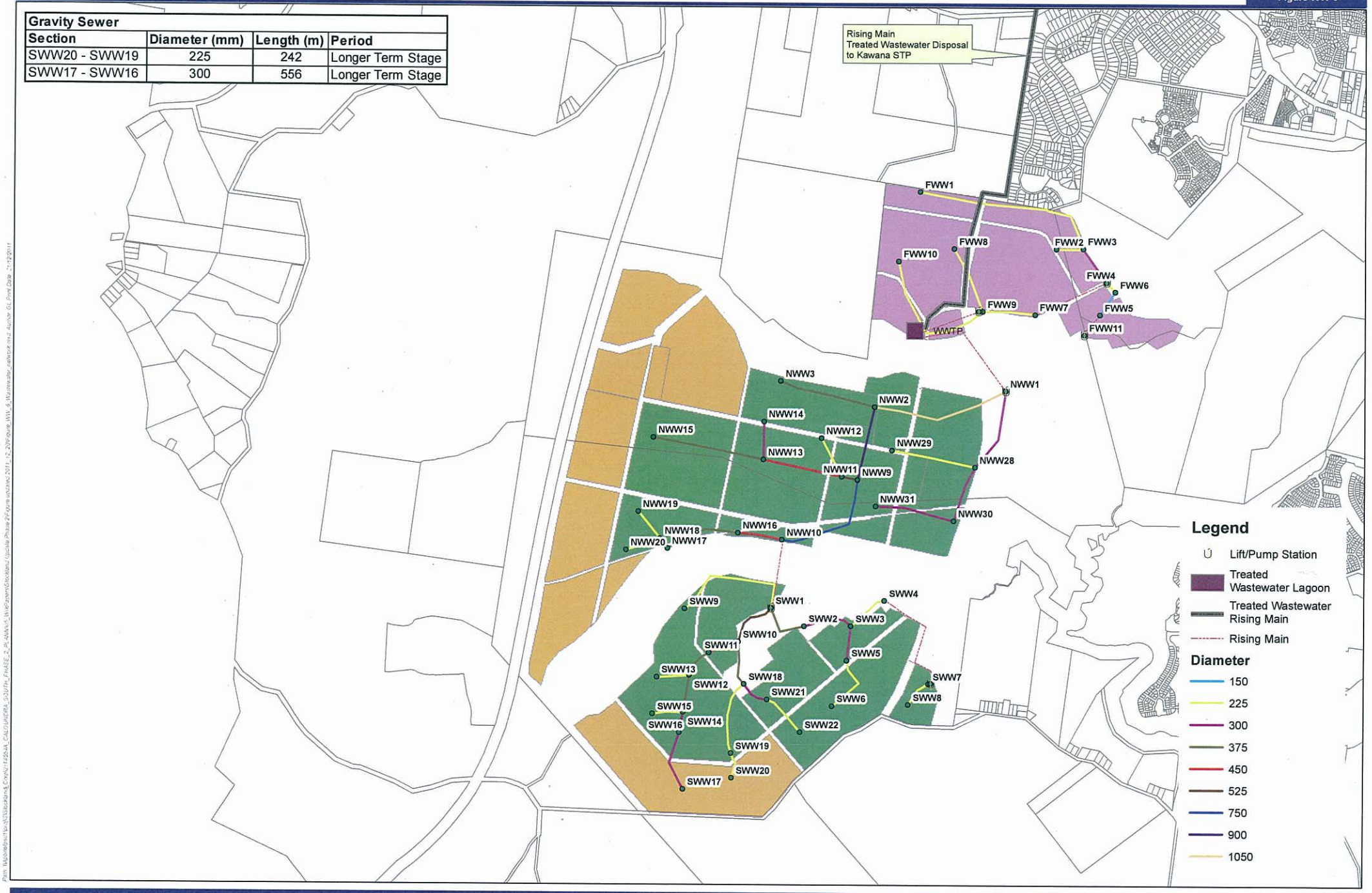


N

0 500 1,000 2,000 meters

Wastewater Network - Mid Stage

Gravity Sewer			
Section	**Diameter (mm)**	**Length (m)**	**Period**
SWW20 - SWW19	225	242	Longer Term Stage
SWW17 - SWW16	300	556	Longer Term Stage



