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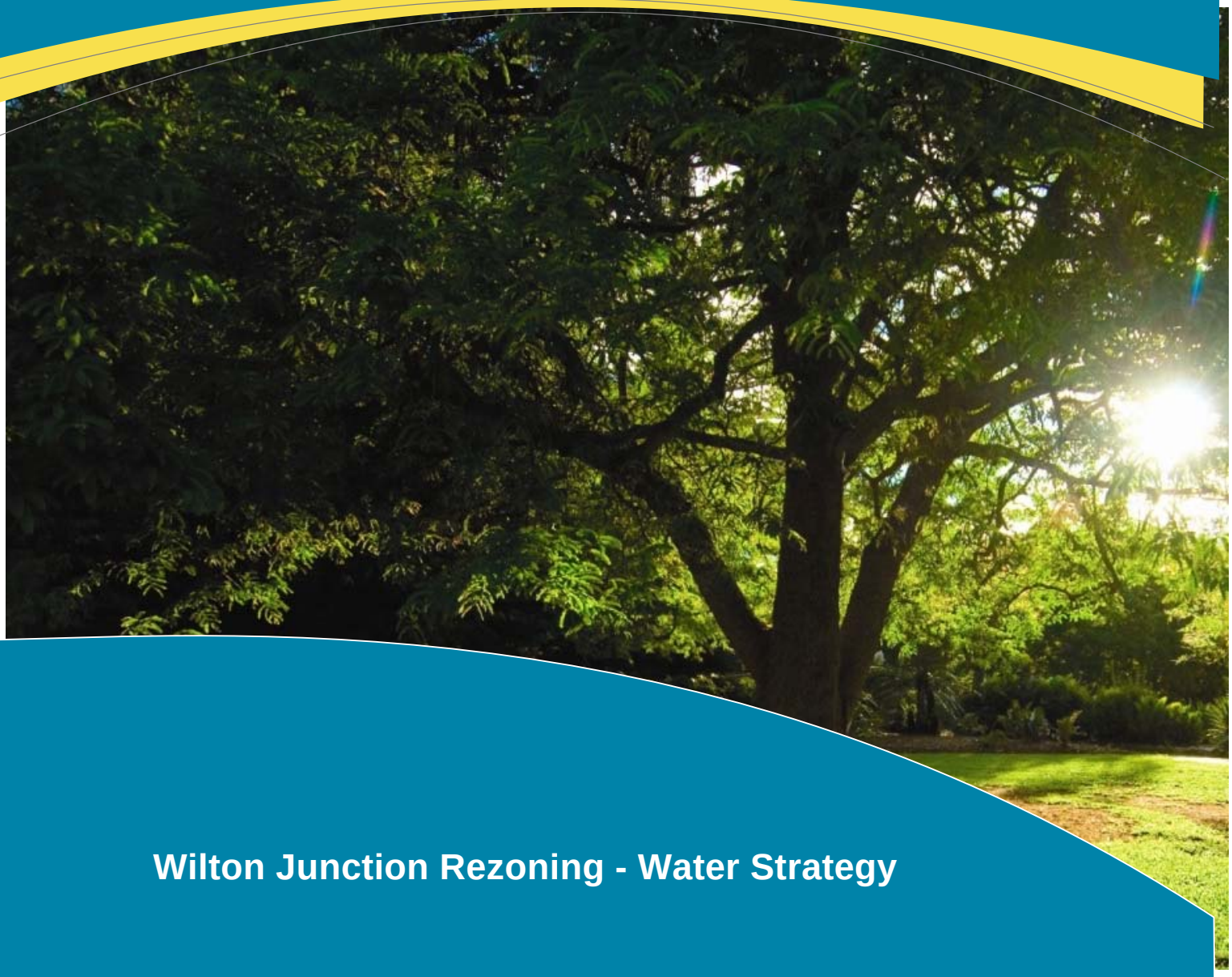

Wilton Junction Rezoning - Water Strategy

Prepared for Wilton Landowners Group

May 2014

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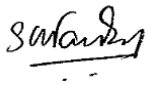
QUALITY STATEMENT

PROJECT MANAGER	PROJECT TECHNICAL LEAD
Megan Collier	Tim Day and Sujit Pandey

PREPARED BY		
Tim Day	…….....	……/……/……
CHECKED BY		
Greg Alford	…….....	……/……/……
REVIEWED BY		
Sujit Pandey	…….....	……/……/……
APPROVED FOR ISSUE BY		
Sujit Pandey		26/05/2014

SYDNEY
Level 21, 141 Walker Street, North Sydney, NSW 2060
PO Box 1831, North Sydney, NSW 2060
TEL +61 2 9493 9700, FAX +61 2 9493 9799

REVISION SCHEDULE

Rev No	Date	Description	Signature or Typed Name (documentation on file).			
			Prepared by	Checked by	Reviewed by	Approved by
1	4/6/13	Draft Report	TD	GA	AJ	SP
2	5/8/13	Final Draft Report	TD	SP	SP	SP
3	29/10/13	Final	SP	AW	AW	SP
4	4/11/13	Final (new costing)	SP	AW	AW	SP
5	9/04/14	Final (Life cycle cost)	SP	BB	BB	SP
6	23/05/14	Final (new clearer figures)	SP	ED	SP	SP

Executive Summary

The Wilton Rezoning Landowners Group, which includes Bradcorp, Lend Lease, Walker Corporation and Governors Hill Pty Ltd, have nominated land adjoining the Hume Highway and Picton Road intersection at Wilton to be rezoned as part of the Potential Homesites Program, a State Government initiative to address Sydney's housing supply shortfall. This proposed development is known as Wilton Junction, and sits within the Wollondilly Shire.

MWH was engaged by the Wilton Rezoning Landowners Group to develop the water servicing strategy to support the proposed Wilton Junction development rezoning.

The proposed Wilton Junction development is proposed to provide 11,900 additional dwellings and 11,000 jobs in Wilton, including Bingara Gorge development. A new town centre will be located near the junction of the Hume Highway and Picton Road and smaller neighbourhood centres will be created within the residentially zoned land.

To meet the Director-General's Key Study Requirements outlined by the Department of Planning and Infrastructure, a strategy and implementation plan was developed detailing the staged delivery of trunk infrastructure to service the initial and ultimate development. This report and supporting analysis addresses the DGRs for the proposed Wilton Junction development. The proposed strategies are likely to be altered to reflect the final design and staging of individual developments.

Sydney Water was engaged extensively during the development of the water strategy regarding the criteria and approach to be adopted for the study.

The water servicing strategy for the proposed Wilton Junction development includes:

- Water supply from the Macarthur Water Filtration Plant.
- Amplified pumping station WP302 located at the Macarthur Water Filtration Plant.
- Construction of 6.5 km of DN600/500/450 trunk main generally along Wilton Road.
- A new pipe crossing of Broughtons Pass Gorge.
- Construction of 2 x 6 ML reservoirs located south of Picton Road.
- Construction of 11 km of DN500-200 distribution pipework.

The estimated capital cost of providing the trunk water servicing infrastructure is $18.9 million not including reticulation pipework costs. This was based on the rates provided by VKL Consulting Ltd. It also assumes that the crossing of Broughtons Pass Gorge is by horizontal directional drilling which is about $4M cheaper than a new pipe bridge adjacent to the Cataract Bridge.

It is proposed the above infrastructure would be delivered in a staged approach, as shown in Table 1.

The location of the water infrastructure is shown in Figure 1.

Further detailed investigations are required to refine the water strategy when the rezoning of Wilton Junction has been confirmed, including hydraulic, geotechnical and environmental impact assessments.

Table 1: Proposed Water Infrastructure Staging Plan

	Stage	Assets Required	Total Dwellings Served	Asset Cost ($M)	Total Stage Cost ($M)
	Existing System	Lead-in to Governors Hill -1.5km DN375	700	2.3	8.45
		Lead-in to Bradcorp -2.6km DN375		4.3	
	2018/19	Minimum DN200 lead-in to Walker from existing DN450 in Picton Rd			
		1 x booster pumping station		0.85	
		Pressure reducing valve		1.0	
1.	Amplify 1.5km of DN200	1.5km of DN450 main	2,000	1.7	2.7
	2021	ACV + Reflux Valve on existing Appin Reservoir inlet mains on Wilton Road		1.0	
2.	Amplify 2.8km of DN300	2.8km of DN450 main	4,000	3.2	4.6
	Amplify WP302 (Part 1) 2025	New WP302 (2 x pump units)		1.4	
3.	New Broughtons Pass Crossing	DN500 HDD crossing	8,000	3.2	9.6
	New Wilton storage (Part 1)	6ML reservoir		3.0	
	New inlet/outlet main 2033	1km x DN600-450 inlet/outlet main		3.4	
4.	Amplify 1.2km of DN300 After 2035	1.2km of DN450 main	9,000	1.3	1.3
5.	Amplify WP302 (Part 2)	Amplify new WP302 (1 x pump unit)	Ultimate development	0.1	2.0
	New Wilton storage (Part 2) After 2035	6ML reservoir	11,900	1.9	
	Remaining Distribution Network and other works			7.35	7.35
	Total Costs			**36.0**	**36.0**

Notes:
1. Capital costs have been provided by VKL Consulting Pty Ltd
2. Capital estimates include the following allowances:
   - 5% scope creep
   - 10% design and investigation
   - 5% construction management
   - 15% contingency
3. Costs assume Broughtons Pass Crossing by HDD

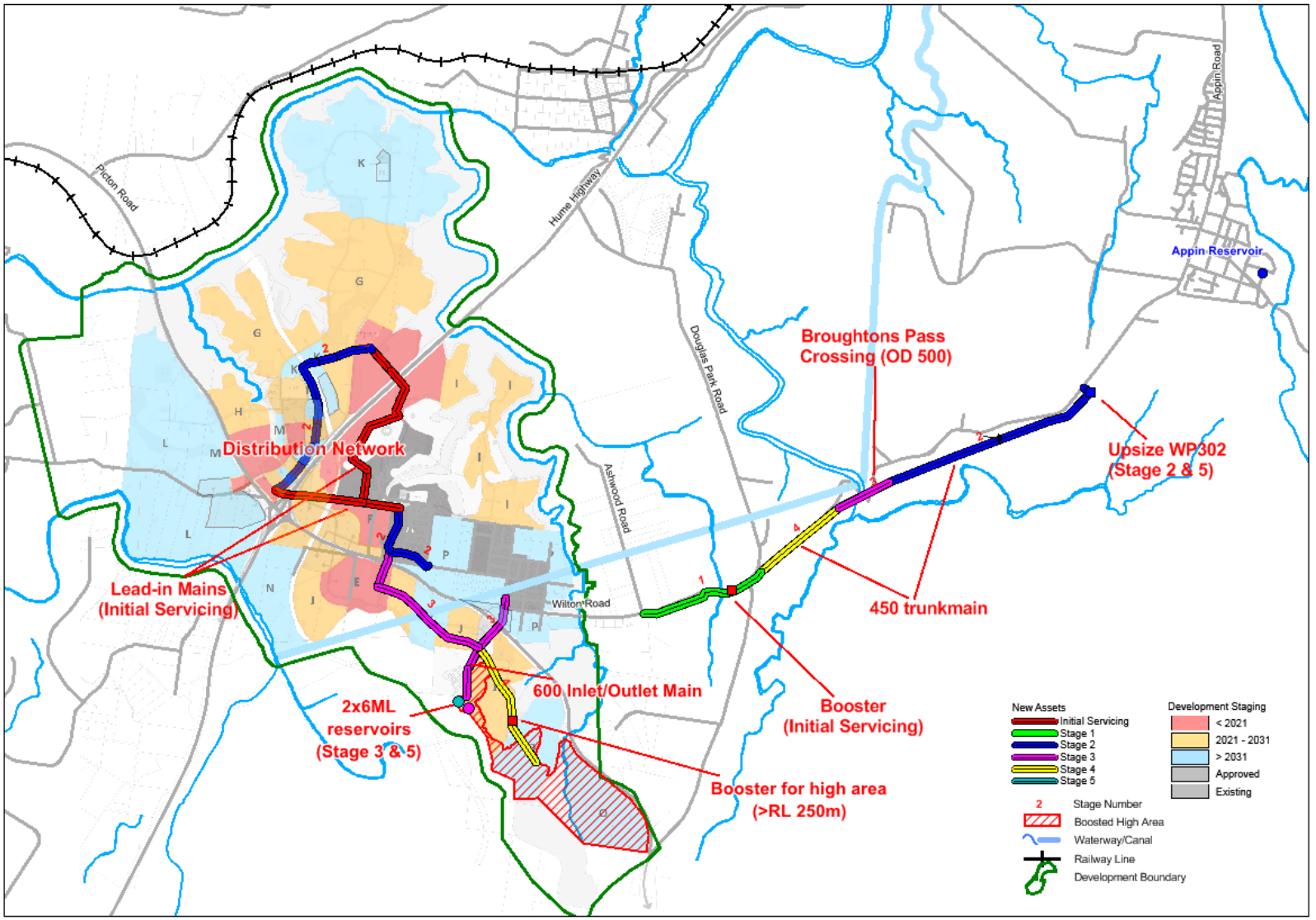


Figure 1: Water Infrastructure for the Wilton Junction Development

Wilton Landowners Group

Wilton Junction Rezoning - Water Strategy

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Abbreviations

ADD	Average Day Demand
AHD	Australian Height Datum
BASIX	Building Sustainability Index
DN	Nominal Diameter (of a pipe)
HDD	Horizontal Directional Drill
HGL	Hydraulic Gradient Line
FSL	Full Supply Level (for Reservoir)
Ha	Hectare
kL	Kilolitre
km	Kilometre
kW	Kilowatt
L/s	Litres Per Second
m	Metre
m/s	Metres Per Second
MDD	Maximum Day Demand
MDP	Metropolitan Development Program
MHD	Maximum Hour Demand
ML	Megalitre
MLD	Megalitres per day
O&M	Operation & Maintenance
OD	Outside Diameter (of a pipe)
PRV	Pressure Reducing Valve
RH	Residual Head
RL	Reduced Level
RMS	Roads and Maritime Services
RSL	Reserve Storage Level (for Reservoir)
SCA	Sydney Catchment Authority
SW	Sydney Water
WFP	Water Filtration Plant
WPS	Water Pumping Station
WSA	Water Services Association

1 Introduction

1.1 Project Background and Context

In November 2011, the NSW Government initiated the Potential Housing Opportunities Program and invited landowners with suitably located substantial landholdings to nominate sites which might be able to deliver additional housing to address Sydney's housing supply shortfall. Walker Corporation, Governors Hill, Bradcorp and Lend Lease responded to the Program and nominated landholdings of more than 100ha in Wollondilly Shire, surrounding the Hume Highway-Picton Road intersection for consideration. This area has subsequently become known as Wilton Junction, and is the subject of this application.

Following a Wollondilly Shire Council resolution in May 2012, the four major landowners (collectively known as the Wilton Junction Landowners' Group) signed an agreement to work cooperatively with Council to prepare a high level Master Plan for Wilton Junction to deliver high quality new housing, jobs close to homes, supporting social and utilities infrastructure and services, and a range of complementary land uses.

A high level Master Plan and a Preliminary Infrastructure Requirements Report were considered by the Council on 17 December 2012, with Council resolving to give in-principle support to the proposal. Council also resolved to request that the rezoning be a state-driven process.

Subsequently, the NSW Government decided to coordinate the statutory planning process, led by the Department of Planning and Infrastructure (now the Department of Planning and Environment, DP&E). The Minister for Planning and Infrastructure (now the Minister for Planning and Environment) proposed to prepare a State Environmental Planning Policy (SEPP), as per Section 24 of the *Environmental Planning and Assessment Act 1979* (EP&A Act), which identifies that a SEPP is an Environmental Planning Instrument, and Section 37 of the EP&A Act, which relates to the making of a SEPP for State or regional significant development. This was done with a view to rezone the land through an amendment to the Wollondilly Local Environmental Plan 2011 (LEP) to facilitate the early delivery of housing and infrastructure, linked to an agreed Infrastructure, Servicing and Staging Plan.

The Department of Planning and Infrastructure issued Key Study Requirements (KSRs) to the Proponents (Walker Corporation, Bradcorp and Governors Hill) to guide the planning investigations for a new town at Wilton Junction. The KSRs set the criteria for carrying out environmental investigations across the Study Area (excluding both Bingara Gorge and the existing Wilton village which will not be affected by any proposed amendments to their current zoning and planning provisions). The investigations examine the potential for the Wilton Junction Study Area to be rezoned under a SEPP.

This report addresses the water servicing requirements to meet the DGRs for the Wilton Junction development.

1.2 Study Area

Wilton Junction is located within Wollondilly Shire Council and is approximately 80km from Sydney Central Business District, and 30km west of Wollongong. The study area includes the existing village of Wilton and the recently approved suburb of Bingara Gorge.

The area is strategically located around the Hume Highway-Picton Road interchange, and represents the next potential major town along this transport corridor south of Campbelltown–Macarthur. Moreover, Wilton Junction has the distinct advantage of a consolidated land ownership of more than 2,700ha in the control of recognised developers, with the resources and capability to expedite housing delivery, roll out enabling infrastructure, deliver social services and provide local employment.

A plan of the Wilton Junction study area is shown in Figure 1-1.

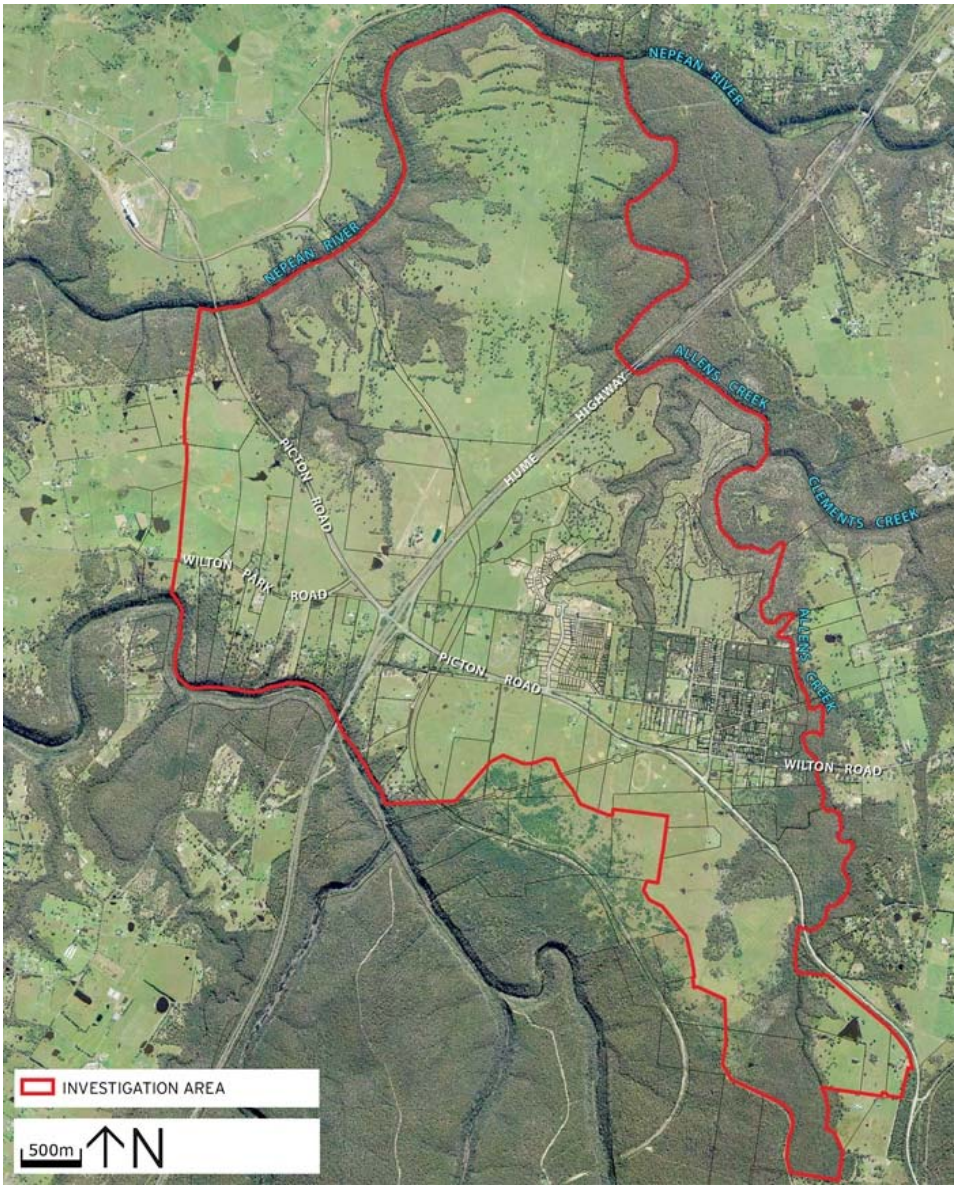

Figure 1-1: Wilton Junction Study Area

1.3 Landownership

There are four major landowners within the Investigation Study Area:

- Bradcorp Pty Ltd (land at Wilton West)
- Walker Corporation (lands south of Picton Road and east of the Hume Highway)
- Governors Hill (land including the Wilton Aerodrome and lands on both sides of Picton Road west of the Hume Highway)
- Lend Lease (land to the north-west of the Hume Highway-Picton Road intersection; but is excluded from the study requirements)

The Investigation Study Area also includes land by other private owners (excluding land in Bingara Gorge and Wilton village) as outlined in the Table 1-1.; with a plan of the extent of ownership being provided in Figure 1-2.

Table 1-1: Wilton Junction Land Ownership

Landowner	Gross area (ha)	Net developable area (ha)
Lend Lease	455	240
Bradcorp	872.4	458.7
Governors Hill	175.3	123.5
Walker Corporation	405.2	230.3
Other landowners**	572.3	489.2
Totals	**2,480.20**	**1,541.70**

** This comprises 113 other private landowners, excluding the new Bingara Gorge estate and the existing Wilton village which will not be affected by any proposed amendments to the existing Wollondilly Shire Council planning provisions.

For the purposes of this rezoning application, the Proponents include Walker Corporation, Governors Hill and Bradcorp. Lend Lease will continue with the planning and delivery of its Bingara Gorge community in Wilton, which is already zoned for residential development. Lend Lease is working with the Proponents of this rezoning application to plan and deliver the new town at Wilton Junction and its associated infrastructure.

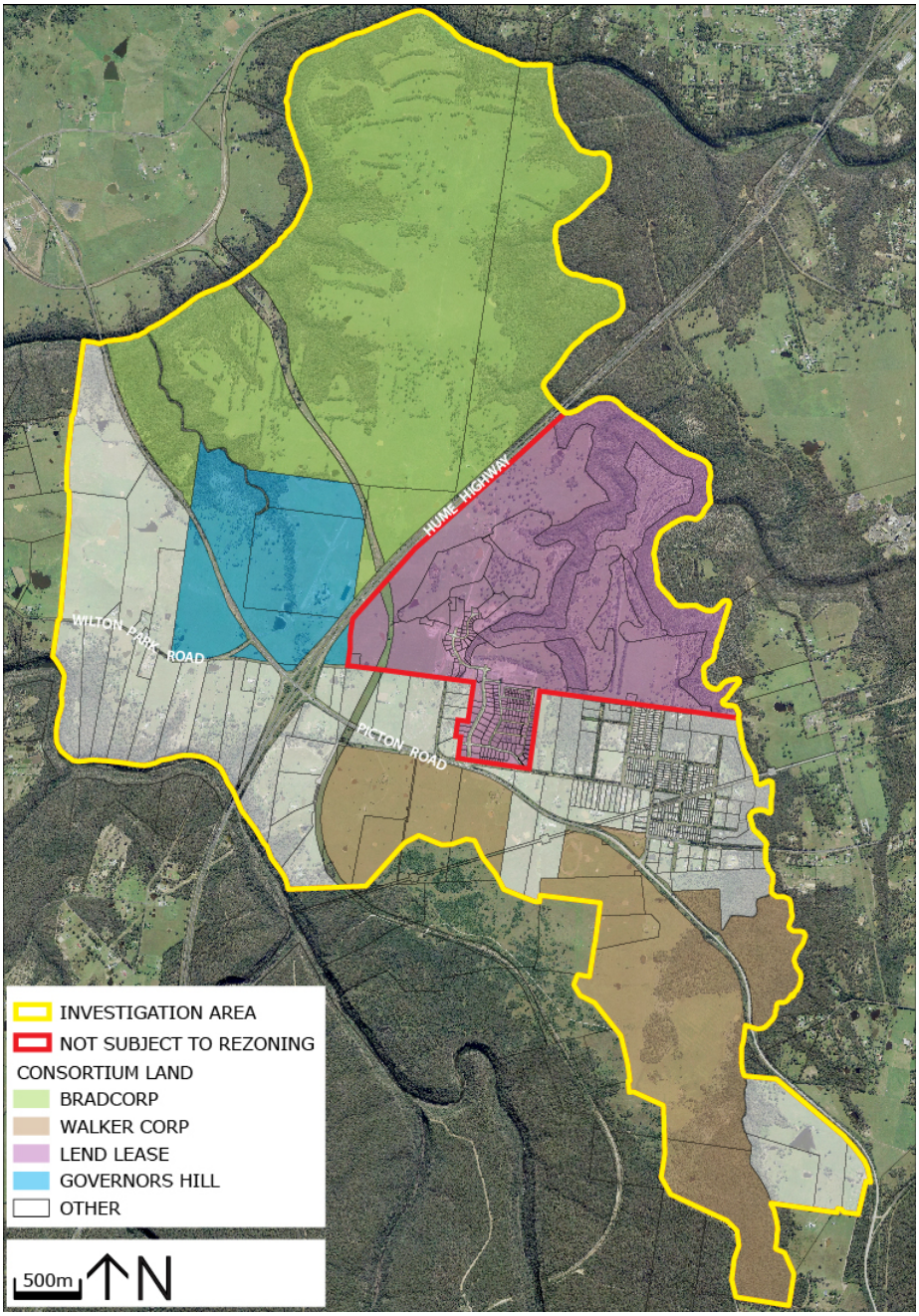

Figure 1-2: Land Ownership

1.4 Project Description

Vision for Wilton Junction

The Proponents have a vision for the proposed rezoning of land at Wilton Junction, which is

"Wilton Junction is a new community cradled in a unique landscape characterised by bushland, rivers, creeks, lakes and ridges set against the backdrop of the Razorback Range. By design, the place and the lives of its people are intertwined with the bush.

