NSW GOVERNMENT Public Works Advisory

Riverina Water County Council

Integrated Water Cycle Management Strategy

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Cover image: Wagga Wagga Beach – Murrumbidgee River (Source: Waggawaggaaustralia.com.au)

Executive Summary

The Integrated Water Cycle Management (IWCM) Strategy is a local water utility's (LWU's) 30-year strategy for the provision of appropriate, affordable, cost-effective and sustainable urban water services that meet community needs and protect public health and the environment. The key outcomes of a LWU's IWCM Strategy are a 30-year Total Asset Management Plan (TAMP), a 30-year financial plan and a drought and emergency response contingency plan (DERCP). The development of Riverina Water's IWCM Strategy has followed the DPIE Water IWCM Strategy Check List. The following tasks have been completed to date.

- IWCM Issues Paper
- Integrated Water Supply Systems Modelling
- Stakeholder and community consultation

Growth Strategy

Residential

Wagga Wagga City has played host to two distinct housing market roles; drawing young adults, attracted to education, transport, employment opportunities and providing homes to both young and mature family households. The importance of Wagga Wagga as a destination for both families and young adults is expected to continue over the forecast period. New residential development opportunities in Estella (University), Springvale (Lloyd), North Wagga Wagga (Bomen), and Forest Hill will cater for an increase in families to the area while continued 'infill' development in Wagga Wagga (Central) will provide household growth for young adults.

Growth in the areas outside Wagga Wagga is expected to be minimal, based on projections from Riverina Water's constituent councils. This expectation is reflected in the Department of Planning projections that show relatively little or no growth in the other LGAs. The forecast 30-year service population in shown in Figure S.1.

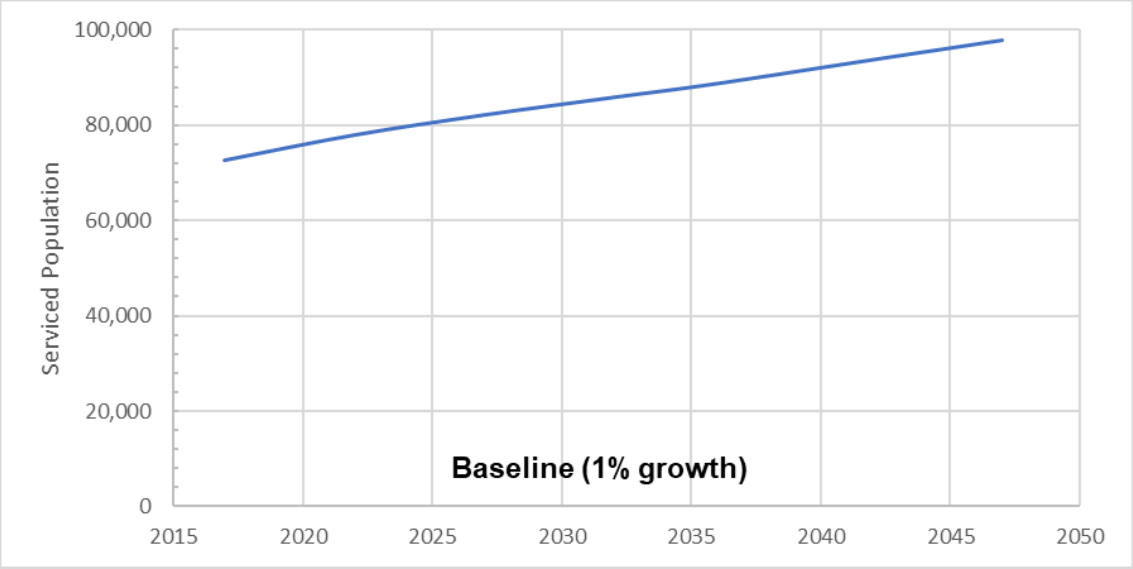

Figure S.1: Forecast service population for Riverina Water

Non-residential

The bulk supply to the RAAF Airbase and Kapooka Army Recruit Training Centre is expected to increase over the next ten years as a result of a 10% and 33% increase in recruits respectively, over this period.

The NSW Government has announced the creation of a Special Activation Precinct (SAP) in the north-east area of Wagga Wagga (called Bomen) to create a world-class business precinct, capitalise on the inland rail, and promote advanced manufacturing, agribusiness, and freight and logistics. The Wagga Wagga precinct will cover an area of approximately 4,500 hectares, including 300 hectares already developed as part of the Bomen Business Park. Building on already-planned private and government investments, the precinct will create up to 6,000 new jobs across a range of industries.

Other major non-residential customers such as Charles Sturt University, Teys Abattoirs and Heinz Watties already have active programs to minimise water consumption with respect to their future operations.

Business Objectives and performance

Riverina Water's Delivery Program sets out the following goals with respect to services to be provided:

- To provide water supply to customers in accordance with acceptable levels of service at lowest sustainable cost.
- To build on a reputation as a leading water utility service provider.
- To offer a comprehensive service in the abstraction, treatment, storage, movement and delivery of water and associated services.
- To achieve a substantial reduction in outdoor water use through demand management measures with a focus on outdoor use and the irrigation of turf.
- To include demand reduction as an alternative to augmentation where systems are stressed.

The service objectives have been developed in line with the above goals.

An IRIS Research survey, commissioned by Riverina Water in 2018, produced some very strong results for Council. The vast majority of residents who have had dealings with Riverina Water have expressed a high level of satisfaction with their experience. Residents across the board have expressed their satisfaction with the quality of the water service that Riverina Water delivers.

A review of the business performance was also undertaken, to identify risks and issues to be addressed in the IWCM Strategy.

The IWCM Strategy

A list of management actions and non-build solutions to address the identified risks are listed in Table S.1.

Table S.1: List of management actions and non-build solutions

Issue/Risk	Action
Potential for LTAAEL to be exceeded	Riverina Water to manage its annual groundwater extraction up to its LTAAEL. If LTAAEL is to be exceeded, consult with Goldenfields. Prepare a Memorandum of Understanding (MoU) with Goldenfields Water.
Proposed replacement Water Sharing Plan (WSP)	Maintain watching brief on changes to legislation and consider acquiring further water entitlements and seek to maintain a buffer for variable climatic conditions.
Fluoridation plants do not comply with COP	Continue to work with NSW Health to minimize risk of replacing fluoridation plants that may be inconsistent with future changes to the Code of Practice (COP). Replace existing fluoridation plants to meet NSW Health and NSW DPIE's requirements.

Issue/Risk	Action
Surface water entitlement expected to be exceeded	Initiate the process to acquire additional town water supply surface water entitlements and obtain additional high security licenses to supply new industries. Implement demand management strategies to reduce demand.
Wagga Wagga SAP will greatly increase water demand; which Riverina Water will not be able to supply within its current license entitlements	Require developers provide their own water entitlement, which Riverina Water will use to source water on their behalf, then treat and supply it.
The sustainable yield and drought resilience of the groundwater source outside of Wagga Wagga are not known	Undertake secure yield assessments of the groundwater sources outside of Wagga Wagga.
Yanco Creek weir update	Maintain a 'watching brief' on the Yanco weir upgrade project to determine whether it impacts drought reliability and raw water quality at Yanco Creek (Morundah water supply system)
Drought resilience of the Wagga Wagga aquifer, and other town groundwater sources	Investigate the impact of the extraction over the last decade on the sustainable yield and drought resilience of the Wagga Wagga alluvial groundwater source. Undertake secure yield assessments of other town groundwater sources, including Woomargama bores, Walla Walla bores, Humula bores, Tarcutta Bores and Bulgary Bores
MIB and Geosmin causing taste issues	Investigate catchment source of MIB if it reoccurs at Wagga Murrumbidgee River intakes, and suitable management/treatment options.
PFAS in Lachlan aquifer	Continue annual PFAS testing and investigate removal options. Undertake a 30-year assessment of production/demand water balance with less/no input from East Wagga Bores and investigate options to supplement/replace the source. Advocate greater involvement and correction activities from state agencies and Department of Defence to treat, remove, and manage PFAS before impact East Wagga bore field
Risk of contamination at Humula wells	Develop a Standard Operating Procedure (SOP) to utilize the alternate water source in Humula when the wells are affected by flood water inundation (ie. use of Humula Bore). Investigate replacing the Humula wells with closed bores, or to protect the wells with a levee system.
Water clarity at Oura due to iron and manganese in the bore.	Investigate another bore source, water treatment options, supply from adjacent systems, or a reduced level of service.
Morundah filtered water clarity impacted	Maintained chlorination dosages for effective disinfection above what's required

Issue/Risk	Action
	Digitisation and upgrade control systems remote monitoring at the Morundah WTP Morundah WTP upgrade to include filter replacements
No Service Levels Agreements (SLAs) with Major Users	Establish service level agreements (SLAs) with the major users and GWCC, based on the outcome of historical demand analysis.
No alternative supply to Southern Trunk in case there was a supply interruption at West Wagga water treatment plant, pump station or West Wagga bore field	Investigate an alternate water supply options into Southern Trunk other than from West Wagga treatment plant, considering surface water option e.g. from the Wagga Wagga system supplied by Murrumbidgee River.
Supply reliability in San Isidore	Investigate a potential new water supply system adjacent to Mt Moorong with a supply reservoir located at a higher elevation, as part of water supply options for future residential development in the area.
Condition rating is not based on recent inspection.	Asset management system is being reviewed in conjunction with council's digital strategy, namely the Enterprise Resource Planning (ERP) system. Develop condition ratings for all asset classes and update as assets are replaced in a central asset management system
Customer Relationship Management (CRM) system does not capture data effectively and is not linked	Update the CRM system in line with Riverina Water's digitization strategy, namely the ERP system.

A list of infrastructure works that form part of the strategy is provided in Table S.2.

Table S.2: List of infrastructure works to address identified risks

Issue/Risk	Action	Timeframe
Yield constraint of Bulgary bores	Investigate supply, treatment and transfer options into Western Trunk Main to supply 30-year projected demands. Consideration include: Augment the supply from the Urana Filtration Plant to supply both Urana and Oaklands to reduce the requirement from Bulgary Bores, consider transfer of water from Southern Trunk system into Western Trunk system. To be investigated with 30-year hydraulic model that includes interconnected supply systems	2020-2025
Dirty water originating from raw water rising mains from East and North Wagga borefields	Install access points into North Wagga and East Wagga bore rising mains for water jetting.	2020-2025
WQ Risk to Woomargama bores	Upgrade the Woomargama Treatment Plant, together with online turbidity/ chlorine meters and develop SOPs. Investigate replacement of abandoned spear points with second bore source to improve reliability/redundancy	2020-2025

Issue/Risk	Action	Timeframe
Oura bore water quality, and reservoir capacity and condition	Replace Oura reservoirs: • New 1.2ML of storage or • Two 600 kL reservoirs	2020-2030 2020-2030 and 2040-2050
WQ Risk due to Yanco weir upgrade	• Replace Morundah WTP with robust treatment processes taking into account possible degradation of raw water quality, or • Construct pipeline from Urana Raw Water pump station to be investigated • Maintain watching brief of DPIE Water / WaterNSW project scope and business case justifying Yanco Weir upgrade	2020-2025
WQ Risk due to Morundah plant performance	Upgrade/replace Morundah WTP. Consideration of issues listed above.	2020-2025
Supply from Southern Trunk to Western Trunk causing low pressure	Stop supply to the Western Trunk from the Southern Trunk. To be investigated with 30-year hydraulic model that includes interconnected supply systems.	by 2030
Pressure issues in Western Trunk. Capacity of Bulgary Bores and West Wagga WTP pumps insufficient	Investigate Urana WTP and the Clear Water Storage Pump to supply both Urana and Oaklands, whilst Bulgary bores supply the rest of the Western Trunk Stop supplying Western Trunk from Southern Trunk. To be investigated with 30-year hydraulic model that includes interconnected supply systems	by 2030
WQ Risk due to uncovered aeration tanks	Ongoing CapEx programme to cover all aeration basins	2020-2025
WQ Risk due to iron bacteria in Tarcutta bore	Replace Tarcutta bore 5.	2022/2023
Supply reliability risks	These issues were investigated with 30-year hydraulic model that includes interconnected supply systems with the following outcomes: Bellevue-Glenoak • New 6.2 ML Glenoak Reservoir • Upgrade Bellvue PS to 10.2 ML/day • Upgrade Glenoak PS to 10.5 ML/day	2037/2038 2035/2036 2029/2030
	North Wagga system • Augment capacity of the Wagga Wagga WTP from 75ML/day to 105ML/day, with around 30 ML/day transferred to the North Wagga System.	
	Estella • New 11 ML Estella Reservoir • Upgrade Estella PS to 20.7 ML/day	2028/2029 by 2030

Issue/Risk	Action	Timeframe
	Brucedale • New 1.5 ML Brucedale Reservoir • Upgrade Brucedale PS to 1.5 ML/day	2025/2026 by 2040
	East Bomen • New 6.0 ML East Bomen Reservoir • Upgrade East Bomen PS to 12.0 ML/day	2032/2033 by 2040
	Western trunk • Upgrade Urana WTP to 3.2 ML/day and upgrade Clear Water Storage pumps to 2.7 ML/day.	2021/2022
	Oaklands and Urana • New 0.5 ML Oaklands Reservoir. • New 1.0 ML Urana Reservoir • Upgrade Oaklands PS to 0.7 ML/day • New Urana Reservoir PS 1.7 ML/day	after 2050 by 2030 2028/2029 by 2030
	Lockhart • New 2.5 ML Lockhart Reservoir	by 2030
	The Rock • Supply from a new 2.0 ML reservoir to be constructed at The Rock, with new 1.6 ML/day PS	2021/2022
	Collingullie • New 1.5 ML Collingullie Reservoir	2035
	Woomargama • Replace WTP and pump station. • Construct a second bore.	2024/2025 2021/2022

Total Asset Management Plan

Riverina Water's current Total Asset Management Plan has been updated to include the capital works for growth and improved levels of service (ILOS) identified, to address the risks. The 30-year capital works programs and the Total Asset Management Plan (TAMP) for the IWCM strategy, are presented in Figure S.2 and Figure S.3 respectively.

