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DRAFT REPORT

Yarrabilba Precinct 3 - Precinct Network Plan - Water and Wastewater Infrastructure

Prepared for Lendlease

September 2016

PLANS AND DOCUMENTS
referred to in the PDA
DEVELOPMENT APPROVAL

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Queensland Government

QUALITY STATEMENT

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			Prepared by	Checked by	Reviewed by	Approved by
1	16/09/2016	Internal Draft	H Lin	S O'Brien	S O'Brien	P Flint
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Lendlease

Yarrabilba Precinct 3 - Precinct Network Plan - Water and Wastewater Infrastructure

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1 Introduction

This report outlines the requirements for the water and sewerage network for Precinct 3 of the Yarrabilba development. Expected population growth and equivalent persons (EP) are assessed based on the proposed subdivision layouts (provided by Lendlease) and the occupancy rates/densities agreed with Logan City Council.

1.1 Overview

In accordance with the Yarrabilba Precinct 3 Context Planning Area Strategy (Precinct 3 CPAS) endorsed by Economic Development Queensland (EDQ), Precinct 3 is the third Precinct of Yarrabilba under the Land Agreement. Precinct 3 has a total area is 254 ha and is located to the west of Precinct 2 development (refer to Figure 1-1). The eastern boundary adjoins the Plunkett Conservation Reserve and the southern boundary is adjacent to the Powerlink power easement. It is noted that more than 60% (157 ha) of Precinct 3 have environmental and conservation values that are to be protected.

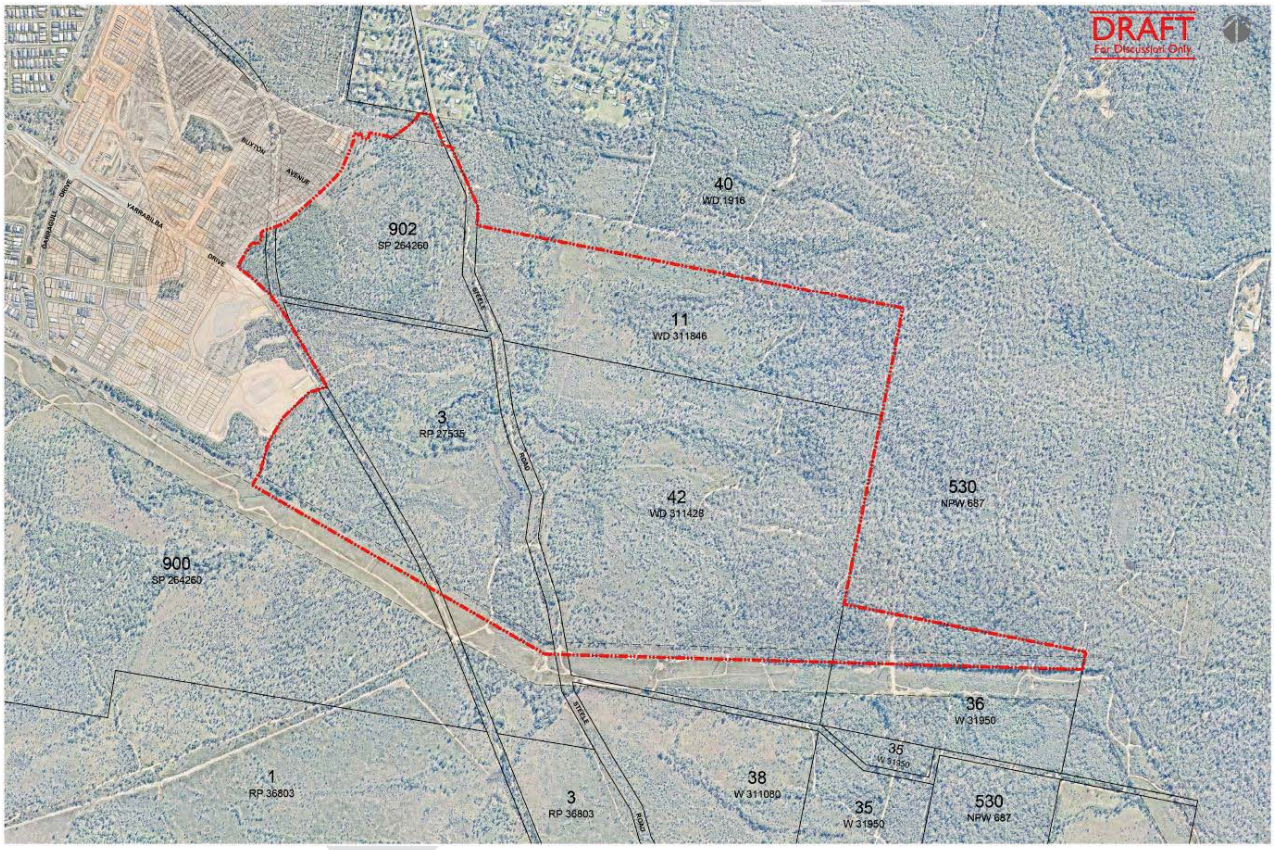

Figure 1-1: Locality of Yarrabilba Precinct 3 Development (extracted from Precinct 3 CPAS)

1.2 Precinct 3 Villages

There are four villages defined in the Precinct 3 CPAS (Figure 1-2) as follows:

- Village 3A:
  - Detached and attached residential allotments (low to medium density)
  - State high school
  - Northern part of the major sports park plus the neighbourhood recreation park
  - Childcare facility

- Village 3B and 3C:

- Detached and attached residential allotments (low to medium density)
- Small scale neighbourhood centre and community facilities in Village 3B only

- Village 3D:
  - Infrastructure purpose, with potential requirements for:
    - Electrical sub-station
    - Sewerage pumping station
    - Other utilities
  - Remaining land (assuming not all the site will be required for utility infrastructure) will be used for employment generating uses (to be determined in future) i.e. general commercial and light industry.

Figure 1-2: Precinct 3 Indicative Village Staging (extracted from Precinct 3 CPAS)

1.3 Development Timeline

Lendlease advises that the Precinct 3 development is likely to start from 2018 with a development sequence of Village 3A, followed by 3B and then 3C. This study assumes that the entire Precinct 3 development would be completed before 2021.

2 Desired Standards of Service

The Desired Standards of Service (DSOS) adopted for this assessment are in accordance with 2014 standards provided by LCC. The DSOS is provided in Appendix A and the key criteria are provided in the following sections.

2.1 Water Demand and Peaking Factors

An average day potable water demand (AD) of 165 L/EP/day plus an unaccounted for water (UFW) allowance of 25 L/EP/day was adopted.

Water supply peaking factors are summarised in Table 2-1.

Table 2-1: Potable Water Demand Peaking Factors

Peaking Factor	Residential Detached	Residential Attached	Commercial / Education	Industry
Maximum Day (MD) / AD	1.7	1.6	1.3	1.3
Maximum Hour (MH) / AD	3.1	2.6	2.0	1.7
Mean Day Maximum Month (MDMM) / AD	1.3	1.3	1.2	1.2

2.2 Water Network Design Criteria

The key criteria applied to this study are outlined in Table 2-2.

Table 2-2: Key Water Network Design Criteria

Parameter	Description
Minimum service pressure	22 m at the property boundary
Maximum service pressure	55 m
Fire flow demands	Residential: 15 L/s Non-Residential: 30 L/s
Residual pressure during fire flow event	12 m at the fire flow location
Background demand during fire	2/3 MH demand
Maximum allowable pipe headloss	5 m/km for diameter <= 150 mm 3 m/km for diameter > 150 mm

2.3 Sewerage Design Flow and Peaking Factors

An average dry weather flow (ADWF) of 165 L/EP/day is adopted for this study in accordance with the 2014 LCC DSOS. As 'Reduced Infiltration Gravity Sewers' (RIGS) are utilised in the Yarrabilba development, the peak weather flow (PWWF) was calculated based on 1,000 L/EP/day.

3 Population Projection

3.1 Approach

The expected population for Precinct 3 was calculated using the following methodology:

1. A lot count was performed for areas where the subdivision was completed and where the future layout was sufficiently detailed.
2. Terrace houses and town houses were regarded as attached residential in Precincts 1, 2 and Precinct 3A.
3. Area of residential lots in the Precinct Villages 3B and 3C are not finalised and so all residential lots are categorised as detached residential with EDQ's planning density of 2.7 EP/residential lot (*Logan South Wastewater Servicing Strategy, May 2016*).
4. Population data, provided by Lendlease (referred to as Paramics Data) was adopted for non-residential demands and future residential areas outside the Precincts 1, 2 and 3 area.
5. New population areas were developed and population assigned to each demand area according to steps 1-4 above.

The maps of the Precinct Village 3A subdivisions and draft street layout of Villages 3B and 3C are provided in Appendix B.

3.2 Paramics Area

The projected yield of each 'paramics' area of the Yarrabilba development was provided by Lend Lease for use in this study. The map of 'paramics' areas outlines the extent of future commercial, industrial, open space and varying densities of residential development within the studied area (*Revised paramics model Sept 13.xlsx*). The provided data is provided in Appendix B.

3.3 Planning Densities and Occupancy Rates

The following planning density and occupancy rates were used for estimating the equivalent persons (EP) for Precincts 1 and 2:

- Residential occupancy rates:
  - Detached dwelling: 2.8 EP/dwelling
  - Attached dwelling: 1.78 EP/dwelling.
  - Future dwelling (lot type is unknown): 2.7 EP/dwelling
- Non-residential planning densities:
  - Commercial and Industrial: 30 EP/ha (water) and 37 EP/ha (sewerage)
  - Education (Primary School): 0.25 EP/pupil and staff
  - Education (High School): 0.5 EP/pupil and staff
  - Toilet block: 1.1 EP/toilet.

3.4 Population Summary

A breakdown of the development in Precincts 1, 2 and 3 is as follows:

- Precinct 1:
  - 527 detached residential lots and 127 attached residential lots
  - District and central park: 10 toilets + 0.16 ha commercial site
  - District centre: 10.91 ha mixed use/employment site
  - Private primary school: 850 students plus 10% allowance for staff
  - Childcare: 70 pupils plus 10% allowance for staff
- Precinct 2:
  - 1,712 detached residential lots and 442 attached residential lots
  - State primary school: 1,100 students plus 60 staff
  - Private high school: 2,400 plus 10% allowance for staff

  - Private high school: 2,400 plus 10% allowance for staff
- Precinct 3 Village A:
  - 211 detached residential lots and 27 attached residential lots (including MFS lots)
  - State high school: 1,160 plus 10% allowance for staff
- Precinct 3 Village B:
  - 490 future residential lots
- Precinct 3 Village C:
  - 230 future residential lots
- Precinct 3 Village D:
  - Future employment generating uses: 10.2 ha (estimated). It is noted that the land use of Precinct 3D will be revised after a better understanding of the utility facilities is available and the remaining area for non-residential development is confirmed. This village will not proposed to be developed before 2026.

A detailed table of the population calculations can be found in Appendix B. A summary of the expected populations in Precincts 1, 2 and 3 is provided in Table 3-1 and Table 3-2.

Table 3-1: Expected Water EP within Precincts 1, 2 and 3

Precinct	Detached Residential	Attached Residential	Commercial/ Employment/ Retail/ Community	Education	Total EP
1	1,658	110	375	253	**2,396**
2	5,432	320	0	1,639	**7,391**
3A	591	48	0	1,015	**1,654**
3B and 3C	1,944	0	0	0	**1,944**
3D*	0	0	306	0	**306**
Total (without 3D)	**9,625**	**378**	**375**	**2,907**	**13,385**
Total (with 3D)	**9,625**	**378**	**681**	**2,907**	**13,691**

*: Precinct 3D will be developed after 2026 and its land use will be revised in future. These EP are included in the network sizing but not included in the short term reservoir capacity assessment.

Table 3-2: Expected Sewerage EP within Precincts 1, 2 and 3

Precinct	Detached Residential	Attached Residential	Commercial/ Employment/ Retail/ Community	Education	Total EP
1	1,658	110	460	253	**2,481**
2	5,432	320	0	1,639	**7,391**
3A	591	48	0	1,015	**1,654**
3B and 3C	1,944	0	0	0	**1,944**
3D*	0	0	377	0	**377**
Total (without 3D)	**9,625**	**478**	**460**	**2,907**	**13,470**
Total (with 3D)	**9,625**	**478**	**837**	**2,907**	**13,847**

*: Precinct 3D will be developed after decommission of interim pumping station PS3A. These EP will not be included in the pumping station PS3A catchment in the interim period. Also, Precinct 3D is to be revised in future and the future revised EP will be included in the future pumping station PS3 catchment.

4 Water Supply Network Assessment

Precinct 3 water supply will continue to be provided from the Travis Road reservoir. In the interim, supply will be provided from the South Maclean pumping station with the long term supply being provided through a new connection to the Southern Regional Water Pipeline (SRWP). Details of the ultimate supply will be determined following completion of the Seqwater regional water strategy, expected to be completed in the first half of 2017.

Pressure management areas (PMA) are proposed as the service pressure at lots with elevation lower than 40 m AHD will potentially be over 55 m, which is the maximum service pressure stated in LCC 2014 DSOS. PMA planning and proposed PMA performance are detailed in the following sections.

4.1 Demand

The maximum day (MD) and mean day maximum month (MDMM) demands of Precincts 1, 2 and 3 were calculated in accordance with the LCC 2014 DSOS. The population of Logan Village was provided by Logan Water as 1,671 EP detached residential, 1,078 EP attached residential and 341 EP non-residential at 2021. The demand is summarised in Table 4-1.

Table 4-1: Yarrabilba Demand Summary

Category	Water Demand (ML/d)			
	Yarrabilba (P1/P2/P3)		Logan Village @2021	
	MD	MDMM	MD	MDMM
Detached residential	2.70	2.06	0.47	0.36
Attached residential	0.13	0.10	0.29	0.23
Commercial	0.10	0.09	0.05	0.05
Industry	-	-	0.02	0.02
Education	0.62	0.58	-	-
Constant flow			0.03	0.02
Leakage/loss allowance	0.34	0.34	0.08	0.08
Total (ML/d)	**3.89**	**3.17**	**0.94**	**0.76**

4.2 Storage and Bulk Supply Assessment

The required reservoir volume to serve the Yarrabilba Precincts 1, 2, 3A and 3B plus 2021 Logan Village population was estimated as 2.8 ML. The existing Travis Road reservoir capacity is 3 ML and therefore sufficient capacity is available to service the Yarrabilba Precincts 1, 2 3A development as well as Logan Village 2021 demand. The storage requirement including Precincts 3B and 3C increases to 3.3 ML.

Existing trunk infrastructure upstream of the Travis Road reservoir does not have sufficient capacity for the completed Precincts 1, 2 and 3 development in the 2021 planning horizon based on LCC advice (refer to Appendix C). The existing LCC network has a capacity for the Yarrabilba development of approximately 7,000 EP. LCC advised that in the 2021 planning horizon, the existing South Maclean pumping station will be under capacity due to population growth including external areas to Yarrabilba. The construction of the bulk water main from the SRWP to Travis Road reservoir is therefore required between 2016 and 2021. The SRWP connection is to be constructed before 2020, however the construction responsibility and funding arrangement will not be defined until Seqwater complete detailed planning and a business case by around mid 2017.

LCC has provided an interim solution (refer to Appendix C) for supply to Yarrabilba Precincts 1, 2 and 3 development, to supply the development up to the provision of the SRWP connection. It is proposed that a 13 ML reservoir (ultimate capacity for Yarrabilba and associated zone) with a Minimum Operating Level (MOL) assumed to be 95 m AHD will be constructed at the Travis Road reservoir site to sustain

three consecutive maximum day demand without the reservoir falling below the minimum operating level (refer to Appendix C). It is noted that the MOL may be increased by LCC as part of the detailed planning for the reservoir. For this report, the more conservative MOL was assumed.