The community respects the location's rich bushland setting, engages with surrounding water features and embraces sustainability.

Inclusive and welcoming of diversity, it's a place to nurture relationships, grow a family - to put down roots.

Founded on a 21st century interpretation of timeless "Garden City" principles, Wilton Junction combines the best features of our most loved country towns with the facilities, services and technologies found in Australia's most successful, edgy, and vibrant town centres.

A safe place to visit – a healthy place to live – a great place to learn - a rewarding place to work – the local community takes pride in the strength of its cultural and civic life and the role of their town in Wollondilly Shire and the region."

Delivering the Vision and Project Description

This vision will be delivered through the creation of a new town with between 11,000 and 13,000 new homes and 11,000 jobs. Residential neighbourhoods will be created around green spaces providing a range of housing choice and facilitating healthy lifestyles options for all new residents. A new town, comprising of approximately 17ha, will be established within the north-west quadrant of the study area and will be surrounded by employment generating uses for business, bulky goods and light industry, comprising of approximately 120 - 130ha of land. Smaller neighbourhood centres will be created within the residential neighbourhoods to cater for convenient daily shopping choices. Community facilities and physical infrastructure will be provided facilitating the creation of a self-sustaining community. Existing significant environmental features and heritage items will be preserved commemorating the natural and historical setting of the study area.

This report forms part of the studies required to be undertaken to meet the Director Generals' Key Study Requirements outlined by the Department of Planning and Infrastructure as part of the investigations for the release and rezoning of land at the junction of the Hume Highway and Picton Road through a SEPP. The study outcomes and report has also informed the development and preparation of a Master Plan for Wilton Junction.

The proposed Master Plan will be informed by the following key principles:

- **Employment and commercial drivers.** The delivery of approximately 11,000 jobs focused around a new town centre and in close proximity to the Hume Highway and Picton Road.
- **Housing.** Providing between 11,000 and 13,000 new dwellings across the precinct, inclusive of the 1,165 already approved at Bingara Gorge and the existing Wilton village.
- **Community facilities**. Provide a diverse range of high quality community facilities including a schools, library, community centre in a town centre and three neighbourhood centres across the precinct.
- **Environment**. Conserving ecological features and biodiversity and establishing a Trust to rehabilitate and manage approximately 614.5ha of bushland.
- **Place making.** Delivering high quality and connected network of streets, spaces and squares throughout the development.
- **Activity centres**. Focus on the delivery of a new town centre and three smaller neighbourhood centres with a diverse mix of retail, commerce, business and light industry.
- **Traffic and transport.** Providing strategic motorway and bus access to surrounding areas, legible movement throughout the development.
- **Infrastructure.** Integrated water, waste water and stormwater management systems and access to all other utilities including gas and NBN.

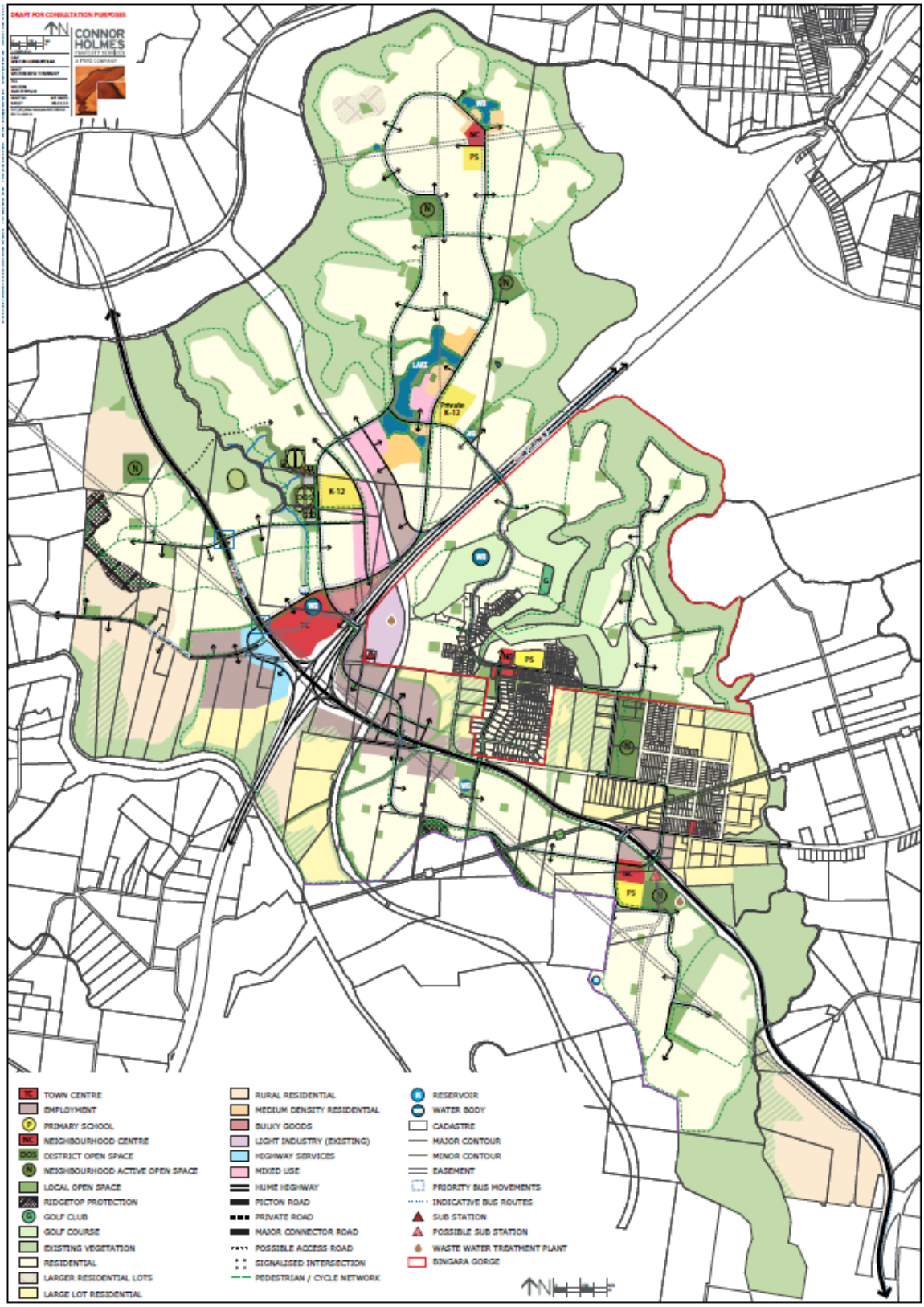

Figure 1-3: Wilton Junction Master Plan

1.5 Study Objectives and Scope

This report forms part of the studies required to be undertaken to meet the DGRs outlined by the Department of Planning and Infrastructure as part of the investigations for the release and rezoning through a State Environmental Planning Policy (SEPP).The study outcomes and report has also informed the development and preparation of a Master Plan for Wilton Junction. The particular DGRs for the provision of water infrastructure involve;

Table 1-2: Director General Requirements and Strategy Response

Director General Requirements	Strategy Response
Preparing an infrastructure, servicing and staging plan in conjunction with relevant agencies to service the release areas with potable water services, in a staged manner as well as a whole	The water strategy was developed in consultation with Sydney Water and meets Sydney Water performance standards. The strategy is provided in Section 6. The staging plan is provided in Section 7.
Details of funding for staging and the entire cost of delivery of required infrastructure and the component and timing of funding proposed to be supplied by Government.	Costing for the strategy is based on industry published documents. A costing plan is provided in Section 6.4 and 6.5. Details of the costing are provided in Appendix E. A staging plan is provided in Section 7.

The water servicing strategy previously undertaken for the Wilton Junction Master Plan (MWH 2012) looked at supply options from the Macarthur and Nepean Water Filtration Plants (WFP). The preferred strategy identified involved supply from the Macarthur WFP, and amplification of the existing trunk network (as detailed in the following section).

The objective of this study is to further refine this water servicing strategy taking into account updated development yields and staging plans, and by identifying spare capacity in the existing water system using Sydney Water's hydraulic model.

The scope of this work includes:

- Prepare a concept level water strategy for the Wilton Junction development
- Identify key potable water infrastructure requirements to meet Sydney Water (SW) criteria and performance standards
- Prepare high level capital cost estimates for water infrastructure (provided by VKL Consulting)
- Prepare a water infrastructure staging plan

This study also assessed two options for the pipeline crossing of Broughtons Pass Gorge:

1. Using horizontal directional drilling technology, and
2. Attaching pipeline to Cataract Bridge.

Identification of operating costs and net present value analysis was not required for this study.

Extensive engagement was undertaken with Sydney Water during the course of this study. Minutes of meetings are provided in Appendix B.

1.6 Previous Studies

Several studies have previously been carried out for servicing of land in the Wilton and the surrounding area. Two key studies for the Wilton area are described below.

1.6.1 Water Strategy in Support of the High Level Wilton Junction Master Plan

In 2012 MWH was engaged by the WJLG to identify feasible water options to support the preparation of the Master Plan for the Wilton Junction development.

The study examined at a high level servicing options from the Macarthur Water Delivery System and the Nepean Water Delivery System.

The water strategy identified a preference for supply from the Macarthur WFP, as the Nepean WFP did not have sufficient capacity and the Nepean Delivery System did not extend to the Wilton area. The preferred water strategy at that time involved:

- The installation of new pumping units at water pumping station WP302.
- Construction of 6.5 km of DN600/500/450 trunk main generally along Wilton Road.
- A new pipe crossing of Broughtons Pass Gorge.
- Construction of 2 x 9 ML reservoirs located south of Picton Road in the vicinity of Thornton's Hill.
- Construction of 1.5 ML elevated reservoir and water pumping station to service high ground levels at the south eastern land parcels.
- Construction of 21 km of DN500-200 distribution pipework.

1.6.2 Water and Wastewater Strategy for Bingara Development

In 2012 AECOM identified a water and wastewater strategy for the approved 1,165 lot Bingara Gorge development involving a new sewage treatment plant, water supply from the Macarthur Water System, and a recycled water supply via a dual reticulation system.

The identified water supply option involved the provision of a new 2 ML surface reservoir located at Macarthur Drive, Wilton as well as some watermain amplifications.

2 Existing and Future Lot Projections

This section describes future growth proposed for the Wilton Junction development, as well as other future growth identified in the adjacent villages of Wilton, Appin and Douglas Park

2.1 Existing Development

Existing development in the Wilton area consists of the township of Wilton with approximately 300 residential dwellings, and the Lend Lease development of Bingara Gorge. The Bingara Gorge development is rezoned and has development approval to construct 1,165 dwellings, golf course and local commercial and community facilities.

2.2 Future Wilton Junction Development

The Wilton Junction development will provide for 11,900 new dwellings, including Bingara Gorge, as well as commercial and light industrial development. The development details are shown in Table 2-1.

A summary of the residential land area and proposed residential development yields for each of the Wilton Junction land owners is outlined in Table 2-2. The proposed annual residential production rate is detailed in Appendix A.

The total dwelling production at ultimate development is expected to be 11,900 of which about 1,800 will come from the Bingara Gorge development.

Table 2-1: Proposed Wilton Junction Residential Dwelling Allotment

Development Type	Units	Yield
Residential		
- Area to be Rezoned	Dwellings	10,100
- Bingara Gorge	Dwellings	1,800
- Total Wilton Junction	Dwellings	11,900
Commercial (Gross Area)	Hectares	54
Industrial (Gross Area)	Hectares	116
Schools		
- Primary	Each	3
- K-12	Each	2

Table 2-2: Proposed Wilton Junction Residential Dwelling Allotment

Landowner	Gross Area (Ha)	Net Developable Area (Ha)	Potential Development Yield	Indicative Yield[1]
Lend Lease (Bingara Gorge)	455	240	1,500 - 2,000	1,800
Bradcorp	872.4	458.7	5,000 - 5,500	5,300
Governors Hill	175.3	123.5	500 - 1,000	800
Walker Corporation	405.2	230.3	2,500 - 3,000	2,800
Other Land	572.3	489.2	1,000 - 1,500	1,200
Total	**2,480.20**	**1,541.70**		**11,900**

Note:
1. The final yield for each landowner has not yet been determined.

The Wilton Junction development will comprise a mix of residential densities as detailed below in Table 2-3.

Table 2-3: Proposed Wilton Junction Residential Dwelling Densities

Dwelling Density	Dwellings	% of Total
250m^2 to 450m^2	3,570	30
600m^2 to 900m^2	5,950	50
950m^2 and over	2,380	20
Total	**11,900**	**100**

Source: Wilton Junction New Town High Level Infrastructure Business Case 2013.

2.3 Other Growth Outside of Wilton Junction Development

Future growth in the villages of Wilton, Appin and Douglas Park, outside of the Wilton Junction development area (including Bingara Gorge development), is detailed below in Table 2-4. This growth has been identified from Sydney Water's property database and is sourced from DP&I data.

Sydney Water's property table (May 2013) allows for 1,700 lots in the Bingara Gorge development but no other development in the Wilton Junction development area.

This future growth identified below was taken into account when predicting the future hydraulic performance of the Appin Water Distribution System.

Table 2-4: Future Growth Outside of Wilton Junction Development

Village	Existing Population	2036 Population	2036 Population Growth	Existing Employment	2036 Employment	2036 Employment Growth
Wilton[1]	1,157	1,710	553	827	978	151
Appin	1,601	15,758	14,157	148	186	38
Douglas Park	1,034	1,698	664	324	399	74

Source: Sydney Water Property Database
Note:
1. Wilton growth identified above is infill growth in the existing village and excludes proposed development in the Wilton Junction development.

3 Design and Performance Criteria

3.1 Drinking Water Criteria

Design demands for the proposed development are based on the Design Criteria Guidelines Supplement (Sydney Water, 2010) and Water Supply Code of Australia, WSA 03—2002-2.2, Sydney Water Edition, Version 2. The criteria and approach described in this section were documented in the Technical Memo "Water and Wastewater Demand Forecasts (MWH14 May 2013)", and subsequently revised following feedback provided by Sydney Water on 21 and 29 May 2013.

For all dwellings, it is assumed that rainwater tanks will be provided for external end uses, and potentially laundry and toilet flushing, with top-up to the rainwater tanks provided from the drinking water supply. For non-residential development, recycled water could potentially be provided as indicated in the VKL Disposal of Treated Effluent Report. The demand assessment undertaken does not take account of the provision of recycled water. This is a conservative assumption and can be further assessed during the next phase of the project.

The demand allowances for a drinking water network with top-up to rainwater tanks are summarised in Table 3-1.

Table 3-1: Demand Allowances for Drinking Water Supply Network with Rainwater Tanks

Item	Design Criteria	Units	Value
Single Dwelling Residential	Average Day Demand	kl/dwelling/day	0.75[1]
	Maximum Day Demand	kl/dwelling/day	1.17[2]
	Maximum Hour Demand	kl/dwelling/day	2.93 (2.5 x maximum day)
Town House (<30 units/net/ha)	Maximum Day Demand	kl/dwelling/day	0.8
	Maximum Hour Demand	kl/dwelling/day	1.76
Commercial	Maximum Day Demand	kL/NHa/day	41
	Maximum Hour Demand	kL/NHa/day	82
Light Industrial	Maximum Day Demand	kL/NHa/day	40
	Maximum Hour Demand	kL/NHa/day	64

Note:
1. ADD = 0.75 kL/lot/d based on measured total water (recycled water and potable water) demand at Rouse Hill (Sydney Water 2010).
2. Max day rate derived from water usage in the Narellan supply zone during January 2013 (refer to Section 3.2).

The demand allowances for development provided with a dual reticulation supply are summarised in Table 3-2.

Table 3-2: Demand Allowances for Drinking Water for a Dual Reticulation Network

Item	Design Criteria	Units	Value
Single Dwelling Residential	Average Day Demand	kl/dwelling/day	0.5
	Maximum Day Demand	kl/dwelling/day	0.8
	Maximum Hour Demand	kl/dwelling/day	2.16
Town House (<30 units/net/ha)	Average Day Demand	kl/dwelling/day	0.5
	Maximum Hour Demand	kl/dwelling/day	0.7
	Maximum Hour Demand	kl/dwelling/day	1.71

The performance criteria adopted for this study are summarised in Table 3-3. The criteria reflect Sydney Water's current risk based approach towards planning criteria in the servicing of future growth areas. For example, the allowance for a limited number of properties to receive less than 15 metres pressure during peak demand periods, and the preference for booster pumping stations instead of elevated reservoirs for areas predicted to receive low pressure.

Table 3-3: Performance Criteria

Item	Design Criteria	Requirement
Pressure	Minimum Pressure	>12m and <15m for 10 customer days >3 m residual head for trunk mains not supplying customers
Pressure	Maximum Pressure	50 m (desirable) 60 m (maximum)
Pumping Station	Pump Capacity	Sufficient to maintain the reservoir level above RSL over the peak demand design period. Generally sized for maximum day demand when supplying surface reservoir, or maximum hour demand when supplying an elevated reservoir
Surface Reservoir	Operating Storage	For initial design, 1/3 maximum day demand
	Reserve Storage	For initial design, a minimum of one third of max day demand. The RSL is determined by the maximum depletion over the peak demand design period.
Elevated Reservoir		Preference for booster pumping station instead of elevated reservoir provided there is a minimum 8m pressure in event of power failure.
Pipeline	Maximum Velocity	2 m/s
	Headlosses	Target 3 - 5 m/km (for mains >=DN200mm)

3.2 Adopted Maximum Day Demand Rate for Residential Growth

The approach for selecting a design maximum day demand rate for future residential growth at Wilton Junction is based on the Sydney Water the Sydney Water document "Water and Recycled Water System Growth Servicing Strategy – Criteria and Guideline 2012". This guideline stipulates that new BASIX compliant properties achieve a 15% reduction in MDD over non BASIX properties.

To select a suitable current maximum day demand rate, demand data for the adjacent Narellan and Rosemeadow water supply zones was analysed for the period from June 2009 to March 2013 (ie period since introduction of new Water Wise Rules).

Note that demand data for the existing Appin water supply zone was not used for this study, due to the unavailability of daily water usage data for the current mining operations at West Appin and East Appin collieries. The demand from the collieries is highly variable and as a result an accurate estimation of current water usage for residential properties was not possible.

As such, to obtain the required design maximum day demand rate, the current maximum day demand rates for the Narellan and Rosemeadow zones were reduced by 10% (rather than 15%), taking into account a proportion of existing dwellings in those zones were built after the introduction of BASIX and are therefore BASIX compliant.

Results of the analysis are shown in Table 3-4.

Table 3-4: Maximum Day Demands for Adjacent Supply Zones

Supply Zone	Measured[1] Maximum Day Rate (kL/dwelling/d)	Adjusted[2] Maximum Day Rate (kL/dwelling/d)
Narellan	1.3[3]	1.17
Rosemeadow	1.05	0.95

Note:
1. Measured over the period June 2009 - March 2013. The maximum day demand event occurred in January 2013.
2. Measured demands reduced by 10% to allow for water savings for BASIX compliance dwellings.
3. As advised by Sydney Water (refer to Appendix B meeting minutes from meeting on 29 May 2013).

Based on this data, a design maximum day rate for a single residential dwelling of 1.17 kL/dwelling/d has been adopted for this study. This rate is similar to design rates adopted for similar recent studies in the South West Growth Centre.

4 Water Demand Projection

This section identifies the future water demands for the Wilton Junction development, based on growth projections presented in Section 2, and the design demand allowances stated in Section 3.

4.1 Future Wilton Demand Projection

Future water demands for the Wilton area are given in Table 4-1. The demands include future infill growth in the existing Wilton Township and the future Wilton Junction development. The demand projection is based on the following assumptions:

- Bingara Gorge development will be supplied with a dual reticulation supply
- the remaining Wilton Junction development will be supplied with rainwater tanks
- recycled water could potentially be provided to industrial and commercial properties for non-potable uses as identified in the VKL Disposal of Treated Effluent Report. The table below assumes that portable water will be provided to the industrial and commercial properties.

The future maximum day demand for the total Wilton area is estimated to be 19.7 MLD. The breakdown of this demand is shown in Table 4-1 below.

Table 4-1: Future Demand Projections for the Wilton Area

Location	Existing Average Day Demand (MLD)	Future Average Day Demand (MLD)	Future Max Day Demand (MLD)	Future Max Hour Demand (MLD)
Wilton Village	0.24	0.34	0.6	1.6
Wilton Junction Development				
Residential with Dual Reticulation	0.02[1]	0.9	1.4	3.5
Residential with Rainwater Tanks		7.6	11.4	27.5
Commercial		0.9	1.8	3.5
Industrial		2.3	3.7	5.9
Special Uses		0.4	0.8	1.6
Totals	0.26	12.4	19.7	43.6

Note:
1. Ultimately Bingara Gorge development is likely to be supplied with a dual reticulation supply. Currently all water demands for the development are provided from the water supply.

5 Existing Water Services

This section describes existing water services available in the vicinity of the proposed Wilton Junction development.

5.1 Water Filtration Plants

Two water filtration plants (WFP) are located in the vicinity of the proposed Wilton Junction development, the Macarthur WFP and Nepean WFP. The capacity of these plants is discussed below.

5.1.1 Macarthur Water Filtration Plant

The Macarthur Water Filtration Plant (WFP) is located on Wilton Road, between Broughtons Pass and Appin about 9 km to the east of Wilton. This plant currently supplies drinking water to the Wilton area.

The Macarthur WFP is operated by Trility (formerly United Utilities Australia Pty Ltd). The plant began operating in 1996. The plant treats raw water sourced from Cataract, Cordeaux, Avon and Nepean Dams. Filtered water is supplied to the Macarthur Water Delivery System, which is divided into the Campbelltown, Narellan and Appin Distribution Systems. See Section 5.2 for further information regarding the Appin Water Distribution System.

The design capacity of the Macarthur WFP is 265 MLD. The clear water tanks have a total capacity 30 ML (2 x 15 ML).

The current maximum day demand from the Macarthur WFP is 124 MLD. This peak demand occurred over the recent summer period in January 2013. Another peak demand of 121 MLD occurred in March 2012. Recorded daily demands for the Macarthur system are shown in Figure 5-1.

The projected 2036 maximum day demand for the Macarthur WFP is estimated to be 244 MLD, excluding Wilton Junction. This has been estimated using Sydney Water's property database (updated May 2013). The projected 2036 demand allows for approximately 98,000 additional dwellings in the Macarthur System including development in the South West Growth Centre (including Oran Park), as well as other major sites and infill, but excludes the proposed Wilton Junction development.

Based on the above projected growth, it appears that the Macarthur WFP has an ultimate spare capacity of 21 MLD and will not require any additional capacity to service the estimated Wilton Junction demand of 18 MLD which excludes Bingara Gorge development. Typically spare system capacity is distributed on a "first come" basis.

5.1.2 Nepean Water Filtration Plant

The Nepean WFP is located is located at Nepean Dam near Bargo, approximately 16 km to the south of Wilton. The plant has a maximum operating capacity of 31 MLD. The clear water tanks have a capacity of 22 kL. Note that the Nepean WFP does not currently supply water to the Wilton area.

The Nepean system has a maximum day demand of 18 MLD as shown in Table 5-1. This peak demand occurred in the recent summer period in January 2013.

The projected 2036 maximum day demand for the Nepean system is estimated to be 26 MLD based on Sydney Water's property database. Therefore, with the added 18 ML/d demand for the Wilton Junction development, there is a capacity shortfall in the Nepean WFP of 13 MLD, and a plant upgrade would be required. This upgrade may include treatment, storage and pumping station facilities.

Additionally, there is no existing Nepean network infrastructure in the Wilton area, and only limited network capacity available in the nearby Picton/Maldon area. As a result, supply to the Wilton Junction development from the Nepean WFP would require significant network amplifications.

The option of supplying the Wilton Junction development from the Nepean WFP is not considered further in this study.

Table 5-1: Capacity for Future Demands at Macarthur and Nepean WFPs

Item	Macarthur WFP	Nepean WFP
Plant Capacity (MLD)	265	31
Clear Water Tank Volume	30 ML	22 kL
Clear Water Tank Pumping Station Capacity (MLD)	12	40
Current Maximum Day Demand (MLD)	124	18
Projected 2036 Maximum Day Demand (MLD) (excluding the Wilton Junction development)	244	26
Spare Capacity for Wilton Junction Development	21	5
Predicted Capacity Excess /Shortfall	3	-13

Source: future demands from Sydney Water property table

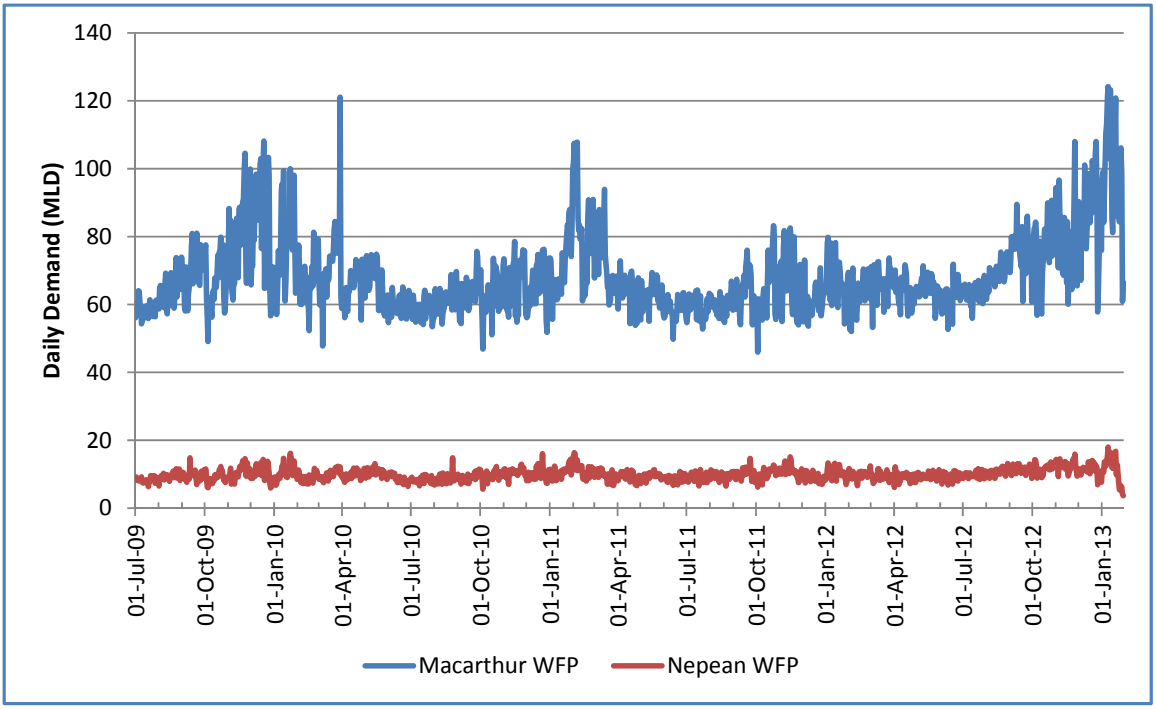

Figure 5-1: Daily Demands From Macarthur and Nepean WFPs

5.2 Water Distribution Systems

5.2.1 Appin Water Distribution System

The Macarthur WFP currently supplies potable water to the townships of Appin, Wilton and Douglas Park via the Appin Water Distribution System.