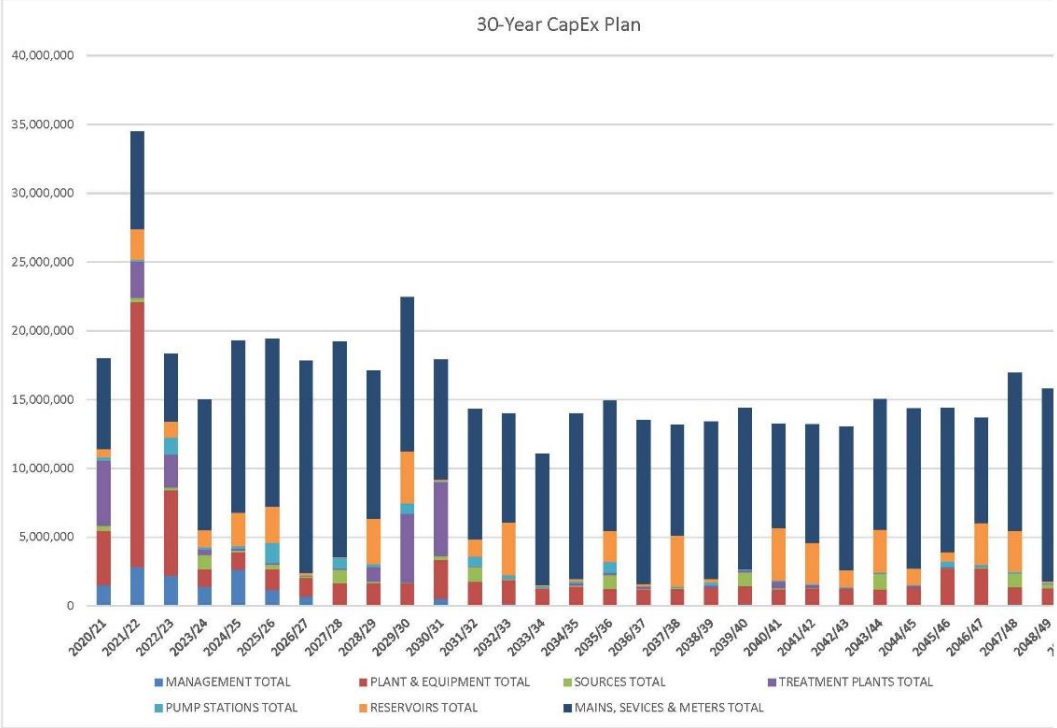

Figure S.2: 30-Year Capital Works Schedule

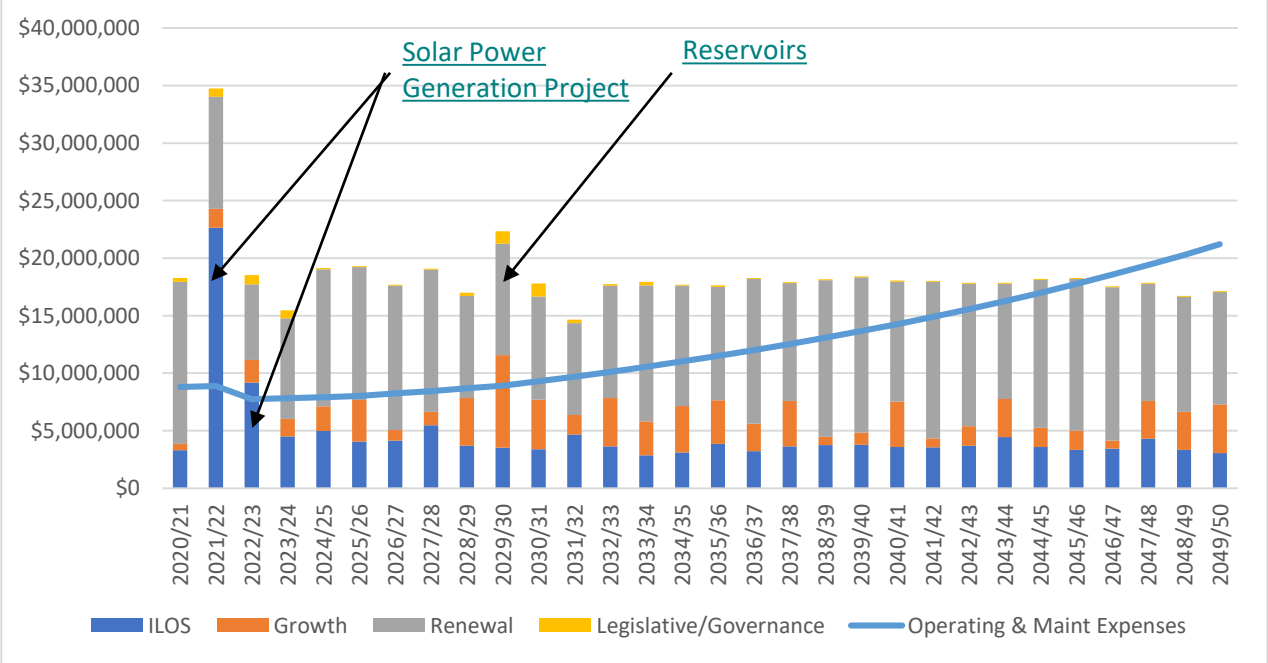

Figure S.3: 30-Year Total Asset Management Plan Expenditure

Long-term Financial Plan (LTFP)

The overall goal of financial planning is to determine the lowest, sustainable price path for the water supply services on which to base Riverina Water's tariff structure. The plan also presents the

sensitivity of financial forecasts to possible changes in key model variables. The impact of three variables were assessed in the financial modelling. These were:

- A percentage increase in the annual Typical Residential Bill (TRB)
- The reduction in annual energy costs from the Photovoltaic (PV) energy generation project
- The forecast annual growth rate.

Riverina Water's preferred Scenario includes a 1.5% annual increase in the TRB, $1.3M annual reduction in energy costs and a 1.0% forecast growth rate.

The typical residential bill, levels of cash and investments, and borrowing outstanding during the forecast period are depicted in Figure S.4.

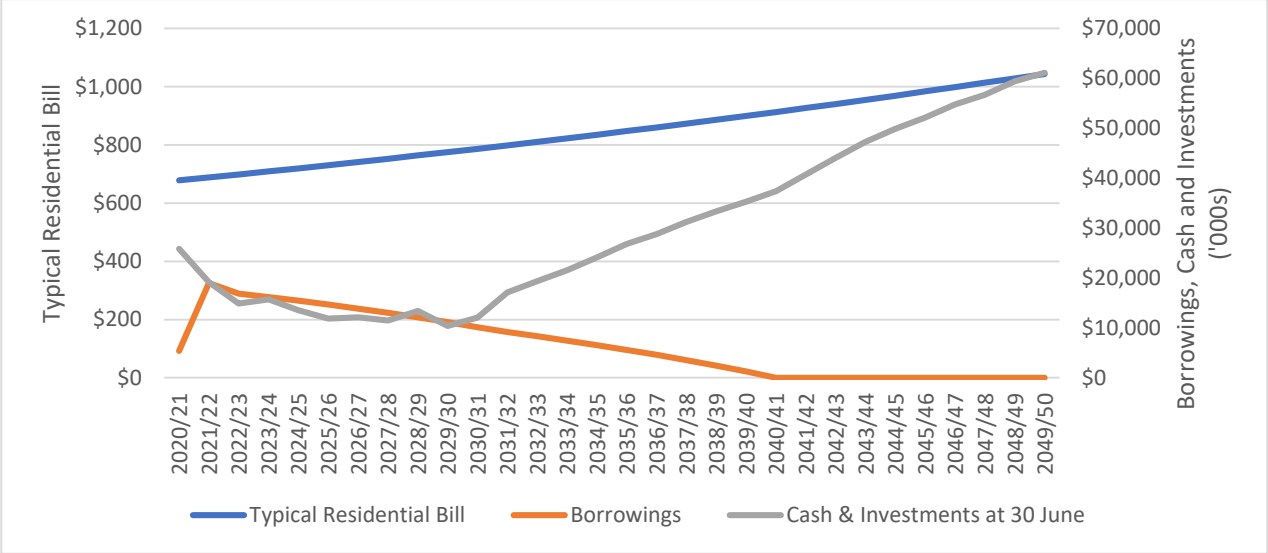

Figure S.4: Cash & Borrowing Projections 1.5% TRB increase, $1.3m electricity reduction, 1% annual growth

The forecast Developer Charge, and its percentage of the total revenue is shown in Figure S.5.

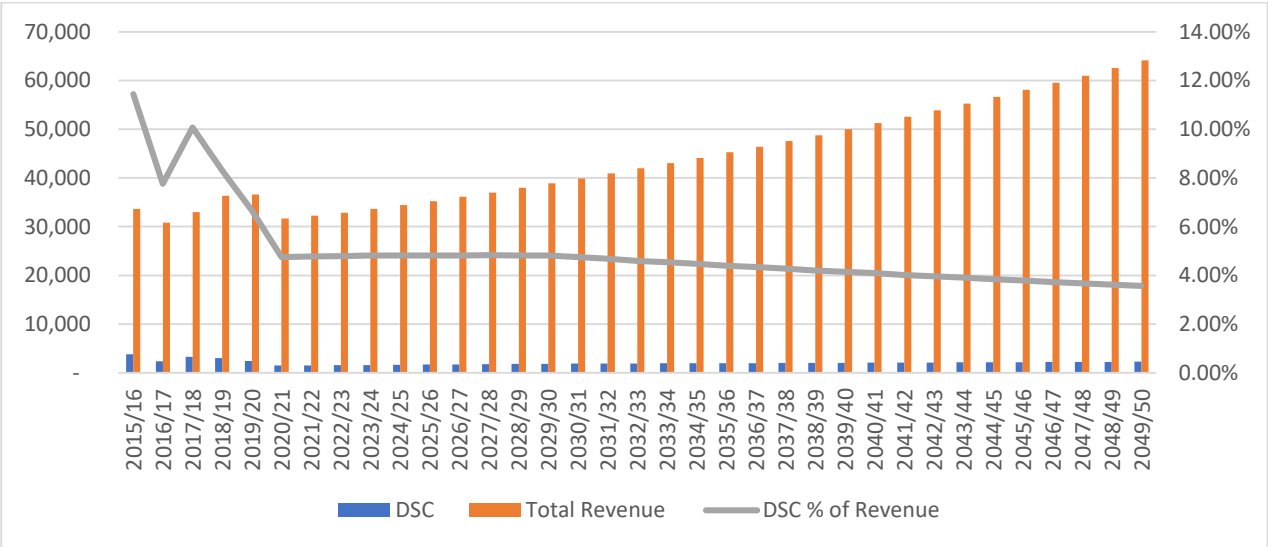

Figure S.5: Forecast Developer Charge and its percentage of total revenue

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Abbreviations and Notations

COP	Code of Practice
CRM	Customer Relationship Management
CSU	Charles Sturt University
DC	Developer Charges
DERCP	Drought and Emergency Response Contingency Plan
DPIE	Department of Planning, Industry and Environment
EPA	Environment Protection Agency
GHC	Greater Hume Council
GL	Gigalitre (1 billion litres)
GWCC	Goldenfields Water County Council
HACCP	Hazard Analysis Critical Control Point
HBT	Health Based Targets
ILOS / LOS	Improved levels of service / levels of service
IWCM	Integrated Water Cycle Management
kL	Kilolitre (1 thousand litres)
km	Kilometre (1 thousand metres)
LGA	Local Government Area
LTAEEL	Long Term Average Annual Extraction Limit
LWU	Local Water Utility
MIB	2-Methylisoborneol
ML	Megalitre (1 million litres)
MoU	Memorandum of Understanding
NHMRC	National Health and Medical Research Council
NSW	New South Wales
PFAS	Per- and poly-fluoroalkyl substances
PV	Photovoltaic
PWA	Public Works Advisory
RAAF	Royal Australian Air Force
RiFL	Riverina Intermodal Freight and Logistics
RWCC	Riverina Water County Council
SAP	Special Activation Precinct
SLA	Service Level Agreement
SOP	Standard Operating Procedure
TAMP	Total Asset Management Plan
TEP	The Energy Project
TRB	Typical Residential Bill
WAL	Water Access License
WCC	Wagga City Council
WTP	Water Treatment Plant

1. The IWCM Strategy

1.1 Process

The Integrated Water Cycle Management (IWCM) Strategy is a local water utility's (LWU's) 30-year strategy for the provision of appropriate, affordable, cost-effective and sustainable urban water services that meet community needs and protect public health and the environment. A local water utility's (LWU's) peak planning documents for its water supply and sewerage businesses are its current IWCM Strategy and its current SBP.

The IWCM Strategy:

- Identifies the water supply and sewerage needs of a LWU
- 'Right sizes' any infrastructure projects and determines their priority
- Identifies the lowest level of stable Typical Residential Bill (TRB) to meet the levels of service
- Includes a 30-year Total Asset Management Plan and Financial Plan.
- Identifies strategies to mitigate identified organisation risks such as drought, water quality health-based targets, climate change and community expectations on levels of service

The process of preparing an IWCM Strategy follows the 2019 Department of Planning Industry and Environment (DPIE Water) Water's IWCM Strategy Check List and broadly includes the following:

- Preparation of an IWCM Issues Paper
- Evaluation of feasible options
- Developing the IWCM Strategy
- Preparation of a Total Asset Management Plan (TAMP) and Financial Plan.

The key outcomes of a LWU's IWCM Strategy are:

- 30-year TAMP
- 30-year financial plan
- Drought and emergency response contingency plan (DERCP)

The process of preparing an IWCM is shown in Figure 1.1.

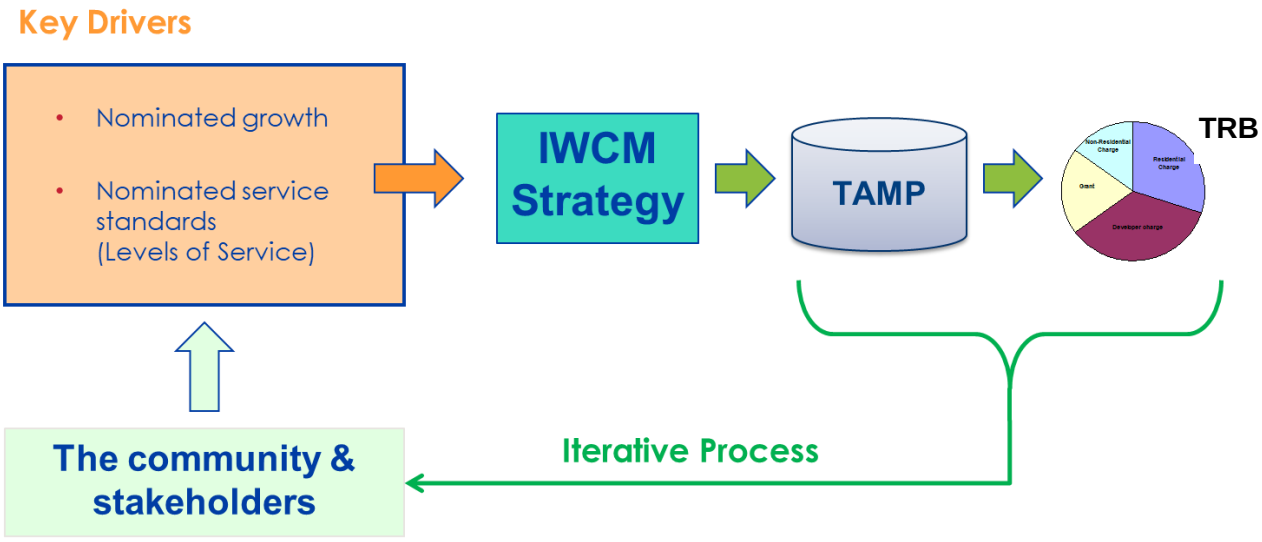


Figure 1.1: Process of preparing an IWCM Strategy

The nominated growth and the adopted levels of service (LOS) targets are the key drivers that impact the development of the TAMP. The 30-year financial plan determines the revenue requirements to support the TAMP and forecasts the Typical Residential Bill (TRB) and the Developer Charge (DC) for the preferred strategy. The process is iterative, and an affordable level of service and DC is determined through community and stakeholder consultation.