4.3 Precinct Water Supply Layout

The proposed water supply layout is shown in Figure 4-1. The water network for Precincts 1, 2 and non-residential lots (including the proposed State high school) of Precinct 3A will be operated as a single Pressure Managed Area (PMA 1). Precincts 3A, 3B and 3C residential lots will be zoned as a second PMA (PMA 2). Supply to PMA 1 is from the Travis Road Reservoir via the 300 mm diameter trunk main along Camp Cable Road. A 600 mm diameter trunk main augmentation will be required in Camp Cable Road following completion of Precinct 3C development.

The pressure reducing valve pit for PMA 1 is located opposite the north-western corner of the proposed Central Park. The inlet is a 300 mm diameter main. Two boundary valves are located on connections to the 600 mm diameter trunk main in Yarrabilba Drive. There are also four reticulation water mains (100 or 150 mm diameter mains) linking both sides of Yarrabilba Drive network which provide additional loops enhancing overall network security. It is noted that these four mains do not connect to the Yarrabilba Drive trunk main after PMA 1 is implemented.

The pressure reducing valve pit of PMA 2 is proposed to have a dedicated 200 mm diameter inlet main servicing the Precinct 3A development. Two other feeds are possible for this PMA and boundary valves are located on these connections.

It is noted that the supply to PMA 2 is proposed to be from the Yarrabilba Drive water trunk main. The 600 mm diameter trunk water main (section between Highlands Street and Summerview Avenue) is scheduled to be constructed along with Yarrabilba Drive Stage 2, which will not be completed until after the completion of Precinct 3. Hence PMA 2 can only be implemented following the construction of the 600 mm diameter section of trunk.

Performance of the network under both peak demand and fire flow conditions is outlined below.

4.4 Network Performance

The hydraulic performance of the PMAs was assessed against the LCC DSOS with the forecast population in the ultimate planning horizon. The following scenarios were assessed:

- Maximum Hour (MH) demand scenario
- Average Day (AD) demand scenario
- Fire Flow scenario.

4.4.1 Ultimate Performance

4.4.1.1 Maximum Hour Performance

The MH peaking factors in Table 2-1 were applied to the network AD demands. The total demands for the two PMAs is summarised in Table 4-2.

Table 4-2: PMA Maximum Hour Demand

Zone	Demand (L/s)
PMA 1 (Precincts 1 & 2 plus Precinct 3 non-res)	57.4
PMA 2 (Precinct 3 residential)	15.3

The MH network performance is shown in Figure 4-2 assuming that both PMA 1 and 2 are in place without pressure reduction. All pressures remain above the minimum required pressure of 22 m. Headloss (m/km) of each trunk and reticulation pipe meet the design standards under the SEQ Code (less than 3 m/km).

4.4.1.2 Average Day Performance

The network was assessed against the DSOS with AD background demands and without pressure management in place. The maximum pressure throughout the network is shown in Figure 4-3. Approximately 50% of the network experiences pressure higher than the DSOS maximum of 55 m. There is potential to reduce these maximum pressures by installing PRVs at the inlet to the proposed PMAs. Pressure reduction is discussed in Section 4.4.1.4.

4.4.1.3 Fire Flow Performance

Fire flow demands were assigned to the network which was then assessed against DSOS. A number of 30 L/s non-residential cases were identified, in particular to service schools in both PMAs. Fire flow was individually simulated at each location (node) within the both PMAs and the location that caused the minimum pressure across the network was identified.

Analysis under the fire flow conditions showed that all areas achieved the design criteria. A plan showing the locations of applied 30 L/s demands and worst case pressure performance in the ultimate planning horizon is provided in Figure 4-4.

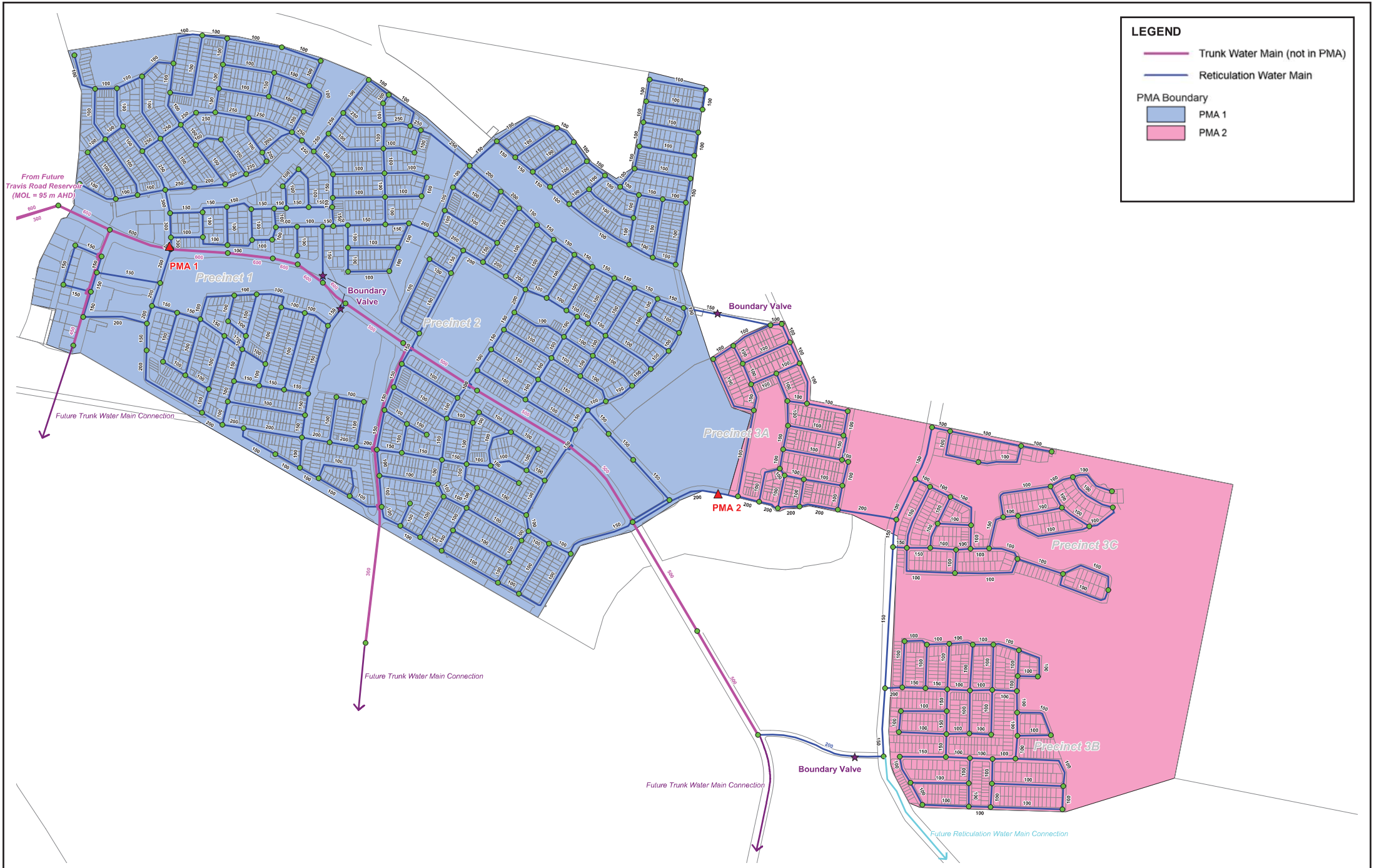

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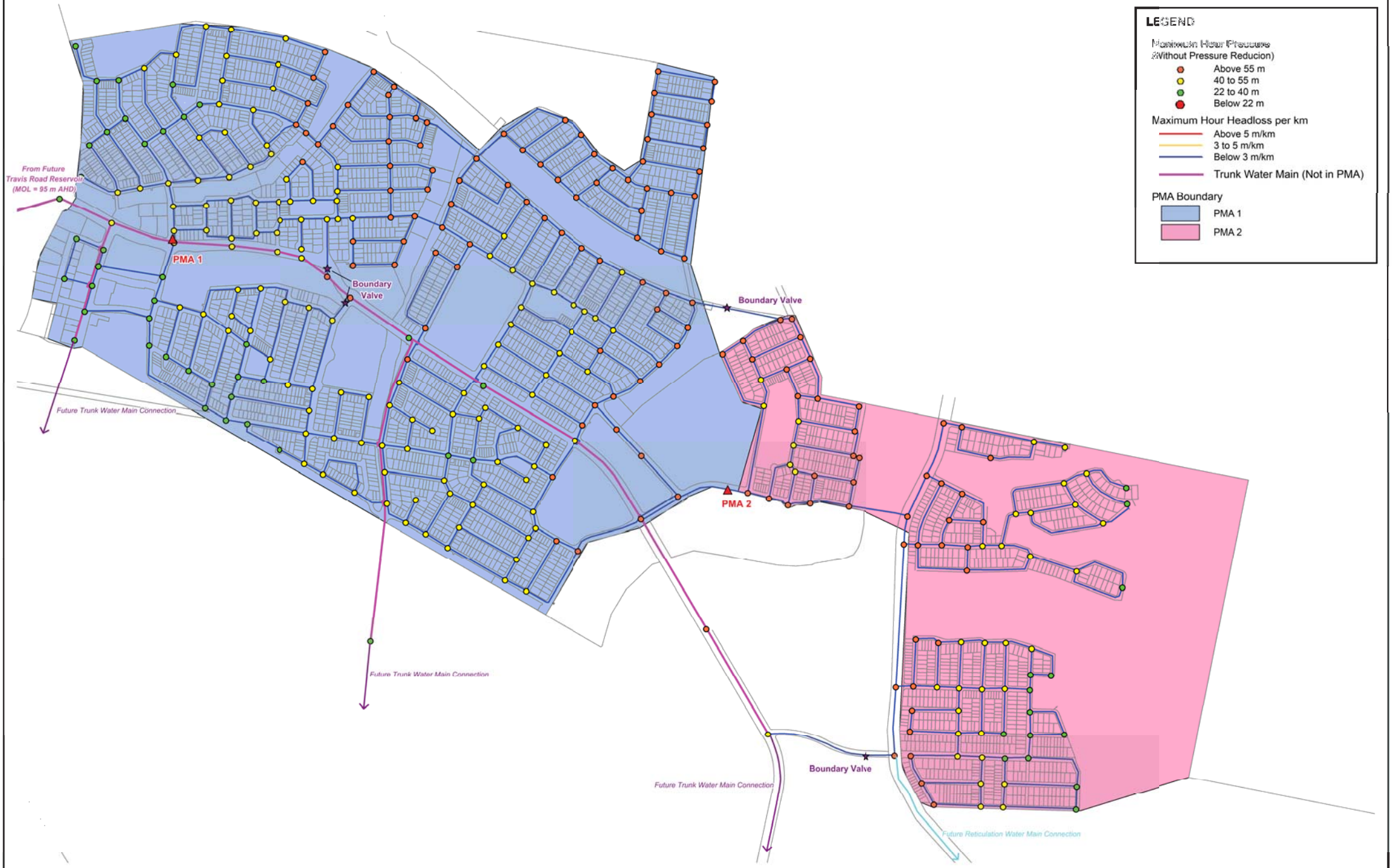
FIGURE TITLE:
LAYOUT OF YARRABILBA
ULTIMATE WATER SUPPLY NETWORK

FIGURE 4-1

FILE NAME: Yarrabilba P3_Potable Water Networks Aug 2016.wor



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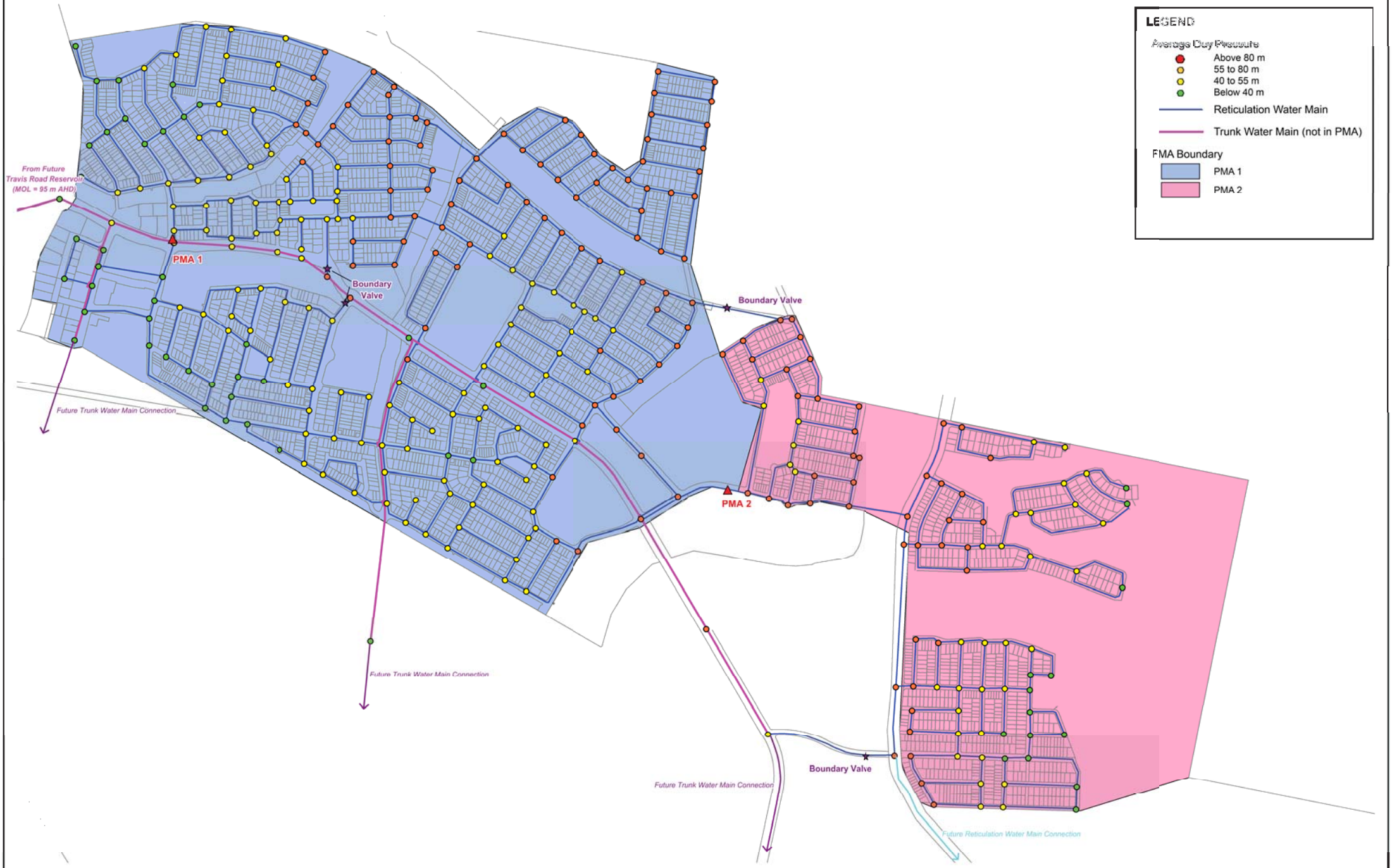