The major assets in the Appin Distribution System are the Appin Reservoir WS412 (10ML storage capacity, FSL 271m) located at the corner of Church and George Streets at Appin and the water pumping station WP302 located at the Macarthur WFP.

Potable water is pumped from the Macarthur WFP clear water tanks via WP302 to Appin Reservoir WS412 via a 300-200mm pipeline, and directly into the system. When the pumps are not operating, the system is supplied via gravity from Appin Reservoir.

The major trunk watermain to the existing Wilton village from Appin Reservoir runs in a south-westerly direction along Wilton Road, across the Broughtons Pass Gorge. This pipeline is 200 to 300mm in diameter. A 200mm watermain branches off to supply Douglas Park, running northerly along Douglas Park Drive. A pressure reducing valve is located on this watermain prior to Douglas Park village.

To service the existing Bingara Gorge development, approximately 3 km of watermains at Wilton have been amplified to 450mm. Sydney Water is currently reviewing the previously recommended servicing solution for the Wilton Village and Bingara Gorge development which involved a 2 ML surface reservoir, to be located at Macarthur Drive, Wilton (AECOM 2012). A potential option Sydney Water is investigating involves the provision of a booster pumping station to service Wilton village and the Bingara Gorge development, together with reducing peak system draws from the existing mines.

6 Water Servicing Strategy

The servicing strategy identified for supplying water to the Wilton Junction development consists of:

- Filtered water supplied from the existing Macarthur WFP
- Amplification of the existing Appin Distribution System trunk infrastructure, including WP302, trunk mains and new reservoirs
- DN500-200 distribution ring main allowing development at four fronts.

6.1 Water Supply Source

The source of potable water for the Wilton Junction development is the Macarthur WFP.

As stated in the previous section, there appears to be sufficient capacity available at the Macarthur WFP to cater for the additional demand from the Wilton Junction development, taking into account other future growth in the Macarthur Water Delivery System. Any changes to the treatment facilities will need to be confirmed formally with Sydney Water and the Macarthur WFP operator during the next phase of the project.

Supply via the Nepean WFP was not considered due to insufficient available capacity at 2036, as identified in the previous section.

6.2 Trunk Water Network Infrastructure

The trunk water infrastructure is discussed further in the following sections. A plan of the trunk water infrastructure required for the Wilton Junction development is shown in Figure 6-1. A summary of trunk network infrastructure is given in Table 6-1.

6.2.1 Water Pumping Station WP302

The existing water pumping station WP302 has a pump capacity of 12 ML/d. This will be insufficient for the ultimate Wilton Junction development demands. The required pump capacity for ultimate development is 20 ML/d.

It has been assumed for this study that a completely new pumping station building, housing all civil, mechanical and electrical components would be provided rather than retrofitting the existing pumping station building. No inspection of the existing pumping station building has been carried out for this study. The feasibility of retrofitting the existing pumping station building should be verified at a later detailed planning stage.

Pumping units at the new pumping station can be staged. For this study it is assumed that ultimately three pumps would be provided. Two pumping units would be initially provided in a duty/stand by arrangement. Further capacity would be provided with an additional pumping unit at a later stage.

It has not been investigated whether there is sufficient power capacity available at the Macarthur WFP site to supply the new pumping station. The available power capacity at the site should be verified at a later detailed planning stage.

6.2.2 Reservoirs

A total of 12 ML of new storage is required for ultimate development. Note this is a reduction from the storage volume identified in the previous High Level Wilton Junction strategy study (18ML), and is based on results using Sydney Water's hydraulic model, which was unavailable for use in the previous study.

A suitable location for the new storage is near Thornton Hill, located at the Wilton Junction development south of Picton Road. Potentially the storage could be located on the nearby Sydney Catchment Authority (SCA) land, subject to approvals from the SCA. The full supply level (FSL) of the new Wilton reservoirs is assumed to be 271 m, which is the FSL of the existing Appin Reservoir WS412.

Two x 6 ML surface reservoirs are proposed instead of a single 12 ML reservoir to allow for staging of these assets. Twin 6 ML reservoirs would provide operational flexibility, allowing one reservoir to be taken out of service as required for maintenance purposes, and would also prevent water quality problems that could arise for a single large reservoir in the early stages of development.

The land area required for the 2 x 6 ML reservoirs is approximately 1 hectare (100m x 100m).

6.2.3 Trunk Main

A new 6.5 km DN600-450 trunk main is required to transfer water from the new WPS to the proposed new Wilton reservoirs located south of Picton Road near Thornton Hill.

It has been assumed for this study that the pipe alignment for the new trunk main would generally follow the existing DN300-200 main alignment along Wilton Road.

This main could be delivered in sections to allow for a staged delivery, rather than provided in a single step.

A major component of the trunk main is the crossing of Broughtons Pass Gorge. The preferred method of crossing the gorge is covered in the following section.

6.2.4 Automatic Control Valves for Appin Reservoir

Automatic control valves (ACVs) would be required on the inlet to Appin Reservoir to regulate water to Appin reservoir. The ACVs would prevent Appin Reservoir from overflowing while WP302 is filling the new Wilton Reservoirs.

The proposed location for the ACVs is on Wilton Road near the corner of Cataract Road at Appin. This location will allow the Appin reservoir to gravity feed to the Appin village while WP302 is filling the new Wilton Reservoirs. This will prevent Appin reservoir being isolated for extended periods of time, which would likely lead to a degradation of water quality in the reservoir.

Table 6-1: Trunk Water Network Infrastructure

Item	Details
Pumping Station	New Pumping Station at WP302
Trunk mains	6.5 km of 600-450 trunk main including new Broughtons Pass Crossing
Reservoir	2 x 6 ML reservoirs
ACVs for Appin Reservoir	ACVs located on existing inlet mains to Appin reservoir

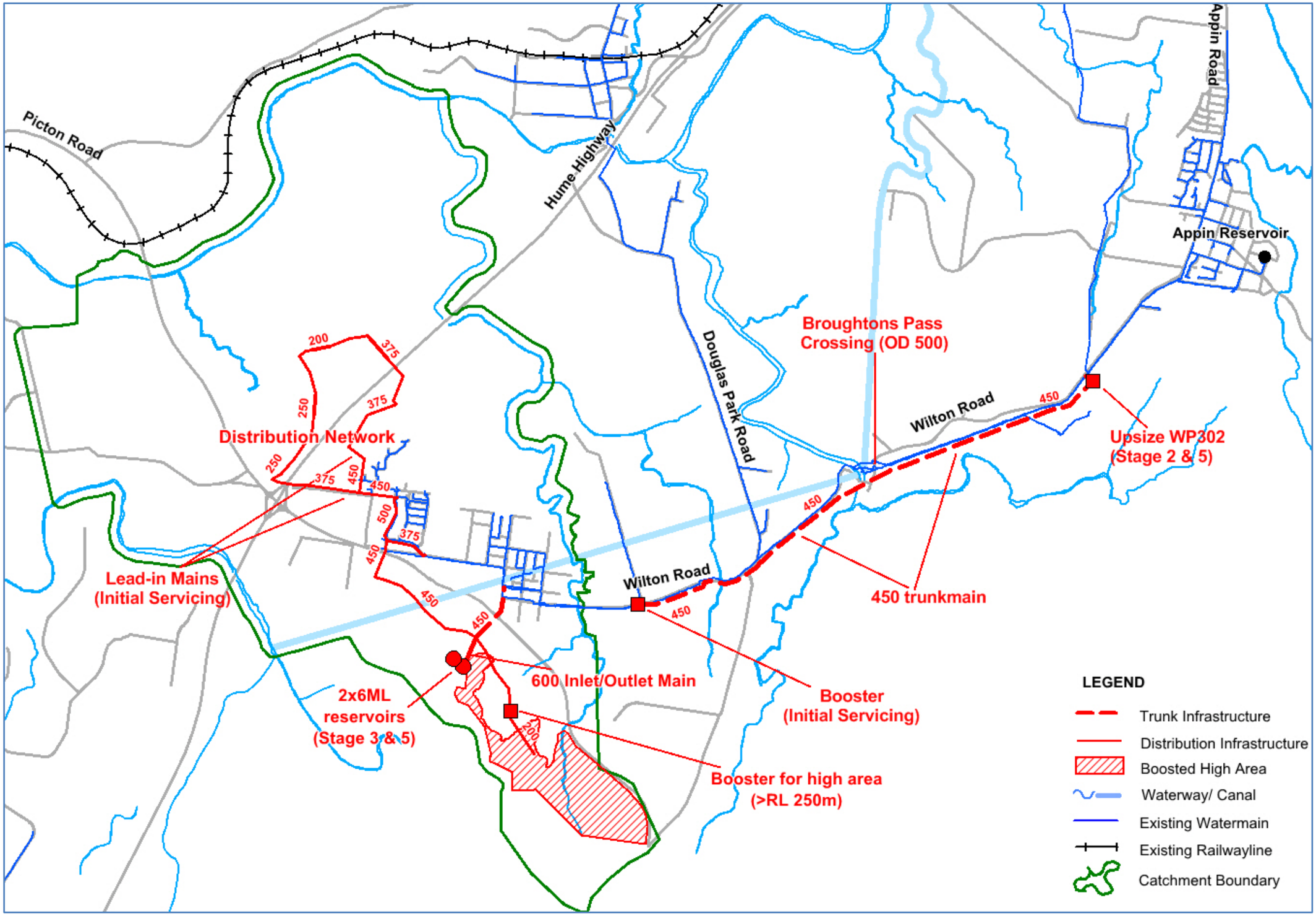

Figure 6-1: Trunk Water Infrastructure for Wilton Junction Development

6.2.5 Broughtons Pass Crossing

A major component of the trunk main is the crossing of Broughtons Pass Gorge, which is located approximately 3 km east of Macarthur WFP. A ground surface elevation profile of the pipe route from Macarthur WFP to Wilton along Wilton Rd is shown in Figure 6-2. The height of Broughtons Pass Gorge is approximately 70 metres. The Cataract River flows through the gorge and is the source for one of Sydney's drinking water supplies.

For this study, a desktop assessment of two options for a watermain crossing of Broughtons Pass Gorge was carried out:

- Option 1: horizontal directional drill (HDD) under Broughtons Pass
- Option 2: attaching to Cataract Bridge plus conventional trenching

To enable a comparable estimate, both crossing options assessed were evaluated between the nominated HDD launch and receiving pits indicated in Figure 6-3.

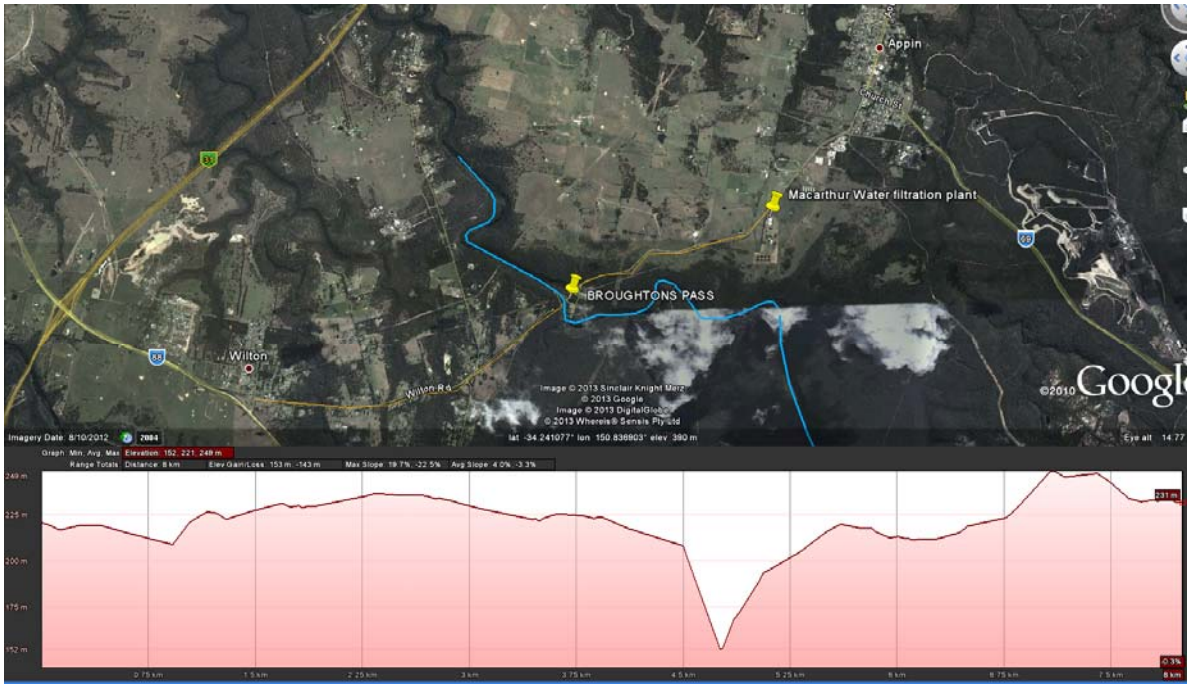

Figure 6-2: Profile of Trunk Watermain Route across Broughtons Pass Gorge

6.2.5.1 Option 1: Horizontal Directional Drill under Broughtons Pass

The proposed HDD route crossing under Broughtons Pass Gorge is shown below in Figure 6-3 (dashed yellow line). The proposed HDD pipe is a 502OD steel pipeline with a wall thickness of 5mm, extending approximately 690 metres between the nominated pit locations. The pipe depth is assumed to be 15 metres below Cataract River. The internal pressure in the pipe at this point is 187m.

The nominated pit locations required for the HDD are located off the road reserve in a location where there is sufficient space to set up the required drilling rig and pipe string (see Figure 6-3). The use of existing easements was considered in determining these locations.

It is anticipated that drilling works would commence on the western side of the gorge with the pipe strung out on the eastern side in an existing easement.

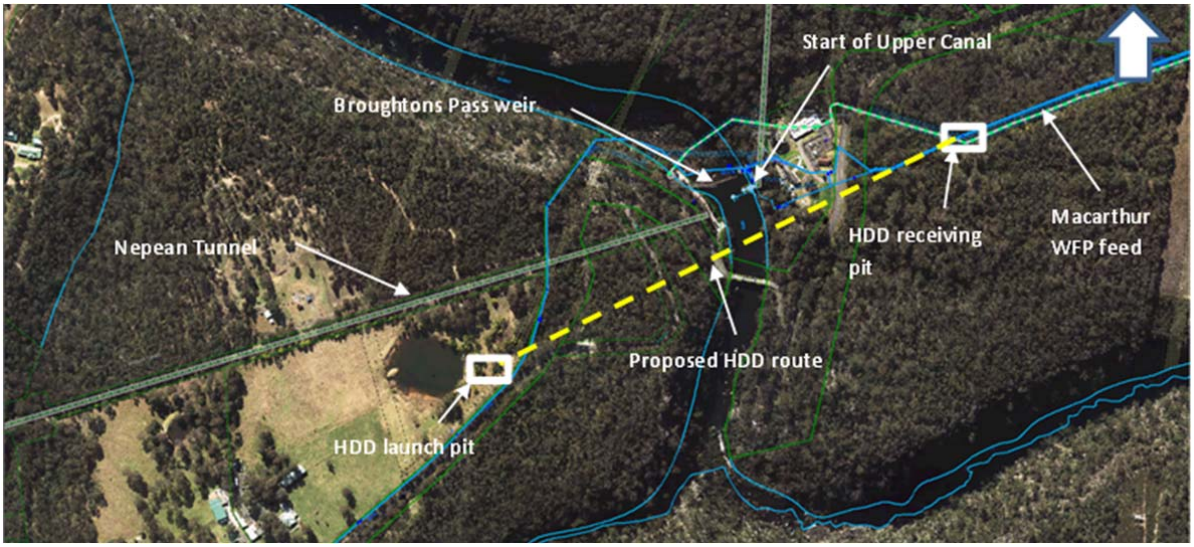

Figure 6-3: Route for HDD Option Crossing Broughtons Pass Gorge

6.2.5.2 Option 2: Bridge plus Conventional Trenching

This option originally required attaching the water main to the existing road bridge known as Cataract Bridge (or Broughtons Pass Bridge) over the Cataract River. Either side of the bridge, the watermain would be laid by conventional trenching. Advice from Wollondilly Shire Council has identified the bridge as a heritage listed item, and the addition of a pipe on the bridge would not be consistent with its heritage status. Additionally there is some structural remediation work required at the bridge abutments.

Therefore this option has been modified to instead provide an elevated pipe bridge adjacent to the existing road bridge. The watermain across Broughtons Pass Gorge would be supported on a prefabricated 1.5 metre wide steel truss girder bridge complete with walkway. Steel piping would require flexible jointing and be designed for thermal expansion and contraction of the bridge and pipe. Installation will require a mobile crane and other plant for lifting and assembling the truss girder components and pipeline. Wilton Road will need to be closed during some of this work.

The proposed 1,450 metre watermain route for this option follows Wilton Road and is shown in Figure 6-4 (green line). The 60 metre long pipe bridge crossing Cataract River is shown in red. The maximum pressure at the crossing is 150m.

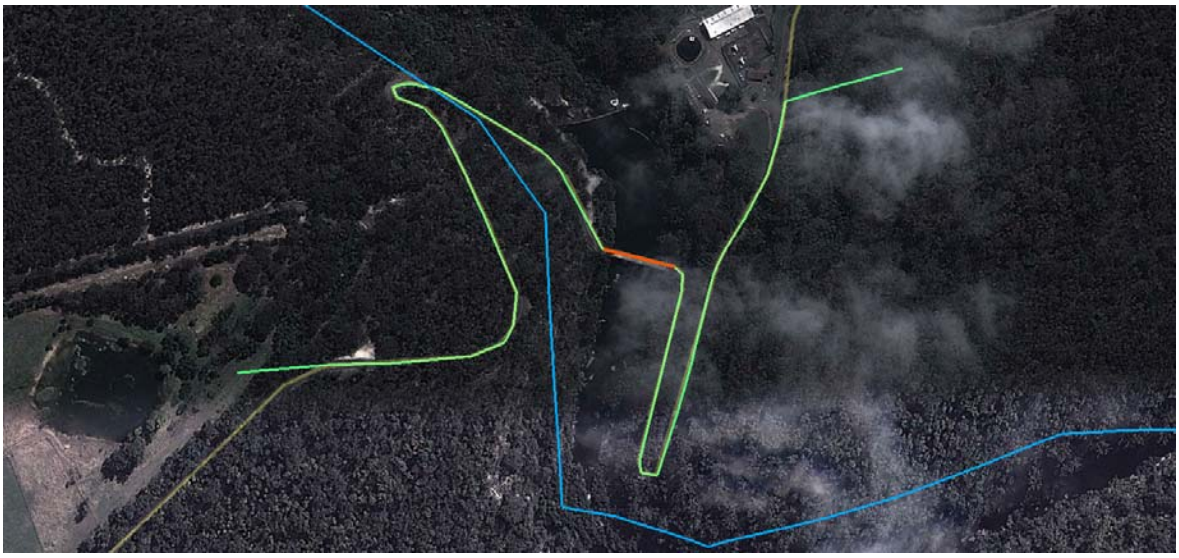

Figure 6-4: Route for Trench and Bridge Option Crossing Broughtons Pass Gorge

6.2.5.3 Broughtons Pass Crossing Option Assessment

The costs and major advantages and disadvantages of the options are given in Table 6-2.

Table 6-2: Broughtons Pass Crossing Option Assessment

Option	Cost		Advantages	Disadvantages
Option 1: HDD	Drilling Works Pipe supply & welding **Total** (incl. 30% contingency)	$1.7 M $0.8 M **$3.2 M**	• Avoids work along winding road and near rock overhangs • Minimal restoration • No traffic impacts • Minimal construction impacts on environment	• Risk of loss of drilling equipment/pipeline • Risk due to location of nearby Nepean and Upper Canal tunnels, Broughtons Pass Weir, and Eastern Gas pipeline. • Risk of contamination caused by “frac out” during drilling works
Option 2: Bridge plus Conventional Trenching	Trenched pipe Traffic management Pipe bridge Indirects **Total** (incl. 30% contingency)	$3.0 M $0.15 M $1.2 M $1.3 M **$7.2 M**	• Conventional, well adopted form of construction • Pipe bridge avoids impacting on heritage status of Cataract Bridge • Visual inspection of pipeline possible	• Closure of Wilton Rd for construction works will result in much longer travel times • Traffic management • Tight working spaces, lack of plant manoeuvrability • Dust and noise impacts • Road restoration

The most cost-effective option to cross Broughtons Pass Gorge is the HDD option. This option is subject to detailed investigations (eg geotechnical and environmental) to ensure the validity of assumptions made in this assessment. Impacts of mine subsidence need to be taken into account during design of the crossing.

It is anticipated that any works under or over the Cataract River will require the involvement and approval of the Sydney Catchment Authority (SCA).

6.2.6 Design and Operational Considerations

6.2.6.1 Security of Supply

The new reservoirs at Wilton have been sized at a total of 12 ML to supply the future growth at Wilton Junction.

However, due to a lack of alternative water supply sources to the Wilton area, additional reservoir capacity may be considered to provide security of supply in the event of a trunk main or WP302 pump failure or fire fighting incident. The need to provide additional storage for security of supply reasons would be determined at later date and would be based on a risk assessment in consultation with Sydney Water.

6.2.6.2 Water Quality

A rechlorination plant may be required to maintain water quality objectives in the amplified Appin Distribution System. If required, the likely location for the rechlorination plant is at the new Wilton Reservoirs.

The need for a rechlorination facility will be confirmed at a later date during detailed planning.

6.2.6.3 Mine Subsidence and Future Mining

The Illawarra Coal seam underlies the region at a considerable depth. Several collieries around Wilton currently extract coal, the nearest being Appin West Mine, 3 km to the north-east. All servicing options for Wilton Junction will be within one or more of the following mine subsidence districts:

- Bargo Mine Subsidence District
- Wilton Mine Subsidence District
- South Campbelltown Mine Subsidence District

All infrastructure associated with the servicing of the Wilton Junction development will need to accommodate the requirements of the Mine Subsidence Board.

- Maximum vertical subsidence of 0.95m
- Maximum ground strains of 2.5mm/m
- Maximum tilt of 6mm/m
- Maximum radius of curvature of 5kms

6.3 Distribution Network

The proposed distribution network for the Wilton Junction development is shown in Figure 6-1.

The distribution network will be supplied from the new 2 x 6 ML surface reservoirs located at Wilton.

11 km of DN500-200 distribution pipework is required to distribute water to the development areas.

A booster pumping station will be required to service elevated land to the south east of the proposed development area above a ground level of RL 250 m, and potentially in areas located adjacent to the surface reservoir. The areas supplied by the booster are shown in Figure 6-2. The booster pumping station would only be required as this area develops (>2022).

It is assumed for this study that directional drilling would be required for major road and rail crossings. These crossings occur at five locations within the distribution system, cross the Hume Highway, Picton Road and the rail corridor.

The majority of the distribution network would be constructed in footpath allocations during development stages. Depending on availability of space in the footpaths, larger distribution pipes (>DN375) may need to be laid in the roadway.

No reticulation pipework has been identified for this study.

Pressure Reducing Valves (PRVs) would be required to reduce maximum operating pressures to be <60 m head. Development areas to the north and north west are expected to have a maximum pressure of approximately 140m head, with minimum ground levels around RL 134m. Other areas have minimum ground levels around 160-170m, which would still require pressure reduction. The number and location of PRVs will require further detailed hydraulic assessment. For the purposes of this study, it has been assumed that 2 PRVs would be required, and located on the distribution network.

A summary of infrastructure for the distribution network is given in Table 6-3.

Table 6-3: Distribution Network Infrastructure

Item	Details
Distribution mains	11km of DN500-200 watermains
Pumping Station	Booster pumping station for elevated area in south eastern part of Walker Corporation land
Pressure Reducing Valves	2 pressure reducing valves (see Figure 6-5 for location)

6.4 Capital Costs

The capital cost estimates are order of magnitude cost and provided for comparative purposes only. The cost estimates have been prepared using available cost estimating sources and MWH experience with similar projects, and are based on desk top assessments.

MWH warrants that reasonable skill, care and diligence was exercised in the preparation of these costs. However, MWH has no control over costs of labour, materials, competitive bidding environments and procedures, unidentified field conditions, financial and/or market conditions, or other factors likely to affect the probable cost of constructing the identified infrastructure. As such, MWH is unable to guarantee the accuracy of this cost estimate against the final outturn cost of the infrastructure and does not accept any liability in the event that actual costs are different from those indicated in our estimate.

Infrastructure costs for the supply of drinking water to the Wilton Junction development are provided in Table 6-4. The total capital cost (excluding reticulation costs) is estimated to be $36M.

Table 6-4: Capital Cost Estimates

Item	Capital Cost ($M)[1]
Trunk Infrastructure	
Pumping Station	1.5
Mains	8.3
Broughtons Pass Crossing[3]	3.2
Reservoirs	4.9
ACV for Appin Reservoir	1
Sub-total	18.9
Distribution Infrastructure	
Mains	14.15
Booster Pumping Station	1.1
Pressure Reducing Valves	1
Sub-total	16.25
Initial Temporary Infrastructure[4]	
Booster Pumping Station	0.85
Sub-total	0.85
Total Water Supply Cost	**36.0**

Notes:
1. Capital costs have been provided by VKL Consulting Pty Ltd
2. Capital estimates include the following allowances:
    a. 5% scope creep
    b. 10% design and investigation
    c. 5% construction management
    d. 15% contingency
3. Costs are for Broughtons Pass Crossing by HDD
4. Infrastructure costs for initial servicing of development is described in more detail in the following section, and included here for completeness.