1.2 Progress

The development of Riverina Water's IWCM Strategy has followed the NSW DPIE's IWCM Strategy Check List. The following tasks have been completed to date.

- **IWCM Issues Paper**

  This report identified and outlined the current and 30-year projected issues relating to Riverina Water's regulatory requirements, growth, levels of service (LOS), and performance of Riverina Water's services. The Issues paper addresses Tasks 1 to 8 of the IWCM Check List.

- **Integrated Water Supply Systems Modelling**

  To address an identified knowledge gap from Riverina Water's IWCM Issues Paper, Riverina Water engaged Public Works Advisory (PWA) to develop an integrated hydraulic model comprising of interconnected water supply systems and undertake analysis to determine the following:

  - Verify the model's behaviour over two peak weeks demand
  - Develop options to address the supply reliability issues when meeting the forecast 2050 demand

  The water supply systems involved were (also refer Figure 31):

  - Wagga Wagga systems (Wagga Low Level, Wagga, High Level and Bellevue systems)
  - North Wagga systems (including Bomen, East Bomen and Estella systems)
  - Southern Trunk Main systems (including villages and up to and including Henty Balance Tank)
  - Western Trunk Main Systems (including villages up to and including Oaklands)

- **Stakeholder and community consultation**

  Stakeholder and community consultation has been undertaken through two workshops with the Project Reference Group (PRG) established by Riverina Water.

  - Workshop 1 was held at the completion of the IWCM Issues paper.
  - Workshop 2 was held at the completion of the options assessment and financial modelling.

This IWCM Strategy report contains a summary of all the outcomes. It outlines the adopted IWCM Strategy and includes a Total Asset Management Plan (TAMP) and a Long Term Financial Plan (LTFP).

2. Background information

2.1 Riverina Water County Council

Riverina Water County Council (Riverina Water) is a Local Water Utility (LWU) operating under the Local Government Act 1993 to provide potable water. Originally, it was the Southern Riverina County Council in 1938 and supplied reticulated water to the Shires of Lockhart, Kyeamba, Mitchell and part of Culcairn. Soon after, Urana and Holbrook were included and the City of Wagga Wagga in 1945. Southern Riverina also held responsibility for the supply of electricity to the area between 1942 and 1995. However, the formation of the Great Southern Energy in 1995 led to a review and the formation of Riverina Water in 1997. Today, Riverina Water services Wagga Wagga City Council, Lockhart Shire Council and parts of the Greater Hume Shire Council and Federation Council.

The entire County District totals 15,400 square kilometres from the Tarcutta and Humula in the east, to Colombo Creek and Urana in the west, Woomargama and Walla Walla in the South and Brucedale, Bulgary and Morundah in the north. There are over 32,400 customers (2017/18) which services approximately 77,600 people. Customers range in water requirements from basic residential use all the way to large-scale industrial purposes.

Riverina Water operates four major systems and eight independent systems across the four Local Government Areas (LGAs). The Riverina Water supply area is shown in Figure 2.1.

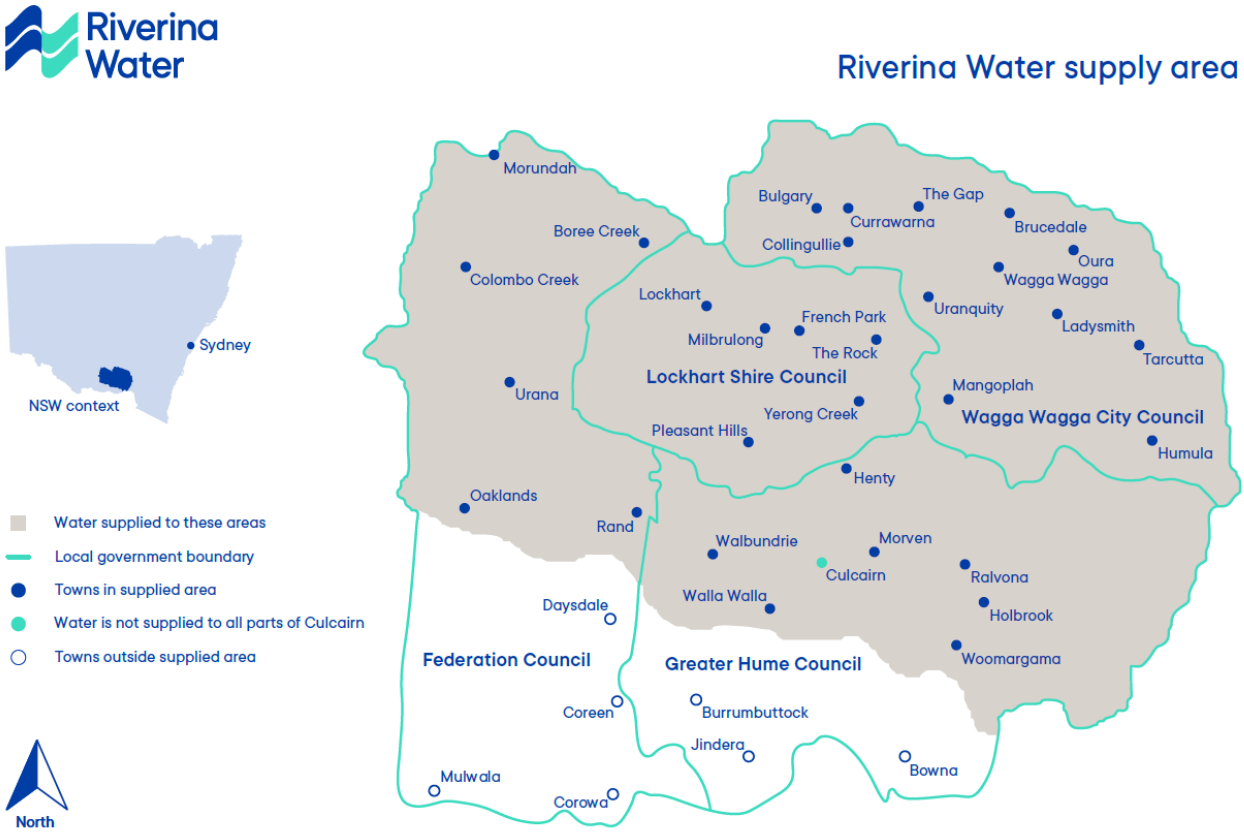


Figure 2.1: Riverina Water supply area map

A list of the serviced communities within each of the Riverina Water systems is given in Table 2.1.

Table 2.1: Communities provided with reticulated services

Water Supply System	Communities
Major Systems	
Wagga Wagga	Wagga Wagga, Bellevue/Glenoak, Gregadoo, Forest Hill, and Ladysmith
Southern Trunk	San Isadore, Kapooka, Uranquinty, The Rock, Mangoplah, Milbrulong, Yerong Creek, Henty, Pleasant Hills, Morven and Walla Walla (Note: Culcairn township is supplied by Greater Hume Shire Council)
North Wagga	North Wagga, Bomen, Estella, Charles Sturt University, Cartwrights Hill, Boorooma, The Gap, Euberta, Tooyal, Currawarna and Brucedale
West Wagga	Bulgary, Lockhart, Boree Creek, Urana, Coorabin and Oaklands
Independent Systems	
Collingullie	Collingullie
Holbrook	Holbrook
Humula	Humula
Morundah	Morundah
Oura	Oura
Tarcutta	Tarcutta
Walbundrie-Rand	Walbundrie-Rand
Woomargama	Woomargama

Greater Hume Shire and Federation Shire councils conduct their own water supply operations for areas outside Riverina Water's proclaimed supply area (refer Riverina Water County Council's Proclamation 1997 – Appendix A). Consultation with these councils during PRG stakeholder meetings did not identify other areas to extend Riverina Water's current supply operations.

2.2 Catchment characteristics

Most of Riverina Water's service areas are located within the Murrumbidgee and Murray River catchments.

Murrumbidgee River catchment

The Murrumbidgee River catchment in southern NSW has many significant wetland habitats of international ecological importance and a diverse climate, ranging from the alpine conditions of the Snowy Mountains to the semi-arid conditions of the Riverina Plains.

The catchment is around 84,000 km^2 in area, with the largest industry, grazing, occupying 64% of the land area in the catchment. Major water users include local councils and water utilities, forestry, tourism, and agriculture, including rice, dairy, wool, wheat, beef, lamb, grapes and citrus.

The Murrumbidgee catchment is shown in Figure 2.2

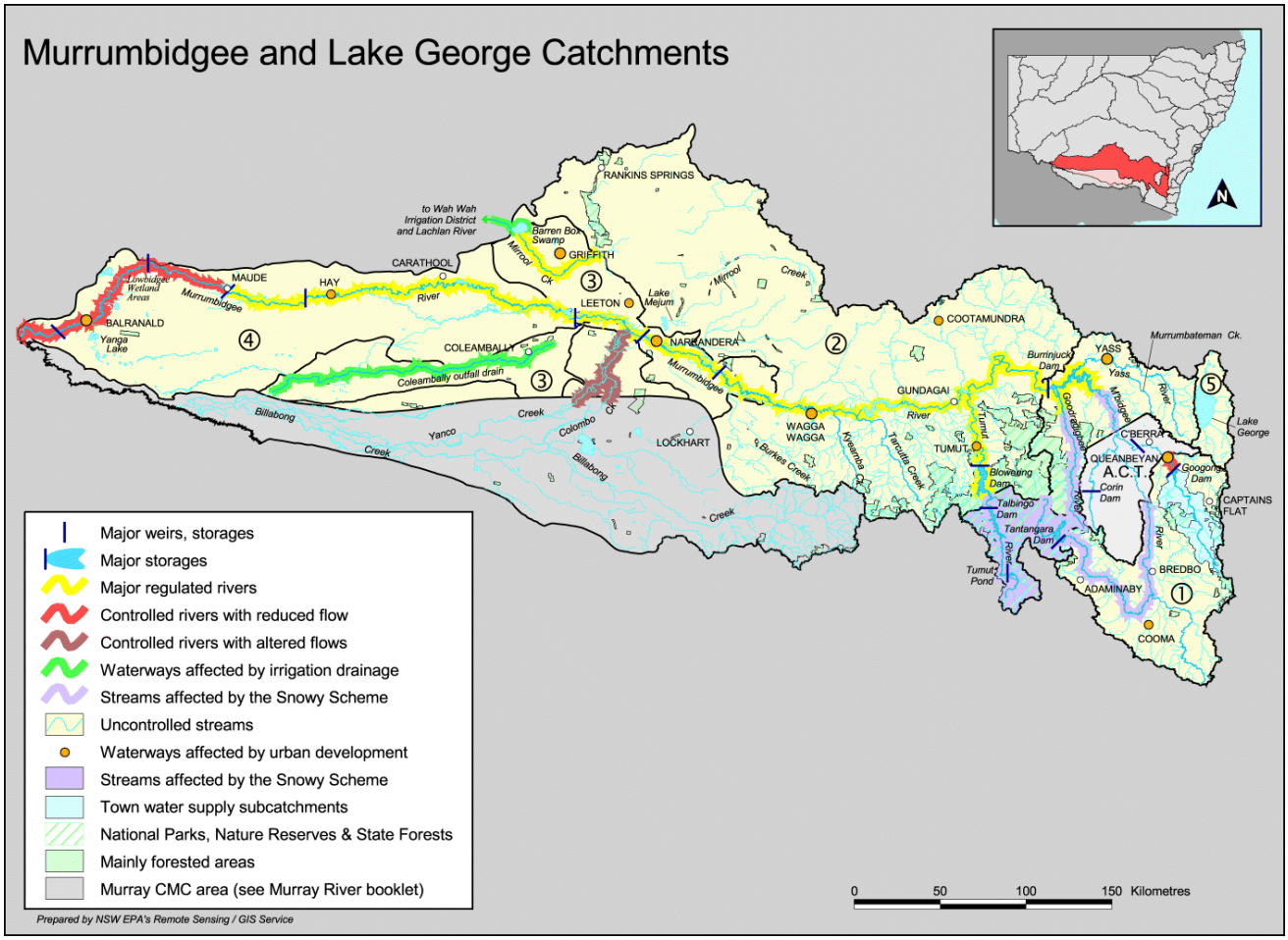


Figure 2.2: Murrumbidgee Catchments

Riverina Water has a water access licence (WAL) entitlement to extract 7 GL/annum from the Murrumbidgee Regulated River, see Section 5.2. The license is classified as a town water supply license. Town water supply licenses make up less than 2% of the water extracted from the Murrumbidgee River, see Figure 2.3.