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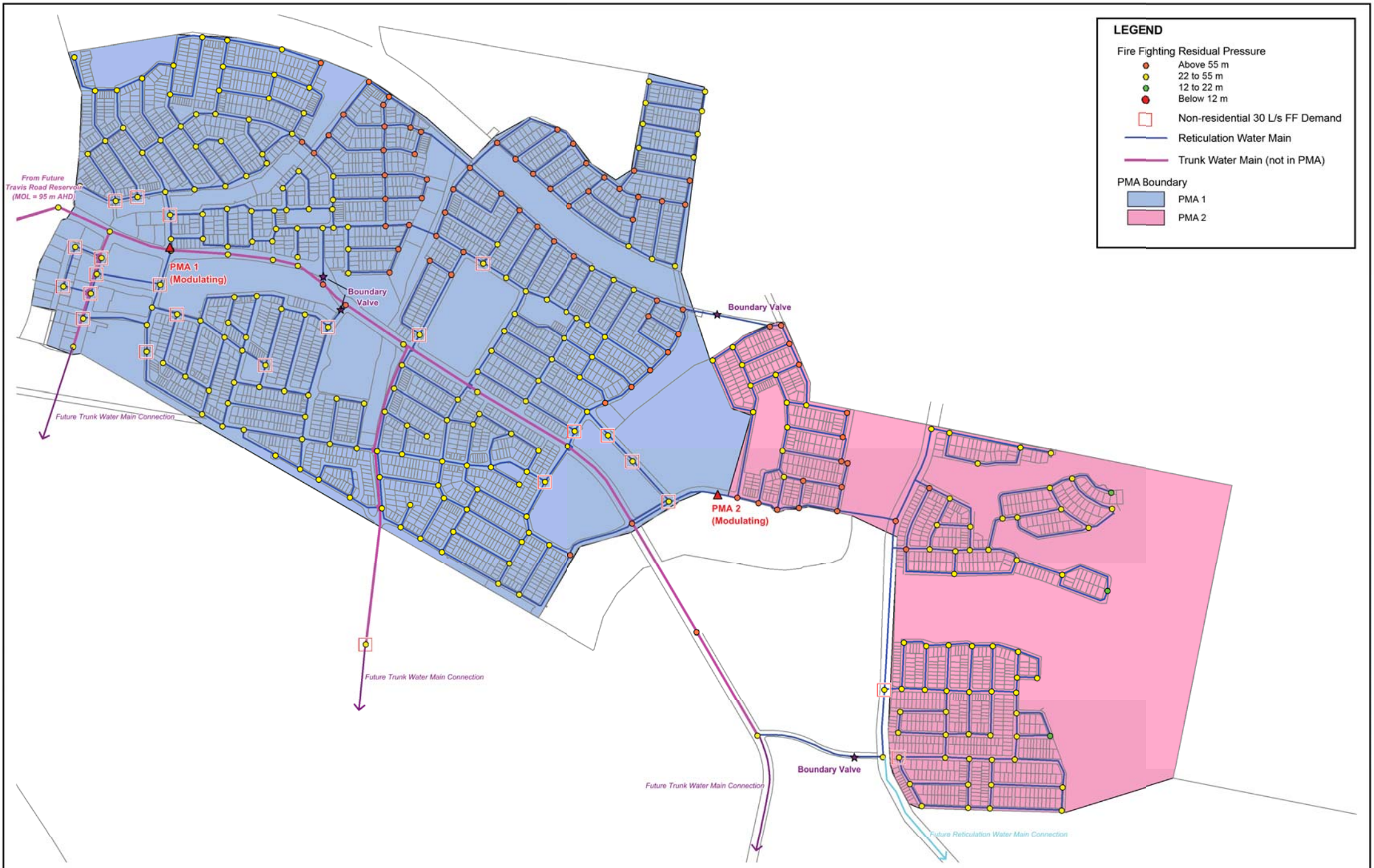

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PROJECT NAME:
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PROJECT ID: 83502580

FIGURE TITLE:
ULTIMATE FIRE FLOW NETWORK PERFORMANCE

FIGURE 4-4

FILE NAME: Yarrabilba P3_Potable Water Networks Aug 2016.wor

4.4.1.4 PMA Performance

The proposed PMAs were assessed for potential pressure reduction at the supply inlet. The following points were identified:

- Critical Pressure Point (CPP) – location of the minimum pressure within the PMA.
- Maximum Pressure Point (MPP) – location of the maximum pressure within the PMA.

PRV settings were determined to ensure that pressure at the CPP remains above the required pressure of 22 m (a minimum of 25 m assumed under all conditions). The performance of each PMA and the proposed pressure reductions are summarised in Table 4-3 and Table 4-4. It is noted that it is assumed that both PMAs will be served by the low level reservoir (MOL 95 m AHD) in future. The locations of PMA critical nodes are shown in **Figure 4-5**.

Table 4-3: PMA 1 Performance and Pressure Reductions

Minimum Static Head (m) (TWL - Highest Elevation)	During Maximum Hour Demand		During Average Day Demand		Maximum Pressure Reduction* (m)	Maximum Flow Rate at Supply Inlet (L/s)
	Pressure at CPP (m)	Pressure at MPP (m)	Pressure at CPP (m)	Pressure at MPP (m)		
41	29.1	66.9	32.4	70.6	16*	57.4

*Maximum pressure reduction is calculated based on a target pressure of 25 m which allows for any errors in the PRV control accuracy. Maximum pressure reduction is the difference between the minimum static head and target pressure of 25 m.

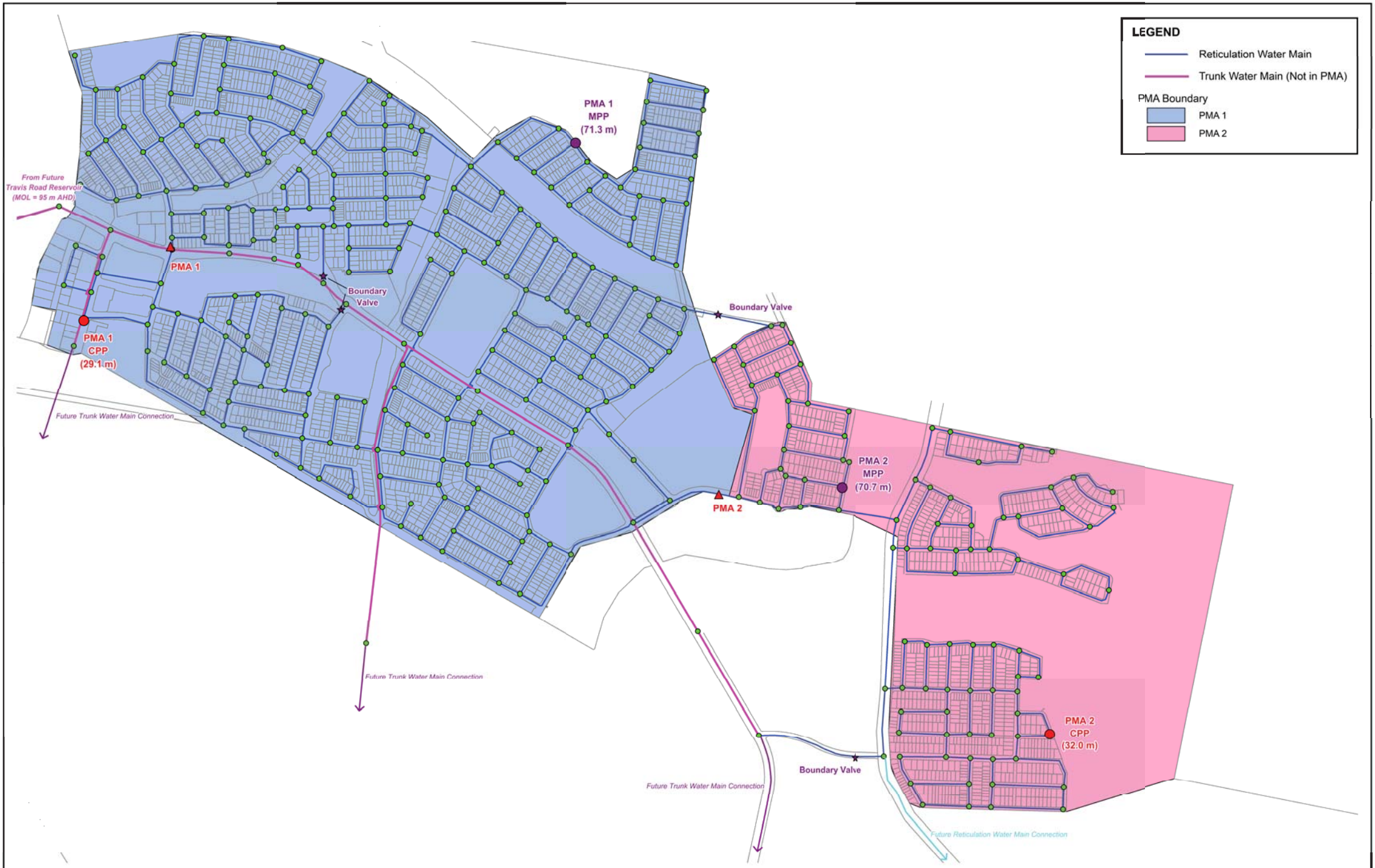
Table 4-4: PMA 2 Performance and Pressure Reductions

Minimum Static Head (m) (TWL - Highest Elevation)	During Maximum Hour Demand		During Average Day Demand		Maximum Pressure Reduction* (m)	Maximum Flow Rate at Supply Inlet (L/s)
	Pressure at CPP (m)	Pressure at MPP (m)	Pressure at CPP (m)	Pressure at MPP (m)		
47	31.7	64.8	37.9	69.8	22*	15.3

*Maximum pressure reduction is calculated based on a target pressure of 25 m which allows for any errors in the PRV control accuracy. Maximum pressure reduction is the difference between the minimum static head and target pressure of 25 m.

The assessment shows that there is potential for maximum pressure reduction of around 7.5 m and 12.9 m in PMA 1 and PMA 2 respectively during average demand conditions and up to 16 m and 25 m during low demand periods at night. With pressure reduction in place for the proposed zone, the maximum target pressures outlined in the DSOS can be achieved throughout most of the PMAs. There are small area around the MPP of each PMA that will remain up to 5 m above the target of 55 m.

Both proposed PRVs will need to be modulated to ensure that fire flows can be met.



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5 Sewerage Network

5.1 Overview

Sewage from the western part of Precinct 3A will be collected by existing gravity sewers servicing Precincts 1 and 2 to pumping station PS 2, which transfers through the existing 200 mm diameter rising main to pumping station PS 1. This pumping station transfers sewage via a 300/375 mm diameter rising main to LCC's Logan Village pumping station (PS LV) and then to Chambers Flat and ultimately to the Loganholme sewerage treatment plant (STP).

Sewage from the eastern part of Precinct 3A and Precincts 3B and 3C will gravitate to an interim pumping station, PS 3A, located in the Precinct 3D area to the west of Yarrabilba Drive. The interim pumping station will be replaced in future by the ultimate pumping station PS 3, which is proposed to service approximately 46,500 EP. The interim pumping station transfers flows to PS 1 and then to LCC's wastewater network. Locations of pumping stations PS 1, PS 2 and PS 3A and the catchment boundary is shown in Figure 5-1.

Recently EDQ, in conjunction with LCC and developer stakeholders, has developed a revised sewerage strategy for the Yarrabilba and Park Ridge areas. Based on the strategy outlined in EDQ's report "Logan South Wastewater Servicing Strategy" dated 27 May 2016 (EDQ Logan South report), a new regional sewage treatment plant will be constructed to the west of Logan Village before 2021. The strategy also includes the provision of a wet weather storage facility at PS1 to ensure that the existing LCC sewerage network has capacity to transfer flows from the Yarrabilba up to 2021, assuming a development growth of around 600 lots per year.

Based on the preferred regional sewerage strategy, the PS1 storage is required to provide sufficient time for a regional STP to be constructed to the west of Logan Village. The preferred strategy concludes that building any further infrastructure to the north of Logan Village to serve Yarrabilba growth would not be cost effective. Therefore a 2.0 ML storage is being constructed adjacent to PS1. Although the EDQ Logan South report states that the storage will be temporary infrastructure, it is believed that the storage should be included as permanent infrastructure, as it will delay future upgrades between Yarrabilba and Logan Village and provide wet weather storage over and above the required standard into the future.

5.2 Sewerage Design Flows

The ADWF and PWWF for Precincts 1, 2, and 3 based on the agreed DSOS (refer to Section 2.3) are summarised in Table 5-1 and Table 5-2.

It is noted that sewage from the initial stages of Village 3A will gravitate to pumping station PS 2. Later stages of Village 3A as well as Villages 3B and 3C will be collected at the interim pumping station PS 3A and transferred through a temporary 250 mm diameter rising main to PS 1. It is proposed that the capacity of the interim station PS 3A will be sufficient to service all of gravity flows from Precinct 3 under the dry weather condition. During wet weather events, the 2 ML wet weather balancing storage is needed to store the excess wet weather flow as the interim solution of Yarrabilba Precincts 1 to 3 development.

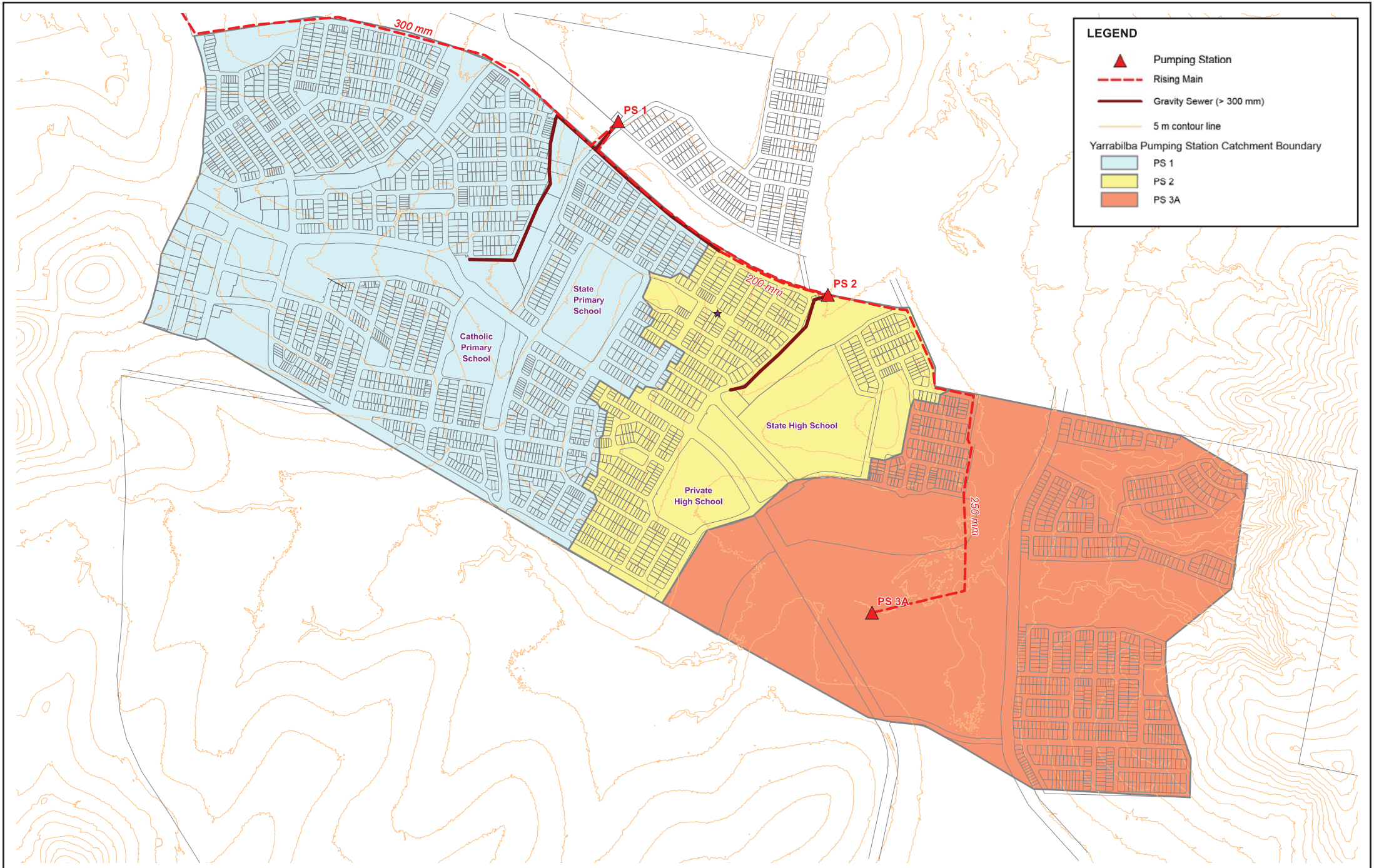
Table 5-1: Precincts 1, 2 and 3 Sewerage Design Flows Summary (by Precinct)

Precinct	EP	ADWF (L/s)	PWWF (L/s)
Precinct 1	2,481	4.7	28.7
Precinct 2	7,391	14.1	85.6
Precinct 3 (Without 3D)	3,598	6.9	41.6
Total	**13,470**	**25.7**	**155.9**

Table 5-2: Precincts 1, 2 and 3 Sewerage Design Flows Summary (by Pumping Station)

Pumping Station	EP	ADWF (L/s)	PWWF (L/s)
PS 1 (local catchment)	7,145	13.6	82.7
PS 1 (including PS 2)	11,274	21.5	130.5
PS 1 (including PS 2 and PS 3A)	13,470	25.7	155.9*
PS 2 (local catchment)	4,008	7.7	46.4
PS 3A (interim station)	2,318	4.4	26.8

*: PWWF to PS1 is larger than PS1 current capacity. A wet weather flow storage is proposed to store the excess wet weather flow. Details are provided in the Section 5.3.