A life cycle cost assessment has been provided in Appendix E.

6.5 Cost Apportionment between Sydney Water and Proponents

This section apportions the estimated capital costs for the Wilton Junction water infrastructure between Sydney Water, as bulk water supplier, and the Proponents based on the proposed strategy. The proposed staging is likely to be altered to reflect the final design and staging of individual developments.

The cost apportionment is based on the following assumptions:

- Trunk network costs would be funded by Sydney Water
- Distribution network costs would be funded by the Proponents for minimum sized watermains (DN100); upsizing costs to larger diameter watermains would be funded by Sydney Water
- Costs for boosters and PRVs would be funded by the Proponents
- Costs for temporary infrastructure to service initial development would be funded by the Proponents.

The estimated breakdown of costs for Sydney Water and the Proponents is provided in Table 6-5.

Table 6-5: Cost Apportionment Between Sydney Water and Proponents

Item	Cost Estimate ($M)	Sydney Water Funded[1] ($M)	Proponents Funded ($M)
Trunk Infrastructure	18.9	18.9	0
Distribution Infrastructure			
Mains	14.15	9.6	4.55
Booster Pumping Station	1.1	0	1.1
Pressure Reducing Valves	1.0	0	1.0
Sub-total	16.25	9.6	6.65
Initial Temporary Infrastructure	0.85	0.85	0
Totals	**36.0**	**29.35**	**6.65**

Notes:
1. Apportionment based on the assumption that Sydney Water pays for the full cost of trunk assets and the watermain upsizing cost (above minimum 100 pipe size)

The estimated apportionment of Proponents' costs will be subject to commercial arrangements between the Proponents.

6.6 Sensitivity Analysis for Preferred Strategy

For the sensitivity analysis, 10% less and 10% additional demand was applied to the maximum day demand model. The modelling results for the sensitivity analysis are given in Appendix C.

With the 10% additional demand case, it is expected that there would only be minor impacts around the high elevation area to the south east of the development site, with a minor increase in the area needed to be supplied via a booster. The majority of the area is at an elevation well below the reservoir and will require pressure reduction, and therefore there is no impact to these areas from an additional 10% demand. There would be no impact on trunk main sizing. There is a minor impact on the reservoir depletion for the future Wilton Reservoir under peak demand, with the minimum level at 30% (down from 47% for the base demand case), which is marginally below the nominal reserve storage level of 33%. Consideration for increasing reservoir capacity has previously been discussed for security of supply reasons in Section 6.2.6.1.

With the 10% less demand case, there may be an opportunity to further optimise the distribution network and to reduce some pipe diameters by one pipe size. There would be no impact on trunk main sizing with the 10% less demand case.

7 Water Infrastructure Staging Plan

This section describes a plan for the staged implementation of infrastructure required to service the Wilton Junction development.

The objectives of the initial servicing are to:

- Provide initial supply to a total of 2,000 dwellings by 2021
- Provide initial supply to up to 1,000 dwellings to each of the four land owners (ie total 4,000 lots).

Options considered for staging of infrastructure include the following:

- Temporary boosters
- Increase existing pump capacity at WP302
- Staged amplification of new watermains
- Staged implementation of new reservoirs
- Staged implementation of new pumping station (pump units).

The infrastructure staging identified in this section is based on providing incremental increases in system capacity at a minimum cost for each stage. Note that the staging plan described in this section provides for 700 dwellings to be serviced from the existing system. The additional dwellings to be serviced will require the provision of additional water infrastructure as described in Table 7-2. The proposed staging is likely to be altered to reflect the final design and staging of individual developments.

7.1 Existing capacity in Appin Distribution System

Key to the timing of new infrastructure is the identification of available spare capacity in the existing Appin system.

Assessment of existing spare capacity in the Appin System was determined using Sydney Water's hydraulic model.

A major factor in determining spare capacity in the existing system is the high and variable peak water demands from the following key customers:

- Appin West Colliery, located near Wilton
- Appin East Colliery, located near Appin
- Inghams Farm, located along Appin Road north of Appin

A reduction in peak demands from these key customers will provide additional spare capacity for future growth. The demands allocated to these key customers in the hydraulic model (as provided by Sydney Water) are shown in Table 7-1. Note that this model assumes that the average and peak demands are the same, and therefore implies that a solution to eliminate the high peak demands from these key customers has been implemented.

Table 7-1: Existing Large Demand Users in Appin Model

Major Customer	Average Demand (kL/d)	Peak Demand (kL/d)
Appin West Colliery	236	236
Appin East Colliery	624	624
Inghams Farm	266	266

7.2 Infrastructure Staging Plan

This section describes the planned staging of the water infrastructure identified, addressing one of the key DGRs for the Wilton Junction development. The water infrastructure staging plan is shown in Table 7-2 and in Figure 7-1.

For initial servicing, approximately 700 dwellings can be supplied from the existing system. The initial servicing stage will require lead-in mains to the initial developments (see Table 7-2 for details) and a booster pumping station located on Wilton Road near Macarthur Drive, which would boost pressure to the whole Wilton area.

A key assumption in determining the available system capacity from Stage 1 onwards is that the WP302 units would be operating during peak demand periods. This assumption needs to be confirmed by Sydney Water in discussion with the Macarthur WFP operator (owner of WP302). To allow WP302 to continue pumping during the peak demand periods, a control arrangement is proposed consisting of ACVs and reflux (one directional) valves, located on the existing inlet mains to Appin reservoir. The ACVs are necessary to prevent overflowing of Appin reservoir, and would open and close as the Appin reservoir depletes and fills. The reflux valves would allow Appin reservoir to feed the Wilton area while the ACV is closed.

The stage numbers are based on the capacity of existing assets and the incremental construction of new assets. The capacity of each stage is expressed in dwellings.

Table 7-2: Staging Plan

	Stage	Assets Required	Total Dwellings Served	Asset Cost ($M)	Total Stage Cost ($M)	Approx Timing
	Initial Stage (existing system)	Lead-in to Governors Hill - 1.5km DN375	700[1]	2.3	8.45	2018/19
		Lead-in to Bradcorp -2.6km DN375		4.3		
		Minimum DN200 lead-in to Walker from existing DN450 in Picton Rd				
		1 x booster pumping station		0.85		
		Pressure reducing valve		1.0		
1.	Amplify 1.5km of DN200	1.5km of DN450 main	2,000	1.7	2.7	2021
		ACV + Reflux Valve[2] on existing Appin Reservoir inlet mains on Wilton Road		1.0		
2.	Amplify 2.8km of DN300	2.8km of DN450 main	4,000	3.2	4.6	2025
	Amplify WP302 (Part 1)	New WP302 (2 x pump units)		1.4		
3.	New Broughtons Pass Crossing	DN500 HDD crossing	8,000	3.2	9.6	2033
	New Wilton storage (Part 1)	6 ML reservoir		3.0		
	New inlet/outlet main	1 km x DN600-450 inlet/outlet main		3.4		
4.	Amplify 1.2km of DN300	1.2 km of DN450 main	9,000	1.3	1.3	After 2035
5.	Amplify WP302 (Part 2)	Amplify new WP302 (1 x pump unit)	Ultimate development	0.1	2.0	After 2035
	New Wilton storage (Part 2)	6 ML reservoir		1.9		

Stage	Assets Required	Total Dwellings Served	Asset Cost ($M)	Total Stage Cost ($M)	Approx Timing
	Remaining Distribution Network and other works		7.35	7.35	
	Total Costs		**36.0**	**36.0**	

Notes:
1. Existing system capacity based on usage of 2.2kL/dwelling/d which is the design total water usage for a dual reticulation system. This is the design total water usage for Bingara Gorge development, prior to the implementation of the recycled water supply expected around 2018. This also assumes the minimum operating level at Appin Reservoir would be maintained at its current level of 75% full.
2. Installation of ACV & Reflux Valves on existing Appin Reservoir inlet mains subject to Sydney Water approval.
3. Optimisation of infrastructure could potentially increase the number of lots supplied at each stage
4. Timing is based on the staging plan provided by the Proponents. Build out rate is provided in Appendix A.
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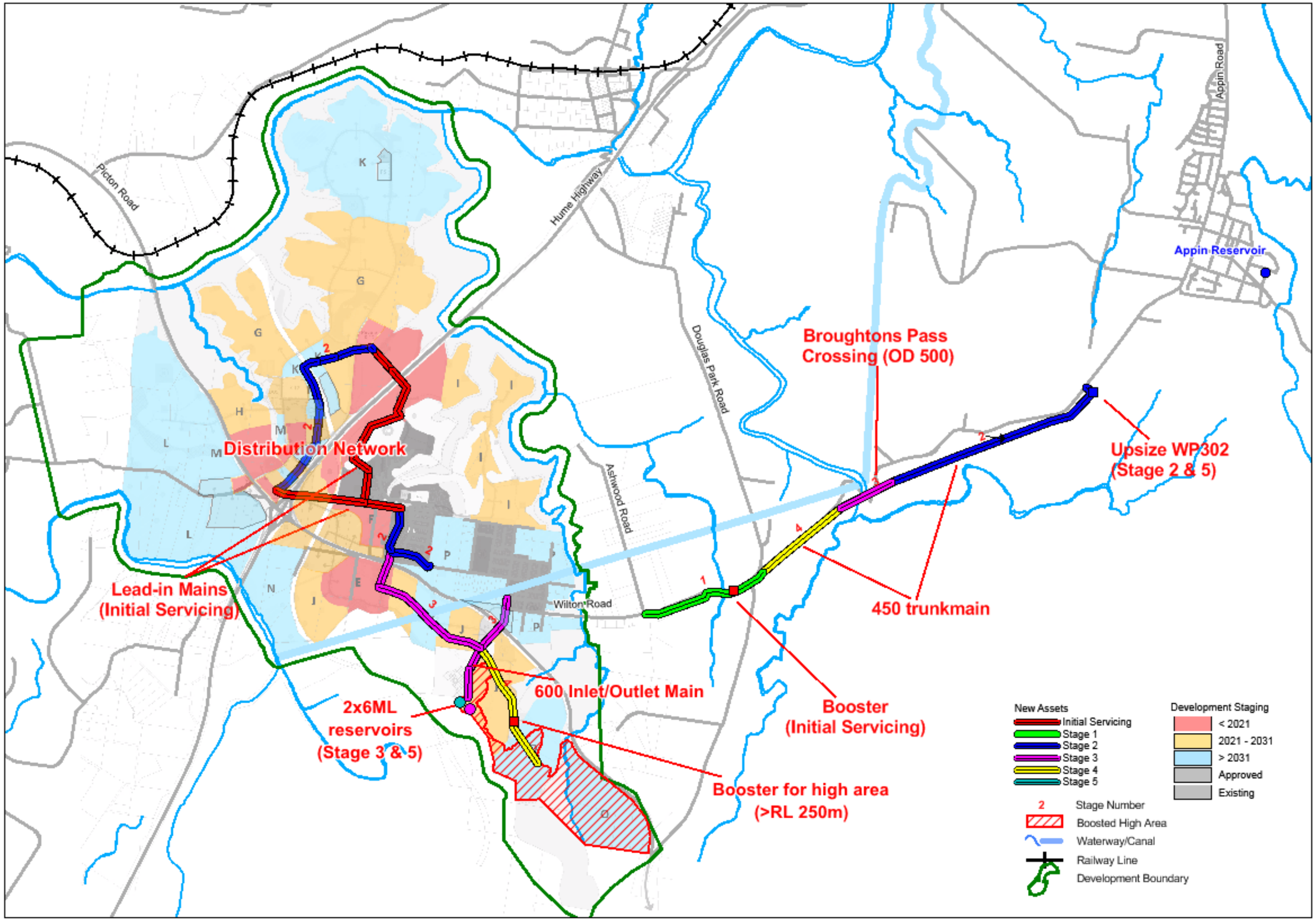


Figure 7-1: Water Infrastructure Staging Plan

8 Recommendations

The recommended water servicing strategy for the proposed Wilton Junction development includes:

- Water supply from the Macarthur Water Filtration Plant.
- Amplified pumping station WP302 from 12ML/d to 20ML/d (located at Macarthur WFP).
- Construction of 6.5 km of DN600/500/450 trunk main generally along Wilton Road.
- A new pipe crossing of Broughtons Pass Gorge.
- Construction of 2 x 6 ML reservoirs located south of Picton Road.
- Construction of 11 km of DN500-200 distribution pipework.

The identified strategy offers a cost-effective, staged infrastructure plan to provide the water services for the Wilton Junction development. The strategy:

- Provides an efficient and cost-effective strategy by utilising available system capacity in the Appin Distribution System and Macarthur WFP.
- Provides flexibility in allowing servicing of the four development fronts simultaneously.
- Provides for a degree of system redundancy through provision of a new trunk main, multiple reservoirs and pumping units.
- Represents value for the government and developer as the future infrastructure has been sized according to Sydney Water's latest design criteria, which is based on actual water usage in adjacent systems, and allows for future water savings through the implementation of BASIX.

The proposed servicing strategies are likely to be altered to reflect the final designs and staging of individual developments. Thus further investigations will be required to confirm these changes and refine the locations and sizing of water infrastructure identified, including:

- Detailed hydraulic model assessment
- Risk assessment including consideration of future security of supply due to the lack of alternative water supply sources to the Wilton area. Additional storage may be required to mitigate future risk scenarios involving trunk main or WP302 pump failure, or a fire fighting incident.
- Geotechnical investigations
- Environmental impact assessment including specialist studies where required
- Stakeholder and community consultation
- Mine Subsidence Board requirements
- Fire Flow requirements
- Risk assessment
- Detailed capital cost estimates

9 References

The following is a list of documents that have been referenced for this study:

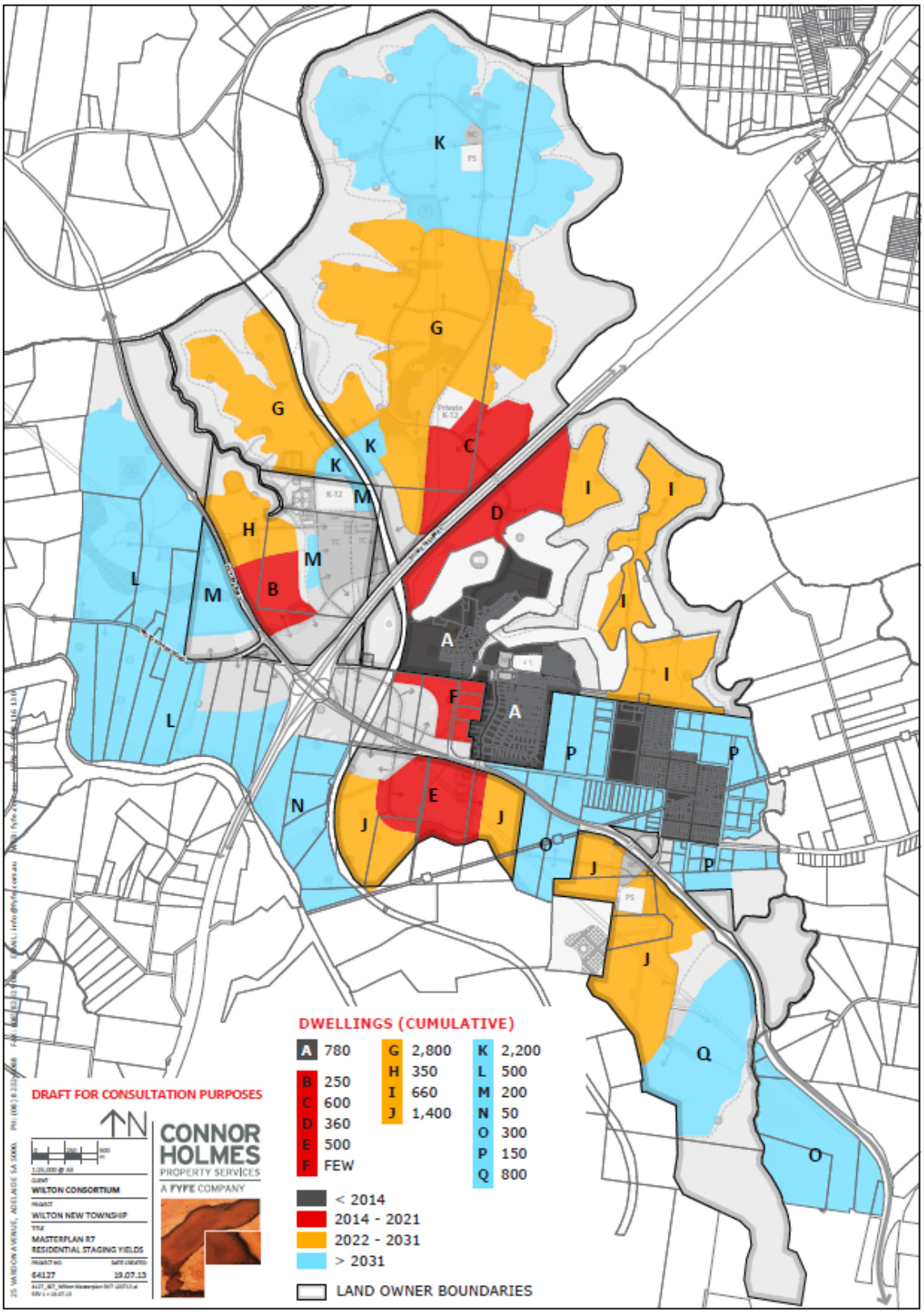
- AECOM, *Bingara Gorge Potable Water Detailed Planning, 2012*
- MWH, *Wilton Junction – A New Town Water Master Plan, 2012*
- Sydney Water, *Design Criteria Guidelines Supplement, 2010*
- Water Services Association of Australia, *Water Supply Code of Australia, WSA 03—2002-2.2, Sydney Water Edition, Version 2*
- Rawlinsons, *Edition 30, 2012*
- Ministry of Energy and Utilities, *NSW Reference Rates Manual - Valuation of Water, Wastewater and Stormwater Assets, 2003*
- Elton Consulting, *Wilton Junction New Town - High Level Infrastructure Business Case, 2012*

Appendix A Wilton Junction Development

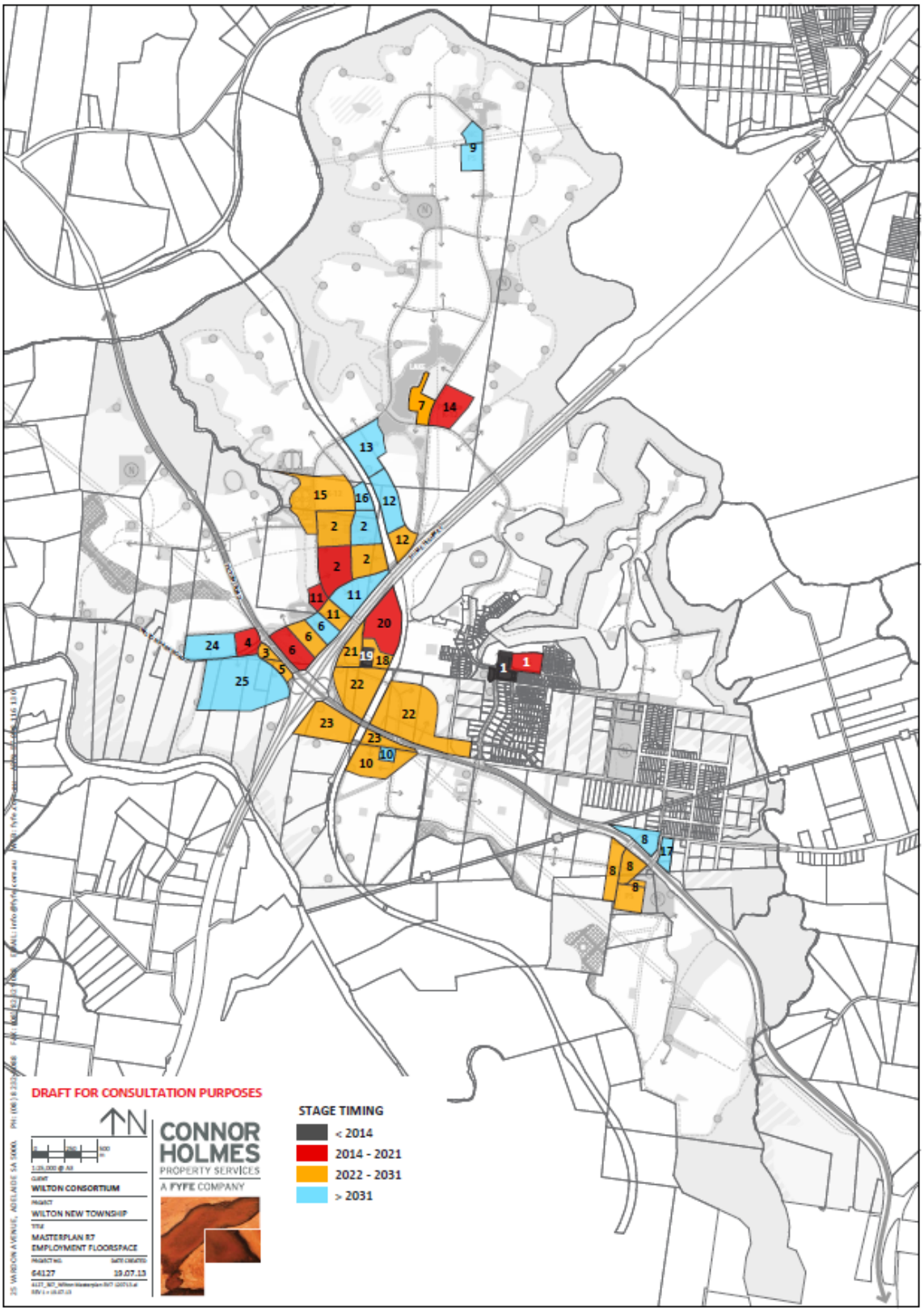
WILTON JUNCTION DEVELOPMENT BUILD OUT RATE

Year	Annual Allotment Production	Cumulative Allotment Production	Annual Dwelling Production	Cumulative Dwelling Production
2007	-	-	-	-
2008	20	20	-	-
2009	40	60	-	-
2010	60	120	20	20
2011	80	200	40	60
2012	100	300	60	120
2013	120	420	80	200
2014	220	640	100	300
2015	270	910	120	420
2016	320	1,230	220	640
2017	370	1,600	270	910
2018	420	2,020	320	1,230
2019	470	2,490	370	1,600
2020	520	3,010	420	2,020
2021	520	3,530	470	2,490
2022	520	4,050	520	3,010
2023	520	4,570	520	3,530
2024	520	5,090	520	4,050
2025	520	5,610	520	4,570
2026	520	6,130	520	5,090
2027	550	6,680	520	5,610
2028	550	7,230	520	6,130
2029	550	7,780	550	6,680
2030	550	8,330	550	7,230
2031	550	8,880	550	7,780
2032	550	9,430	550	8,330
2033	450	9,880	550	8,880
2034	450	10,330	550	9,430
2035	450	10,780	450	9,880
2036	450	11,230	450	10,330
2037	350	11,580	450	10,780
2038	200	11,780	450	11,230
2039	120	11,900	350	11,580
2040			200	11,780
2041			120	11,900
Total	**11,900**	**11,900**	**11,900**	**11,900**

WILTON JUNCTION DEVELOPMENT STAGING PLAN



Wilton Junction Masterplan - Residential Staging Yields



Wilton Junction Masterplan – Employment Floorspace

Appendix B Design Criteria Technical Memo and Notes from Meetings with Sydney Water

MWH®

BUILDING A BETTER WORLD

MEMORANDUM

TO: Richard Schuil – Sydney Water

DATE: 14 May 2013

CC:

REF:

FROM: Greg Alford & Tim Day – MWH

MWH Australia Pty Ltd

SUBJECT: Water and Wastewater Demand Forecasts

Base Data Assumptions

The base inputs underpinning the water demand and wastewater flow forecasts include;

- The total number of dwellings in the rezoning precinct is expected to be;
  - 10,200 dwellings from the landholdings of Bradcorp, Walker Corporation, Governers Hill and other identified developable land in the rezoning precinct.
  - 1,700 from the Bingara Gorge (Lend Lease) development
  - 300 existing dwellings in Wilton
- Average occupancy rate for residential dwellings is forecast to be 2.8 - from the "Wilton Junction – Social Infrastructure Background Investigations Report (5 October 2012)" prepared by Elton Consulting.
- Non-residential development based on the "Wilton Junction - Population and Employment Need (October 2012)" Report prepared by MacroplanDimasi;
  - The total Commercial Land (Gross) = 54Ha
  - The total Industrial Land (Gross) = 116Ha
- There will be 3 primary schools and 1 high school in the rezoning precinct. There is also a primary school proposed for the Bingara development.
- The gross developable area (A) for Wilton Junction = 2,584 Ha
- Build Out Rate is still being finalised. The latest update from the proponent's Wilton High Level Business Case is given in Attachment A. Note that an updated Build Out Rate will be issued soon.

Wastewater Flow Forecasts

The base design parameters underpinning the wastewater flow forecasts for this study are;

- Residential Dwellings = 2.8 EP/dwelling
- ADWF Design Flow = 150 L/EP/day
- Light Industrial = 40EP/Ha[1]
- Commercial = 40EP/Ha[1]
- Schools = 0.2EP/student
- PDWF = d x ADWF (where $d = 0.01(\log A)^4 - 0.19(\log A)^3 + 1.4(\log A)^2 - 4.66\log A + 7.57$)
- PWWF (Low Infiltration (LI) sewers) = 3 x PDWF
- Containment Factor[2] = 0.8
- Pump Station Pump Capacity = 2.5 x PWWF
- Pump Station Emergency Storage = 4 hrs x PDWF

[1] *Based on preliminary advice from advice from SWC*

[2] *Based on Table B3 from WSA 02-2002-2.2 for a 1 in 1 ARI (which corresponds with the nearby Picton system that has a 10 in 10 year ARI)*

The Bingara Gorge has been rezoned, is proceeding with development and has occupied dwellings on the ground. For the wastewater scheme, it is assumed that all of the Bingara Gorge as well as the existing Wilton customers will be serviced by the current (or upgraded) Bingara Gorge STP. Therefore, the projected WW flows in Table 1 below are based on the remaining development area which is for 10,200 dwellings.