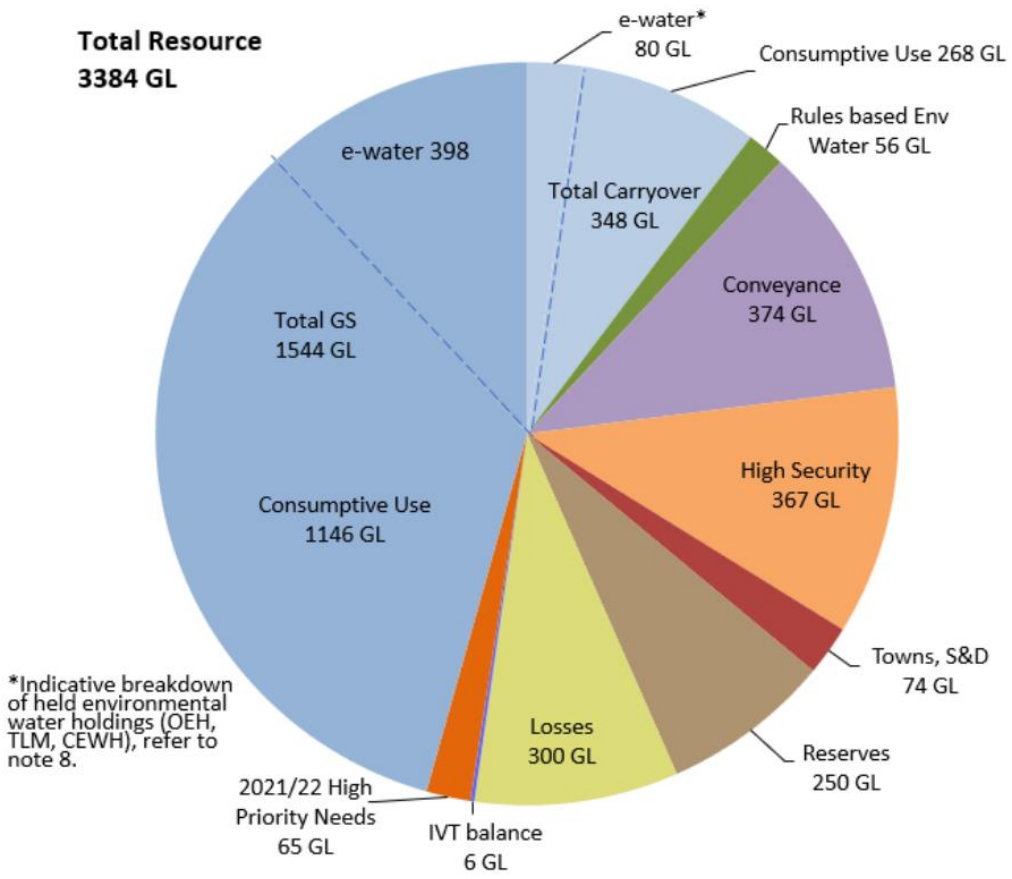


Figure 2.3: Murrumbidgee regulated river – resource distribution 2020/21

Murray River catchment

The Murray River catchment is located south of the Murrumbidgee and covers 35,500 square kilometres. It is bounded in the south by the Murray River. Geographically, it is made up of Alpine regions in the east sloping to riverine plains stretching through most of the land mass. The region experiences floods fed by the Murray River, Edward-Wakool River system and the Billabong Creek and its tributaries.

The region is rich in agricultural production and takes up over three quarters of land use. Irrigation, dry land cropping and grazing are the main industries with forestry in higher rainfall areas.

The Murray River catchment is shown in Figure 2.4.

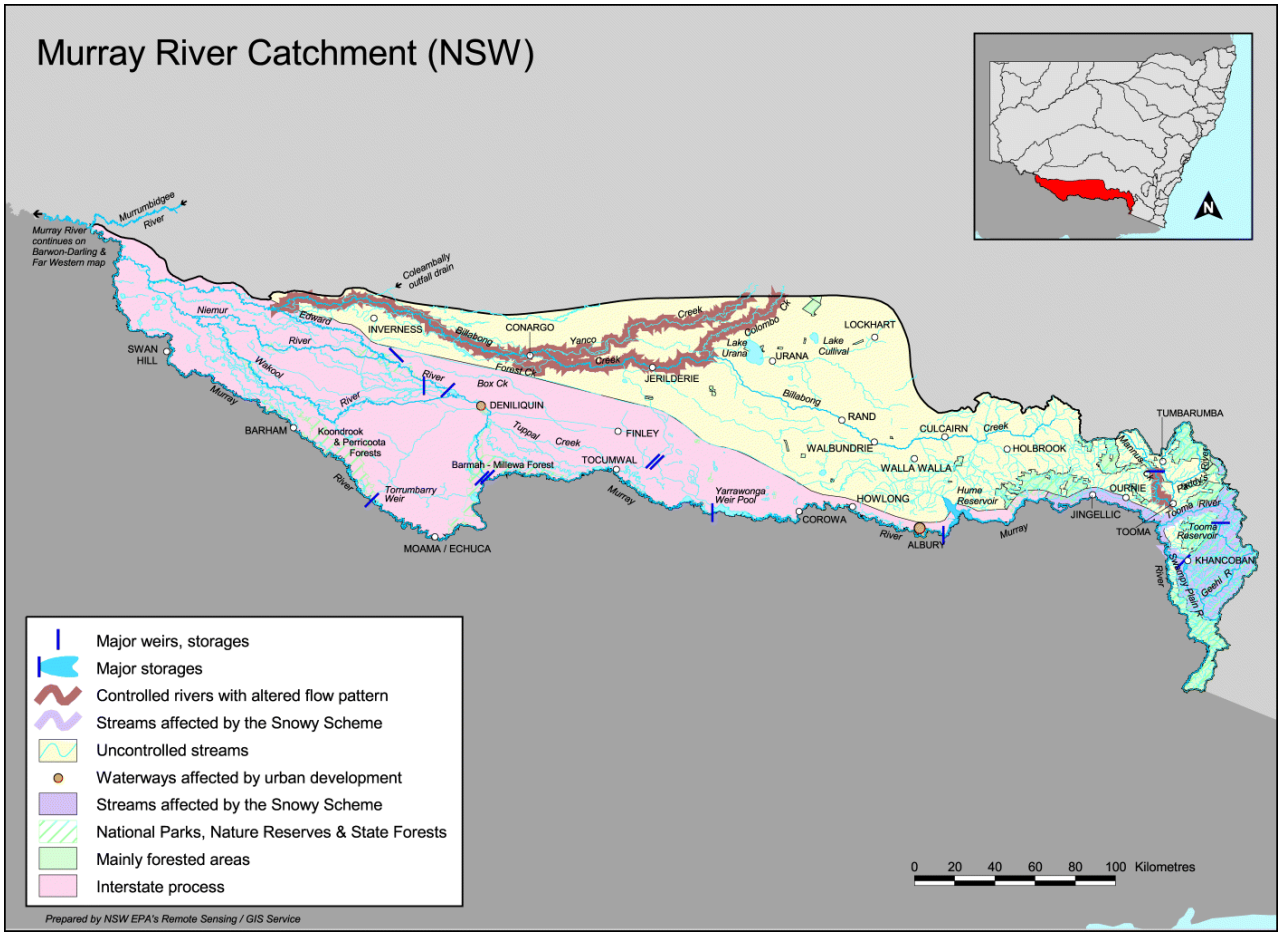


Figure 2.4: Murray River catchment

2.3 Residential population and growth

Most of the population serviced by Riverina Water is within Wagga Wagga LGA. The total estimated serviced population by LGA is given in Table 2.2.

Table 2.2: Riverina Water estimated total serviced population by LGA

LGA	Private Dwelling		Serviced Population - Non-private dwelling (hotels, colleges, hospitals, nursing homes, institutions etc.)	Total
	Serviced Population - Separate House	Serviced Population - Other (semi-detached, row or terrace house, flat, unit)		
Federation	1,100	10	110	**1,220**
Greater Hume	3,500	210	800	**4,510**
Lockhart	2,400	80	380	**2,860**
Wagga Wagga	53,000	5,470	5,350	**63,820**
Total	**60,100**	**5,780**	**6,640**	**72,520**

Wagga Wagga LGA

Wagga Wagga City Council engaged *.id* to develop population and household forecasts for Wagga Wagga LGA and present what is driving population change in the community and how the population, age structure and household types will change each year between 2016 and 2036.

The *.id* study found that the bulk of recent growth in Wagga Wagga has been in the small areas of Bourkelands – Tatton, Glenfield Park and Springvale - Lloyd. Recently, Wagga Wagga City has played host to two distinct housing market roles; drawing young adults, attracted to education, transport, employment opportunities and providing homes to both young and mature family households. Recent migration into the area largely arrived from the surrounding Local Government areas, metropolitan Sydney or overseas. Conversely, the flows away from the City were largest toward South East Queensland and greater Melbourne.

The importance of the Wagga Wagga City as a destination for both families and young adults is expected to continue over the forecast period. New residential development opportunities in Estella - University, Springvale - Lloyd, North Wagga Wagga - Bomen, and Forest Hill - East Wagga Wagga will cater for an increase in families to the area while continued 'infill' development in Wagga Wagga (Central) will provide household growth for young adults.

The *.id* analysis split the Wagga Wagga LGA into 15 forecast areas, shown in Figure 2.5.

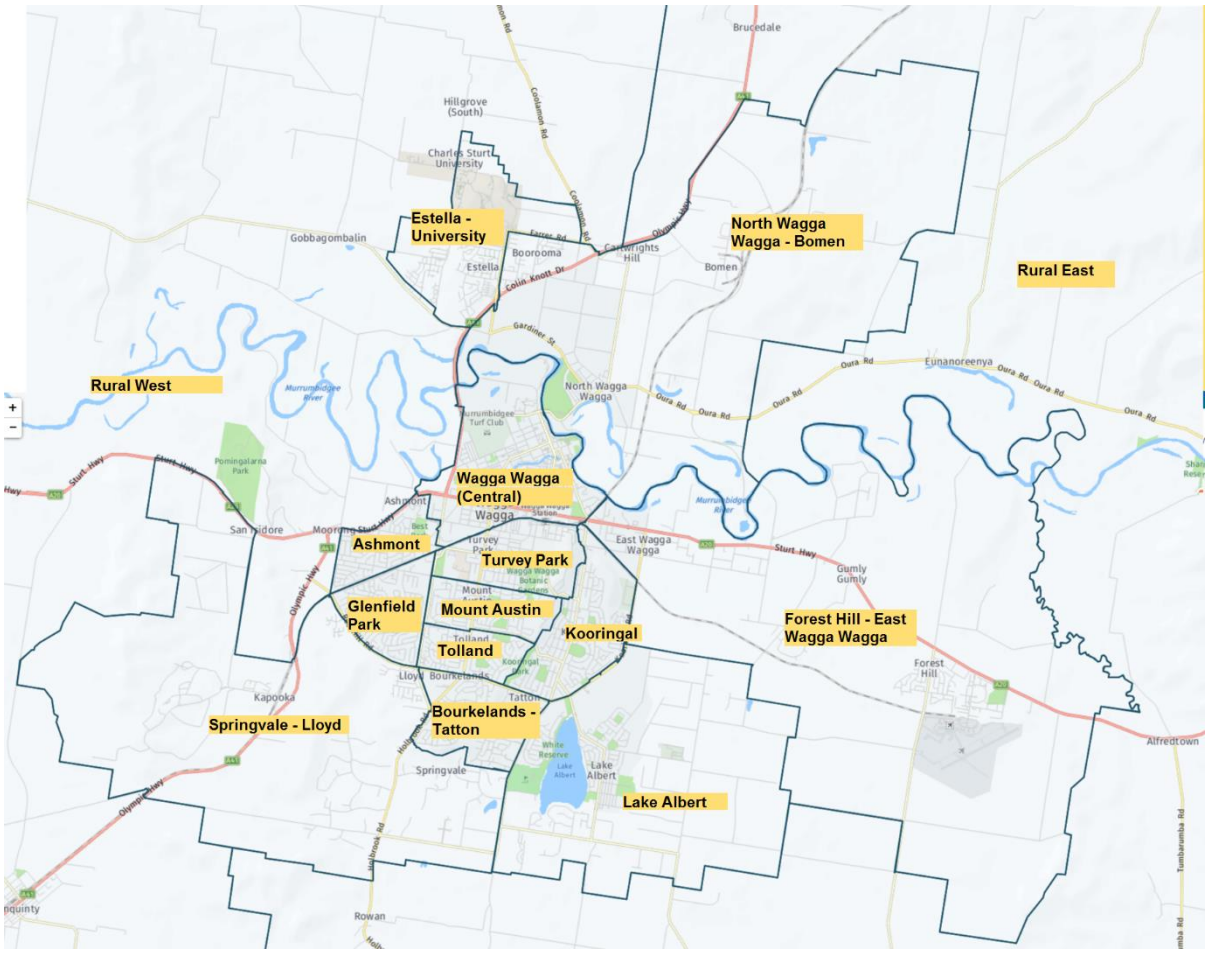


Figure 2.5: Wagga Wagga City Council - .id forecast areas

The population and dwelling forecasts to 2036 are provided in Table 2.3 and Table 2.4 respectively.

Table 2.3: .id forecast five yearly population growth for Wagga Wagga LGA

.id Forecast Area	2016-2021	2021-2026	2026-2031	2031-2036
Ashmont	-51	43	46	32
Bourkelands - Tatton	358	-50	-78	-39
Estella - University	1,423	1,327	1,094	1,195
Forest Hill - East Wagga Wagga	466	372	326	279
Glenfield Park	41	-16	-30	-30
Kooringal	101	154	72	167
Lake Albert	196	93	71	74
Mount Austin	155	33	57	54
North Wagga Wagga - Bomen	552	444	206	-63
Rural East	96	90	87	162
Rural West	264	188	180	193
Springvale - Lloyd	1,028	1,010	1,008	984
Tolland	70	79	48	49
Turvey Park	14	14	8	44
Wagga Wagga (Central)	724	504	536	444
Total Wagga Wagga LGA	5,437	4,286	3,630	3,545

Note: the population is projected to decrease in the areas of Bourkelands-Tatton and Glenfield Park

Table 2.4: id forecast five yearly dwelling growth for Wagga Wagga LGA

.id Forecast Area	2016-2021	2021-2026	2026-2031	2031-2036
Ashmont	15	15	16	20
Bourkelands - Tatton	124	3	0	0
Estella - University	442	428	442	480
Forest Hill - East Wagga Wagga	157	130	130	125
Glenfield Park	4	0	0	0
Kooringal	37	45	62	84
Lake Albert	66	56	34	21
Mount Austin	5	8	15	15
North Wagga Wagga - Bomen	210	170	98	9
Rural East	50	50	51	70
Rural West	76	74	75	74
Springvale - Lloyd	351	350	350	350
Tolland	3	1	2	2

.id Forecast Area	2016-2021	2021-2026	2026-2031	2031-2036
Turvey Park	48	25	15	15
Wagga Wagga (Central)	227	225	225	225
Total Wagga Wagga LGA	1,815	1,580	1,515	1,490

Outside Wagga Wagga LGA

Riverina Water does not expect the areas outside Wagga Wagga to grow significantly over the next 30 years. This expectation is reflected in the Department of Planning projections that show relatively little or no growth in the other LGAs compared to Wagga Wagga LGA. The following dwelling growth rates have been nominated for towns in the other three LGAs:

- one dwelling per year for Urana
- two dwellings per year for The Rock and Walla Walla
- four dwellings per year for Holbrook and Henty
- five dwellings per year for Lockhart.

Riverina Water Service Area growth forecast

Based on the nominated growth in the respective LGAs, the total estimated serviced population is given in Table 2.5.