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MWH now part of Stantec

Lendlease
Communities

LENDLEASE REFERENCE

PROJECT NAME:
YARRABILBA DEVELOPMENT

PROJECT ID: 83502580

FIGURE TITLE:
YARRABILBA SEWERAGE PUMPING STATION CATCHMENT

FIGURE 5-1

FILE NAME: Yarrabilba P3_Sewerage Catchment Sep 2016.wor

5.3 External Network Constraints and Interim Solution

As outlined in the EDQ Logan South report, the existing LCC sewerage network has a number of capacity constraints between the Yarrabilba and the Loganholme STP. The key existing assets that will be impacted by the additional flows from Precinct 3 are:

- PS LV, Logan Village pumping station with current capacity of 98 L/s: Capacity will be exceeded by around October 2018
- 375 mm diameter sewer receiving flows from the Logan Village rising main (capacity of 120 L/s): Capacity will be exceeded around February 2019.

As the new regional sewage treatment plant is scheduled to be constructed by 2021, the provision of a wet weather balancing storage at the Yarrabilba PS1 site is proposed by the EDQ Logan South report as the interim sewerage service solution for the Yarrabilba development. The function of the wet weather balancing storage is to store wet weather flows that are in excess of the available capacity in the transfer system between Yarrabilba and Chambers Flat. Stored wet weather flows would be pumped by the Yarrabilba PS1 and back to the existing LCC network during off peak periods.

5.3.1 PS 1 Wet Weather Storage Required Timing

To determine the required year for construction of the storage, the Yarrabilba growth was forecast based on lot sales and dwelling completion data since 2014. This growth rate was assumed to be approximately 600 lots per year based on growth over the past two years. Residential development in Precincts 1 and 2 (9,872 EP) is forecast to be fully occupied by December 2019. Precinct 3 residential development and part of Precinct 5 will be either complete or substantially complete by 2021.

Based on recent discussions with LCC, the capacity of the Logan Village PS available for Yarrabilba is limited to:

- 82.6 L/s in 2016
- 66.3 L/s in 2021.

It is noted that this capacity assumes PWWF for existing Logan Village development of 1,300 L/EP/d and a lower design flow of 1,000 L/EP/d for the new development in the corridor.

The required timing for the PS 1 storage is shown in Figure 5-2, and depends on the assumed PWWF generated by Yarrabilba:

- If the design flow rate is assumed to be equal to the design standard of 1,000 L/EP/d then the storage will be needed in middle of 2018.
- If the design flow rate is based on the performance of the system during 2015 storms then the PWWF reduces to 680 L/EP/d and the timing would be delayed to late 2019.

It is noted that Lendlease are proposing to construct the storage over the next six months, in conjunction with civil works for Precinct 2 Village 5, with completion before March 2017.

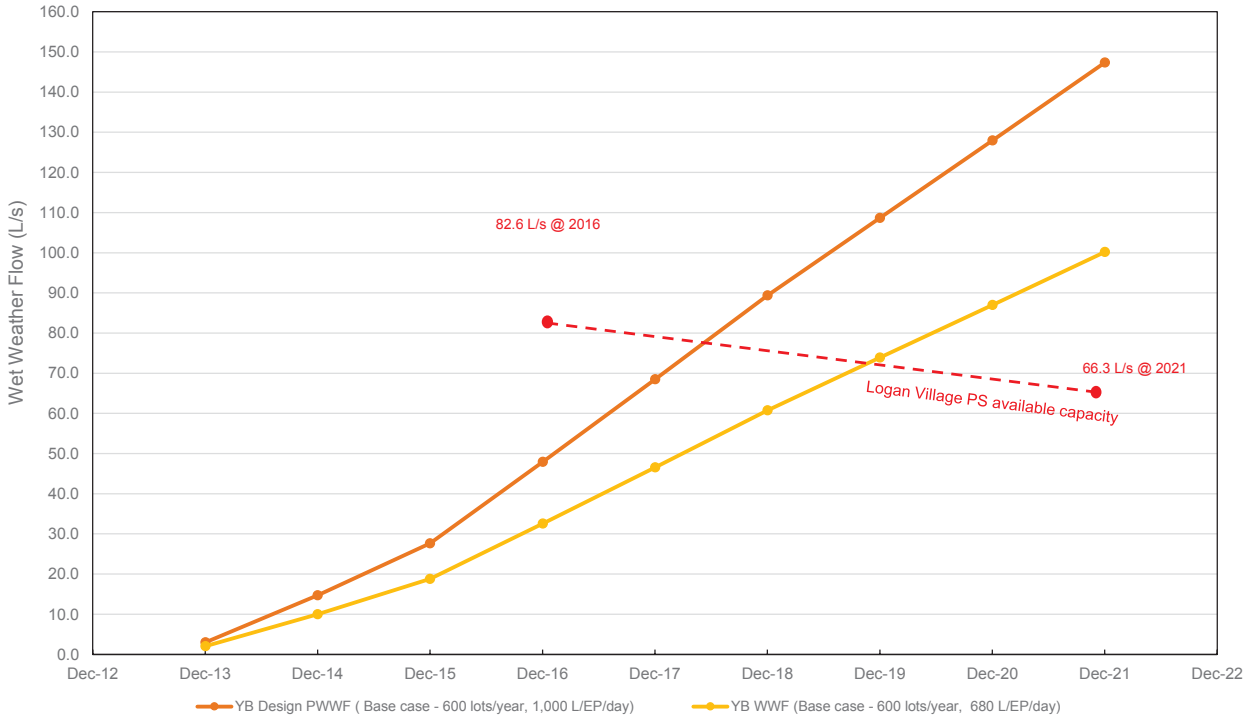


Figure 5-2 : Capacity of Transfer System from Yarrabilba to Chambers Flat

5.3.2 Sizing of Wet Weather Balancing Storage

LCC stipulated that the storage should be sized to cater for the wet weather flows generated by a 12 month storm event. MWH provided the following detailed sizing assessment for the storage to both EDQ and LCC for approval and comment. It was agreed that the storage should be sized at 2.0 ML and the design has progressed for construction over the next 6 months.

The following sections detail the sizing of the storage.

5.3.2.1 Wet Weather Data

Lendlease undertook a flow survey from January to May 2016 aimed at capturing storm response data for the existing system. This data was to be used to calibrate the wet weather response, however up to the middle of May there were no significant wet weather events at Yarrabilba and therefore the calibration could not be undertaken.

As an alternative, available SCADA data (provided and derived by LCC) from storms that occurred between February and May 2015 has been used to estimate the performance of the future network. The average recurrence interval (ARI) of the four wet weather events that occurred during this period were analysed in accordance with the Design Rainfall Intensity Chart from Bureau of Meteorology web site (refer to Figure 5-3):

- Event 1 (20/02/2015 0:15 to 20/02/2015 17:45)
    - 80.4 mm rainfall over 17.5 hours
    - ARI is slightly lower than 12 months
    - Catchment was dry
    - Long duration event and low intensity
- Event 2 (01/04/2015 01:15 to 01/04/2015 09:15)
    - 56.8 mm rainfall over 8 hour
    - ARI is slightly lower than 12 months
    - Catchment was dry
    - Short duration intense event
- Event 3 (02/04/2015 18:15 to 03/04/2015 07:15)

- 56.4 mm rainfall over 13 hours
- ARI is lower than 12 months
- Catchment was wet (the day after Event 2)
- Long duration event and low intensity

- Event 4 (01/05/2015 08:45 to 01/05/2015 23:15)
  - 184 mm rainfall over 14.5 hours
  - ARI is greater than 100 years
  - Catchment was wet
  - Short duration high intensity event

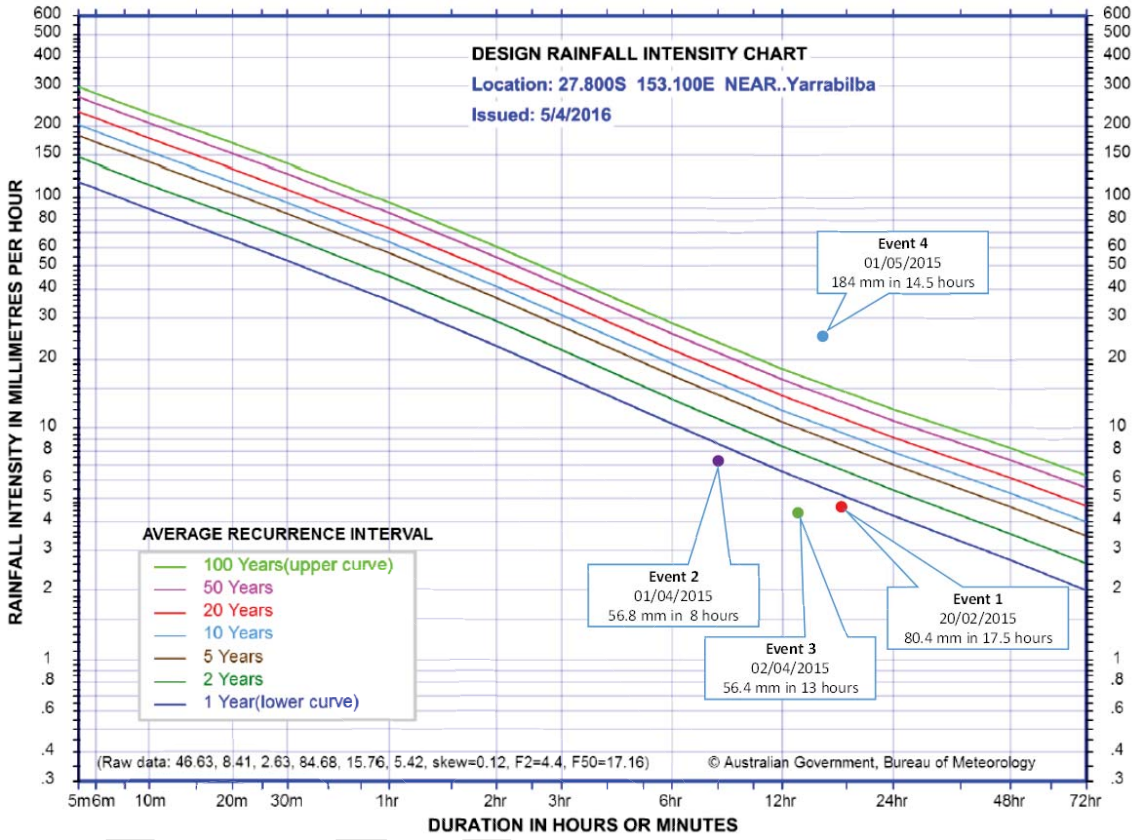


Figure 5-3 : 2015 Storm Event ARI Analysis

Analysis of Events 1 to 3 indicate that the return period was approximately 12 months. Logan Water Alliance (LWA) analysed the response based on pump operational data to derive an outflow hydrograph of Yarrabilba pumping station PS1. This approach provides a reasonable, if slightly conservative, estimate of the outflow which has been adopted for as the basis of calculations of storage volume.

LWA has suggested that a minimum rate of 3 x ADWF should be adopted. The reason given for this assumption was that the WWTP has a capacity of 3 x ADWF with any higher flows being bypassed to the Logan River. This approach lacks any logical connection to the operation of the Yarrabilba storage. The agreed available downstream capacity of 66.3 L/s in 2021 is therefore adopted for calculations of the storage size.

5.3.2.2 Adopted Hydrographs for 2021

To convert the 2015 storm response hydrographs to future 2021 design hydrographs, the following assumptions/methodologies are adopted:

- Dry weather flow was developed as follows:
  - Assumed 2015 residential population of 1,526 EP (565 occupied residential house) based on regular lot counts undertaken on site by Lendlease
  - Population to be served at 2021 of 12,729 EP

  - Dry weather pattern 2015 as provided by LWA (derived from PS1 SCADA)
  - Future dry weather flow component assumed to be 2015 patterns multiplied by the ratio of future population and 2015 residential population (12,729 / 1,526 = 8.34)

- Wet weather flow was derived through as follows:
  - 2015 wet weather response hydrograph was determined by removing the dry weather hydrograph
  - Catchment area served at the time of the storm events was calculated as 24.21 ha (Precinct 1 Northern and Southern Villages), including:
    - 20.94 ha of occupied residential houses
    - 0.25 ha of childcare centre
    - 1 ha of catholic primary school site
    - 2 ha of non-residential based on an assumed 20% of Precinct 1 retail, commercial and employment sites
  - The 2021 sewerage catchment area was calculated as approximately 191.9 ha including:
    - 119.9 ha of Precincts 1 and 2 residential lots (2,995 lots or 8,087 EP)
    - 9.4 ha of Precinct 3A residential lots (234 lots or 632 EP)
    - 48.6 ha from other residential lots (estimated based on the EP density of 67.5 EP/ha and remaining 3,280 future EP)
    - 0.25 ha from the childcare centre site
    - 2 ha from Catholic primary school site (50% developed)
    - 1.7 ha from State primary school site (25% of overall site)
    - 10 ha of other retail, commercial and employment sites
  - It is noted that the future state and private high schools sites (refer to Figure 5-1) are not included in the future catchment area calculation as these schools will not be in operation until after December 2021.
  - The 2021 wet weather flow hydrograph was derived by up-scaling the 2015 wet weather flow response hydrograph using an area served ratio of 7.9 (191.9 ha / 24.2 ha). This methodology was adopted based on the general industry approach of estimating the wet weather flow of future greenfield development assuming that I/I would be similar to the existing catchments and the wet weather response is proportional to the catchment area.

- A design hydrograph was then derived by combining the future dry and weather flow components at each time interval.

5.3.2.3 Storage Sizing for 2015 Storm Events

The calculation of storage required was undertaken using a simple water balance model, assuming that flows greater than 66.3 L/s are stored. It was also assumed that the stored volume is transferred to Logan Village when the inflow to PS1 falls below 66.3 L/s. The volumes required to be stored are shown in Table 5-3.

The accumulated stored volume for each time interval was calculated and the maximum stored volume for each of the storm events is provided in Figure 5-4.