Table 1: Forecast WW Flows

Category	Number	Rate	EP	ADWF (ML/d)	PDWF (ML/d)	LI PWWF (ML/d)
Residential	10,200 Dw.	2.8 EP/dwelling	28,560	4.3	7.6	18.3
Commercial	54 Ha	40 EP/Ha	2,160	0.3	0.6	1.4
Light Industrial	116 Ha	40 EP/Ha	4,460	0.7	1.2	3.0
Schools	4,000	0.2 EP/student	800	0.1	0.2	0.5
Total			**37,557**	**5.7**	**10.2**	**30.5**

Note calculated d factor (based on A = 2,584 Ha) for PDWF = 1.78.

Water Demand Forecasts

The residential Maximum Day Demand (ADD) to be adopted for this study was based on a number of sources:

- existing water consumption data in Appin system
- existing water consumption and demand data for the adjoining Rosemeadow system

The existing daily water demand data for the Appin and Rosemeadow Systems from 2009 to present is shown in Attachment B. Note the daily demand for the Appin System is highly variable due to the very large and intermittent demands from the existing mining operations in the system. Since the mining demand could not be separated from the remaining system demand (due to unavailability of daily demand data for the mines), this data could not be used to determine a MDD for future growth.

The MDD for the Rosemeadow System is 6 ML/d based on a peak demand on 13 January 2013. Based on this figure, the MDD rate for a single residential dwelling is **1.05** kL/dwelling/d.

Water usage and demand data for the Appin and Rosemeadow Systems is shown below in Table 2. The average usage figures have been increased by peaking factors in the current respective models. Based on this data, MDD rates for single residential dwelling is in the range **1.02-1.28** kL/dwelling/d.

Table 2 - Water usage figures for Appin and Rosemeadow Supply Zones

Water Supply Zone	Period	Average Usage (kL/lot/d)	MDD Factor	MDD Rate (kL/lot/d)	MDD Reduced by 15%
Appin	2012	0.52	2.312[1]	1.20	1.02
	Jan-Mar 2013	0.78	1.93[2]	1.50	1.28
Rosemeadow	2012	0.60	1.75[3]	1.05	

Notes
1. MDD factor in the latest Appin MDD model (2012)
2. MDD factor reduced to convert "summer average" demand
3. MDD factor based on Rosemeadow MDD=6 ML/d in January 2013 (see chart in Attachment B

It is recommended to adopt a MDD rate of 1.05 kL/dwelling/d for Wilton Junction. Note this is lower that the adopted South West Growth Centre MDD rate of 1.1 kL/dwelling/d (which was based on Narellan system usage).

The design parameters adopted for the water strategy are given in Table 3:

Table 3: Forecast Wilton Junction water demand

Category	**ADD (ML/d)**	**MDD (ML/d)**	**MHD (ML/d)**
Residential	0.75 kL/dwlg/d	1.1 kL/dwlg/d	2.75 kL/dwlg/d
Commercial	20.5 kL/Ha/d	41 kL/Ha/d	82 kL/Ha/d
Light Industrial	25 kL/Ha/d	40 kL/Ha/d	64 kL/Ha/d
Schools - Primary	18.5 kL/school/d	37.5 kL/school/d	75 kL/school/d
Schools - High	37.5 kL/school/d	75 kL/school/d	150 kL/school/d

The projected water demands for the Wilton Junction are given in Table 4 below are based on 11,900 new dwellings (including Bingara Gorge).

Table 4: Forecast Wilton Junction water demand

Category	**Number**	**ADD (ML/d)**	**MDD (ML/d)**	**MHD (ML/d)**
Residential	11,900 dwellings	8.9	13.1	32.7
Commercial	54 Ha	1.1	2.2	4.4
Light Industrial	116 Ha	2.9	4.6	7.4
Schools/Community		0.2	0.3	0.7
Total		**13.0**	**20.2**	**45.2**

Other future Appin System demands to be taken into account for the water modelling task include:

- Future infill in the existing villages of Appin, Douglas Park and Wilton (data to be extracted from Sydney Water property table records)
- Future 337dwellings growth at Appin North occupied by 2015-16. (MDD = 0.74 ML/d based on 2.2 kL/dwelling/day)

Service Level Parameters to be adopted for the strategy include:

- Target Residual pressure = >12m and <15m for 10 customers days (but subject to risk assessment)
- Reservoir Level = Maintain level above reserve storage level (RSL)

Wastewater Servicing Strategy

Existing Wastewater Services

The existing villages of Appin, Wilton and Douglas Park have on-site sewerage systems. Sydney Water is progressing with providing sewerage to these villages through their Priority Sewerage Program.

The existing Wilton village will be provided with a pressure sewerage scheme, with each lot draining to its own pot. The wastewater will be pumped to a new treatment plant to be constructed by Lend Lease for the Bingara Gorge development.

The Bingara Gorge development will also be provided with a pressure sewerage scheme. Lend Lease is proposing a scheme with about 4 lots draining to each pot.

Wilton Junction Wastewater Strategy

The proposed wastewater strategy for the Wilton Junction development involves the following

- A new centrally located treatment plant, located adjacent to the Bingara Gorge treatment plant
- Low-infiltration gravity sewerage system is assumed as a base case. Alternative options that may be considered include
    - Pressure sewerage system
    - Combined low-infiltration and pressure sewerage systems
    - Leak-tight sewerage system
- 6 SPS locations
- Sewage treatment process based on meeting the effluent quality targets shown in Table 5 including:
    - Membrane bioreactor
    - Chemical dosing and filtration (to reduce phosphorus to 0.1 mg/L)
    - Disinfection (depending on end-use)
- Biosolids strategy options to include:
    - Tankering off-site
    - On-site stabilisation and dewatering/thickening for re-use
- Servicing of initial lots by either
    - Multiple temporary package MBR units and effluent disposal by irrigation
    - Transfer to Bingara Gorge treatment plant

Table 5: Effluent Quality Targets

Pollutant	**50%ile limit**
BOD	7 mg/L
TSS	6 mg/L
NH_3	0.5 mg/L
Total Nitrogen	6 mg/L
Total Phosphorus	0.1 mg/L

The effluent disposal strategy is being devised by J. Wyndham Prince, and includes:

- Land irrigation
- Potentially industrial re-use
- Recreational lake potentially combining wastewater effluent and stormwater
- Discharge to waterways as offset for environmental flow releases from dams

Water Servicing Strategy

Existing Water Services

The existing villages of Appin, Wilton and Douglas Park are supplied by the Appin Water Supply Zone. The Appin zone is supplied water from the Macarthur water filtration plant (WFP).

A pumping station at Macarthur WFP pumps water to the existing Appin reservoir (10ML capacity) located at Appin. This pumping station also pumps directly into the system while the reservoir is filling. The Appin reservoir supplies the entire system when the pumps are off.

Sydney Water's current plan for the Bingara Gorge development involves provision of a booster pumping station for the existing Wilton village and the new development. A local solution is being investigated to reduce peak demands from the existing mining operations in the area. The 2ML reservoir previously proposed for the Bingara Gorge development is now not being provided.

Wilton Junction Water Strategy

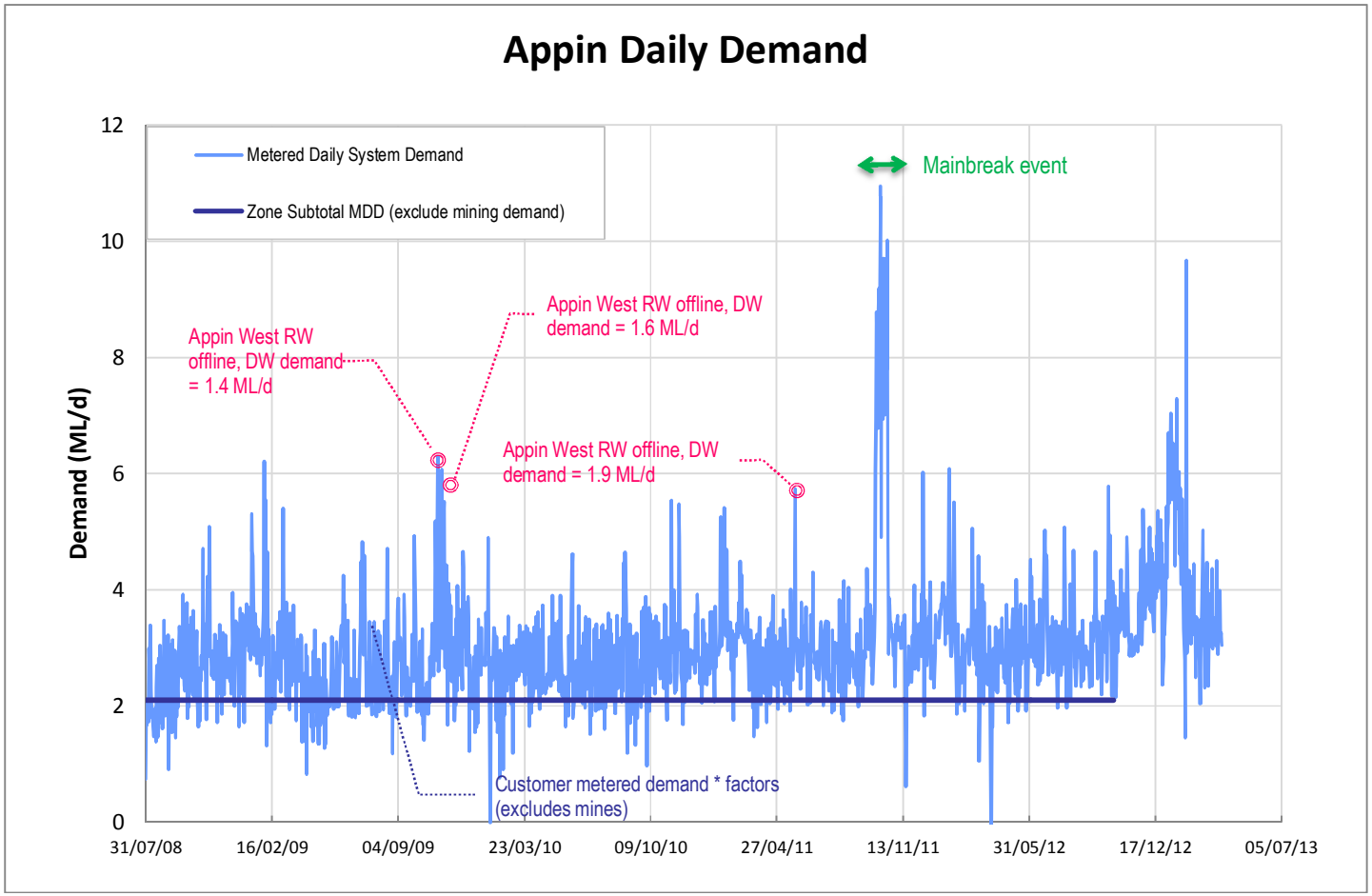
The water strategy for the Wilton Junction development involves the following

- Supply from Macarthur WFP
- New pumping units/station at the Macarthur WFP to supply Wilton demand to new Wilton reservoir, located on or adjacent to Walker Corporation land south of Picton Road.
- 2 x new Wilton reservoirs (approx. 18ML total capacity to be confirmed) proposed to allow staged delivery
- New trunk main (approx.6 km) from the existing WFP to Wilton including new crossing of Broughtons Pass gorge
- Options for crossing Broughtons Pass gorge include
    - HDD directional bore
    - Pipe strapped to existing Cataract Bridge (this is a Council owned bridge)
- Servicing of initial lots by temporary booster pumping stations and potentially temporary reservoir (if required)

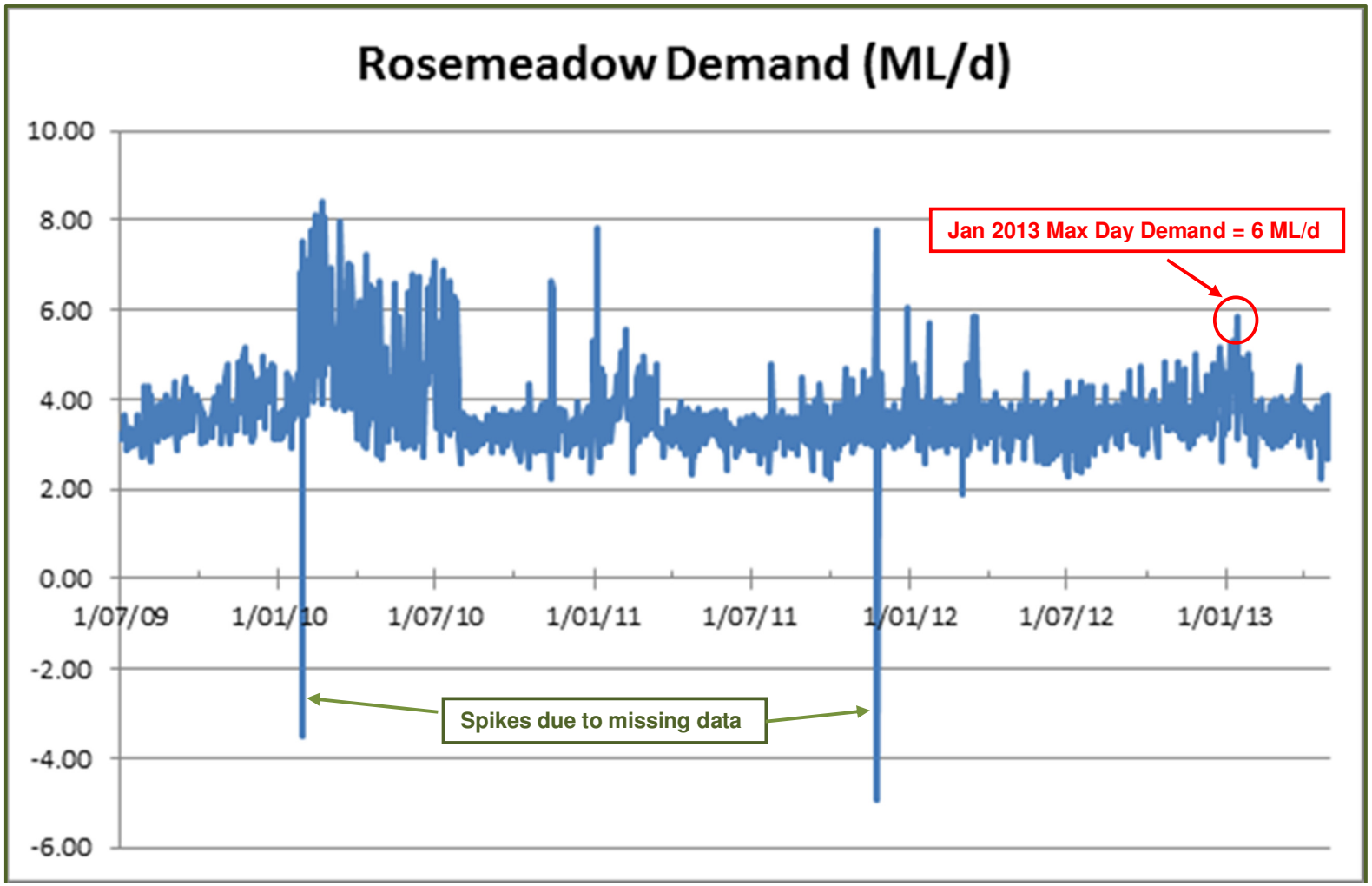
Attachment A – Latest Version Build-Out Rates

Year	**Annual Allotment Production**	**Cumulative Allotment Production**	**Annual Dwelling Production**	**Cumulative Dwelling Production**
2007	-	-	-	-
2008	20	20	-	-
2009	40	60	-	-
2010	60	120	20	20
2011	80	200	40	60
2012	100	300	60	120
2013	120	420	80	200
2014	160	580	100	300
2015	220	800	120	420
2016	270	1070	160	580
2017	320	1390	220	800
2018	380	1770	270	1070
2019	430	2200	320	1390
2020	480	2680	380	1770
2021	520	3200	430	2200
2022	520	3720	480	2680
2023	520	4240	520	3200
2024	520	4760	520	3720
2025	520	5280	520	4240
2026	520	5800	520	4760
2027	520	6320	520	5280
2028	550	6870	520	5800
2029	550	7420	520	6320
2030	550	7970	550	6870
2031	550	8520	550	7420
2032	550	9070	550	7970
2033	550	9620	550	8520
2034	550	10170	550	9070
2035	550	10720	550	9620
2036	510	11230	550	10170
2037	350	11580	550	10720
2038	200	11780	510	11230
2039	120	11900	350	11580
2040	-	-	200	11780
2041	-	-	120	11900

Attachment B – Appin Daily Demand



Attachment B – Rosemeadow Daily Demand



Attachment C - Water Usage

Appin System 2012 Calendar Year

	Property Type	#Properties	#Properties No Readings	Usage kL/year	Usage kL/d	Average Usage kL/lot/d
194	AGRICULTURE	20		14,967	41	2.05
242	CHURCH PROPERTY	4		729	2	0.50
138	CLUB	1		976	3	2.67
193	COM STRATA UNIT	9		487	1	0.15
146	COMMERCIAL	18	19	3,560	10	0.54
	COMMUNITY SERVICES		8		0	
233	DUAL OCCUPANCY	11		3,230	9	0.80
023	GOVERNMENT	1		34	0	0.09
171	HOTEL	1		1,504	4	4.12
002	IND STRATA UNIT	12		331	1	0.08
001	INDUSTRIAL	5	1	4,244	12	2.33
237	LOT FOR DEV	2		67	0	0.09
212	MASTER STRATA	4		516	1	0.35
238	MIXED DEVLPMENT	2		1,454	4	1.99
089	OCCUPIED LAND	5	305	3,015	8	1.65
239	PUBLIC RESERVE	6		1,346	4	0.61
127	SCHOOL(STATE)	3		1,897	5	1.73
070	SINGLE DWELLING	1,339	53	256,404	702	0.52
071	STRATA UNIT	26	4	2,744	8	0.29
	UTILITIES		7		0	
	VACANT LAND		276		0	
		1,469	673	297,505	815	

Appin System January-March 2013

	Property Type	#Properties	#Properties No Readings	Usage kL/3mths	Usage kL/d	Average Usage kL/lot/d
194	AGRICULTURE	20		5,002	55	2.74
242	CHURCH PROPERTY	4		170	2	0.47
138	CLUB	1		398	4	4.36
193	COM STRATA UNIT	8		142	2	0.19
146	COMMERCIAL	17	20	1,386	15	0.89
	COMMUNITY SERVICES		9		0	
233	DUAL OCCUPANCY	11		1,379	15	1.37
023	GOVERNMENT	1		5	0	0.05
171	HOTEL	1		416	5	4.56
002	IND STRATA UNIT	9		71	1	0.09
001	INDUSTRIAL	5	1	1,257	14	2.76
237	LOT FOR DEV	1		37	0	0.41
212	MASTER STRATA	4	4	124	1	0.34
238	MIXED DEVLPMENT	2		401	4	2.20
089	OCCUPIED LAND	7	304	9,597	105	15.02
239	PUBLIC RESERVE	5		1,532	17	3.36
127	SCHOOL(STATE)	3		601	7	2.20
070	SINGLE DWELLING	1,315	45	93,372	1,023	0.78
071	STRATA UNIT	26		800	9	0.34
	UTILITIES		7		0	
	VACANT LAND		276		0	
		1,440	666	116,690	1,279	

Rosemeadow System 2012 Calendar Year

	Property Type	#Properties	#Properties No Readings	Usage kL/year	Usage kL/d	Average Usage kL/lot/d
194	AGRICULTURE				0	
242	CHURCH PROPERTY	4		1,047	3	0.72
138	CLUB				0	
193	COM STRATA UNIT				0	
146	COMMERCIAL	13		16,941	46	3.57
	COMMUNITY SERVICES		46		0	
233	DUAL OCCUPANCY	30		9,597	26	0.88
073	FLATS	3		14,992	41	13.69
023	GOVERNMENT	6		2,165	6	0.99
171	HOTEL				0	
002	IND STRATA UNIT				0	
001	INDUSTRIAL				0	
237	LOT FOR DEV	4		128	0	0.09
212	MASTER STRATA	3	134	640	2	0.58
238	MIXED DEVLPMENT				0	
089	OCCUPIED LAND		86		0	
170	PRIVATE SCHOOL	1		16,129	44	44.19
166	PRIVATE HOSPITAL	1		13,017	36	35.66
240	PUBLIC CHARITY	5		1,744	5	0.96
239	PUBLIC RESERVE	6		6,962	19	3.18
127	SCHOOL(STATE)	5		8,181	22	4.48
070	SINGLE DWELLING	4,838	17	1,061,680	2,909	0.60
071	STRATA UNIT	300		43,086	118	0.39
	UTILITIES		1		0	
	VACANT LAND	1	196	17	0	0.05
		5,220	480	1,196,326	3,278	

M E E T I N G N O T E S

Client Name WJLG
Project Name Wilton Junction Development
Contract No.

Meeting Name	Meeting with Sydney Water		
Meeting Venue	Sydney Water Head Office Parramatta, Level 11		
Date Of Meeting	4 July 2013	Time Of Meeting	10:00-11:00
Chairperson		Recorder	Tim Day

Attendees

Name	Initials	Organisation/role
Richard Schuil	RS	SWC/ E & ES - Growth Manager
Lydia Aristuti	LA	SWC/ E & ES Planner
Tim Day	TD	MWH+PB

Apologies

MEETING NOTES

1. SW role for wastewater system

RS advised SW are still unclear what role they would have with the Wilton Junction wastewater system

2. Hawkesbury – Nepean River water quality model

RS advised Wilton Junction development was not included in H-N model. SW may be able to do a high level assessment of the impacts of Wilton Junction if provided with discharge quality and quantity data.

3. Commercial arrangements with Macarthur WFP

SW confirmed that the pumping station (WP302) supplying the Appin water system is owned by the WFP.

Issue of upsizing clear water tanks may require discussions with WFP operator.

SW understanding is that there is a single power supply at the WFP which they think presents a long term risk with the proposed development.

4. Maximum Day Demand (MDD) Allowance - Residential

SW recommends to use a design MDD rate of 1.17 kL/dwelling/d based on recent summer usage. Note this is up slightly from the allowance of 1.1 kL/dwelling/d used in the first draft report.

5. SW Modelling Approach/Assumptions for Current Interim Servicing Solution

Identified spare capacity of 280 dwellings to 2015/16 (no change to mine usage).

By 2015 implement changes at mines which will increase spare capacity to 400 dwellings (total).

Install booster (for Wilton village and Bingara Gorge) by 2017. Booster designed for 1,200 dwellings at Bingara Gorge by 2020.

Allowance is 2.2 kL/dwelling/d for new dwellings at Bingara Gorge based on dual reticulation system, which is the total water demand (potable + recycled water). This is due to Lend Lease not implementing recycled water until 600 dwellings

MEETING NOTES
have been connected (approx 2018), and therefore recycled water network will be supplied from potable network in the interim. Note this is close to double the allowance for remaining Wilton Junction development (ie SW is anticipating higher usage at Bingara Gorge due to customers assuming recycled water will be available). Modelling carried out over design "hot week" period. Note SW did not assume WP302 would be operating at peak demand hours. Appin Reservoir can lower to 60% full (currently lower limit at 70% full). This is because SW is implementing a booster for low pressure area in vicinity of Appin Reservoir. Note RS agreed a single booster for the whole Wilton area would be preferable to multiple boosters for the interim servicing. Actions: 1. TD to provide quality and quantity figures ex effluent management system to SW for input into H-N river model

M E E T I N G M I N U T E S

Client Name WJLG
Project Name Wilton Junction Development
Contract No.

Meeting Name	SW Feedback to Tech Memo: Water and Wastewater Demand Forecasts		
Meeting Venue	Sydney Water Head Office Parramatta, Level 11		
Date Of Meeting	29 May 2013	Time Of Meeting	11:30-12:30
Chairperson		Recorder	Tim Day

Attendees

Name	Initials	Organisation/role
Richard Schuil	RS	SWC/ E & ES - Growth Manager
Lydia Aristuti	LA	SWC/ E & ES Planner
Tim Day	TD	MWH+PB

Apologies

MEETING NOTES

SW gave feedback on the Technical Memo - Water and Wastewater Demand Forecasts, which was submitted for review on 7 May 2013.

1. General comments

RS prefers the title for the Tech Memo to be "Basis of Planning"

Page 3, use word "proposed" instead of "will"

Page 4, use "current proposal" rather than "current plan"

2. Occupancy Rate

SW note that the occupancy rate of 2.8 is not consistent with census data for Wollondilly LGA which is 3.0.

3. Wastewater System Design

Overflow target

RS questioned the use of containment factor. TD explained it was to do with sizing the wastewater network to achieve a wastewater system overflow performance target.

RS asked whether a model or spreadsheet flow schedule would be used for this study. TD advised latter.

RS said the Tech Memo should highlight the adoption of a overflow target of 10 in 10 years as per the Picton wastewater system as a "starting point" for the Wilton study.

Leak-tight scheme

RS suggested the following statement included in report:

"SW is currently trialling leak-tight wastewater systems in two catchments and at this stage there is no evidence that this type of system should be adopted as the 'business as usual' wastewater scheme. Therefore low-infiltration wastewater scheme should be adopted as base case for this study

Temporary pump-outs

RS suggested that this should be in the options mix for initial servicing. Storage should be sized at 4 hours at peak flow.

RS acknowledges that temporary pump-outs are probably not a cost-effective servicing option, but useful to service initial development if permanent infrastructure cannot be delivered on time.

STP effluent

Explain reasons for effluent targets.

RS notes that he is now being asked to investigate land disposal and Nepean River discharge options for the near-by Menangle Park development (as opposed to transfer to adjacent Glenfield wastewater system).

4. Design Allowances - Wastewater

EP totals

check totals in Table 1

5. Design Allowances - Water

Light Industrial allowance

SW note Light Industrial allowance of 40 kL/ha is high and not consistent with current approach for growth servicing strategies. Current approach is to use demand per employee.

SW have used 39 employees/ha and 0.2 EP/employee at Prospect East study

Also DP&I reference on their website of 43 employees/ha

Maximum Day Demand (MDD) Allowance - Residential

SW noted that the use of Rosemeadow demand data measured at 15 minute intervals resulted in different results that those stated in the Tech Memo which were based on daily records. For the Rosemeadow system, this MDD is 5.4 ML/d (compared with the figure of 6 ML/d in the Tech Memo). This MDD results in a MDD residential rate much smaller than the figure of 1.05 kL/dwlg/d as per Tech Memo (no figure given but on pro rata basis this would be 0.95 kL/dwlg/d).