Table 2.5: Serviced population estimate

	2017	2022	2027	2032	2036	2042	2047
Riverina Water Serviced Population	72,500	77,800	82,000	85,700	88,600	93,600	97,700

2.4 Non-residential users and growth

2.4.1 Non-residential retail customers

Riverina Water services more than 6,000 non-residential retail customers. Some of the largest include the Teys Abbatoir (average use of 650 ML/year), the Heinz-Watties Factory (average use of 140 ML/year) and Charles Sturt University (average use of 280 ML/year), all located in North Wagga.

Demands from non-residential users were projected to grow at different rates relative to residential growth in their respective water supply system and depending on the user category (e.g. commercial user demand is expected to increase at same rate as residential demand, however pool user demand is not expected to grow).

2.4.2 Bulk supply customers

Riverina Water also services two bulk supply customers – the RAAF Airbase (average use of 125 ML/year), and the Kapooka Army Base (average use of 310 ML/year). The RAAF Air based is supplied at Forest Hill from Wagga High Level water supply system. Kapooka Army Base is supplied from Southern Trunk Main system.

The bulk supply to the RAAF Airbase is expected to increase by about 12 ML/year over the next ten years as a result of a 10% increase in recruits over this period. The bulk supply to the Kapooka Airbase is expected to increase by about 80 ML/year over the next ten years, as a result of a 33% increase in recruits over this period. There is also expected to be a small number of new dwellings in the Kapooka Marriage Quarters.

2.4.3 Bomen Special Activation precinct (SAP)

Special Activation Precincts (SAPs) are unique to regional NSW and bring together planning and investment to focus on growing jobs and economic activity in an area. Precincts will support industries in line with the competitive advantages and economic strengths of each area.

In January 2019 the NSW Government announced the creation of a SAP in the north-east area of Wagga Wagga (called Bomen) to create a world-class business precinct, capitalise on the inland rail project currently under construction, and promote advanced manufacturing, agribusiness, and freight and logistics. DPIE Water together with the Wagga Wagga City Council are developing a master plan for the SAP. The master plan proposal will identify the scale, type and extent of the development in the SAP along with the infrastructure needed to support its development and mitigate its impact.

The Wagga Wagga precinct will cover an area of approximately 4,500 hectares, including 300 hectares already developed as part of the Bomen Business Park. The precinct will incorporate the Riverina Intermodal Freight and Logistics (RiFL) hub to create faster and easier access to national and international markets for regional producers. Building on already-planned private and government investments, the precinct will create up to 6,000 new jobs across a range of industries.

The anticipated Development stage growth and predicted peak daily demand are summarised in Table 2.6 and Table 2.7. These are taken from the 2020 Draft Wagga Wagga SAP Design Report (1).

Table 2.6: Peak Daily Demand per Pressure Zone & Development Stage (ML/day) and % of Total Water Demand per Pressure Zone and Stage

Stage	Pressure Zone			Total	% of Total Water Demand
	Bomen	Brucedale	East Bomen		
1	1.93	-	10.90	**12.83**	68%
2	2.39	-	0.09	**2.48**	13%
3	0.15	1.44	2.05	**3.65**	19%
Total	**4.47**	**1.44**	**13.05**	**18.96**	100%-
% of Total Water Demand	24%	8%	69%	100%	

Table 2.7: Anticipated Development Stage Growth

Stage	Growth Projections by 2030	Growth Projections by 2040	Growth Projections by 2060
1	35%	87%	95%
2	0%	0%	80%
3	0%	0%	0%

3. Urban water services

Riverina Water provides potable water to Wagga Wagga City, three major trunk systems (Northern, Western and Southern) and eight independent village systems. These are shown in Figure 3.1.

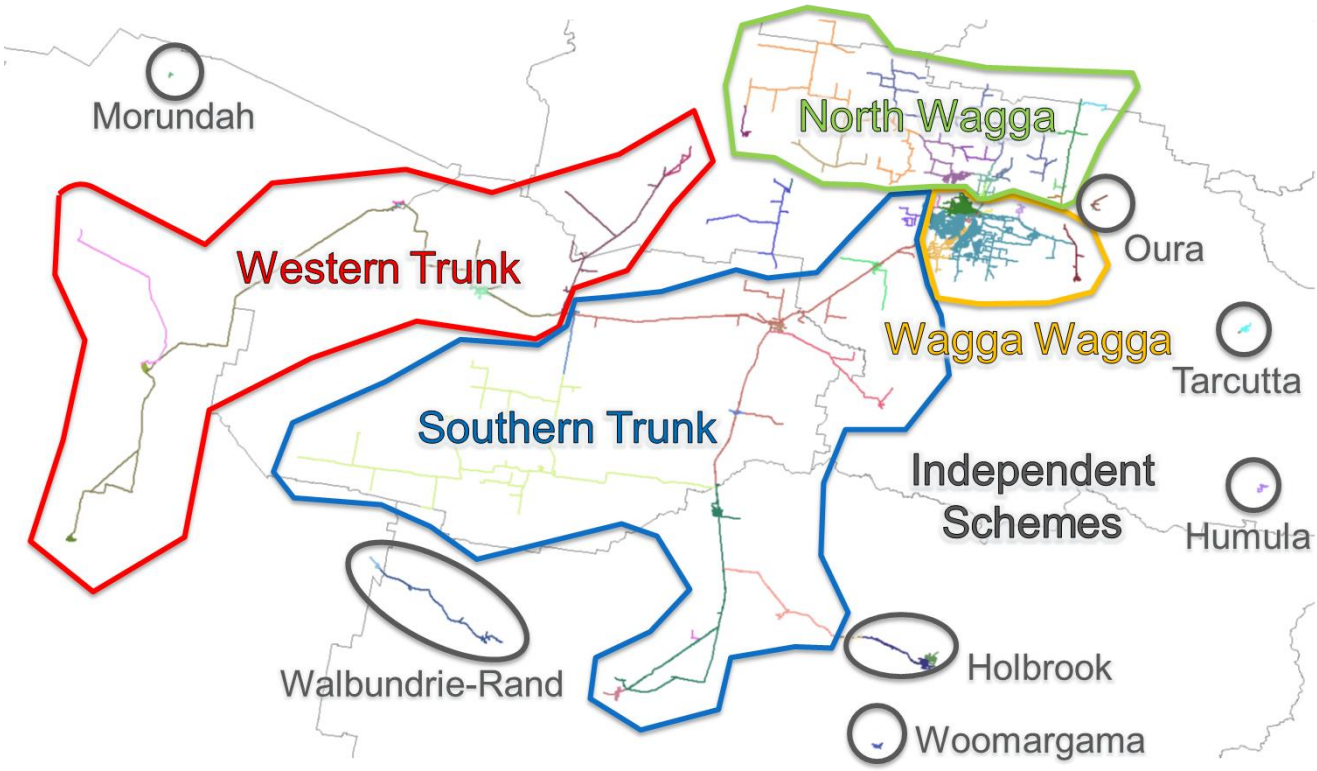


Figure 3.1: Riverina Water's water supply systems

The Wagga Wagga supply systems and major trunk mains systems are interconnected, either sharing source, treatment works and/or able to be transferred between systems (in various degrees). These include:

- Wagga Wagga systems
- North Wagga systems
- Southern Trunk systems
- Western Trunk systems

There are a number of sub-systems within each major supply system

3.1 Wagga Wagga Water Supply System

The Wagga Wagga Water Supply Scheme services the city of Wagga Wagga and surrounding areas of Bellevue/Glenoak, Gregadoo, Forest Hill, and Ladysmith. The Wagga Wagga City System is shown in Figure 3.2.

The Wagga Wagga water supply systems are described as:

- Wagga Low Level system
- Wagga High Level system
    - Wagga Bellevue/Glenoak (sub) system
    - Ladysmith (sub) system
    - Gregadoo (sub) system

The Wagga Low Level system water sources and treatment plants are:

- Murrumbidgee River => Wagga Filtration Plant
- East Wagga Bores => East Wagga Aeration Plant

The Wagga High Level system water sources and treatment plants are:

- Murrumbidgee River => Wagga Filtration Plant
- East Wagga Bores => East Wagga Aeration Plant
- West Wagga Bores => West Wagga Aeration Plant
- Transfer from Wagga Low Level system

Water sources into Wagga Bellevue/Glenoak (sub) system, Ladysmith (sub) system & Gregadoo (sub) system water Water source is transfer from Wagga High Level system.

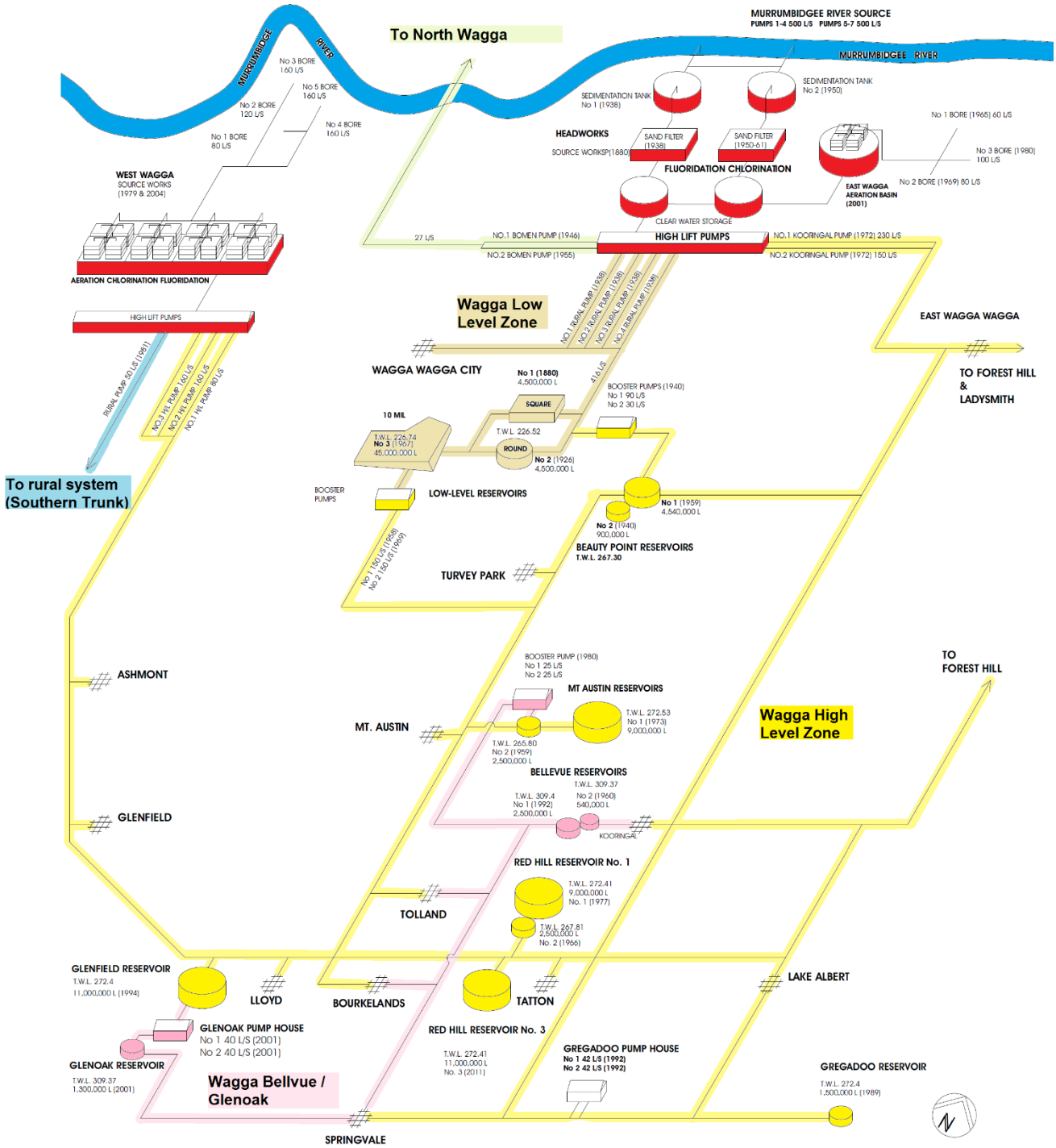


Figure 3.2: Wagga Wagga City Water Supply System

3.2 Southern Trunk Water Supply Scheme

The Southern Trunk Water Supply supplies rural areas in Wagga Wagga, Lockhart and parts of Greater Hume Shire LGAs, including San Isadore, Kapooka, Uranquinty, The Rock, Mangoplah, Milbrulong, Yerong Creek, Henty, Pleasant Hills, Morven and Walla Walla. The main supply to the Southern Trunk comes from the West Wagga WTP, with the Gardiners Crossing WTP, located at the southern end of the Southern Trunk, providing supplementary supply in Summer. The Southern Trunk system is shown in Figure 3.3.

The township of Culcairn is supplied by Greater Hume Shire Council (GHSC). Riverina Water has the ability to supply Culcairn during an operational contingency via temporary interconnection from its Southern Trunk Main.

The Southern Trunk Main system is described as:

- Southern Trunk Main system

  Water Source and Treatment Plant:

  - West Wagga Bores => West Wagga Aeration Plant (supply from Wagga to Walla Walla)
  - Walla Walla Bores => Gardiners Crossing Aeration Plant (supply only from Henty Balance Tank to Walla Walla)
- Uranquinty (sub) system
  - Transfer from Southern Trunk Main system
- The Rock (sub) system
  - Transfer from Southern Trunk Main system
- Mangoplah (sub) system
  - Transfer from Southern Trunk Main system
- Milbrulong (sub) system
  - Transfer from Southern Trunk Main system
- Yerong Creek (sub) system
  - Transfer from Southern Trunk Main system
- Pleasant Hill (sub) system
  - Transfer from Southern Trunk Main system
- Morven (sub) system
  - Transfer from Southern Trunk Main system
- Walla Walla (sub) system
  - Transfer from Southern Trunk Main system

Note: San Isadore, The Rock (South), and Henty distribution systems are included in Southern Trunk Main system ie. they do not have their own dedicated storage reservoirs and are supplied directly from the trunk main.