Table 5-3: Calculated Stored Volumes for 2015 Storm Events

Event	ARI	Stored Volume (kL)
Event 1	Approximately 1 in 12 months	1,639
Event 2	Approximately 1 in 12 months	171
Event 3	Approximately 1 in 12 months	1,502

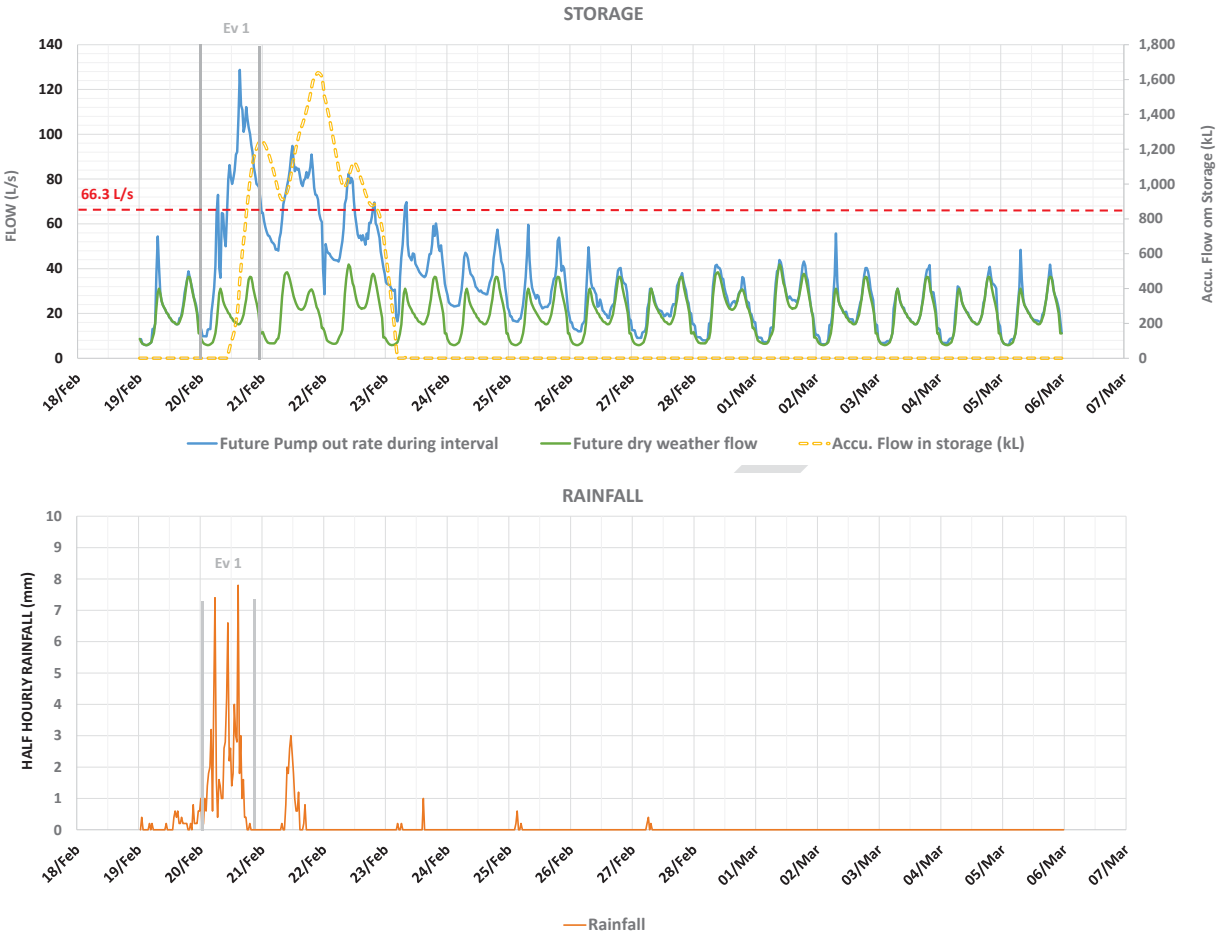


Figure 5-4 : Wet Weather Balancing Storage Estimate Based on 2015 Storm Event 1

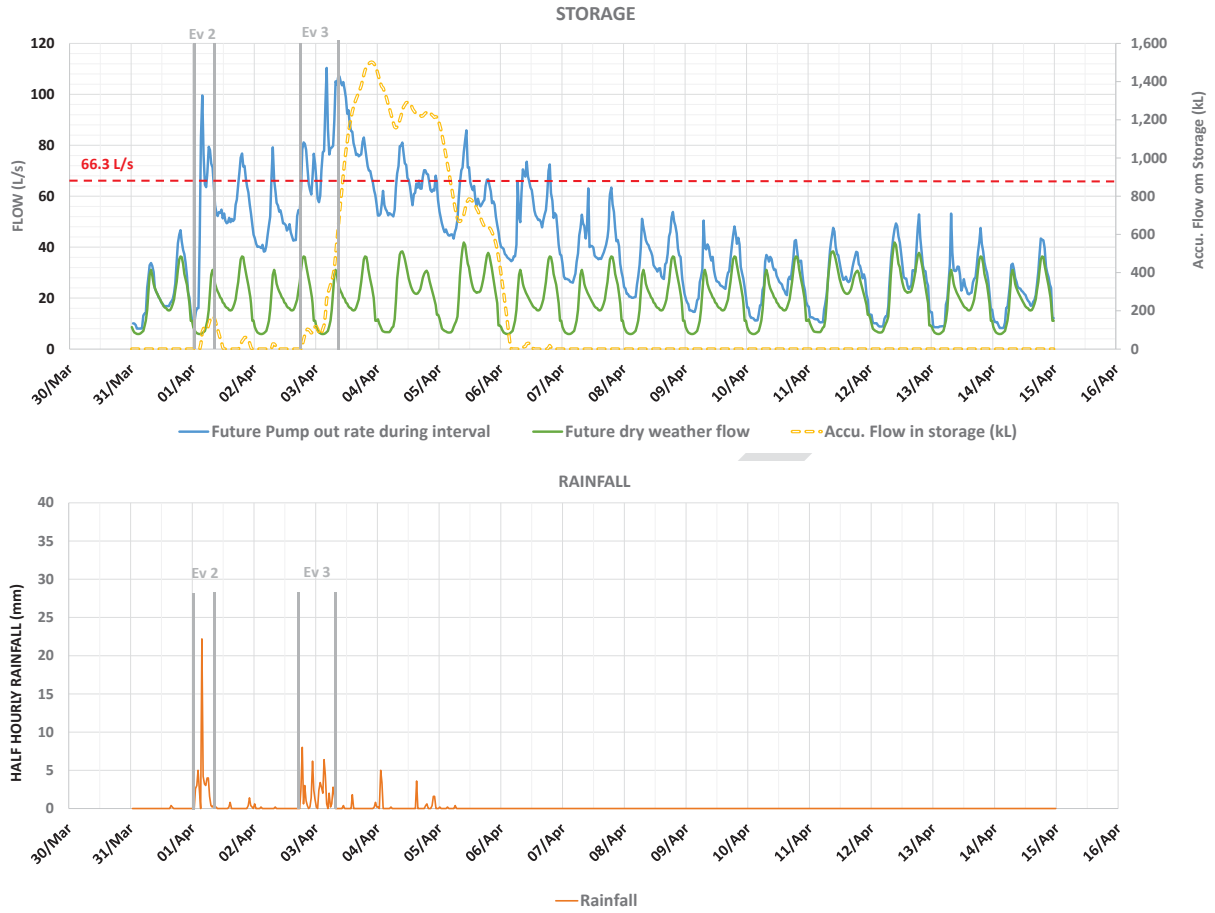


Figure 5-5 : Wet Weather Balancing Storage Estimate Based on 2015 Storm Events 2 and 3

In the absence of a wet weather calibration of the Yarrabilba network, the minimum required wet weather storage volume is 1,639 kL. Due to the uncertainty of the data and performance, it is proposed to include a factor of safety of 1.2, which results in a tank size of 1.97 ML. It is also noted that a 144 kL emergency storage tank already exists on site, together with 90 kL of storage is the PS 1 reticulation system. This storage is activated before the wet weather tank storage is used.

A storage tank with a volume of 2.0 ML is therefore being progressed.

5.4 Internal Sewerage Network

The following sections detail the internal sewerage network components servicing the Yarrabilba Precincts 1 to 3 development. The proposed layout of trunk mains to service Precinct 3 is shown in Figure 5-1.

5.4.1 Reticulation Sewers

In accordance with the LCC's DSOS, the internal sewerage network for Yarrabilba Precincts 1, 2 and 3A as designed by KN Group for Lendlease are included in Appendix D. Internal sewerage network layouts for Precincts 3B and 3C will be provided to EDQ and LCC in future as the lot layout is available. These areas will be connected to PS 3A together with initial development in Precinct 5.

5.4.2 Pumping Stations

5.4.2.1 Pumping Station PS1 and PS2

Pumping station PS1 transfers sewage from the Yarrabilba development to LCC's Logan Village pumping station via a 300 mm diameter rising main and a 375 mm diameter sealed sewer. Pumping

station PS1 catchment includes Precinct 1 and the eastern portion of Precinct 2 development. Based on the flow meter readings, pumping station PS1 has a single pump capacity of approximately 120 L/s and combined pumping capacity of 155 L/s (estimate extracted from EDQ's Logan south report).

Pumping station PS2 is going through the commissioning phase and will be operational by early 2017. It services the western portion of Precinct 2 and early stages of Precinct 3A development. The collected sewage will be transferred via a 200 mm diameter rising main to a manhole (located in Precinct 2 Village 4) in the PS1 catchment.

The details of pumping stations PS1 and PS2 can be found in the Lendlease reports 'Yarrabilba Pumping Station PS1 Design Overview '(January 2014) and 'Yarrabilba Pumping Station PS2 Design Overview '(November 2015).

5.4.2.2 Interim Pumping Station PS 3A

Sewage from the western and southern stages of Precinct 3A and Precincts 3B and 3C cannot be gravitated to either pumping station PS1 and PS2. These lots are located in the future Yarrabilba pumping station PS3 catchment, which collects sewage from future precincts to the south of the power line easement. Future pumping station PS3 will serve more than 46,000 EP in the ultimate planning horizon.

The total population of the western portion of Precinct 3A and Precinct 3B and 3C is approximately 2,400 EP, which is less than 5% of future pumping station PS3 service population. Construction of the ultimate PS3 station at this stage is not a financially feasible option. Also, the future pumping station PS3 will transfer the collected flow through a 600 mm diameter (or larger) rising main to LCC's Logan Village pumping station or to the regional STP in accordance with EDQ's Logan south report. Details of future Logan Village pumping station functionality or operation have not been defined at this point. It is therefore proposed to build an interim pumping station, PS 3A, in the vicinity of the future pumping station PS3 site,

The interim PS 3A pumping station should service development for at least five years, i.e. up to the end of 2021. The interim pumping station will be part of the interim sewerage solution, which utilises the PS 1 storage during wet weather events. It is proposed to construct PS 3A with a nominal design capacity of 100 L/s, which maximise the use of the proposed 250 mm diameter rising main and would be sufficient to service up to 8,600 EP or 3,185 lots, prior to the construction of the ultimate pumping station PS 3. This capacity will provide some flexibility in the available system capacity and will serve the following development:

- Precinct 3A, 3B and 3C (approximately 2,320 EP)
- Precinct 5 early stages (up to 6,200 EP).

It is noted that a further storage could be provided at PS 3A for wet weather operational flexibility, or if the STP construction is delayed. There is sufficient space available at the PS 3A site for such storage.

The temporary rising main from PS 3A to PS 1 is proposed as a 250 mm diameter main with a maximum velocity of 2 m/s. Other interim pumping station design parameters are as follows:

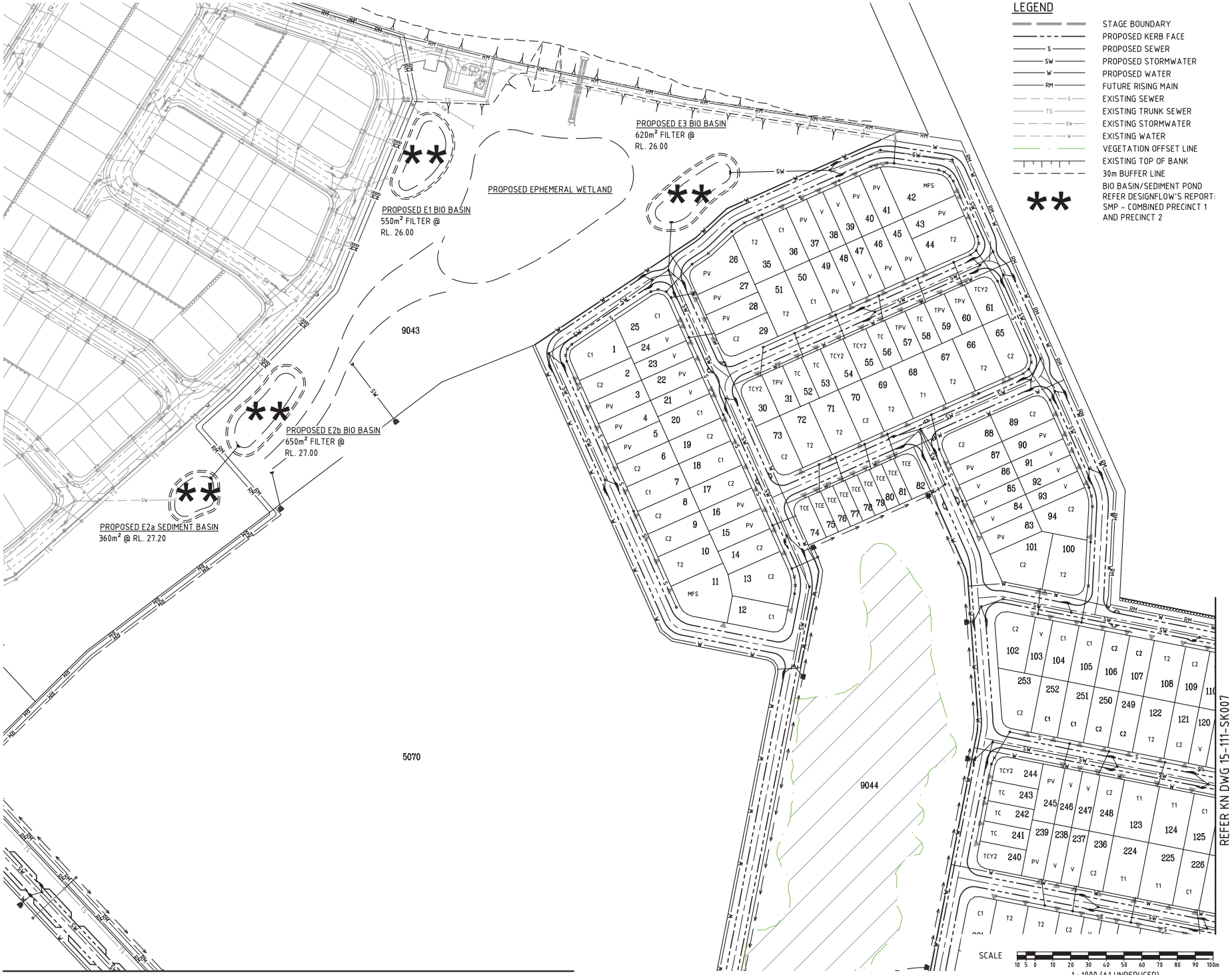
- Pumping station is located at Precinct 3D and to the west of future Yarrabilba Drive (refer to drawings in Appendix D)
- Total length of rising main is approximately 3,000 m and the proposed alignment is shown in the drawings in Appendix D
- Maximum service population is 8,640 EP based on the design unit flow of 1,000 L/EP/day
- Wet well diameter size as 3.2 m based on Table 3-2 of LWA's Standard Specification for Sewer Pump Stations.