Additionally, SW advise the MDD in Narellan system over the recent summer resulted in a calculated MDD rate of 1.3 kL/dwlg/d. After applying a reduction of 10% (as per SW approach to take into account water efficiencies from BASIX compliant dwellings; 10% reduction adopted due to some properties in Narellan system connected post BASIX and therefore are deemed BASIX compliant) this results in a design MDD rate of 1.17 kL/dwlg/d.

RS suggested to adopt this higher value for strategic planning purposes.

Average Day Demand (ADD) Allowance - Residential

Explain source of 0.75 kL/dwlg/d. TD explained this is based on measured data in Rouse Hill system as stated in SW design criteria document. RS requested this be stated in Tech Memo.

MDD Allowance - Schools

Clarify basis of Table 3 allowances for schools. WSA allowance is 90 kL/d

6. Future Other Growth outside Wilton Junction development.

RS requested TD to analyse latest SW property table database (updated May 2013) to identify future forecast growth to be serviced from the Macarthur WFP. This data to identify future demands and spare capacity at Macarthur WFP.

The future growth should also be included in Appin model when predict future performance of Appin system.

7. Bingara Gorge development

Current strategy for Bingara development involves provision of booster after 400 dwellings have been connected, currently

MEETING NOTES
anticipated to be in 2017/18. Bingara development to have recycled water scheme implemented after 600 dwellings have been connected. Actions:

Wilton Junction New Town
Rezoning Project

Water Technical Working Group
21st May, 2013

Attendance:

Richard Schuil (RS) – Sydney Water

David Demer (DD) – Sydney Water

Grahame Kelly (GK) – Bradcorp

Trent Kelly (TK) – Bradcorp

David Crompton (DC) – JWP

Tim Day (TD) – MWH

Greg Alford (GA) - MWH

Minutes recorded by MWH

General Items

- DD offered that SWC are expecting next week to receive confirmation from State Govt regarding SWC role in providing wastewater services to the Wlton Junction New Town development.

Water Servicing Strategy

- TD explained the approach to the water planning strategy and how the Max Day Demand figure of 1.05KL/dwelling/day was derived. TD also explained how it closely matched the figure of 1.1 KL/dwelling/day that was derived from the Narellan water supply system and adopted in the South West Growth Centre (SWGC) study recently completed by SWC.

- RS noted that in January 2013, the Narellan Water Supply system experienced a Max Day Demand equivalent to 1.3KL/dwelling/day.

- GK expressed concern that 1.2ML/d of spare water system capacity may currently be in the process of being fully allocated to the Bingara Gorge development.

- RS indicated that whilst SWC may be discussing bulk water supply options with Lend Leaase for Bingara Gorge, nothing has been finalised at this point.

- RS indicated that SWC initial work on the water servicing strategy suggested that with a low cost boosting arrangement, there was spare capacity for approx 500 lots but MWH will need to confirm this.

- RS reiterated that servicing standards could be pushed below 15 metres pressure so long as they minimum water pressure was identified along with the number of customers expected to be affected.

Wastewater Servicing Strategy

- GK explained the total water quality cycle being developed for the Wilton Junction development. This involves no direct effluent discharge to a natural river but rather a lake containing both stormwater run-off and treated effluent that may eventually flow into a receiving water.

- DC explained the approach being adopted will meet Director General Requirements (DGRs).

- RS explained that SWC have built a receiving water model for the Hawkesbury Nepean River system and that is now undergoing validation. This will be a tool for SWC to engage with EPA on key nutrient pollution parameters.

- TK - Adrian Miller has previously indicated that 10,000 dwellings had been allowed in that model to come from the Wilton Junction (WJ) development. RS did not know that any allowance had been made in the model for WJ.

- GK explained the treatment servicing options of either;

    - 2,000 ET upgrade of the existing Bingara Gorge plant which requires a commercial agreement with the existing plant operator

    - A new 2,000 ET plant alongside the existing Bingara gorge that would then form the first stage of an ultimate plant

    - Local temporary package treatment plants below 2,500 EP that will irrigate locally on development land

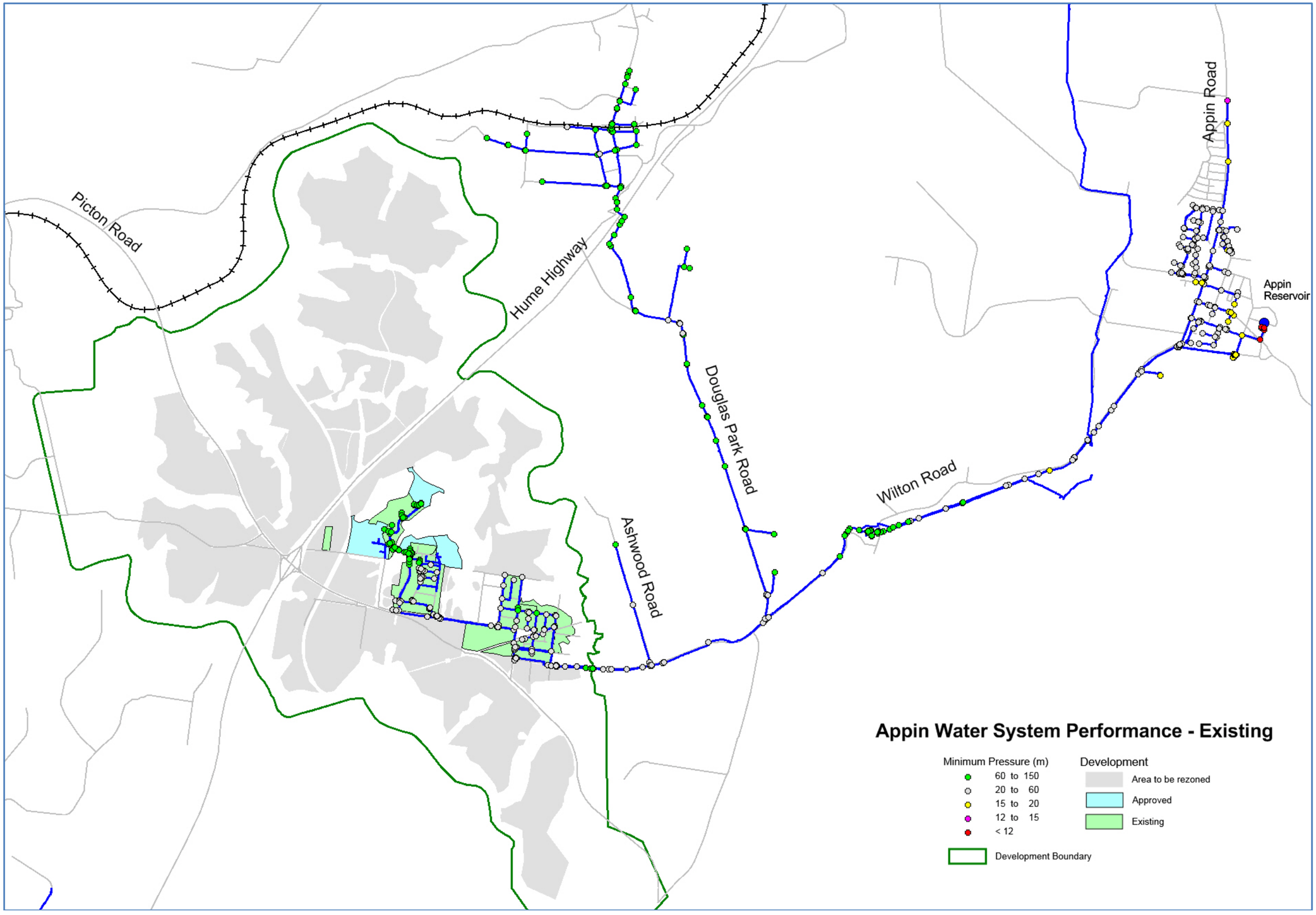
- TK asked if SWC had any concerns or preferences with the ultimate WW network, in particular low pressure sewer or leak tight systems. RS responded that they didn't and that the system should be selected on a lowest life cycle cost basis.

- RS suggested assessing cost savings of providing contingency measures at SPSs (eg generator or dual power supply) in lieu of emergency storages.

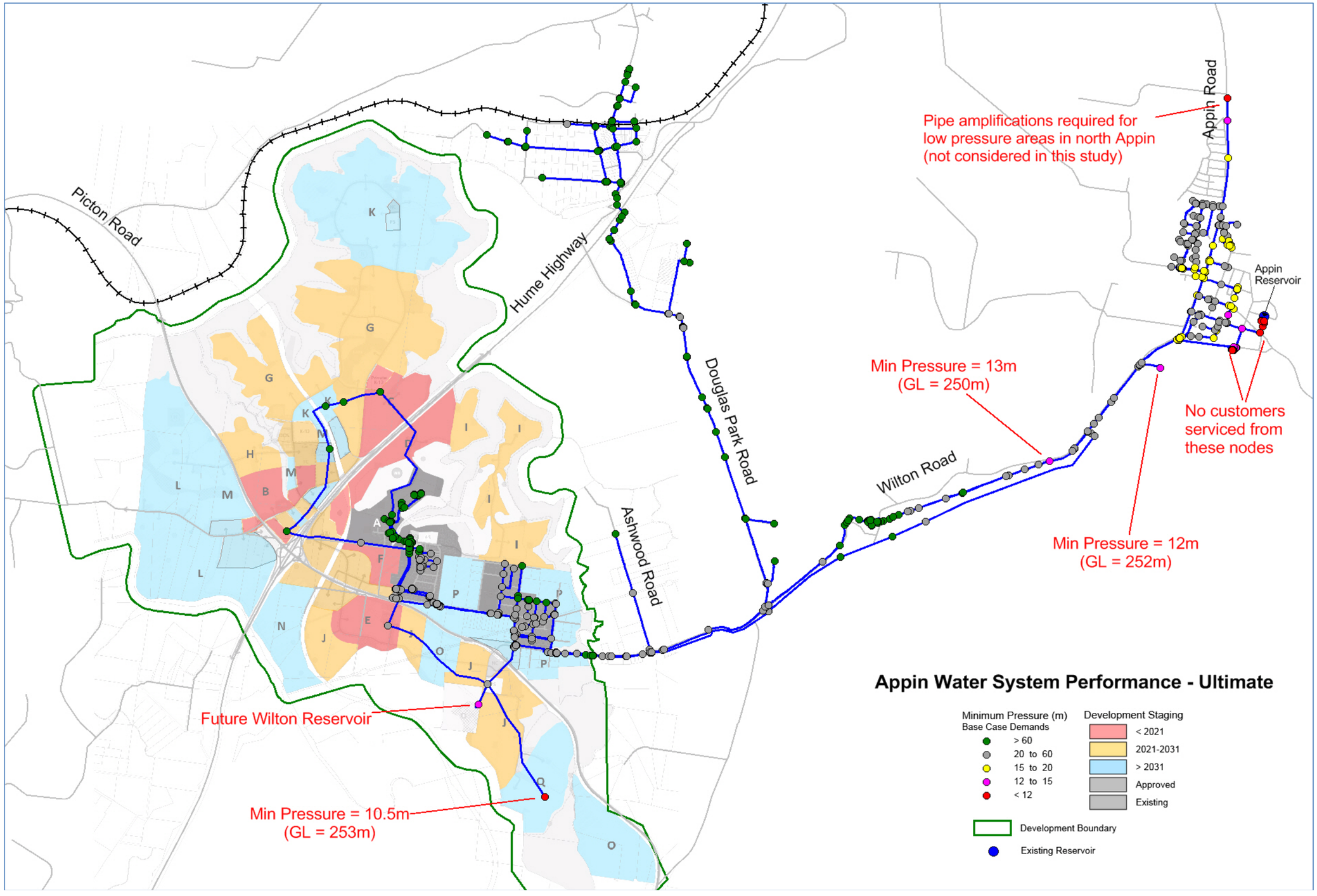
Actions:

RS to confirm what has been allowed for with regards to the Wilton Junction development in the Hawkesbury Nepean River model.

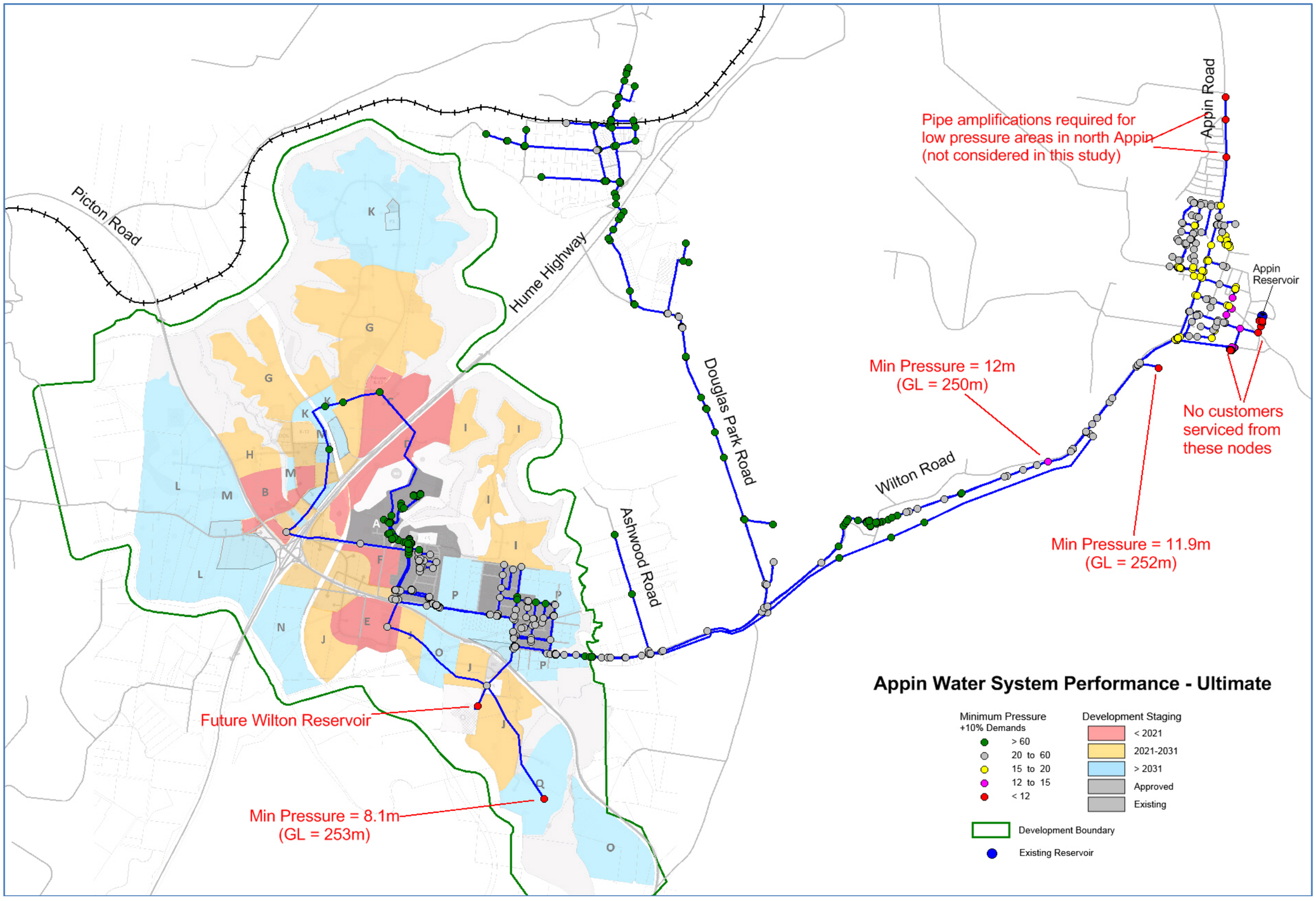
Appendix C Water Modelling Results



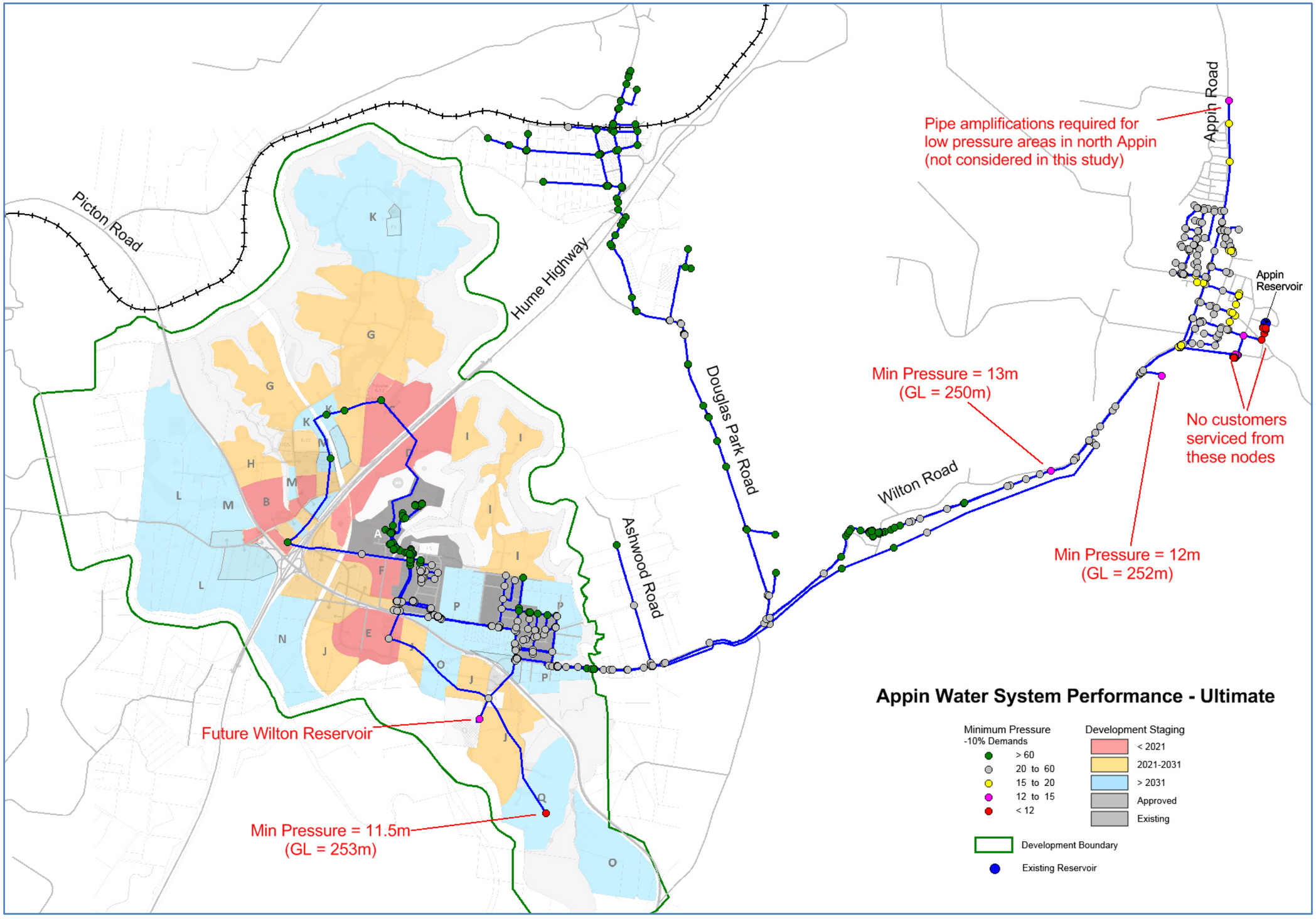
Appin Water Supply Zone Performance - Existing



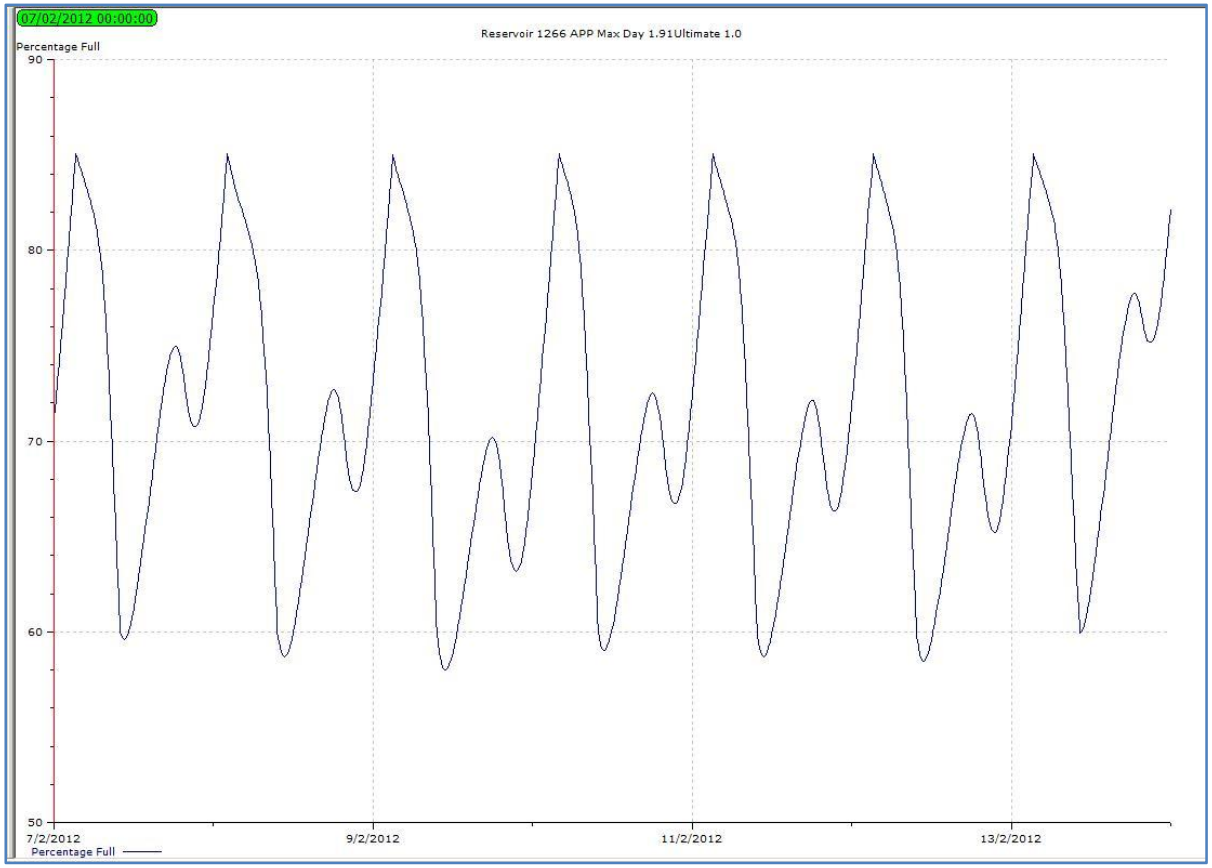
Appin Water Supply Zone Performance - Ultimate Development



Appin Water Supply Zone Performance - Ultimate Development Plus 10% Demand Case

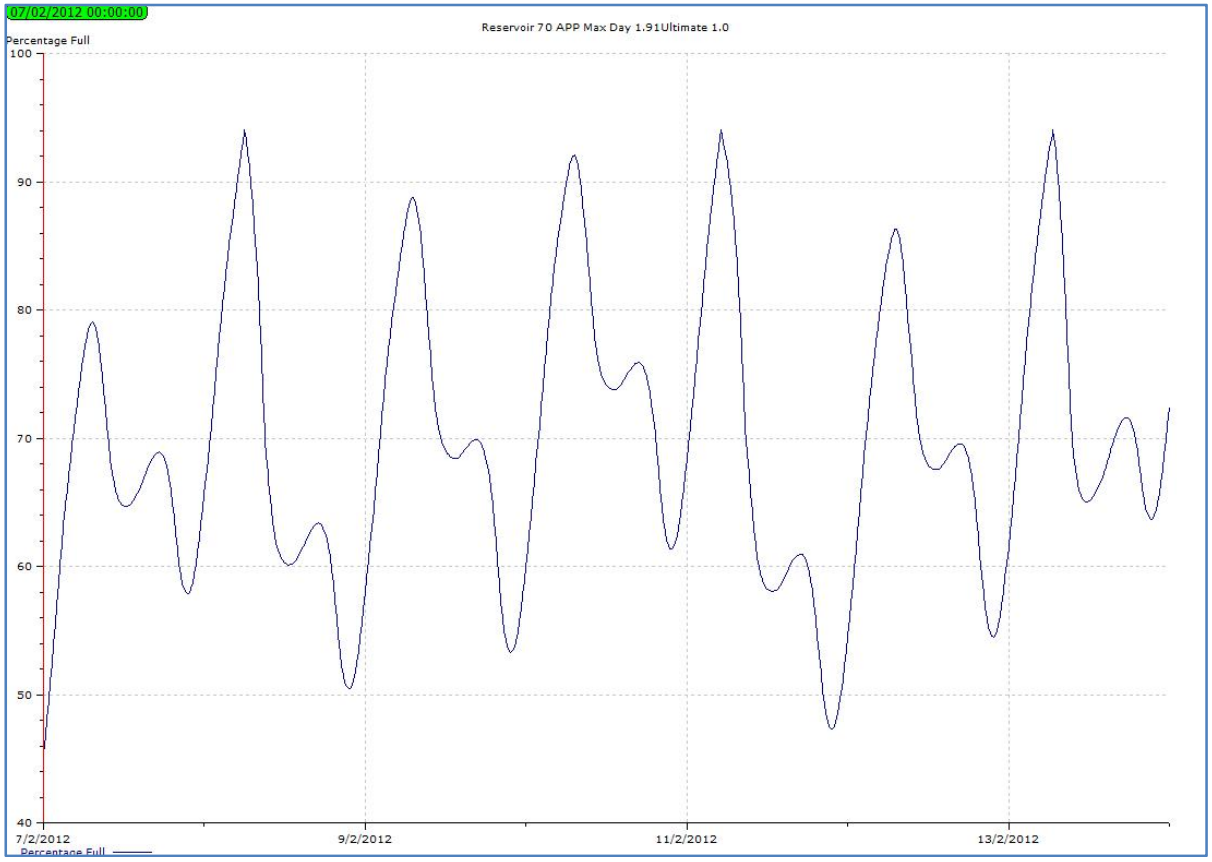


Appin Water Supply Zone Performance - Ultimate Development Less 10% Demand Case



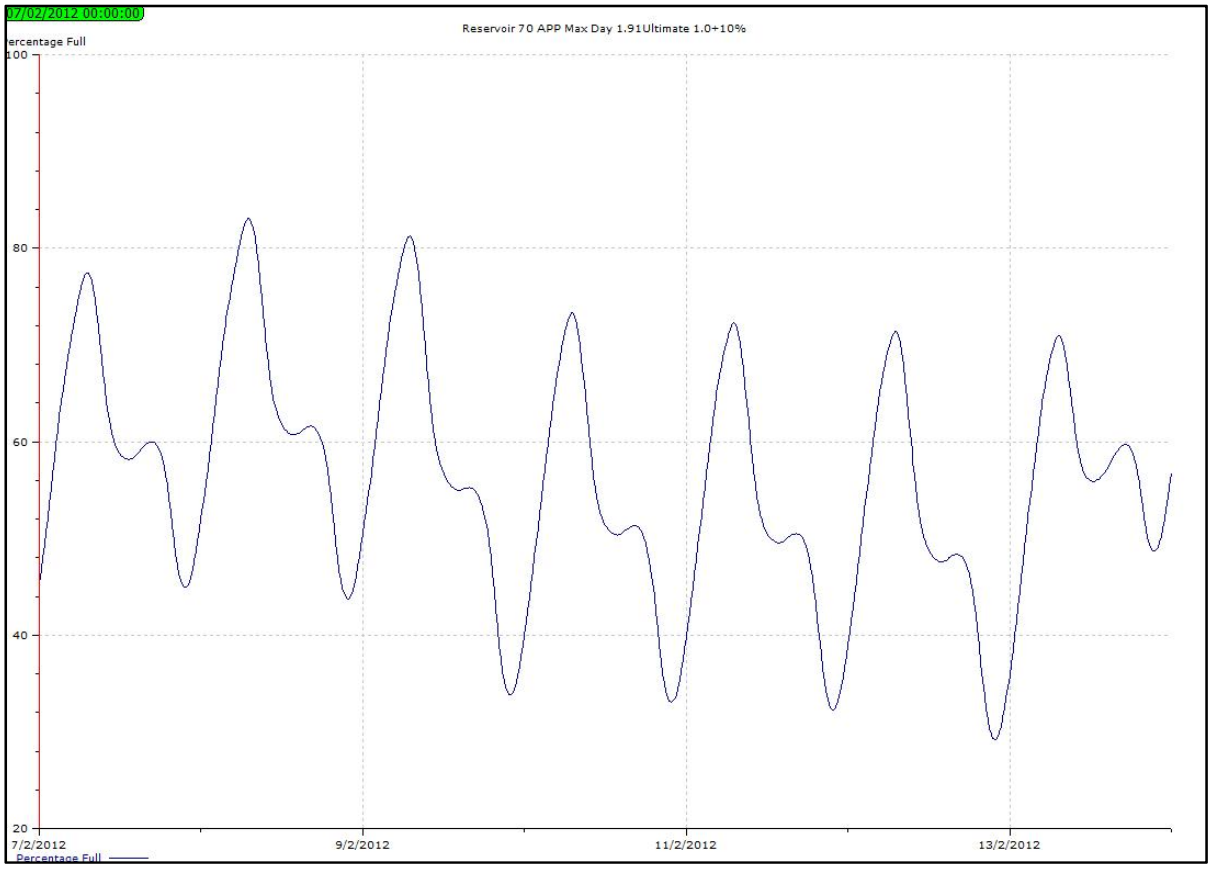
Appin Reservoir Performance - Ultimate Development

Note:
Appin Reservoir minimum level at ultimate development over maximum week design period is 58%, which is above the Appin Reservoir reserve storage level of 45%.