N

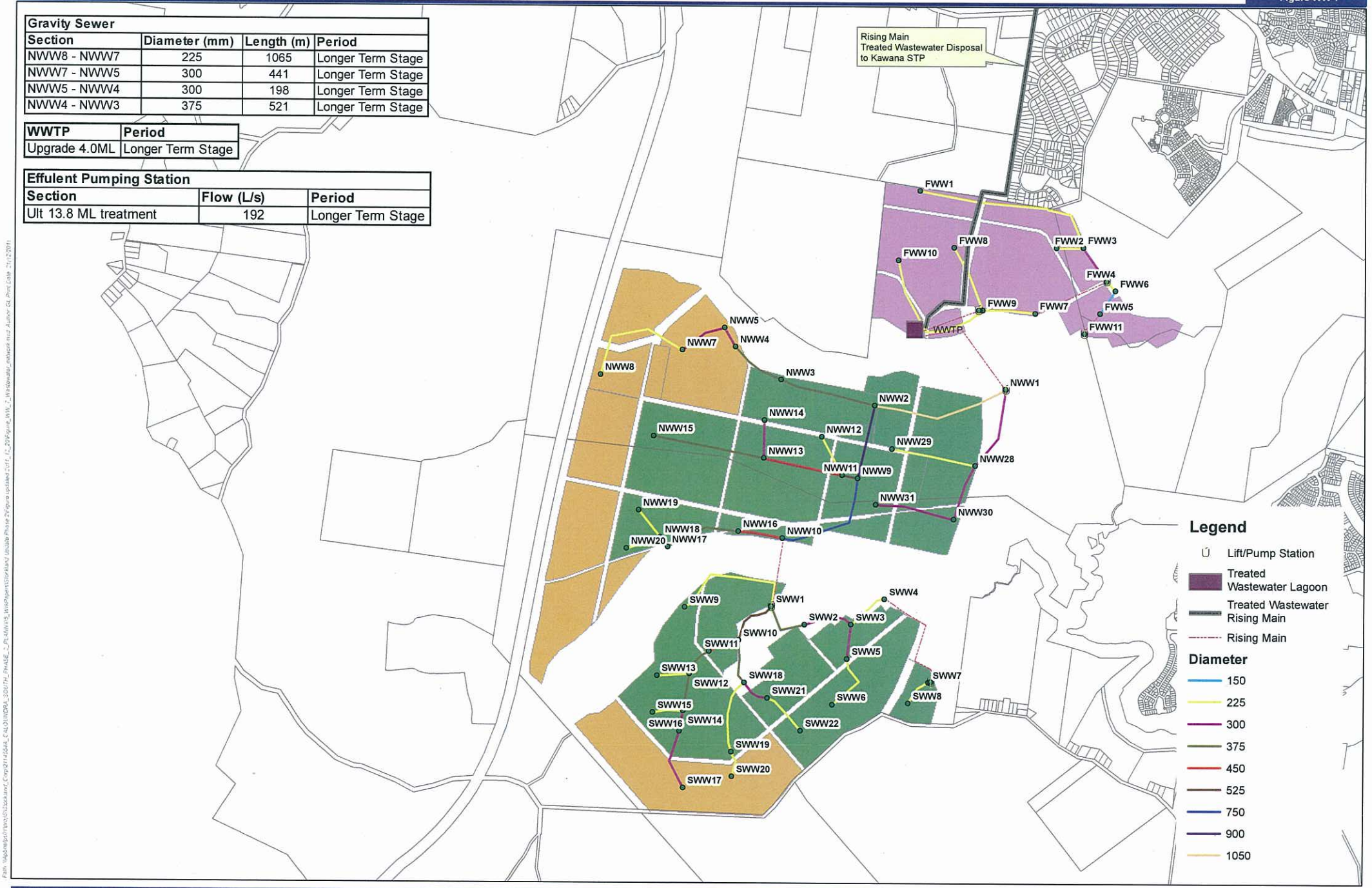
0 500 1,000 2,000 meters

Wastewater Network - Longer Term Stage

Gravity Sewer			
Section	Diameter (mm)	Length (m)	Period
NWW8 - NWW7	225	1065	Longer Term Stage
NWW7 - NWW5	300	441	Longer Term Stage
NWW5 - NWW4	300	198	Longer Term Stage
NWW4 - NWW3	375	521	Longer Term Stage

WWTP	Period
Upgrade 4.0ML	Longer Term Stage

Effluent Pumping Station		
Section	Flow (L/s)	Period
Ult 13.8 ML treatment	192	Longer Term Stage