6 Conclusions

The following conclusions are drawn from the assessment of the water supply and sewerage network requirements for Precinct 3:

1. The estimated population of Precincts 1, 2 and 3 is 13,385 EP for water and 13,470 EP (not including EP for the unknown future development of Precinct 3D)
2. The proposed water network layout, as outlined in Figure 4-1, can service the ultimate demands in the area with the following proposed PMA arrangement:
   - PMA 1 serving Precinct 1, Precinct 2 and non-residential lots of Precinct 3A (including the proposed State high school)
   - PMA 2 serving Precinct 3A, 3B and 3C (all residential lots).
3. Assuming a MOL of 95 m AHD, the two proposed PMAs can adequately supply the ultimate Precincts 1, 2 and 3 development. Two modulating PRVs will need to be provided:
   - PMA 1 with a pressure reduction of around 16 m at a maximum flow rate of 57.4 L/s
   - PMA 2 with a pressure reduction of around 22 m at a maximum flow rate of 15.3 L/s
4. It is noted that PMA 2 facility will be installed after the 600 mm diameter Yarrabilba Drive trunk water main (section between Highlands Street and Summerview Avenue) is completed in future.
5. The 300 mm diameter trunk main in Camp Cable Road provides sufficient capacity to service Precincts 1, 2 and 3 development and Logan Village 2021 demand based on the projections provided by LCC.
6. A total of 3.3 ML of storage capacity is required to supply Precincts 1, 2 and 3 development and forecast Logan Village demand in the 2021 planning horizon.
7. LCC has advised that the trunk infrastructure upstream of the Travis Road reservoir does not have sufficient capacity for the Yarrabilba Precincts 1, 2 and 3 development in 2021. The existing LCC network has a capacity of approximately 7,000 EP available for the Yarrabilba development. LCC has proposed that the ultimate reservoir (13 ML) should be constructed as soon as possible to enable supply to Yarrabilba to around 2020, when it is proposed that a new connection to the SRWP will be completed.
8. The ultimate strategy for treating sewage from the Yarrabilba development is to construct a new STP to the west of Logan Village. It is proposed that this STP will be operational by 2021, based on the EDQ Logan South strategy agreed with LCC and developers. Sewage from Precinct 3 will be collected at a regional pumping station, PS 3, and transferred to the new STP via Logan Village.
9. Before 2021, sewage will be transferred to the Loganholme STP through the existing LCC network, which has a number of capacity constraints between the proposed development and the Chambers Flat PS. To overcome these deficiencies, it is proposed that a 2.0 ML wet weather storage be constructed at PS1.
10. Sewage from of the western area of Precinct 3A (approximately 1,300 EP) will be collected by pumping station PS2 and discharged to PS1.
11. An interim pumping station, PS 3A, will be constructed within Precinct 3D, as a temporary station prior to the construction of the ultimate PS 3 station. PS 3A will transfer sewage to PS 1 for transfer to Logan Village. It is proposed to size this station for 100 L/s to allow for a minimum of five years development. This will service approximate 2,320 EP from Precinct 3 and up to a further 6,200 EP from future development, likely to be in Precinct 5.

Appendix A Precinct 3A Detailed Sewerage Layout Drawings



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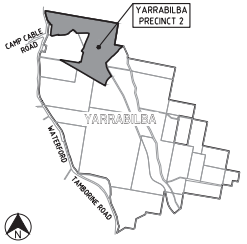

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Drawing Title

P03A FUNCTIONAL LAYOUT
SERVICES PLAN
SHEET 1

Drawn	Designed	Checked	Date
JAS	JAS	GBG	MAY 16

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A1	15-111-SK005	A

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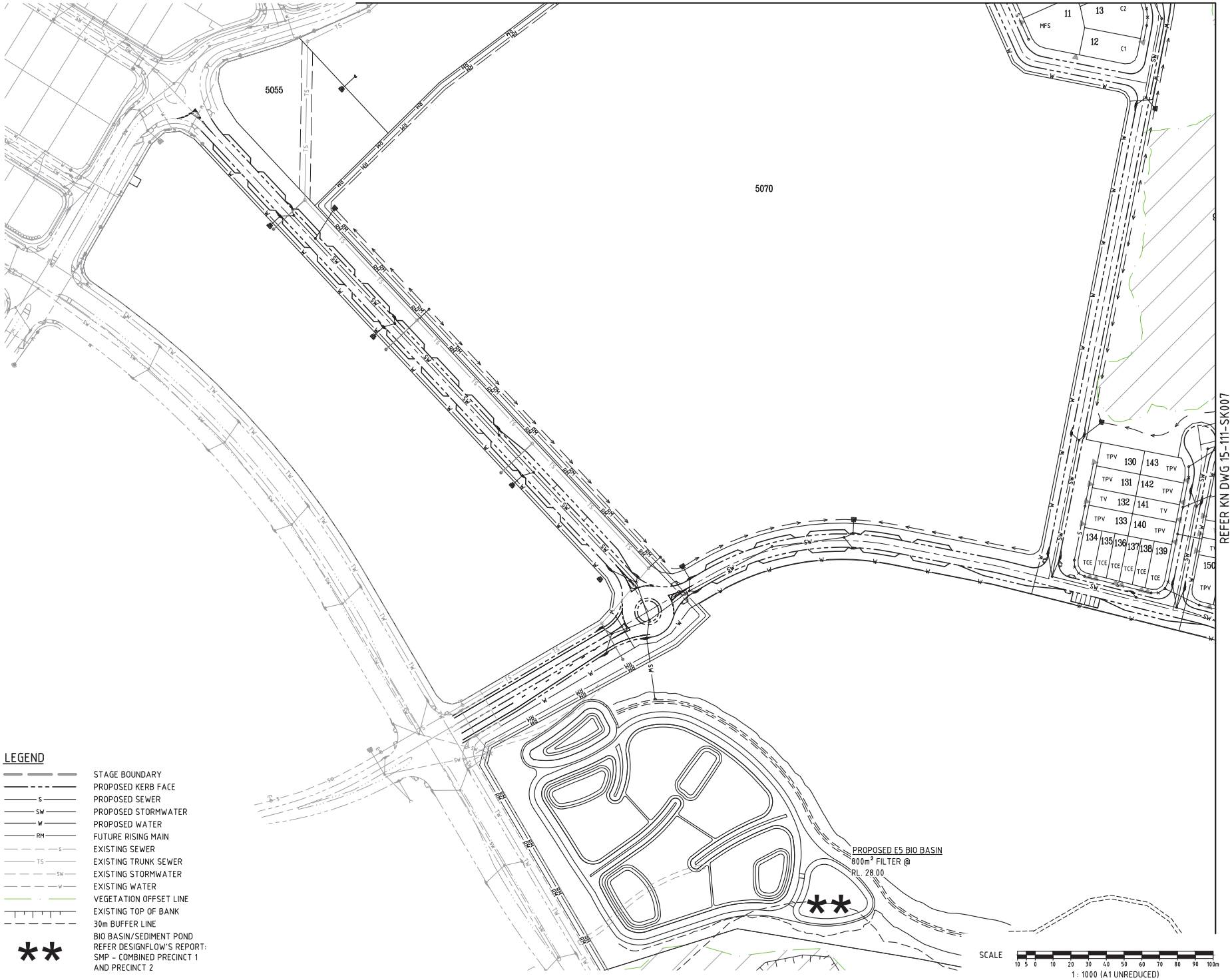

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LEGEND

- STAGE BOUNDARY
- PROPOSED KERB FACE
- PROPOSED SEWER (S)
- PROPOSED STORMWATER (SW)
- PROPOSED WATER (W)
- FUTURE RISING MAIN (RM)
- EXISTING SEWER (S)
- EXISTING TRUNK SEWER (TS)
- EXISTING STORMWATER (SW)
- EXISTING WATER (W)
- VEGETATION OFFSET LINE
- EXISTING TOP OF BANK
- 30m BUFFER LINE
- ** BIO BASIN/SEDIMENT POND REFER DESIGNFLOW'S REPORT: SMP - COMBINED PRECINCT 1 AND PRECINCT 2

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P03A FUNCTIONAL LAYOUT
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SHEET 2

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JAS	JAS	GBG	MAY 16

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A1	15-111-SK006	A

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LEGEND

- STAGE BOUNDARY
- PROPOSED KERB FACE
- PROPOSED SEWER (S)
- PROPOSED STORMWATER (SW)
- PROPOSED WATER (W)
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- 30m BUFFER LINE
- ** BIO BASIN/SEDIMENT POND REFER DESIGNFLOW'S REPORT: SMP - COMBINED PRECINCT 1 AND PRECINCT 2

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RL. 25.00

PROPOSED E8 BIO BASIN
450m² FILTER @
RL. 25.50

PROPOSED E5 BIO BASIN
800m² FILTER @
RL. 28.00

PROPOSED EPHEMERAL WETLAND

REFER KN DWG 15-111-SK014
FOR DETAILS OF TRUNK SEWER
DOWNSTREAM CONNECTION

SCALE
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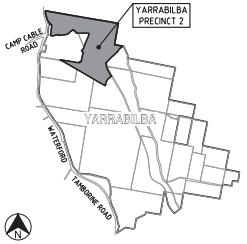

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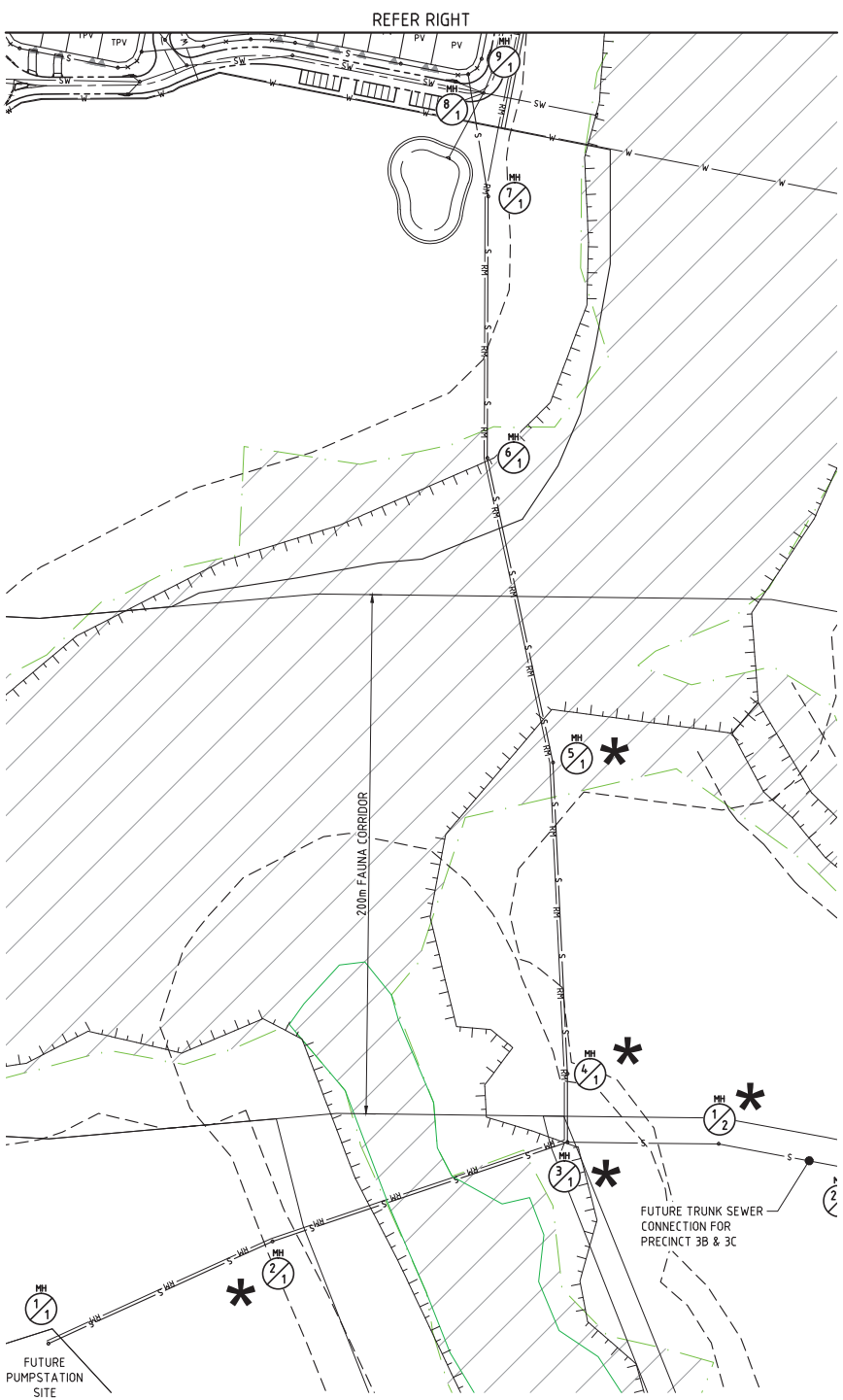

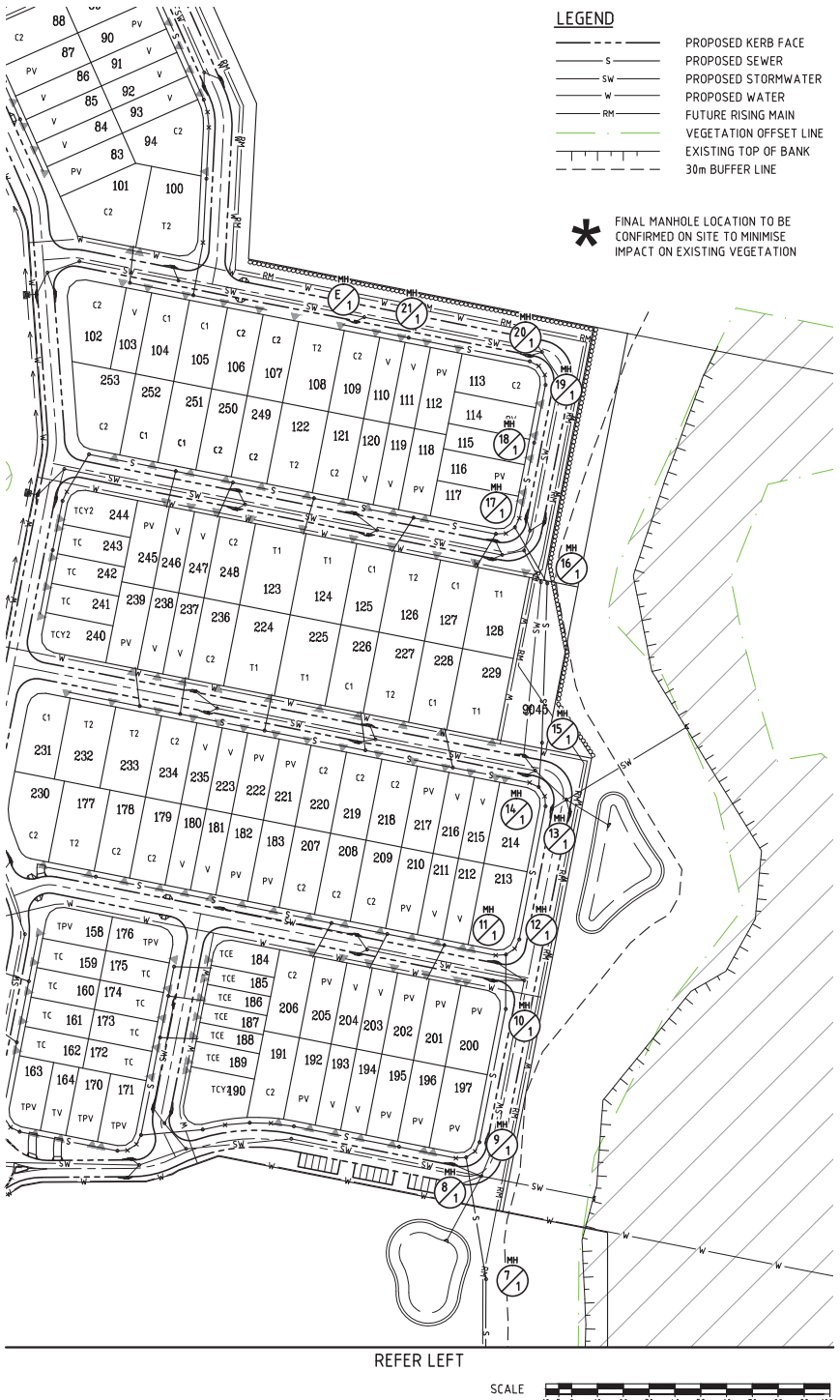

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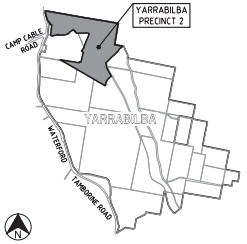