Future Wilton Reservoir Performance - Ultimate Development

Note:
Wilton Reservoir minimum level at ultimate development over maximum week design period is 47%, which is above the nominal reserve storage level of 33%.



Future Wilton Reservoir Performance - Ultimate Development Plus 10% Demand Case

Note:
Wilton Reservoir minimum level at ultimate development with 10% additional demand over maximum week design period is 30%, which is just below the nominal reserve storage level of 33%.

Appendix D Broughtons Pass Crossing

TO: Tim Day

DATE: 16 May 2013

CC:

REF: 83500321 Wilton

Author: Pat Joyce

MWH Australia Pty Ltd

Reviewer Saviz Gharavi

SUBJECT: BROUGHTONS PASS GORGE CROSSING OPTIONS

1. Introduction

This memo outlines the initial review of the sizing and cost for a watermain crossing of Broughtons Pass Gorge. The watermain is required as part of a water strategy for the Wilton Junction Rezoning project. Two options are presented in this memo namely a horizontal directional drill (HDD) (Option 1) under Broughtons Pass, and a conventional trench and elevated pipe bridge option (Option 2).

2. Location

As shown in Figure , Macarthur Water Filtration Plant (WFP) is the nominated supply for the Wilton Township. The WFP is located approximately 7.5 km and 3 km east of Wilton and Broughtons Pass respectively. A ground surface elevation profile traveling east to west (WFP to Wilton) along Wilton RD is also shown in Figure . The height of Broughtons Pass Gorge is approximately 70 m, through the gorge flows the Cataract River – one of the Sydney Water drinking supply sources.

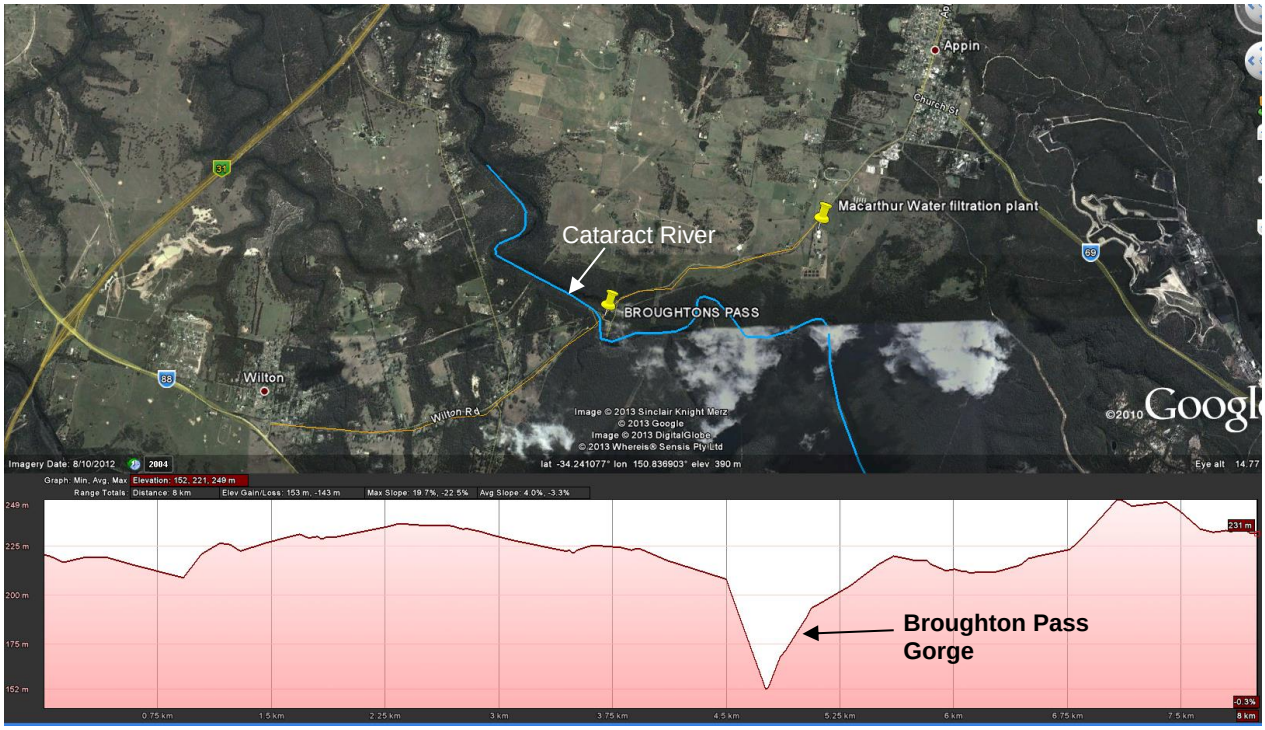


Figure Crossing Site locality

3. Scope of works

As mentioned previously, water from Macarthur WFP is required to supply Wilton Junction. A pressurised 502OD steel pipeline with a wall thickness of 5 mm is required to convey 225 L/s to the township. Conventional open trench pipe installation methods shall be adopted as the form of pipeline construction either side of Broughtons Pass Gorge. To enable a comparable estimate, both crossing options provided herein will be evaluated between the nominated HDD launch and recieval pits given in Figure .

Hydraulic modelling results of the watermain provided an RL of 300 m for the hydraulic grade line (HGL) over Cataract River.

4. Option 1 HDD

4.1. Introduction

Shown below in Figure is the proposed HDD route (dashed yellow line) required to cross under Broughtons Pass gorge and a drinking water reservoir, the source of water supply canal to prospect reservoir for Sydney. The HDD alignment extends a true length of 686 m and does not impact on the existing vital services. Works under the reservoir will require the involvement and approval of the Sydney Catchment Authority (SCA).

The depth of the Broughtons Pass gorge is approximately 70 m and according to an earlier geotechnical investigation carried out by GHD in February 2003 for the “Condell Park” subdivision in Wilton, the surrounding geology is primarily rock formation belonging to the Wianamatta Group, Liverpool subgroup comprising Ashfield Shale, the transitional Mittagong Formation and Hawkesbury Sandstone.

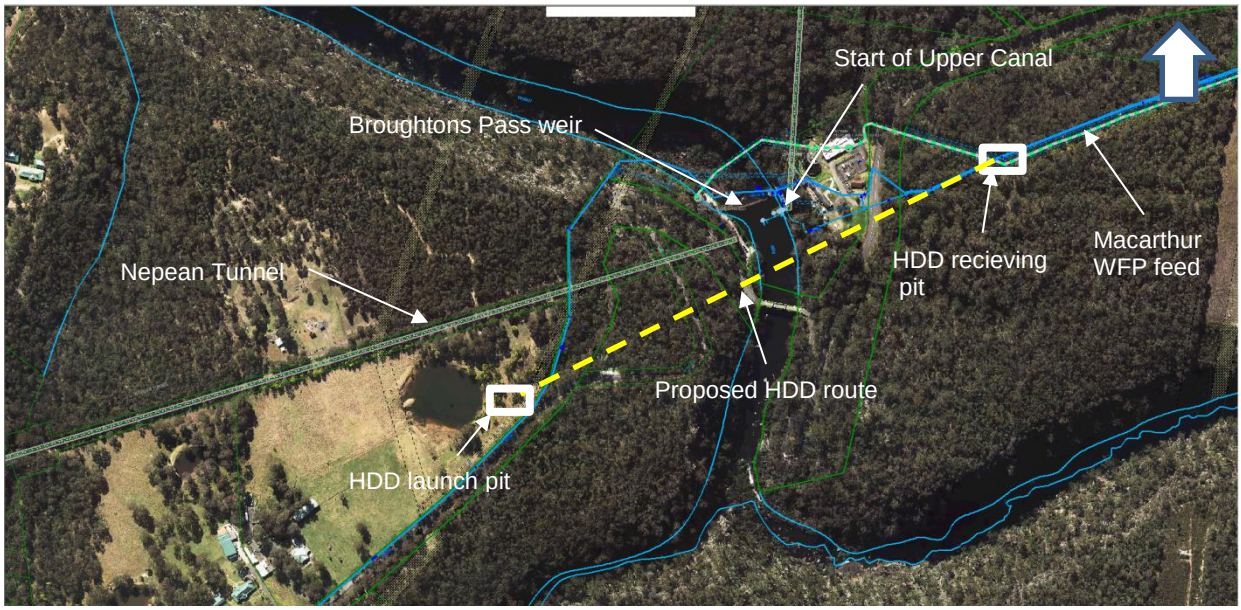


Figure HDD Alignment & Existing infrastructure

Design Assumptions

- The geology of the site is Hawkesbury Sandstone, however the rock strength class was not indicated in the February 2003 GHD Geotechnical Investigation.

- The pipe depth is assumed to be 15 m below the Cataract River. This depth was considered adequate to ensure sound material is present below the river bed.
- Using Sydney Water (2 m interval) topographical data, a surface was created which enabled a surface long section profile to be determined between the launch HDD pits. An RL of 113 m (below the Cataract River) was determined for the pipe which would reflect the lowest point of the pipe, and coincides with the 15 m depth requirement below the river bed. The internal pressure in the pipe at this point relates to 1.87 MPa.
- The corresponding velocity in the pipe for the given flow rate of 225 L/s is 1.15 m/s. A 502OD steel pipe with a wall thickness of 5 mm and a rated pressure of 4.3 MPa has been adopted for design. An epoxy lining (internal) was chosen as the susceptibility for cracking cement lined pipes is far greater during a pipe bend. The pipeline will consist of welded joints, polyethylene pipe was explored but was not used due to limitations on internal diameter requirements and pressure rating
- A bending radius of 500xOD was adopted for the steel pipe to enable curvature under Broughtons Pass and smooth transitions between launch and receiving pits.
- It is anticipated that drilling works would commence on the eastern side of the gorge with the pipe strung out on the eastern side in an existing easement.
- The cost estimation for both options was based on available market information and our assessment of probable cost.
- The sources of information used to arrive at these assumptions are as follows:
    - Topographical GIS information from Sydney Water (2 m contours);
    - Preliminary Geotechnical Investigation Proposed Rural Subdivison “Condell Park”, Wilton, NSW
    - Tyco Water Sintakote Steel Design Pipeline Catalogue
    - Google Earth aerial images

4.2. HDD Longsection Design

The HDD design is formed with a series of bends comprising a radius of 250 m joined with straight sections. The 250 m bend radius accommodates both the locations of the HDD pit setups and the required 15 m depth below the river bed. The overall true length of the drill is 686 m with depths ranging from a minimum of 3 m to a maximum of 43 m.

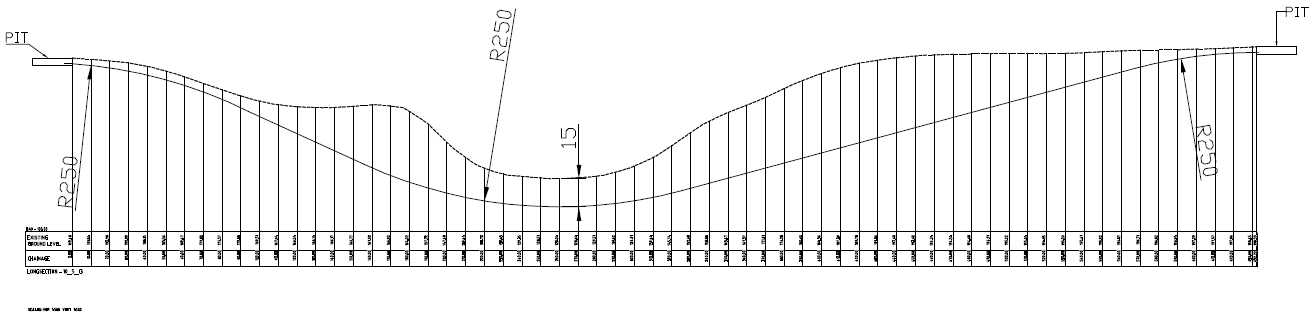


Figure HDD Longsection

4.3. Opportunities and Constraints

4.3.1.Safety & Constructability

1. Pros.

- Wilton Rd crossing Broughtons Pass gorge consists of a series of switchback turns and dangerous rock overhangs. Construction with HDD negates the need to perform any works in these areas.
- The nominated pit locations required for the HDD are located off the road reserve in a location where there is sufficient space to set up the required drilling rig and pipe string. The use of existing easements was considered in determining these locations, see Figure .

- Minimal restoration works are required for HDD construction as opposed to that of open trenched construction. Open trenched construction requires excavation, pipe installation, backfilling, and road restoration operation to occur over a certain length. Considering the Hawkesbury Sandstone geology in the area, a pipe installation rate of approximately 20 m would not seem unreasonable. It is preferable for continuous operation during a HDD, and as such over a length of 686 m installation could be completed in less than a month.

2. Cons.

- Risk of soft spots in ground formation and loss of drilling equipment. A pipeline corridor geotechnical survey is required to reduce the uncertainty in the design.
- Mine subsidence due to mining activities within the region affecting the pipeline integrity.
- Lack of access to pipeline during its service life.
- The Nepean and Upper Canal Tunnels are located at approximately 85 and 150m respectively away from the HDD. A minor risk exists from drilling operations affecting the structural integrity of these heritage structures.
- Eastern gas pipeline (Sydney to Melbourne gas pipeline) owned by Jemena has not been identified but it is well known within this region of the Wollondilly Shire and shall be identified for future stages in the design.

4.3.2.Community

1. Pros.

- HDD operations are located in areas away from Wilton Rd which should not impact on traffic and negates the need for traffic management along Wilton Rd.
- No traffic impacts are expected as a result of the HDD operations. Appropriate signage will be required at the entrance to drilling locations, and speed control zones may be required to be implemented at these areas.
- Pending further investigations with land owners, pipe stringing on the western side of the gorge may be considered as a potential option. The western side (Wilton Side) of Broughtons Pass side is closer to the M5 presenting a more convenient location for material deliveries.

2. Cons.

- Neighbouring properties may impose restrictions on construction hours, in particular at the drill side (western side of gorge).

4.3.3.Environment

1. Pros.

- During installation of the pipe using HDD, the risks and impacts to the environment are minimal and are expected to be localised to the launch and receiving pits. Enclosures and containment areas are formed ensuring any spills, noise and dust (if any) can be easily controlled.

2. Cons

- Insufficient depth below the Broughtons Pass reservoir and the risk of contamination caused by “frac out” during drilling works (drilling fluid lost in fissures penetrating into the river bed)
- Minor clearing of vegetation in the location of the HDD pits is required. Necessary permits will be required prior to clearing vegetation.
- There will be a risk of contamination of ground water if the pipeline leaks during the service life of the pipeline. Any uncontrolled release of treated potable water can have potential negative impact on the environment

4.4. Cost

The cost of crossing Broughtons Pass using a HDD form of construction has been initially estimated at:

- $1.67 million for drilling works including site mobilisation/demobiliastion and plant set up and install.
- Epoxy lined pipe supply including welding and non-destructive weld testing at $1100 p/m, totalling $755,000
- Grand total **$3.15 million** (inclusive of 30% contingency)
-

3. Option 2 Trench Installation and Pipe Bridge Crossing

3.1. Introduction

Shown below in Figure is the proposed watermain route (green line), and the 60 m length Pipe Bridge (red) required to cross Cataract River. The 1450 m pipeline route follows Wilton Rd and is expected to be buried at minimum cover ranging between 0.9 - 1.2 m.

An existing road bridge known as Broughtons Pass Bridge over the Cataract River was considered as a potential candidate to assist with the watermain crossing (attach to bridge). Advice received from Wollondilly Shire Council has identified the bridge as a heritage listed item requiring some structural remediation at the abutments, and the addition of pipes on the bridge would not be consistent with heritage status. In order to cross the Cataract River an elevated pipe bridge adjacent to the existing road bridge has been proposed. It is anticipated any works over the Cataract River reservoir will require the involvement and approval of the Sydney Catchment Authority (SCA).

The geology of the area is primarily rock formation of Hawkesbury sandstone. It is anticipated that trenching excavation works would advance from both the eastern and western side of the Broughtons Pass gorge terminating at the pipe bridge.

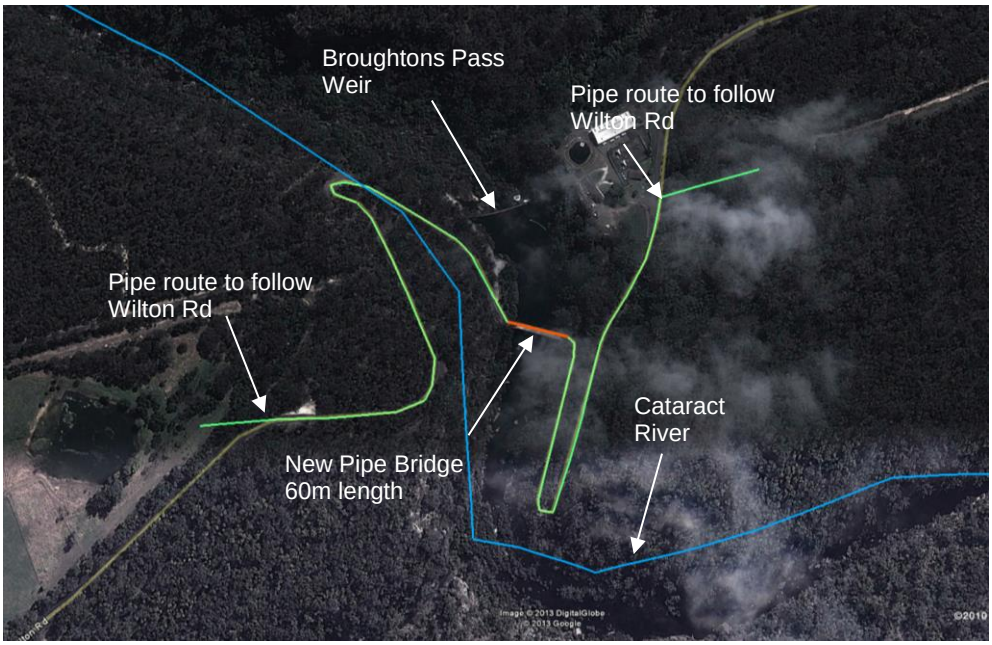


Figure Trench and Pipe bridge option

3.2. Design Assumptions

- An RL of approximately 155 m was determined for the pipe bridge. Further investigations into the finished level of the pipe bridge are required which would incorporate placement relative to flood levels. The internal pressure in the pipe at this point relates to 1.5 MPa.

- The corresponding velocity in the pipe for the given flowrate of 225 L/s is 1.3 m/s. A 502OD steel pipe with a wall thickness of 5 mm and an allowable rated pressure of 4.3 MPa has been adopted for design.
- Cement lining (internal) was chosen for the pipe and spherical slip joints used to join subsequent pipes. It is anticipated piled thrust blocks will be required at bend locations due the pipe location relative to the steep road embankments.

3.3. Pipe Bridge

A pipe bridge is required to span 60 m over the Cataract River to support the watermain. In order to minimise the impact on the reservoir during construction all works will occur from both banks where bridge segments shall be launched to join over the river. Controlling bridge deflections (sag) during construction and service life will be a key element in its design; the bridge is required to consist of a support condition at its ends which assists in reducing the overall span length.

3.3.1.Foundation

Foundation preparation is required for the abutments, good ground conditions in the area of the river bank suggest rock foundations could be utilised as load bearing supports.

3.3.2.Superstructure

A prefabricated 1.5 m wide steel truss girder bridge complete with walkway is required to support the watermain. Steel piping would require flexible jointing, and considerations to thermal expansion and contraction of the bridge and pipe must be made to avoid damage.

Installation of the bridge will require girder components to be transported and offloaded near to the bridge site on either side, preferably using part of Wilton Rd within the gorge. Mobile cranes will be required for lifting the bridge sections during unloading, and suitable plant will be required for bridge segment launching (Wilton Rd will be required to be closed during lifting operations). Piping will also necessitate lifting with a mobile crane onto the bridge deck.

3.4. Opportunities and Constraints

3.4.1.Safety & Constructability

1. Pros

- Traditional open trenched pipe installation within Broughton Pass gorge is a conventional well adopted form of pipeline construction. Inspections relating to quality assurance of the pipeline construction can be carried out during installation.
- An excavator rock saw and hammer are required to excavate the hard ground. This may prove advantageous as no shoring will be required due to the self-supporting trench walls. (shoring can add sufficient costs to the construction)

2. Cons

- It is expected that given the ground conditions a typical pipe installation rate of 20 m per day could be expected. Over a 1450 m length with two crews advancing the pipeline from the eastern and western sides of the gorge, an installation time ranging from 2 to 3 months could be expected.
- The area around Wollondilly Shire Council has active coal mining works. During the detail design stage an investigation into the effect of mine subsidence on the pipeline must be accounted for.
- Failure of bridge installation method causing contamination of Broughtons Pass reservoir.
- Lack of plant manoeuvrability and tight working spaces within the gorge.

1.1.1.Community

1. Pros

- No advantages pertinent to the community have been identified during construction of the pipeline.
- Installation of a dedicated pipe bride negates the need to attach a pipeline to the heritage listed Cataract River Bridge, and disrupt the heritage status and aesthetics of the road bridge.

2. Cons

- Residents living in Appin regularly travelling to Wilton (and vice versa) will be impacted by any road closures along Wilton Rd. Wilton Rd adjoin the two villages with a distance of 12 km. Road closures to Wilton Rd would require residents have to detour via Campbelltown a total distance of 45 km. For people who rely on Wilton Rd, residents may be inconvenienced greatly during construction.
- Neighbouring properties may reserve the right to impose restrictions on noise and construction hours, in particular at the western side of the gorge close to the town of Wilton.
- Construction of the pipe bridge will require the closure of Wilton Rd and will result in an impact to road commuters. Traffic management measures must be implemented and lane closures employed during installation.

2.1.1.Environment

1. Pros

- Visual inspection of the bridge crossing and monitoring leak detection can be implemented, which reduces the risk of contamination of groundwater.

2. Cons

- On the eastern side of the gorge along the existing easement nominated for the pipe route, clearing of vegetation is required to place the pipeline. Necessary permits will be required prior to clearing vegetation.
- Road permits will be required to carry out trenching works in the road.
- During rock sawing and breaking of trenches, dust and noise is expected. Dust suppression will be required, and moving chain wire fences along the excavation covered with mesh cloth used to prevent debris from leaving the works zone onto the adjacent road lane.
- Silt traps will be required at any excavations near to the reservoir to avoid any uncontrolled discharge and contamination into surrounding waterways.

2.1. Cost

The cost of crossing Broughtons Pass using with traditional open trench excavation and construction of a dedicated pipe bridge crossing Cataract River has been initially estimated, key components within the estimation are as follows:

- Trench Installation (inclusive of pipe supply and restoration) $2.96 million
- Traffic management $154,000
- Pipe bridge $1.15 million
- Indirects (design, overheads) $1.28 million
- Grand total **$7.18 million** (inclusive of 30% project contingency)

3. Recommendation

The preferred option required to cross Broughtons Pass Gorge which offers a constructible and cost effective solution is Option 1 HDD.

However this option would require detailed investigations (e.g. environmental assessment, community consultations, etc) to ensure the validity of the assumptions in the feasibility study, including a geotechnical investigation of the ground conditions under the Cataract River is essential to confirm a suitable depth below the river bed, and to ensure no impacts are felt to the drinking water reservoir during the construction and during the service life of the pipeline.