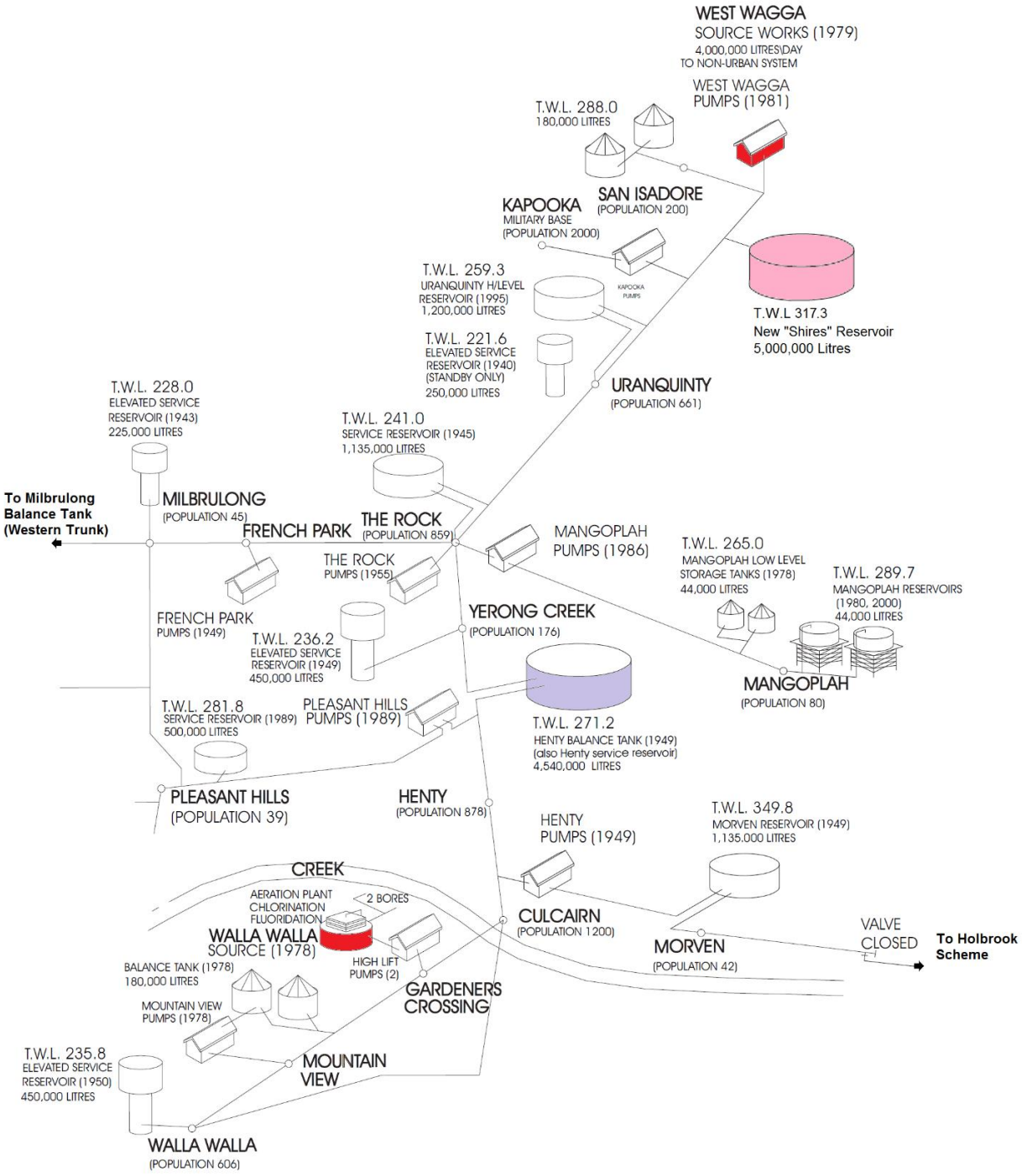


Figure 3.3: Southern Trunk Supply System

3.3 North Wagga Water Supply Scheme

The North Wagga Water Supply Scheme services North Wagga, Bomen, Estella, Charles Sturt University, Cartwrights Hill, Boorooma, The Gap, Euberta, Tooyal, Currawarna and connects to the Brucedale scheme in the North. The main supply to the North Wagga System is the North Wagga WTP, with a small amount of bulk supply water supplied to the Brucedale sub-system by Goldenfields Water County Council. There are a small number of Riverina Water customers supplied from Goldenfields Water's system .The scheme is shown in Figure 3.4.

The North Wagga system is described as:

- North Wagga System
- Bomen System
    - East Bomen (sub) system
- Brucedale System
- Estella System
    - The Gap (sub) system
    - Tooyal (ub) system
    - Cottee (sub) system
    - Currawarna (sub) system

The above systems are supplied primarily from North Wagga Aeration Plant (sourced from North Wagga Bores) via Bomen Reservoir, as well as from Wagga Filtration Plant/East Wagga Aeration Plant (sourced from Murrumbidgee River and East Wagga Bores)

- Goldenfields Bulk Supply System supplies (20) Riverina Water customers along Goldenfields' trunk main, as well as a number of customers from Riverina Water's spur mains. There is a limited ability for Goldenfields Waters' bulk connect to supply into Brucedale system.

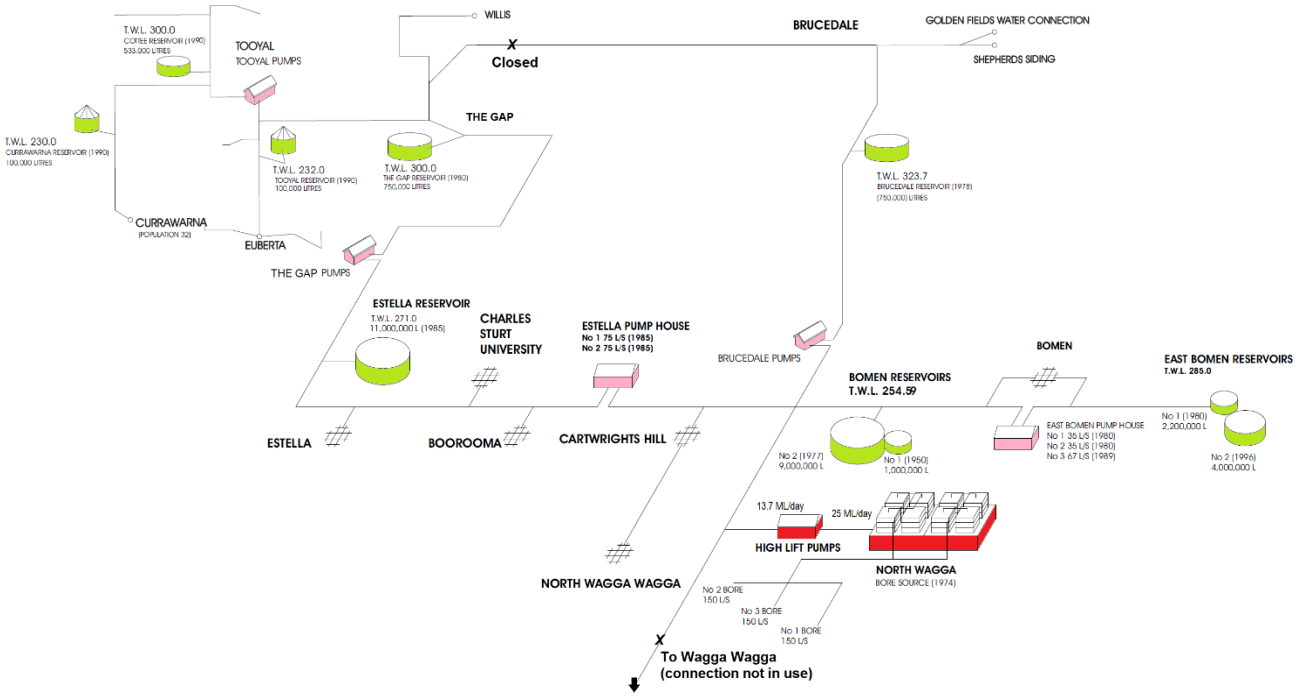


Figure 3.4: North Wagga Water Supply System

3.4 Western Trunk Water Supply Scheme

The Western Trunk Water Supply Scheme services Bulgary, Lockhart, Boree Creek, Urana, Coorabin and Oaklands. The main supply to the Western Trunk comes from the Bulgary Bores, with the Urana WTP, providing supplementary supply in Summer to the sub-systems at the far western end of the Western Trunk; Urana, Coorabin and Oaklands. There is also an ability to transfer from the Southern Trunk to the Western Trunk. The scheme is shown in Figure 3.5.

The Western Trunk Main System is described as:

- Western Trunk Main System
- Lockhart (sub) system
- Boree Creek (sub) system
- Urana (sub) system
- Oaklands (sub) system

The above systems are supplied primarily from Bulgary Aeration Plant (sourced from Bulgary Bores) via Milbrulong Balance Tank, as well as transfer from the Southern Trunk Main system.

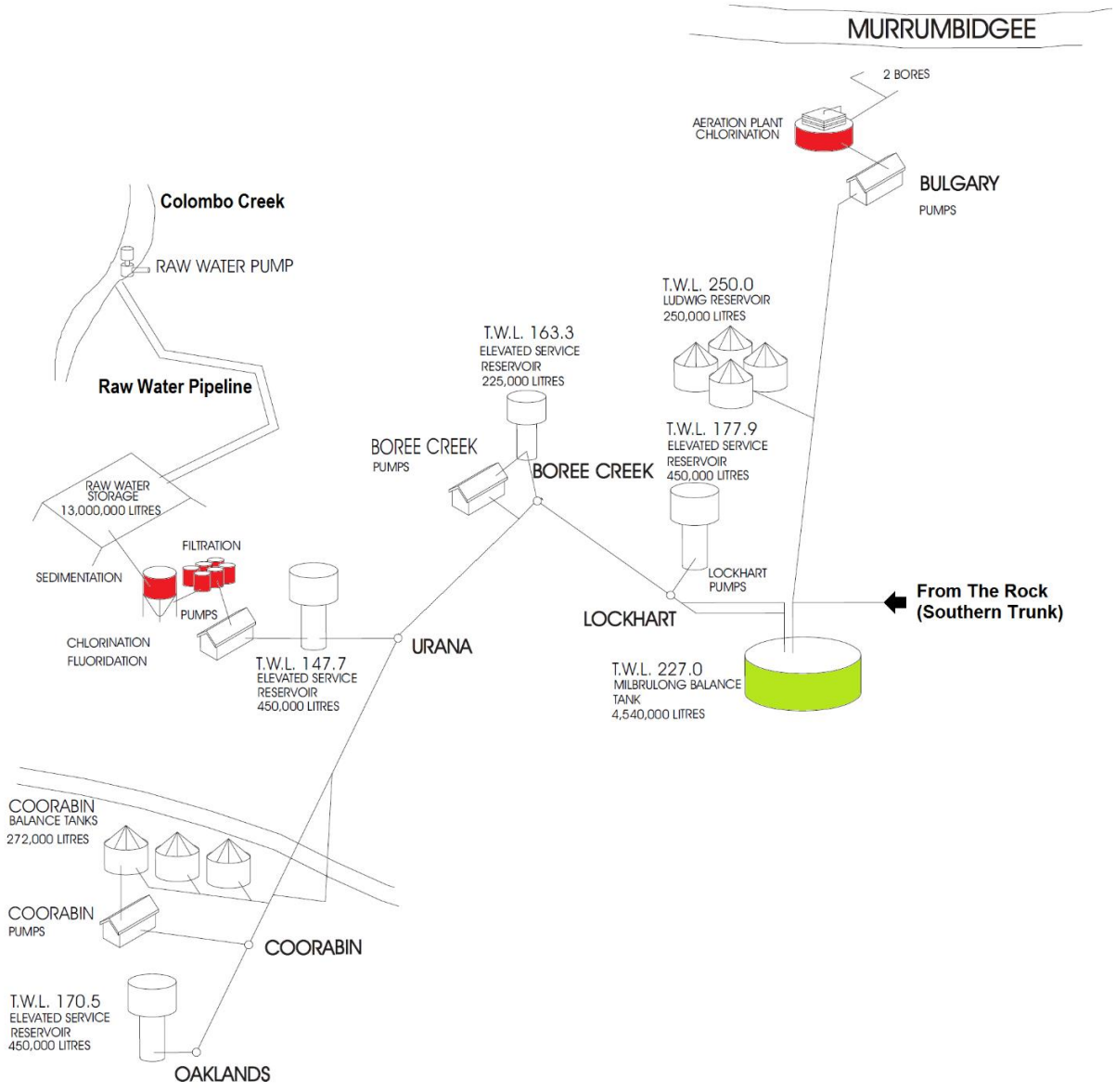


Figure 3.5: Western Trunk Water Supply System

3.5 Collingullie Water Supply Scheme

The Collingullie Water Supply Scheme is an independent village scheme that services Collingullie as well as an extensive rural pipeline reticulation system. It sources water from two bores in the local Murrumbidgee alluvium supply the town with good quality groundwater. The scheme is shown in Figure 3.6.

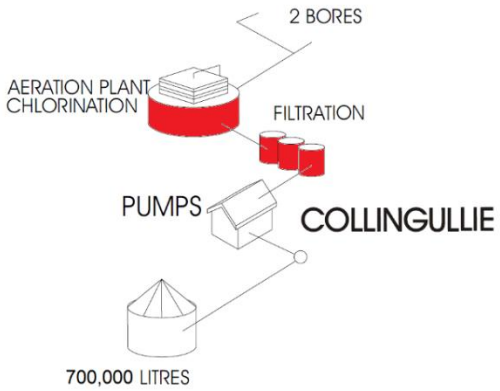


Figure 3.6: Collingullie Water Supply System

3.6 Holbrook Water Supply Scheme

The Holbrook Water Supply Scheme services Ralvona, Millswood and Holbrook and is an independent village system. Raw water is extracted from three Ralvona bores in the Billabong Valley. Two pressure zones serve Holbrook township, namely the low level and high level systems. The scheme is shown in Figure 3.7.

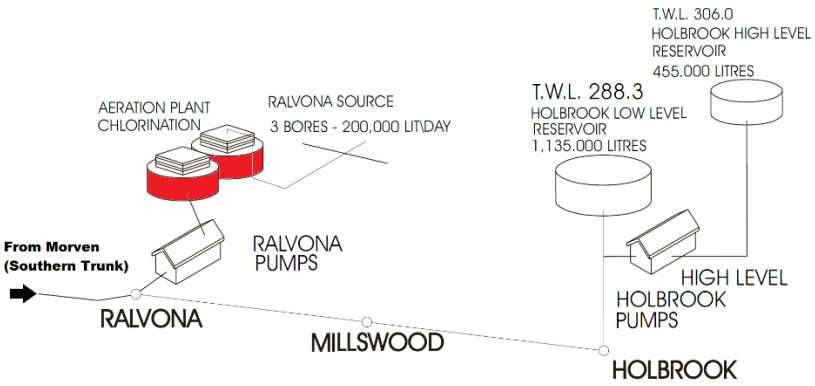


Figure 3.7: Holbrook Water Supply System

3.7 Humula Water Supply Scheme

The Humula Water Supply Scheme services Humula only as an independent village system. Raw water is sourced from two wells and a bore. The scheme is shown in Figure 3.8.