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Drawing Title

P03A FUNCTIONAL LAYOUT
PRELIMINARY TRUNK SEWER
LAYOUT PLAN

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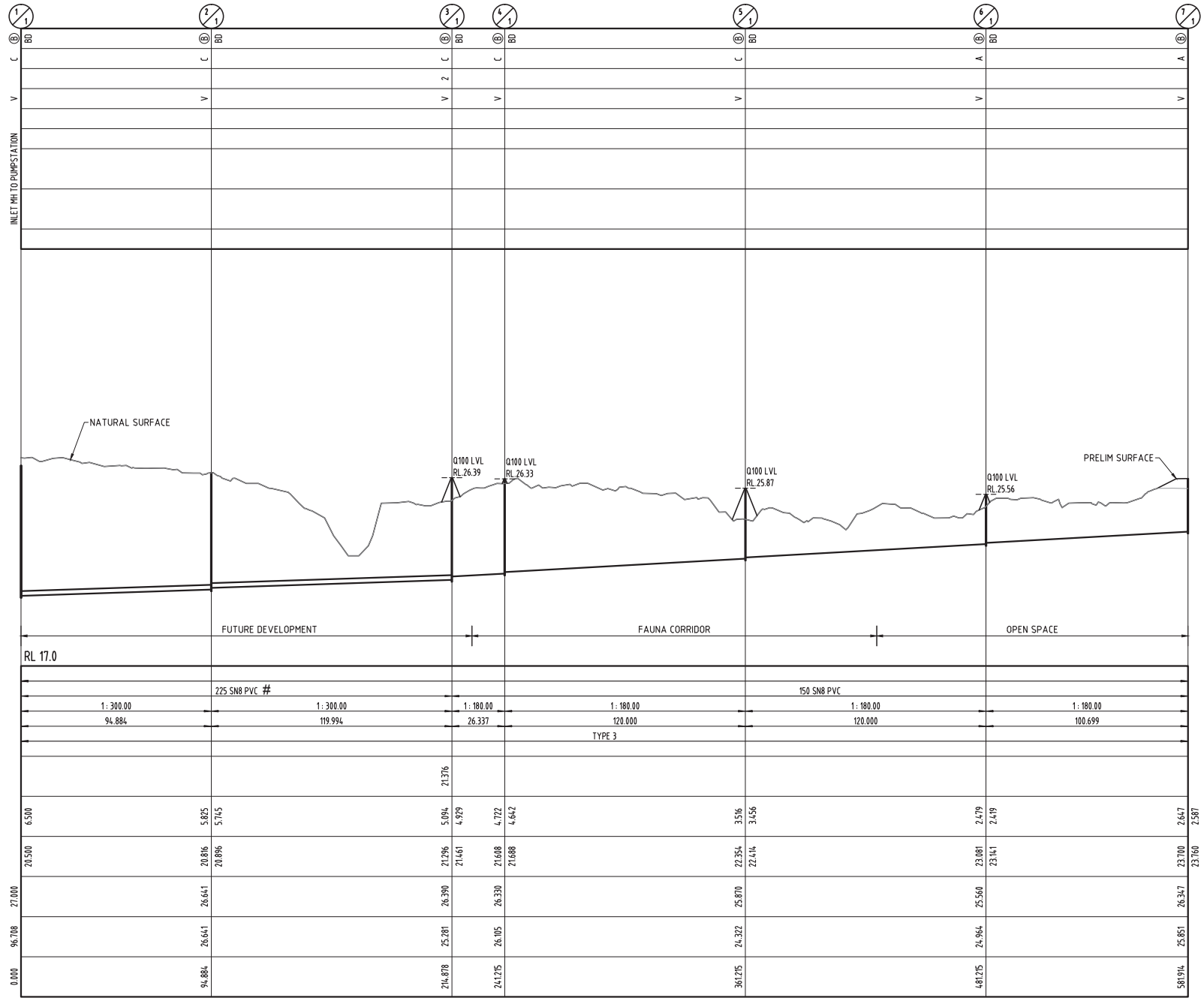
AS SHOWN	14 of -

	Drawing No	Revision
A1	15-111-SK014	A



LEGEND:

COVER TYPES
Ⓑ = CLASS B NON-TRAFFICABLE
Ⓓ = CLASS D TRAFFICABLE
BD = BOLT DOWN
REFER STD. DWG. No. SEQ-SEW-1308-1 & SEQ-SEW-1308-5 to SEQ-SEW-1308-11

MAINTENANCE HOLE TYPES
A = CAST IN-SITU CONC. 1.050Ø
B = CAST IN-SITU CONC. 1.200Ø
C = CAST IN-SITU CONC. 1.500Ø PE LINED
D = CAST IN-SITU CONC. 1.800Ø PE LINED
REFER STD. DWG. No. SEQ-SEW-1307-1

FINAL PIPE SIZE TO BE DETERMINED IN DETAILED DESIGN

DO NOT SCALE THIS DRAWING
IF IN DOUBT - ASK!

NORTH

LOCALITY PLAN

REVISIONS

No	Description	Date	By
A	FOR APPROVAL	JUN/16	JAS

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FUNCTIONAL DRAWINGS

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ABN 35 112 053 611

Approved - RPEQ 12805

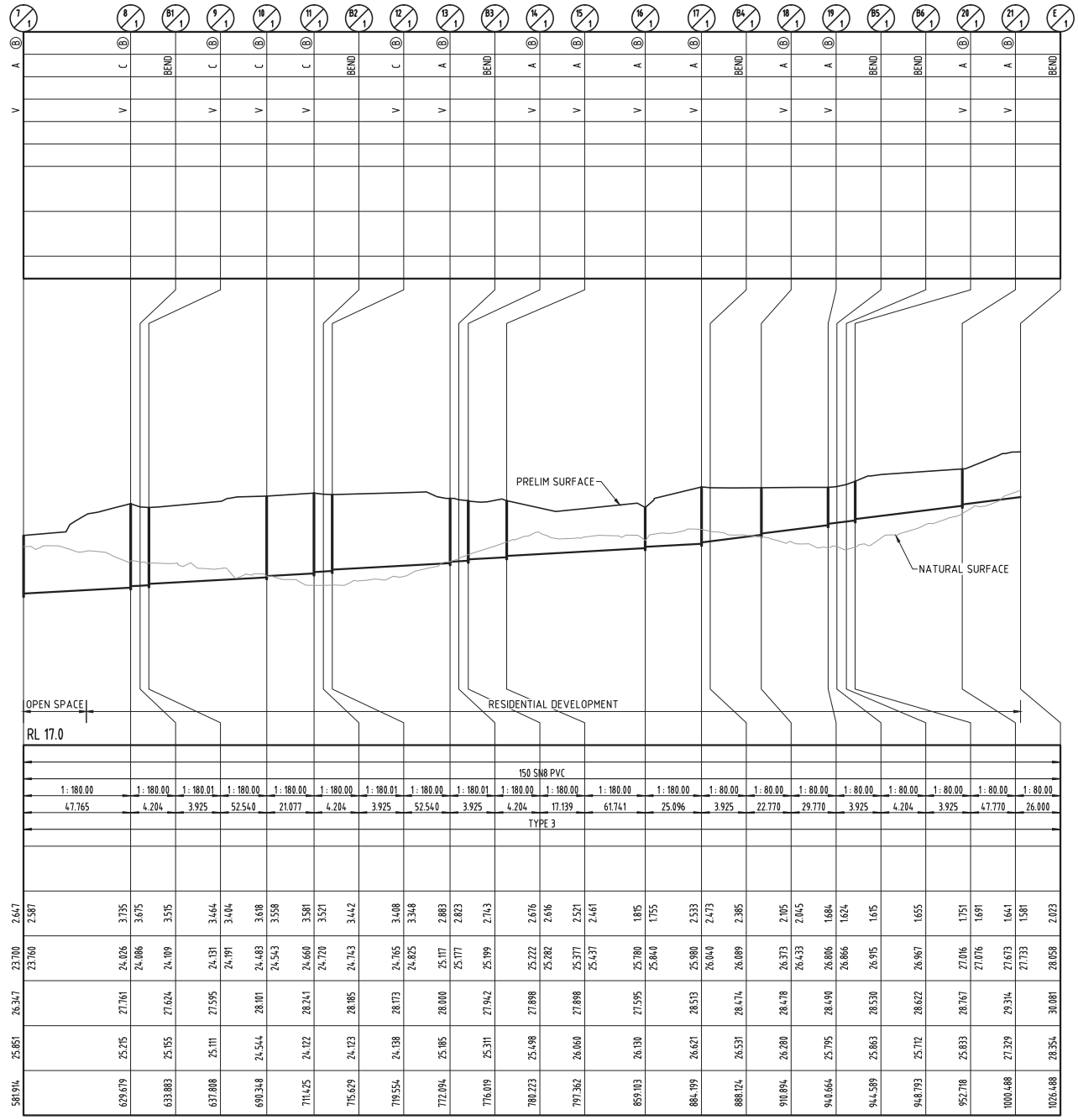
Drawing Title
P03A FUNCTIONAL LAYOUT
PRELIMINARY TRUNK SEWER
LONG. SECTION - SHEET 1

Drawn	Designed	Checked	Date
JAS	JAS	GBG	MAY 16

Scale	Sheet
AS SHOWN	15 of -

Drawing No	Revision
15-111-SK015	A

A1



SCALE A 1:1000 (Horiz.) 10 5 0 10 20 30 40 50 60 70 80 90 100m

B 1:100 (Vert.) 1 0.5 0 1 2 3 4 5 6 7 8 9 10m

(A1 UNREDUCED)

DO NOT SCALE THIS DRAWING
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NORTH

LOCALITY PLAN

REVISIONS

No	Description	Date	By
A	FOR APPROVAL	JUN/16	JAS

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Drawing Title

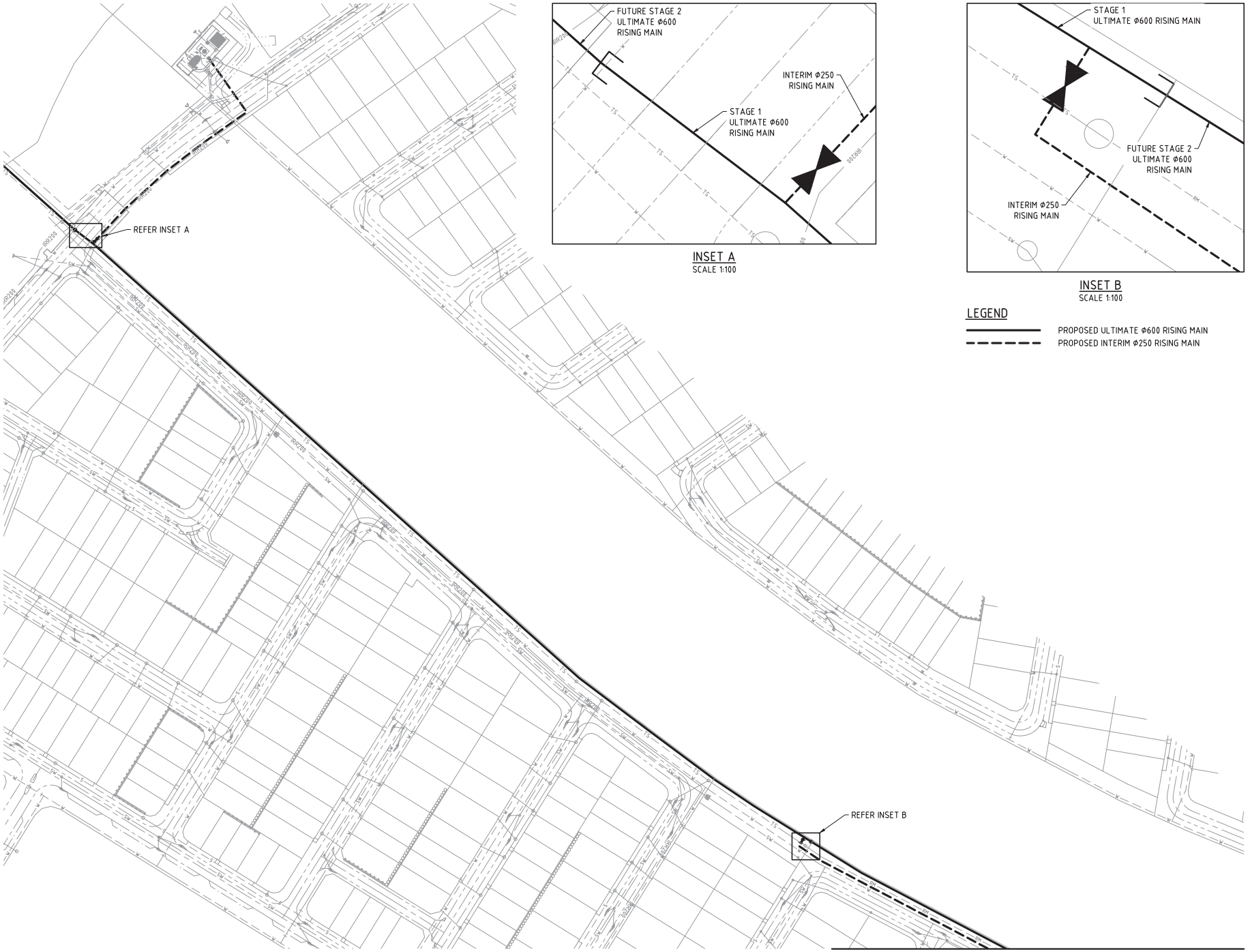
P03A FUNCTIONAL LAYOUT
PRELIMINARY TRUNK SEWER
LONG. SECTION - SHEET 2

Drawn	Designed	Checked	Date
JAS	JAS	GBG	MAY 16

Scale	Sheet
AS SHOWN	16 of -

Drawing No	Revision
15-111-SK016	A

A1



INSET A
SCALE 1:100

INSET B
SCALE 1:100

LEGEND

PROPOSED ULTIMATE Ø600 RISING MAIN
PROPOSED INTERIM Ø250 RISING MAIN

REFER KN DWG 15-111-SK021

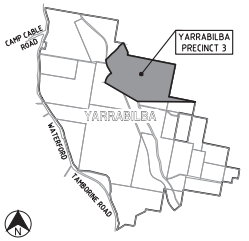
SCALE 1 0.5 0 1 2 3 4 5 6 7 8 9 10m
1 : 100 (A1 UNREDUCED)

SCALE 10 5 0 10 20 30 40 50 60 70 80 90 100m
1 : 1000 (A1 UNREDUCED)

DO NOT SCALE THIS DRAWING
IF IN DOUBT - ASK!