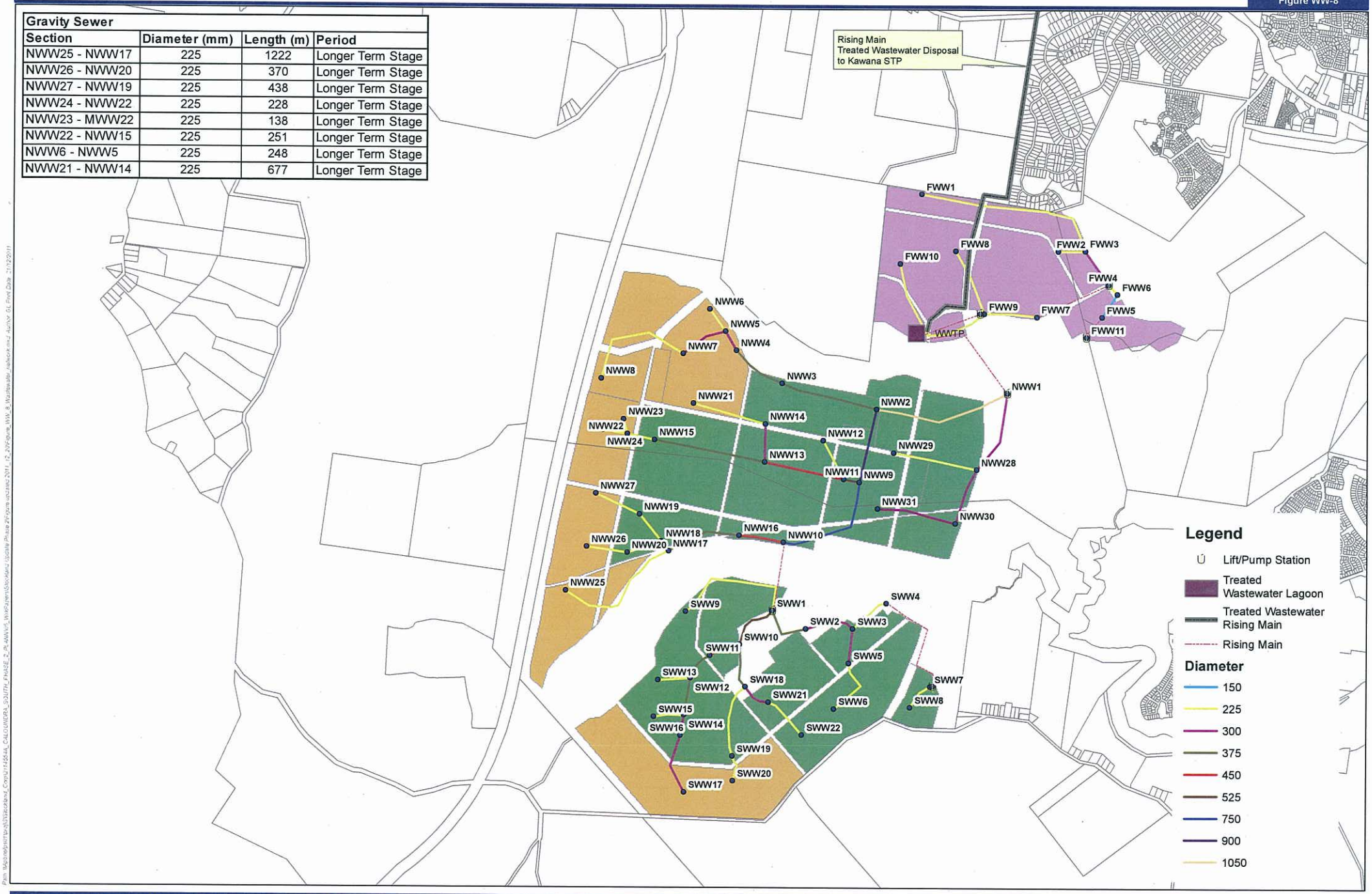


N

0 500 1,000 2,000 meters

Wastewater Network - Longer Term Stage

Gravity Sewer			
Section	**Diameter (mm)**	**Length (m)**	**Period**
NWW25 - NWW17	225	1222	Longer Term Stage
NWW26 - NWW20	225	370	Longer Term Stage
NWW27 - NWW19	225	438	Longer Term Stage
NWW24 - NWW22	225	228	Longer Term Stage
NWW23 - MWW22	225	138	Longer Term Stage
NWW22 - NWW15	225	251	Longer Term Stage
NWW6 - NWW5	225	248	Longer Term Stage
NWW21 - NWW14	225	677	Longer Term Stage



Wastewater Network - Longer Term Stage