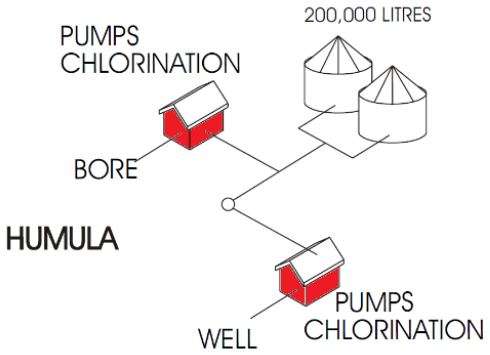


Figure 3.8: Humula Water Supply System

3.8 Morundah Water Supply Scheme

The Morundah Water Supply Scheme services the town of Morundah only. It is an independent village system. The raw water source is surface water from Colombo Creek. The scheme is shown in Figure 3.9.

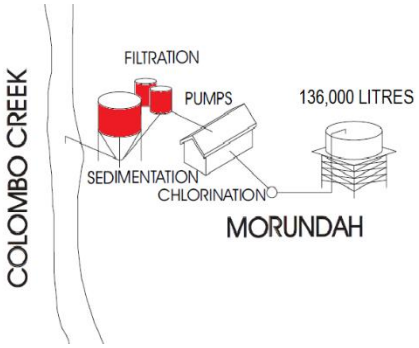


Figure 3.9: Morundah Water Supply System

3.9 Oura Water Supply Scheme

The Oura Water Supply Scheme services Oura only as an independent village system. The Oura system can draw raw water from two bores along the Murrumbidgee river. The scheme is shown in Figure 3.10.

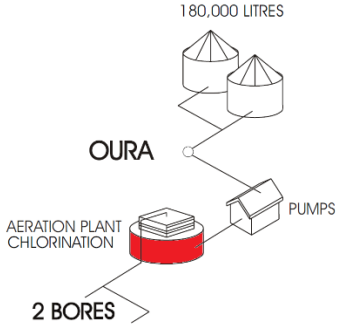


Figure 3.10: Oura Water Supply System

3.10 Tarcutta Water Supply Scheme

The Tarcutta Water Supply Scheme services the town of Tarcutta only as an independent village system. Raw water can be sourced from 2 bores. The scheme is shown in Figure 3.11.

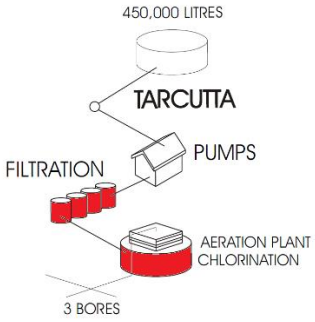


Figure 3.11: Tarcutta Water Supply System

3.11 Walbundrie/Rand Water Supply Scheme

The Walbundrie/Rand Water Supply Scheme services the Walbundrie and Rand populations as an independent village system. Raw water is sourced from two bores off Billabong Creek. The scheme is shown in Figure 3.12.

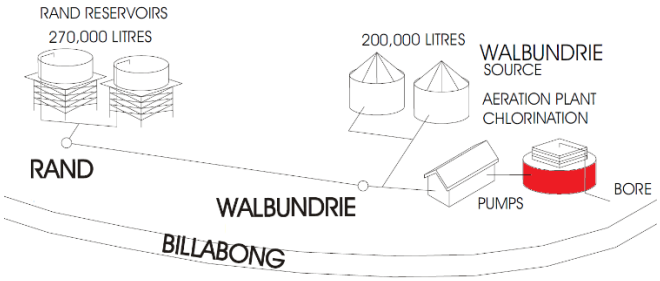


Figure 3.12: Walbundrie/Rand Water Supply System

3.12 Woomargama Water Supply Scheme

The Woomargama Water Supply Scheme services the town of Woomargama only. It is an independent village system with a population of 120. Raw water is sourced from a single bore along Woomargama Creek and two spearpoints are also available for a backup supply. The scheme is shown in Figure 3.13.

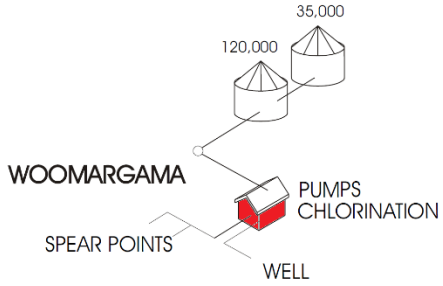


Figure 3.13: Woomargama Water Supply System

4. Business Objectives and Targets

Riverina Water's Delivery Program (2019/2020 – 2021/2020) and Operational Plan (2019/2020) (2) sets out the following goals with respect to services to be provided:

- To provide water supply to customers in accordance with acceptable levels of service.
- To build on a reputation as a leading utility service provider.
- To offer a comprehensive service in the abstraction, treatment, storage, movement and delivery of water and associated services.
- To achieve a substantial reduction in outdoor water use through demand management measures with a focus on outdoor use and the irrigation of turf.
- To include demand reduction as an alternative to augmentation where systems are stressed.

In line with the above goals, Riverina Water has determined the following service objectives and targets. These are currently consistent with previous levels of service objectives.

Further investigation to categorise these levels of service targets into (similar) water supply systems is ongoing. This will assist in describing more accurately levels of service expectations to customers rather than having 'generic' parameters based on the lowest common denominator (eg. One size fits all).

Types of supply systems being consider include:

- Wagga urban system (including North Wagga/Bomen systems)
- Township/village systems (those with standpipe reservoirs or higher elevated reservoirs)
- Trunk main systems

4.1 Water security objective

Water restrictions may be applied to encourage wise water use, to reduce excessive demand, or to conserve limited resource in time of drought. Restrictions may also be applied at the request of the Minister of Department of Planning Industry and Environment (DPIE) Water or to comply with an adopted Water Sharing Plan.

The strategy will include Stage 1 water restrictions (rather than a permanent conservation measure) to ban on sprinklers between 10am and 5pm), pricing (stepped tariff), targets for reduced demand, changes to domestic irrigation culture, regulations, information and rebates.

4.2 Water quality objective

Where it can be achieved, water quality should meet the 2011 Australian Drinking Water Guidelines, published jointly by the National Health and Medical Research Council (NHMRC) and the Natural Resource Management Ministerial Council. Some aesthetic or taste parameters may not be achieved at times.

In conjunction with NSW Health, Riverina Water developed its Drinking Water Management System in February 2019, superseding its national Hazard Analysis Critical Control Point (HACCP) accreditation (that it maintained since 2006).

A degree of future proofing to accommodate possible introduction of Health Based Targets (HBTs) will be considered during water asset replacements and improvements.

4.3 Supply reliability objective

4.3.1 Pressure and flow

Provide pressures between 12 and 120 metres head at the water meter when service has no flow. Provide water to each connection at an available flow rate not less than:

Diameter of service pipe (mm)	20	25	32	40	50
Minimum flow rate (litres per minute)	20	35	60	90	160

The minimum flow rate available for rural properties may be less where elevations or operational factors limit the supply. In some situations, the flow may be restricted to 11 kl/day.

4.3.2 Interruptions to supply

Planned

Domestic customers will receive 24 hours written notice and industrial customers will receive 7 days' written notice.

Unplanned

Not to occur more than 2 times per year if lasting up to 12 hours. Not to occur more than 5 times per year if lasting up to 5 hours.

4.3.3 Response time

Council aims to meet the following response times depending on priority.

Priority 1	failure to maintain continuity or quality of supply to a large number of customers or to a critical use at a critical time.	1 hour during working hours or 2 hours after working hours
Priority 2	failure to maintain continuity or quality of supply to a small number of customers or to a critical user at a non-critical time	3 hours during working hours or 4 hours after working hours
Priority 3	failure to maintain continuity or quality of supply to a single customer	One working day
Priority 4	minor problem or complaint, which can be dealt with at a time convenient to the customer and the water authority	Within two weeks

4.3.4 Water for fire-fighting

Provide fire flows in reticulation systems in accordance with NSW Water Directorate Fire Flow guidelines. A positive residual head should be maintained while supplying fire flow plus 75% of the design peak instantaneous demand.

Internal systems designed for fire-fighting purposes must recognise that direct pumping from Council water mains is not permitted.

4.4 Environmental sustainability objective

Riverina Water is currently going through the design and approval process for a solar pilot plant that will reduce our electricity costs and carbon footprint. As well as integrating renewable energy into Riverina Water's long-term strategy, we will continue to work towards our mission statement "To provide our community with safe, reliable water at the lowest sustainable cost." With our mission statement in mind, a "Renewable Energy Action Plan" (REAP) is being proposed in conjunction with a "Net Zero Roadmap (NZR)".

Riverina Water are members of the Sustainability Advantage (SA) program run by the NSW Department of Planning, Industry and Environment (DPIE), and approached SA for assistance.

The proposed NZR will include:

- Define how Riverina Water's emissions contribute to its climate change exposure.
- Develop a baseline model of Riverina Water's emissions including electricity consumption, fleet, etc.
- Provide a desktop study to identify opportunities, best-practice examples of carbon abatement and a list of commitments from other water organisations and councils.
- Compile an initial list of emission reduction opportunities.
- Provide an in depth look at Riverina Water's electricity usage and model the impact of the planned solar pilot plant project and other solar future potential solar projects.
- Model the impact if Riverina Water moved to renewable power purchase agreements (PPAs)
- Provide a Marginal Abatement Cost Curve (MACC) modelling to rank abatement opportunities.
- The model and decarbonisation roadmap would evaluate different trajectories towards Net Zero over 10 years. Various abatement options will be compared against each other and ranked using MACC as well as payback period, NPV and Internal Rate of Return.

5. Business performance review, risks and management

IRIS Research (3) was commissioned by Riverina Water in 2018 to conduct a comprehensive telephone-based survey among the residents of the area. The survey sought a range of resident attitudes and opinions as input into the continual improvement of Riverina Water's delivery of services. A total of 504 interviews were conducted with residents from the Riverina Water Council area.

The survey has produced some very strong results for Council. The vast majority of residents who have had dealings with Riverina Water have expressed a high level of satisfaction with their experience. Residents across the board have expressed their satisfaction with the quality of the water service that Riverina Water delivers. Some opportunities for improvement have been identified by respondents in the way that Riverina Water communicates with them.

A review of the business performance was also undertaken as part of the IWCM development process, to identify risks and issues to be addressed in the IWCM Strategy.

5.1 Regulatory Issues and Management

The following risks were identified after a review of Riverina Water's compliance with legislative and regulatory requirements.

Water Management Act

Regulatory (Reg) Risk 1: There is a potential for the Long-Term Average Annual Extraction Limit (LTAAEL) set for Riverina Water and Goldenfields Water County Council (GWCC) in the Water Sharing Plan for the Wagga Wagga Alluvial Groundwater Source to be exceeded. If this occurs, Riverina Water's entitlement may be reduced.

Management

Riverina Water to manage its annual groundwater extraction up to its LTAAEL (calculated to be 12.37GL).

Goldenfields Water to be consulted by Riverina Water if Riverina Water intends to or has exceeded its LTAAEL in any of the five proceeding years, to collectively manage the water utility share component of 20,200ML/year.

A Memorandum of Understanding (MoU) to be prepared between Riverina Water and Goldenfields Water to formalise the arrangements to jointly manage LTAAEL.

Reg Risk 2: The NSW Government is proposing to incorporate the Wagga Wagga and Mid Murrumbidgee Zone 3 alluvial groundwater sources into a replacement WSP, which will be called the 'Water Sharing Plan for the Murrumbidgee Alluvial Groundwater Sources 2019'. Riverina Water's allocation (or LTAAEL) from the Murrumbidgee Alluvial Groundwater Source may be reduced in the future replacement WSP.

Management

Continued watching brief on changes to legislation, and consideration to acquire further water High Security and/or Town Water entitlements to maintain a buffer for variable climatic conditions (either surface water or groundwater entitlements).

Fluoridation of Public Water Supplies Act

Reg Risk 3: Except for Holbrook, the small independent water supply schemes are not fluoridated. The water from Ralvona bores which supplies Holbrook is naturally high in fluoride.

Management

Riverina Water's 'integrated' water supply systems are fluoridated as per Council's Fluoridation Policy, which was supported by Council Resolution #69/316 (25th June 1969). The Policy was updated in 2020 and approved by Council following public consultation (refer to Appendix C).

There is no intention to fluoridate independent supply systems other than noting Holbrook's water supply is naturally fluoridated from Ralvona bore sources. There is no regulatory requirement to fluoridate the water supply to these independent schemes.

Reg Risk 4: The North Wagga, West Wagga and Gardiners Crossing WTP fluoridation systems do not comply with the Code of Practice.

Management

Works have commenced to determine economic assessment to either replace or upgrade existing fluoridation facilities. Scope of works, budgets and procurement strategies are currently being examined.

Reg Risk 5: The NSW Fluoridation Code of Practice (COP) is currently under review by NSW Health. It is unknown whether the changes to the COP following the review will impact on Riverina Water's operations.

Management

Riverina Water is replacing a number of its fluoridation plants and is working with NSW Health regarding possible changes to the COP. Fluoridation plants being replaced are Bulgary WTP, Gardiners Crossing WTP, West Wagga WTP and North Wagga WTP.

Riverina Water will continue to work with NSW Health to minimize risk of replacing fluoridation plants that may be inconsistent with future changes to the COP.

5.2 Water Security Issues and Risk Management

Water licenses

Details of the licenses held by Riverina Water for the main water sources which supply Wagga Wagga, North Wagga and the Southern and Western Trunks are given in Table 5.1.

Table 5.1: Water Access License Details – main water sources

License Number	Water Source	Water Sharing Plan (WSP)	Systems	Entitlement (ML/ annum)
WAL33470	Wagga Wagga Alluvial Groundwater Source, East Wagga Bores, West Wagga Bores and North Wagga Bores	Murrumbidgee Unregulated and Alluvial Water Sources	Wagga, North Wagga and Southern Trunk systems	14,000
WAL33161	Mid Murrumbidgee Zone 3 Alluvial Groundwater Source, Bulgary Bores	Murrumbidgee Unregulated and Alluvial Water Sources	Western Trunk	1,000
WAL37747	Murrumbidgee Regulated River Water Source	Murrumbidgee Regulated River Water Source	Wagga systems North Wagga Systems	7,000

License Number	Water Source	Water Sharing Plan (WSP)	Systems	Entitlement (ML/ annum)
WAL37748	Murrumbidgee Regulated River Water Source, Colombo Creek	Murrumbidgee Regulated River Water Source	Urana and Western Trunk Systems	805

Riverina Water also holds some licenses other than town water supply entitlements, such as High Security licensed entitlement of 1 GL for extraction from the Murrumbidgee River, and 200 ML for extraction from Murrumbidgee Alluvial Water Source. These licenses are held to assist development take up in Wagga, and to mitigate some risks associated with reduction of town water entitlements.