NORTH

LOCALITY PLAN



REVISIONS

No	Description	Date	By
A	FOR APPROVAL		

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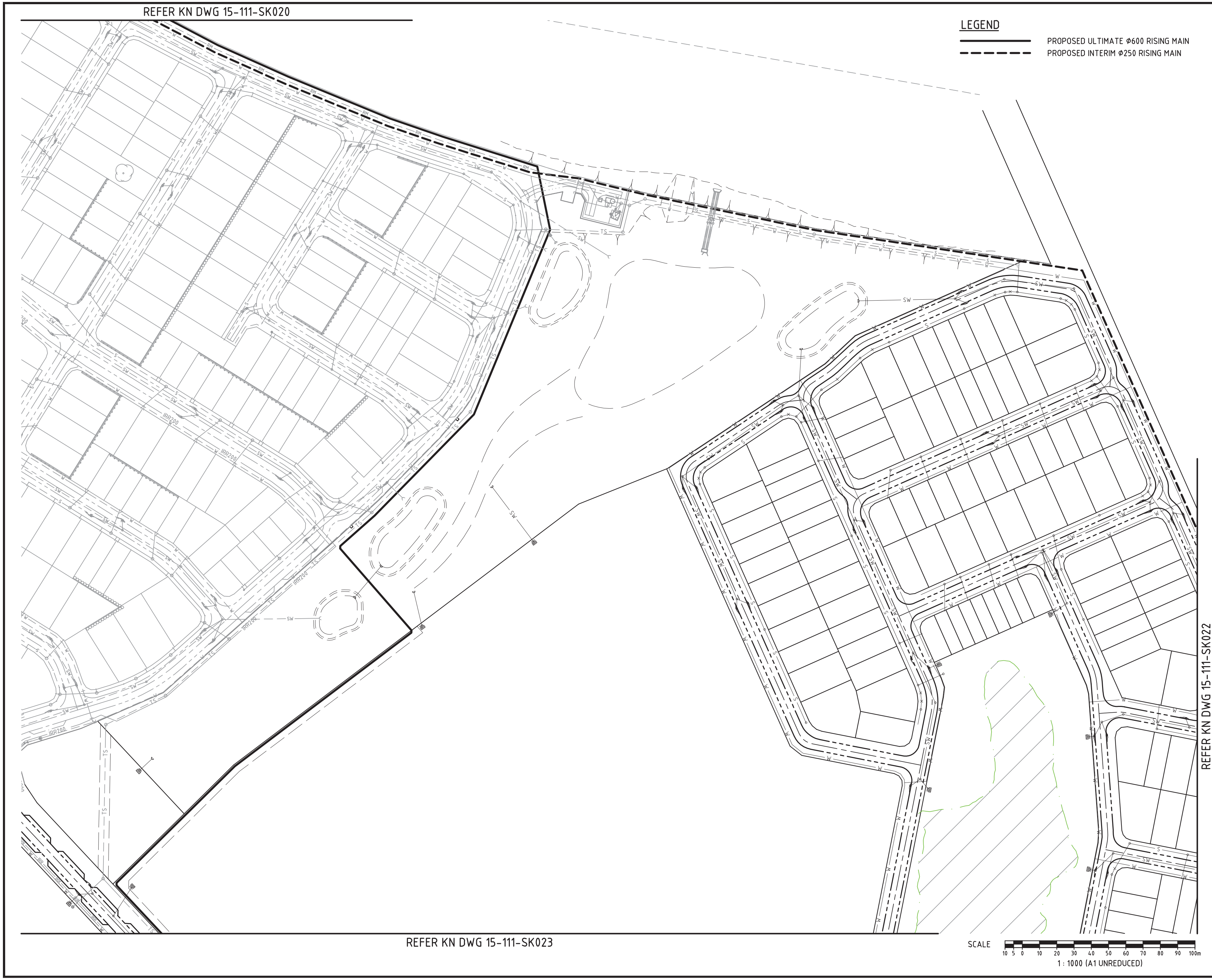
Drawing Title

FUNCTIONAL LAYOUT
RISING MAIN LAYOUT
SHEET 1

Drawn	Designed	Checked	Date
JAS	JAS	GBG	MAY 16

Scale	Sheet
AS SHOWN	20 of 11

	Drawing No	Revision
A1	15-111-SK020	A



DO NOT SCALE THIS DRAWING
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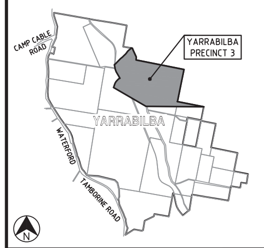
NORTH

LOCALITY PLAN



REVISIONS

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A	FOR APPROVAL		

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Drawing Title

FUNCTIONAL LAYOUT
RISING MAIN LAYOUT
SHEET 2

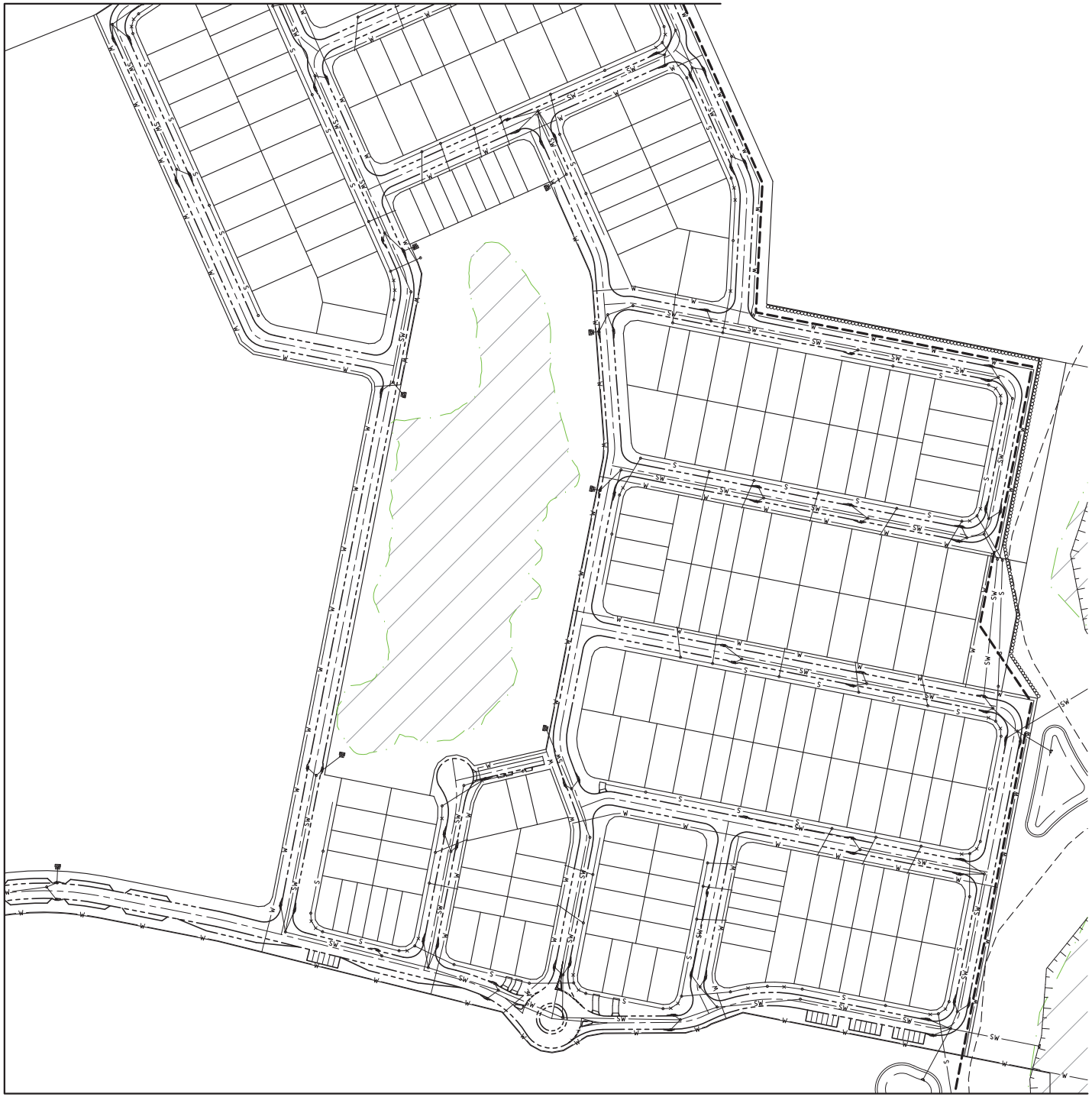
Drawn	Designed	Checked	Date
JAS	JAS	GBG	MAY 16

Scale: AS SHOWN
Sheet: 21 of 11

A1 | Drawing No: 15-111-SK021 | Revision: A

REFER KN DWG 15-111-SK021

REFER KN DWG 15-111-SK023



REFER KN DWG 15-111-SK024

LEGEND

PROPOSED ULTIMATE Ø600 RISING MAIN

PROPOSED INTERIM Ø250 RISING MAIN

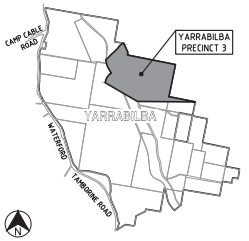
SCALE 10 5 0 10 20 30 40 50 60 70 80 90 100m

1 : 1000 (A1 UNREDUCED)

DO NOT SCALE THIS DRAWING
IF IN DOUBT - ASK!

NORTH

LOCALITY PLAN



REVISIONS

No	Description	Date	By
A	FOR APPROVAL		

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Approved - RPEQ 12805

Drawing Title

FUNCTIONAL LAYOUT
RISING MAIN LAYOUT
SHEET 3

Drawn	Designed	Checked	Date
JAS	JAS	GBG	MAY 16

Scale	Sheet
AS SHOWN	22 of 11

	Drawing No	Revision
A1	15-111-SK022	A

REFER KN DWG 15-111-SK021

REFER KN DWG 15-111-SK022

REFER KN DWG 15-111-SK024

LEGEND

PROPOSED ULTIMATE Φ600 RISING MAIN

PROPOSED INTERIM Φ250 RISING MAIN

SCALE

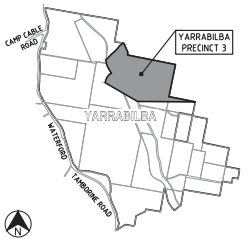
10 5 0 10 20 30 40 50 60 70 80 90 100m

1 : 1000 (A1 UNREDUCED)

DO NOT SCALE THIS DRAWING
IF IN DOUBT - ASK!

NORTH

LOCALITY PLAN



REVISIONS

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Approved - RPEQ 12805

Drawing Title

FUNCTIONAL LAYOUT
RISING MAIN LAYOUT
SHEET 4

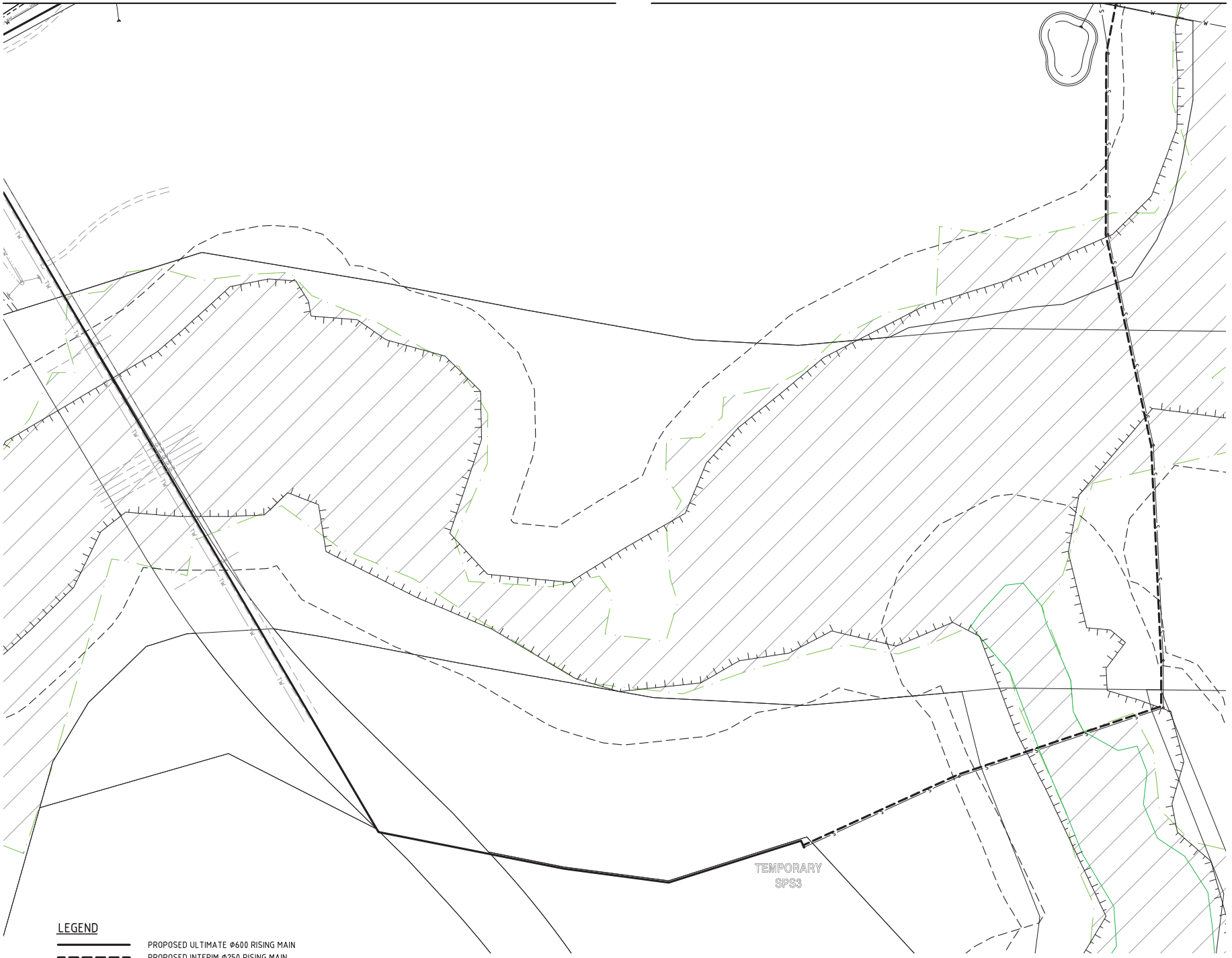
Drawn	Designed	Checked	Date
JAS	JAS	GBG	MAY 16

Scale	Sheet
AS SHOWN	23 of 11

	Drawing No	Revision
A1	15-111-SK023	A

REFER KN DWG 15-111-SK023

REFER KN DWG 15-111-SK022



LEGEND

PROPOSED ULTIMATE Ø600 RISING MAIN

PROPOSED INTERIM Ø250 RISING MAIN

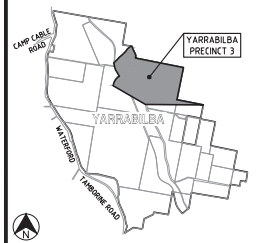
SCALE 10 5 0 10 20 30 40 50 60 70 80 90 100m

1 : 1000 (A1 UNREDUCED)

DO NOT SCALE THIS DRAWING
IF IN DOUBT - ASK!

NORTH

LOCALITY PLAN



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A	FOR APPROVAL		

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ABN 35 112 053 611

Approved - RPEQ 12805

Drawing Title

FUNCTIONAL LAYOUT
RISING MAIN LAYOUT
SHEET 5

Drawn	Designed	Checked	Date
JAS	JAS	GBG	MAY 16

Scale	Sheet
AS SHOWN	24 of 11

	Drawing No	Revision
A1	15-111-SK024	A