Appendix E Cost Estimates

WILTON JUNCTION

DISTRIBUTION POTABLE WATER PIPELINE PRELIMINARY COST ESTIMATE

Version 1 - 31st October 2013
Ref: MWH
Fig. 6.1 Wilton Junction Rezoning Water Strategy Report

Section Details:- Wilton West & High Area Booster Walkers Land
Diameter / Material Type:- DN200 DICL
Length:-
Length:- (i) Along Existing Verge - Rural Areas:- 2,445 m
(ii) Along Existing Verge - Urban Areas:- ..... m
(iii) In Existing Road Pavement:- ..... m
Underbore Length:- (i) Rural ..... m
(ii) Urban ..... m

PRELIMINARY ESTIMATED CONSTRUCTION COST *(5573-050-I.xls)*

No.	Description	Qty	Unit	Rate	Amount
1	Establishment & OH&S	2	item	40,000.00	$ 80,000.00
2	Supply materials, clear, excavate in OTR, bed, lay, backfill, test, chlorinate, WAX pickup complete including valves, bends, thrust blocks, pits & restoration of grassed surface, sediment & erosion control				
	(a) DN100		m	180.00	$ -
	(b) DN150		m	250.00	$ -
	(c) DN200	2445	m	290.00	$ 709,050.00
	(d) DN250		m	370.00	$ -
	(e) DN300		m	405.00	$ -
	(f) DN375		m	645.00	$ -
	(g) DN450		m	720.00	$ -
	(h) DN500		m	870.00	$ -
	(i) DN600		m	995.00	$ -
3	Extra over for restoration of AC roads or concrete driveways		m2	155.00	$ -
4	Provision for underbore of existing roads complete		m	2,000.00	$ -
5	Other Special Items				
	(a) Provision for soft rock		m3	55.00	$ -
of Bo	(b) Provision for hard rock	300	m3	140.00	$ 42,000.00
	(c) Traffic Management		Days	2,000.00	$ -
				Sub Total	**$ 831,050.00**
				Scope Creep 5%	$ 41,552.50
				Design & Investigate 10%	$ 87,260.25
				Construction Management 5%	$ 43,630.13
				Contingency 15%	$ 150,523.93
				TOTAL	**$ 1,154,016.81**

WILTON JUNCTION

DISTRIBUTION POTABLE WATER PIPELINE PRELIMINARY COST ESTIMATE

Version 1 - 31st October 2013
Ref: MWH
Fig. 6.1 Wilton Junction Rezoning Water Strategy Report

Section Details:- Wilton West to Governors Hill
Diameter / Material Type:- DN250 DICL
Length:-
Length:- (i) Along Existing Verge - Rural Areas:- 1,685 m
(ii) Along Existing Verge - Urban Areas:- ……. m
(iii) In Existing Road Pavement:- ……. m
Underbore Length:- (i) Rural 80 m Rail
(ii) Urban ……. m

PRELIMINARY ESTIMATED CONSTRUCTION COST *(5573-050-I.xls)*

No.	Description	Qty	Unit	Rate	Amount
1	Establishment & OH&S	1	item	80,000.00	$ 80,000.00
2	Supply materials, clear, excavate in OTR, bed, lay, backfill, test, chlorinate, WAX pickup complete including valves, bends, thrust blocks, pits & restoration of grassed surface, sediment & erosion control				
	(a) DN100		m	180.00	$ -
	(b) DN150		m	250.00	$ -
	(c) DN200		m	290.00	$ -
	(d) DN250	1685	m	370.00	$ 623,450.00
	(e) DN300		m	405.00	$ -
	(f) DN375		m	645.00	$ -
	(g) DN450		m	720.00	$ -
	(h) DN500		m	870.00	$ -
	(i) DN600		m	995.00	$ -
3	Extra over for restoration of AC roads or concrete driveways		m2	155.00	$ -
4	Provision for underbore of existing roads complete	80	m	2,000.00	$ 160,000.00
5	Other Special Items				
	(a) Provision for soft rock	400	m3	55.00	$ 22,000.00
of Bo	(b) Provision for hard rock	300	m3	140.00	$ 42,000.00
	(c) Traffic Management		Days	2,000.00	$ -
				Sub Total	**$ 927,450.00**
				Scope Creep 5%	$ 46,372.50
				Design & Investigate 10%	$ 97,382.25
				Construction Management 5%	$ 48,691.13
				Contingency 15%	$ 167,984.38
				TOTAL	**$ 1,287,880.26**

WILTON JUNCTION

DISTRIBUTION POTABLE WATER PIPELINE PRELIMINARY COST ESTIMATE

Version 1 - 31st October 2013
Ref: MWH
Fig. 6.1 Wilton Junction Rezoning Water Strategy Report

Section Details:- 11th Hole Bingara Gorge to Wilton West & Connection to Governors Hill Via Condell Park Rd EW
Diameter / Material Type:- DN375 DICL
Length:-
Length:- (i) Along Existing Verge - Rural Areas:- 2,120 m
(ii) Along Existing Verge - Urban Areas:- 1,890 m
(iii) In Existing Road Pavement:- ……. m
Underbore Length:- (i) Rural ……. m
(ii) Urban 250 m Hume Highway
150 m Spine Road
100 m Rail Link

PRELIMINARY ESTIMATED CONSTRUCTION COST *(5573-050-I.xls)*

No.	Description	Qty	Unit	Rate	Amount
1	Establishment & OH&S	1	item	225,000.00	$ 225,000.00
2	Supply materials, clear, excavate in OTR, bed, lay, backfill, test, chlorinate, WAX pickup complete including valves, bends, thrust blocks, pits & restoration of grassed surface, sediment & erosion control				
	(a) DN100		m	180.00	$ -
	(b) DN150		m	250.00	$ -
	(c) DN200		m	290.00	$ -
	(d) DN250		m	370.00	$ -
	(e) DN300		m	405.00	$ -
	(f) DN375	4010	m	645.00	$ 2,586,450.00
	(g) DN450		m	720.00	$ -
	(h) DN500		m	870.00	$ -
	(i) DN600		m	995.00	$ -
3	Extra over for restoration of AC roads or concrete driveways	3780	m2	155.00	$ 585,900.00
4	Provision for underbore of existing roads complete	500	m	2,000.00	$ 1,000,000.00
of Bo	Other Special Items				
	(a) Provision for soft rock	1000	m3	55.00	$ 55,000.00
	(b) Provision for hard rock	925	m3	140.00	$ 129,500.00
	(c) Traffic Management	90	Days	2,000.00	$ 180,000.00
				Sub Total	**$ 4,761,850.00**
				Scope Creep 5%	$ 238,092.50
				Design & Investigate 10%	$ 499,994.25
				Construction Management 5%	$ 249,997.13
				Contingency 15%	$ 862,490.08
				TOTAL	**$ 6,612,423.96**

WILTON JUNCTION

DISTRIBUTION POTABLE WATER PIPELINE PRELIMINARY COST ESTIMATE

Version 1 - 31st October 2013
Ref: MWH
Fig. 6.1 Wilton Junction Rezoning Water Strategy Report

Section Details:- Wilton Rd WP302 to Cnr Wilton Rd / Ashwood (Excluding Boughton Pass Underbore)
Diameter / Material Type:- DN450 DICL

Length:-	5,460 m
Length:- (i) Along Existing Verge - Rural Areas:-	5,460 m
(ii) Along Existing Verge - Urban Areas:-	……. m
(iii) In Existing Road Pavement:-	……. m
Underbore Length:- (i) Rural	20 m
(ii) Urban	……. m

PRELIMINARY ESTIMATED CONSTRUCTION COST *(5573-050-I.xls)*

No.	Description	Qty	Unit	Rate	Amount
1	Establishment & OH&S	1	item	50,000.00	$ 50,000.00
2	Supply materials, clear, excavate in OTR, bed, lay, backfill, test, chlorinate, WAX pickup complete including valves, bends, thrust blocks, pits & restoration of grassed surface, sediment & erosion control				
	(a) DN100		m	180.00	$ -
	(b) DN150		m	250.00	$ -
	(c) DN200		m	290.00	$ -
	(d) DN250		m	370.00	$ -
	(e) DN300		m	405.00	$ -
	(f) DN375		m	645.00	$ -
	(g) DN450	5460	m	720.00	$ 3,931,200.00
	(h) DN500		m	870.00	$ -
	(i) DN600		m	995.00	$ -
3	Extra over for restoration of AC roads or concrete driveways	100	m2	155.00	$ 15,500.00
4	Provision for underbore of existing roads complete	20	m	2,000.00	$ 40,000.00
5	Other Special Items				
	(a) Provision for soft rock	1650	m3	55.00	$ 90,750.00
of Bo	(b) Provision for hard rock	1000	m3	140.00	$ 140,000.00
	(c) Traffic Management	90	Days	2,000.00	$ 180,000.00
				Sub Total	**$ 4,447,450.00**
				Scope Creep 5%	$ 222,372.50
				Design & Investigate 10%	$ 466,982.25
				Construction Management 5%	$ 233,491.13
				Contingency 15%	$ 805,544.38
				TOTAL	**$ 6,175,840.26**

WILTON JUNCTION

DISTRIBUTION POTABLE WATER PIPELINE PRELIMINARY COST ESTIMATE

Version 1 - 31st October 2013
Ref: MWH
Fig. 6.1 Wilton Junction Rezoning Water Strategy Report

Section Details:- From DN600 Outlet Main to Hole 11 Bingara Golf Course
Diameter / Material Type:- DN450 DICL
Length:-
Length:- (i) Along Existing Verge - Rural Areas:- 1,860 m
(ii) Along Existing Verge - Urban Areas:- 790 m
(iii) In Existing Road Pavement:- ……. m
Underbore Length:- (i) Rural ……. m
(ii) Urban 125 m

PRELIMINARY ESTIMATED CONSTRUCTION COST *(5573-050-I.xls)*

No.	Description	Qty	Unit	Rate	Amount
1	Establishment & OH&S	1	item	120,000.00	$ 120,000.00
2	Supply materials, clear, excavate in OTR, bed, lay, backfill, test, chlorinate, WAX pickup complete including valves, bends, thrust blocks, pits & restoration of grassed surface, sediment & erosion control				
	(a) DN100		m	180.00	$ -
	(b) DN150		m	250.00	$ -
	(c) DN200		m	290.00	$ -
	(d) DN250		m	370.00	$ -
	(e) DN300		m	405.00	$ -
	(f) DN375		m	645.00	$ -
	(g) DN450	2650	m	720.00	$ 1,908,000.00
	(h) DN500		m	870.00	$ -
	(i) DN600		m	995.00	$ -
3	Extra over for restoration of AC roads or concrete driveways	2980	m2	155.00	$ 461,900.00
4	Provision for underbore of existing roads complete	129	m	2,000.00	$ 258,000.00
5	Other Special Items				
	(a) Provision for soft rock	700	m3	55.00	$ 38,500.00
of Bo	(b) Provision for hard rock	600	m3	140.00	$ 84,000.00
	(c) Traffic Management	65	Days	2,000.00	$ 130,000.00
				Sub Total	**$ 3,000,400.00**
				Scope Creep 5%	$ 150,020.00
				Design & Investigate 10%	$ 315,042.00
				Construction Management 5%	$ 157,521.00
				Contingency 15%	$ 543,447.45
				TOTAL	**$ 4,166,430.45**

WILTON JUNCTION

DISTRIBUTION POTABLE WATER PIPELINE PRELIMINARY COST ESTIMATE

Version 1 - 31st October 2013
Ref: MWH
Fig. 6.1 Wilton Junction Rezoning Water Strategy Report

Section Details:- Existing 450 to Reservoir Site I/O Main
Diameter / Material Type:- DN450 DICL

Length:-	720 m
Length:- (i) Along Existing Verge - Rural Areas:-	305 m
(ii) Along Existing Verge - Urban Areas:-	415 m
(iii) In Existing Road Pavement:-	50 m
Underbore Length:- (i) Rural	……. m
(ii) Urban	145 m

PRELIMINARY ESTIMATED CONSTRUCTION COST *(5573-050-I.xls)*

No.	Description	Qty	Unit	Rate	Amount
1	Establishment & OH&S	1	item	150,000.00	$ 150,000.00
2	Supply materials, clear, excavate in OTR, bed, lay, backfill, test, chlorinate, WAX pickup complete including valves, bends, thrust blocks, pits & restoration of grassed surface, sediment & erosion control				
	(a) DN100		m	180.00	$ -
	(b) DN150		m	250.00	$ -
	(c) DN200		m	290.00	$ -
	(d) DN250		m	370.00	$ -
	(e) DN300		m	405.00	$ -
	(f) DN375		m	645.00	$ -
	(g) DN450	720	m	720.00	$ 518,400.00
	(h) DN500		m	870.00	$ -
	(i) DN600		m	995.00	$ -
3	Extra over for restoration of AC roads or concrete driveways	100	m2	155.00	$ 15,500.00
4	Provision for underbore of existing roads complete	145	m	2,000.00	$ 290,000.00
5	Other Special Items				
	(a) Provision for soft rock		m3	55.00	$ -
of Bo	(b) Provision for hard rock	350	m3	140.00	$ 49,000.00
	(c) Traffic Management	30	Days	2,000.00	$ 60,000.00
				Sub Total	**$ 1,082,900.00**
				Scope Creep 5%	$ 54,145.00
				Design & Investigate 10%	$ 113,704.50
				Construction Management 5%	$ 56,852.25
				Contingency 15%	$ 196,140.26
				TOTAL	**$ 1,503,742.01**

WILTON JUNCTION

DISTRIBUTION POTABLE WATER PIPELINE PRELIMINARY COST ESTIMATE

Version 1 - 31st October 2013
Ref: MWH
Fig. 6.1 Wilton Junction Rezoning Water Strategy Report

Section Details:- Picton Road to Condell Park Road E-W
Diameter / Material Type:- DN450 DICL
Length:-
Length:- (i) Along Existing Verge - Rural Areas:- ……. m
(ii) Along Existing Verge - Urban Areas:- 530 m
(iii) In Existing Road Pavement:- 40 m
Underbore Length:- (i) Rural ……. m
(ii) Urban ……. m

PRELIMINARY ESTIMATED CONSTRUCTION COST *(5573-050-I.xls)*

No.	Description	Qty	Unit	Rate	Amount
1	Establishment & OH&S	1	item	90,000.00	$ 90,000.00
2	Supply materials, clear, excavate in OTR, bed, lay, backfill, test, chlorinate, WAX pickup complete including valves, bends, thrust blocks, pits & restoration of grassed surface, sediment & erosion control				
	(a) DN100		m	180.00	$ -
	(b) DN150		m	250.00	$ -
	(c) DN200		m	290.00	$ -
	(d) DN250		m	370.00	$ -
	(e) DN300		m	405.00	$ -
	(f) DN375		m	645.00	$ -
	(g) DN450		m	720.00	$ -
	(h) DN500	530	m	870.00	$ 461,100.00
	(i) DN600		m	995.00	$ -
3	Extra over for restoration of AC roads or concrete driveways	80	m2	155.00	$ 12,400.00
4	Provision for underbore of existing roads complete		m	2,000.00	$ -
5	Other Special Items				
	(a) Provision for soft rock	200	m3	55.00	$ 11,000.00
of Bo	(b) Provision for hard rock	300	m3	140.00	$ 42,000.00
	(c) Traffic Management	20	Days	2,000.00	$ 40,000.00
				Sub Total	**$ 656,500.00**
				Scope Creep 5%	$ 32,825.00
				Design & Investigate 10%	$ 68,932.50
				Construction Management 5%	$ 34,466.25
				Contingency 15%	$ 118,908.56
				TOTAL	**$ 911,632.31**

WILTON JUNCTION

DISTRIBUTION POTABLE WATER PIPELINE PRELIMINARY COST ESTIMATE

Version 1 - 31st October 2013
Ref: MWH
Fig. 6.1 Wilton Junction Rezoning Water Strategy Report

Section Details:- Reservoir Outlet to Distribution System
Diameter / Material Type:- DN600 DICL
Length:-
Length:- (i) Along Existing Verge - Rural Areas:- 360 m
(ii) Along Existing Verge - Urban Areas:- ..... m
(iii) In Existing Road Pavement:- ..... m
Underbore Length:- (i) Rural ..... m
(ii) Urban ..... m

PRELIMINARY ESTIMATED CONSTRUCTION COST *(5573-050-I.xls)*

No.	Description	Qty	Unit	Rate	Amount
1	Establishment & OH&S	1	item	40,000.00	$ 40,000.00
2	Supply materials, clear, excavate in OTR, bed, lay, backfill, test, chlorinate, WAX pickup complete including valves, bends, thrust blocks, pits & restoration of grassed surface, sediment & erosion control				
	(a) DN100		m	180.00	$ -
	(b) DN150		m	250.00	$ -
	(c) DN200		m	290.00	$ -
	(d) DN250		m	370.00	$ -
	(e) DN300		m	405.00	$ -
	(f) DN375		m	645.00	$ -
	(g) DN450		m	720.00	$ -
	(h) DN500		m	870.00	$ -
	(i) DN600	360	m	995.00	$ 358,200.00
3	Extra over for restoration of AC roads or concrete driveways		m2	155.00	$ -
4	Provision for underbore of existing roads complete		m	2,000.00	$ -
5	Other Special Items				
	(a) Provision for soft rock		m3	55.00	$ -
of Bo	(b) Provision for hard rock	350	m3	140.00	$ 49,000.00
	(c) Traffic Management		Days	2,000.00	$ -
				Sub Total	**$ 447,200.00**
				Scope Creep 5%	$ 22,360.00
				Design & Investigate 10%	$ 46,956.00
				Construction Management 5%	$ 23,478.00
				Contingency 15%	$ 80,999.10
				TOTAL	**$ 620,993.10**

WILTON JUNCTION
POTABLE WATER PUMP STATION PRELIMINARY COST ESTIMATE

Version 1 - 31st October 2013
Ref: MWH
Fig. 6.1 Wilton Junction Rezoning Water Strategy Report

Water Pump Station No. Upsizing WP302

No. of Pumps:-	2 Duty 1 Standby
Duty Point:-	225 ℓ/s against 58 m Head
Power Per Pump (kw):-	107
Total Station Power:	320
Rising Main Dia:-	DN450 DICL

Note: The cost has been broken into Stage 2: $1.4M and Stage 5: $0.105M; Total: $1.505M. The increase in cost is due to items that will be required during both the stages.

PRELIMINARY ESTIMATED CONSTRUCTION COST *(5573-051-I.xls)*

No.	Description	Qty	Unit	Rate	Amount
1	Establishment & OH&S	1	item	80,000.00	$ 80,000.00
2	Construct Water Pump Station complete including electrical controls				
	(i) 2 pumps		item		$ -
	(ii) 3 pumps	1	item	750,000.00	$ 750,000.00
3	Supply & install complete Flow Meter	1	No.	50,000.00	$ 50,000.00
4	Supply & install telemetry upgrade if required	1	No.	50,000.00	$ 50,000.00
5	Supply & install filter	1	No.	25,000.00	$ 25,000.00
6	Supply & install variable speed drive	3	No.	20,000.00	$ 60,000.00
7	Install standby generator connection	1	No.	10,000.00	$ 10,000.00
8	Fencing, access and sealed parking area		item		$ -
9	Power supply		item		$ -
10	Commissioning	1	item	15,000.00	$ 15,000.00
11	Other				
	11.1 Provision for rock				
	(i) Soft rock		m3		$ -
	(ii) Hard rock		m3		$ -
	11.2 Traffic Management		Days		$ -
				Sub Total	**$ 1,040,000.00**
				Scope Creep 5%	$ 52,000.00
				Design & Investigate 10%	$ 109,200.00
				Construction Management 5%	$ 54,600.00
				Contingency 15%	$ 188,370.00
				TOTAL	**$ 1,444,170.00**

WILTON JUNCTION
POTABLE WATER PUMP STATION PRELIMINARY COST ESTIMATE

Version 1 - 31st October 2013
Ref: MWH
Fig. 6.1 Wilton Junction Rezoning Water Strategy Report

Water Pump Station No. High Level Booster Walkers Land

No. of Pumps:-	2
Duty Point:-	30 ℓ/s against 30 m Head
Power Per Pump (kw):-	25
Total Station Power:	50
Rising Main Dia:-	DN250 DICL

PRELIMINARY ESTIMATED CONSTRUCTION COST *(5573-051-I.xls)*

No.	Description	Qty	Unit	Rate	Amount
1	Establishment & OH&S	1	item	70,000.00	$ 70,000.00
2	Construct Water Pump Station complete including electrical controls				
	(i) 2 pumps	1	item	425,000.00	$ 425,000.00
	(ii) 3 pumps		item		$ -
3	Supply & install complete Flow Meter	1	No.	50,000.00	$ 50,000.00
4	Supply & install telemetry upgrade if required	1	No.	70,000.00	$ 70,000.00
5	Supply & install filter	1	No.	25,000.00	$ 25,000.00
6	Supply & install variable speed drive	2	No.	20,000.00	$ 40,000.00
7	Install standby generator connection	1	No.	10,000.00	$ 10,000.00
8	Fencing, access and sealed parking area	1	item	15,000.00	$ 15,000.00
9	Power supply	1	item	60,000.00	$ 60,000.00
10	Commissioning	1	item	15,000.00	$ 15,000.00
11	Other				
	11.1 Provision for rock				
	(i) Soft rock		m3	55.00	$ -
	(ii) Hard rock	100	m3	140.00	$ 14,000.00
	11.2 Traffic Management	20	Days	2,000.00	$ 40,000.00
				Sub Total	**$ 834,000.00**
				Scope Creep 5%	$ 41,700.00
				Design & Investigate 10%	$ 87,570.00
				Construction Management 5%	$ 43,785.00
				Contingency 15%	$ 151,058.25
				TOTAL	**$ 1,158,113.25**

WILTON JUNCTION
POTABLE WATER PUMP STATION PRELIMINARY COST ESTIMATE

Version 1 - 31st October 2013
Ref: MWH
Fig. 6.1 Wilton Junction Rezoning Water Strategy Report

Water Pump Station No. Temporary Booster Wilton Rd - 4,000 ET

No. of Pumps:-	2 (1 Duty, 1 Standby)
Duty Point:-	54.2 ℓ/s against 25 m Head
Power Per Pump (kw):-	22
Total Station Power:	44
Rising Main Dia:-	DN450 DICL

PRELIMINARY ESTIMATED CONSTRUCTION COST *(5573-051-I.xls)*

No.	Description	Qty	Unit	Rate	Amount
1	Establishment & OH&S	1	item	70,000.00	$ 70,000.00
2	Construct Water Pump Station complete including electrical controls				
	(i) 2 pumps	1	item	200,000.00	$ 200,000.00
	(ii) 3 pumps		item		$ -
3	Supply & install complete Flow Meter	1	No.	50,000.00	$ 50,000.00
4	Supply & install telemetry upgrade if required	1	No.	70,000.00	$ 70,000.00
5	Supply & install filter	1	No.	25,000.00	$ 25,000.00
6	Supply & install variable speed drive	2	No.	20,000.00	$ 40,000.00
7	Install standby generator connection	1	No.	10,000.00	$ 10,000.00
8	Fencing, access and sealed parking area	1	item	15,000.00	$ 15,000.00
9	Power supply	1	item	60,000.00	$ 60,000.00
10	Commissioning	1	item	15,000.00	$ 15,000.00
11	Other				
	11.1 Provision for rock				
	(i) Soft rock		m3	55.00	$ -
	(ii) Hard rock	100	m3	140.00	$ 14,000.00
	11.2 Traffic Management	20	Days	2,000.00	$ 40,000.00
				Sub Total	**$ 609,000.00**
				Scope Creep 5%	$ 30,450.00
				Design & Investigate 10%	$ 63,945.00
				Construction Management 5%	$ 31,972.50
				Contingency 15%	$ 110,305.13
				TOTAL	**$ 845,672.63**

WILTON JUNCTION
POTABLE WATER RESERVOIRS PRELIMINARY COST ESTIMATE

Version 1 - 31st October 2013
Ref: MWH
Fig. 6.1 Wilton Junction Rezoning Water Strategy Report

PARAMETERS

Storage Volume:-	6 ML	Note: This costing has been broken into
No. of Reservoirs:-	2	Stage 3: $3M and Stage 5: $1.9M; Total: $4.9M
Type of Reservoirs:-	On Ground	The increase in the total cost is due to items
Diameter of Tank:-	38 m	that will be required during both the stages.
Height:-	6.05 m	

PRELIMINARY ESTIMATED CONSTRUCTION COST *(5573-053-I.xls)*

No.	Description	Qty	Unit	Rate	Amount
1	Establishment & OH&S	1	item	50,000.00	$ 50,000.00
2	Clearing	0.75	Ha	15,000.00	$ 11,250.00
3	Earthworks	7500	m3	13.00	$ 97,500.00
4	Extra Over for rock - bulk				
	(i) Soft rock	2000	m3	12.00	$ 24,000.00
	(ii) Hard rock	1000	m3	25.00	$ 25,000.00
5	Gravel working platform x 150mm	1125	m3	70.00	$ 78,750.00
6	Blinding layer 50mm	110	m3	400.00	$ 44,000.00
7	Ring concrete foundation 240 x 600 x 0.75	108	m3	650.00	$ 70,200.00
8	Base slab 2400 x 0.3	720	m3	650.00	$ 468,000.00
9	Pipework, valves & pits within 10m of reservoir perimeters	2	No.	75,000.00	$ 150,000.00
10	Supply materials & construct reservoir complete including roof & access	2	No.	930,000.00	$ 1,860,000.00
11	Fencing, access & parking	1	item	40,000.00	$ 40,000.00
12	Telemetry	1	item	60,000.00	$ 60,000.00
13	Power supply	1	item	50,000.00	$ 50,000.00
14	Mechanical controls for valves	1	item	130,000.00	$ 130,000.00
15	Flow meter	2	No.	50,000.00	$ 100,000.00
16	Landscaping	3500	m2	30.00	$ 105,000.00
17	Chlorination & commissioning	1	item	15,000.00	$ 15,000.00
18	Testing	1	item	5,000.00	$ 5,000.00
				Sub Total	**$ 3,383,700.00**
				Scope Creep 5%	$ 169,185.00
				Design & Investigate 10%	$ 355,288.50
				Construction Management 5%	$ 177,644.25
				Contingency 15%	$ 612,872.66
				TOTAL	**$ 4,698,690.41**