The long-term average annual extraction limit (LTAAEL) for the Wagga Wagga Alluvial Groundwater Source is 16,998 ML/year for all water utility access licenses. Riverina Water's calculated LTAAEL for the groundwater source was calculated to be 12,371 ML/year.

Water Security Issues

The review identified the following water security risks.

***Water Security (WS) Risk 1**: North Wagga is growing and is supplied by the Wagga Wagga alluvial groundwater source. Riverina Water will have to supplement the supply with water sourced from the Murrumbidgee regulated water source, otherwise there is a risk that Riverina Water's entitlement to extract from the alluvial groundwater source will be exceeded.*

Management

The future entitlements required to service North Wagga system will depend on how interconnectivity between the major supply systems are managed, including source works, treatment and pumping (transfers) between:

- Wagga Wagga systems
- North Wagga systems
- Southern Trunk systems
- Western Trunk systems

Riverina Water's 2050 water source and pumping "game plan", described in Section 5.4, is to supply North Wagga with water treated at and pumped from the Wagga WTP, which sources water from the Murrumbidgee River.

***WS Risk 2**: The forecast surface water extraction is expected to exceed Riverina Water's total entitlement limit from the Murrumbidgee regulated river water source in 2031.*

Riverina Water's source management strategy includes maximising extraction from the groundwater entitlement, as the water quality is it is cheaper to treat to the required quality.

In order that Riverina Water not exceed the licensed extraction for this groundwater source, Riverina Water will increasingly rely on the Murrumbidgee River instead of groundwater. This is a continuance of the 2012 IWCM whereby a new 55ML Wagga filtration plant has since been commissioned in readiness with scalability to meet 2050 demands.

Based on this strategy, the forecast increase in the surface water extraction requirement and a comparison of this extraction against the surface water entitlement, is shown in Figure 5.1. The current (surface and groundwater) entitlements are expected to be exceeded in approximately 2031.

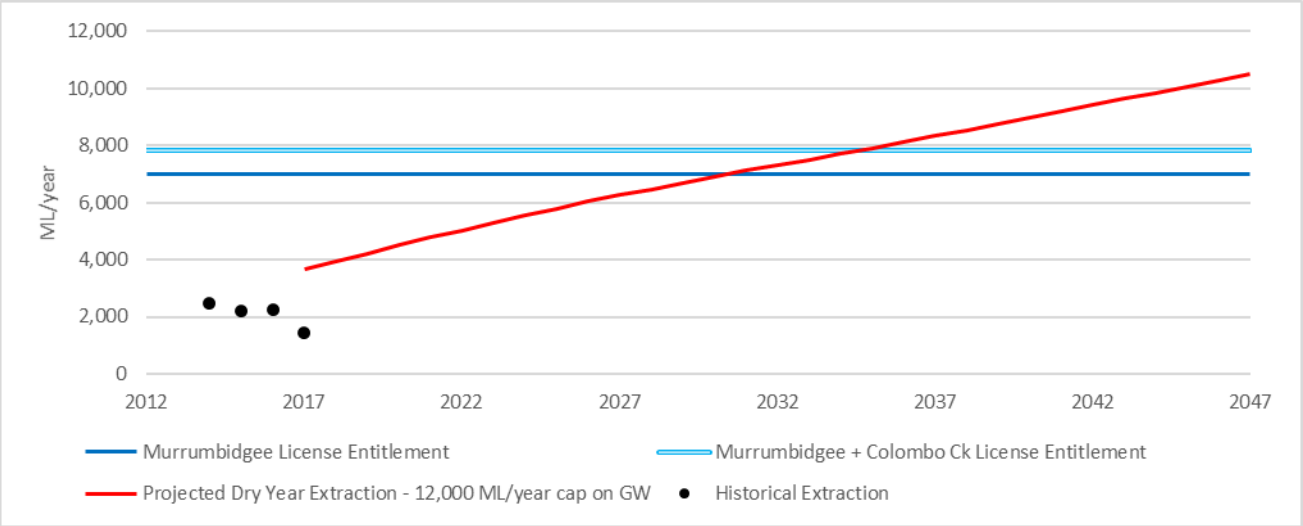


Figure 5.1: Projected dry year extraction from Murrumbidgee River at the Waterworks

Management

Riverina Water will initiate the process to acquire additional town water supply surface water entitlements and seek to obtain additional high security licenses to supply non-residential demands.

WS Risk 3: The Wagga Wagga (Bomen) SAP will greatly increase water demand; which Riverina Water will not be able to supply within its current license entitlements

Management

Riverina Water will require major "wet industries" to provide their own water entitlement, which Riverina Water will use to extract water on their behalf, then treat and supply it.

Riverina Water's 2050 water source and pumping "game plan", described in Section 5.4, is to supply North Wagga with water treated at and pumped from the Wagga WTP, which sources water from the Murrumbidgee River.

Drought Reliability

WS Risk 3: NSW Government interfered into Riverina Water's operation during the 2000s Millennium Drought, despite availability of entitlement and water in the Murrumbidgee catchment (i.e. introduced statewide 50% reduction in town water allocations). The Minister can always exercise his/her powers over the state's water sharing plans (including Riverina Water's drought management plan).

If this 50% reduction in town water allocation scenario occurred again, for an entire year (instead of 3 months), Riverina Water would not be able to meet the required dry extraction after 2025.

Management

Riverina Water will consider, in the development of the Drought and Emergency Response Contingency Plan (DERCP), the possibility of reduced allocation for an extended period during a drought.

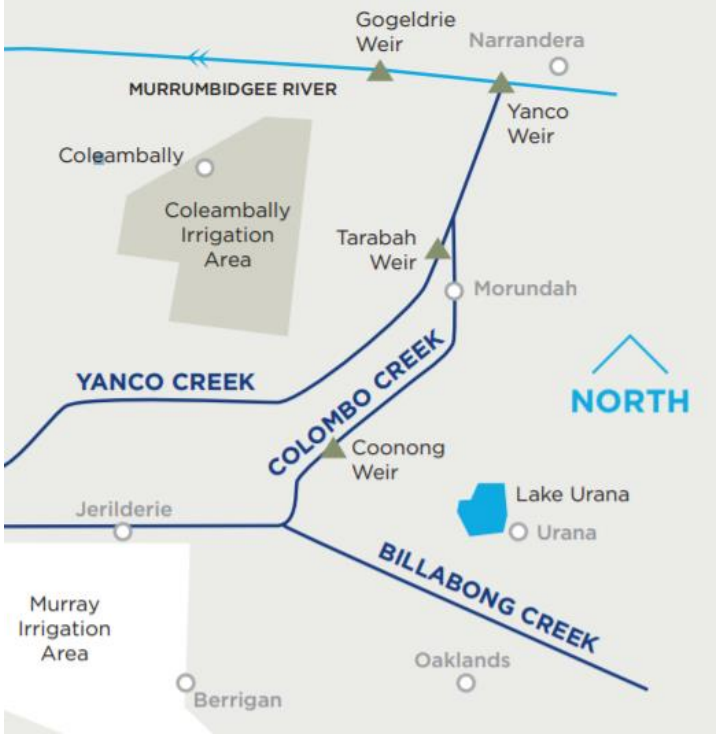
Riverina Water (and other local government water utilities) will advocate their IWCM strategies to manage their source water entitlements to the Minister.

Knowledge gaps

Additionally, the following knowledge gaps, relating to the water security assessment, were also identified:

WS Knowledge Gap 1: The project scope and impacts associated with the Yanco Weir upgrade on the Murrumbidgee River is still being investigated. Impact of the works may affect the drought reliability and raw water quality of the Colombo Creek/Yanco Creek system. NSW DPIE Water are still developing their business case with respect to sustainable diversion limits.

A diagram showing the Yanco Weir on the Murrumbidgee River is shown in Figure 5.2.



(4)

Figure 5.2: Yanco Weir and Colombo Creek

Management

Riverina Water is maintaining a 'watching brief' on the Yanco weir upgrade project as a registered stakeholder, and as a member of Yanco Creek and Tributaries Advisory Council Inc. (YACTAC).

NSW DPIE have indicated that the new Yanco weir may improve certainty of water entitlements in the system with better flow regulation.

WS Knowledge Gap 2: The yield assessment of the Wagga Wagga alluvial source was undertaken in 2011. The impact of the extraction over the last nine years, on the sustainable yield and drought resilience of the Wagga Wagga alluvial groundwater source, is unknown. It's assumed that there has been no significant changes since the groundwater systems was modelled in January 2011. Riverina Water and Goldenfields Water are still the major extractors from this system.

In January 2011 Riverina Water engaged Dr. Noel Merrickj to perform an optimal groundwater yield analysis for the mid-Murrumbidgee Zone 2 Aquifer. This was in addition to the development of a groundwater model undertaken by NSW Department of Water & Energy in March 2008.

The report stated "*Model simulation indicates that the long-term river leakage has been about 9 GL/a on average over the past 30 years, with a leakage rate of 17 GL/a in 1 out of 10 years, and the borefields have yielded an average of about 18 GL/a. The optimisation model indicates that the river-aquifer system could deliver about 19 GL/a on average with the existing bore network, without any*

breach of water level constraints.". The water level constraints related to no loss of capillary mechanism between Murrumbidgee River and Cowra formation

The resulting report indicates that the river-aquifer system "could deliver about 19 GL/year on average with the existing bore network, without any breach of water level constraints" that is no loss of capillary mechanism between Murrumbidgee River and Cowra formation.

The report also indicates that:

- allowing relaxing of the river-aquifer disconnection to 1m, the optimal production increases to 25 GL/year
- an additional benefit of approx. 15% in total production (to 22GL/year) could be realised with additional bores.

Management

Investigate the impact of the extraction over the last nine years on the sustainable yield and drought resilience of the Wagga Wagga alluvial groundwater source, and to assess whether conditions have significantly changed since a detailed hydrological analysis report was prepared in 2011 (refer "Optimal Groundwater Yield Analysis for the Mid-Murrumbidgee Zone 2 Aquifier", Prof: Noel Merrick, 2011).

Riverina Water have downrated the flow rate from these bores from 150 to 100 L/s. This rate was sustainable (no significant change in the boundary condition) during the Millennium Drought and the recent 2018/19 Drought. The modelling by Noel Merrick was also based off this extraction rate. This provides evidence that the downrated yield of 100 L/s is sustainable during a drought. There is no intention to increase this extraction rate, as all future increase in demand will be supplied from surface water.

WS Knowledge Gap 3*:* The sustainable yield and drought resilience of the groundwater source outside of Wagga Wagga are not known. No studies have been done for these sources.

Management

Riverina Water to undertake secure yield assessments of the groundwater sources outside of Wagga Wagga.

WS Knowledge Gap 4: The maximum extraction from Bulgary bores is possibly limited by groundwater sustainable yield effects, which will impact the maximum daily extraction rate

Management:

Augment the supply from the Urana Filtration Plant to both Urana and Oaklands on peak demand periods. This will cap the demand required from Bulgary Bores.

This measure has resulted from Riverina Water's 2050 water source and pumping "game plan", described in Section 5.4, which was developed using the integrated systems model.

5.3 Water Quality Issues and Risk Management

Riverina Water's customer satisfaction survey (3) had a 'satisfied' rating of 80%, 73% and 67% for water clarity, smell and taste respectively, and a dissatisfied rating of 6%, 9% and 11% respectively. Urban residents gave a 'High' level mean satisfaction rating to the three water quality attributes whereas rural residents gave a 'Medium' level satisfaction rating to water taste.

The following IWCM water quality risks were identified during the study.

Major water supply systems

Water Quality (WQ) Risk 1: MIB (2-Methylisoborneol) and Geosmin was detected in the Murrumbidgee River which *caused an 'earthy' taste* in the treated water supplied form the Wagga Filtration Plant. The current treatment plant cannot remove this taste and odour causing compound. This is an aesthetic issue, not a health issue.

Management

Maintain awareness of any reoccurrence and investigate likely catchment source i.e. Tumut River, Tarcutta Creek, Kyeamba Creek, Murrumbidgee River upstream from Gundagai.

Consider UV/Ozone treatment at Wagga Filtration Plant if the issue occurs more frequently. Implement operational procedures that reduce raw water sourced from Murrumbidgee River, noting the relevance of this option reduces as Wagga' growth relies on surface water.

WQ Risk 2: Per- and poly-fluoroalkyl substances (PFAS) have been identified in the Lachlan Aquifer, upstream of East Wagga Bore field. It's been originally estimated that the travel time to East Wagga Bores is conservatively 55 years. Latest positive PFAS testing results (Feb20) at a sentinal bore (supposedly outside the affected zone) now indicates impacts of PFAS may be sooner. There is reluctance from defence and NSW DPIE Water to pursue further investigation to ascertain a revised prediction of PFAS impacting to East Wagga borefield. PFAS may be *harmful to human health*.

Management

Riverina Water is conducting annual PFAS testing in addition to RAAF's PFAS operational plan's testing annual regime (i.e. 6 months offset). This is in addition to testing for PFAS in the surface water.

Riverina Water is continuing to monitor the situation, and waiting for further advice from the lead agencies, DPIE Water and NSW EPA, regarding revision of the groundwater hydraulic model and, strategies in managing PFAS in the groundwater .

Responses to PFAS also include:

- Continue to research latest PFAS removal technologies that are still being refined
- Undertake a 30-year impact assessment with less/no input from East Wagga Bores, that may include the following
    - Additional surface water license need to be sought earlier, together with augmentation of surface water treatment processes at Wagga Filtration plant (or alternatively, a new treatment facility upstream from current operations
    - Increase production at West Wagga and North Wagga Aeration Plants, but noting limitations to what systems may be supplied from these facilities

WQ Risk 3: Dirty water originating in the North Wagga, East Wagga and West Wagga bores' rising main can *impact on the water clarity*. Pigging/scouring of the lines is unable to be undertaken without affecting production due to lack of scour points.

Management

Riverina Water has successfully trialled water jetting of raw water rising mains at West Wagga, after installing access points into the pipeline. Methodology has proven a success, but subject to whether the pipeline can be totally dewatered and the frequency/spacing of access points.

Riverina Water has completed the water jetting of West Wagga raw water mains and will continue the design and installation of access points into North Wagga and East Wagga raw water mains in preparation for water jetting.

Independent schemes

WQ Risk 4: NSW Health have identified that the Woomargama bores and Humula wells may be directly connected to surface water, and Humula wells are susceptible to overland flood inundation. The proposed Health Based Targets will assess these sources as surface water sources with a *high risk of microbial contamination*

Management

Woomargama

Woomargama bore and spear points are considered most at risk with no alternate supply and located in a catchment where stock graze immediately adjacent to the sources.

Risks to water quality to be managed by the upgrade of Woomargama Treatment Plant, together with online turbidity/chlorine meters, regular manual checks and replacement of spear points with a bore

Humula

Formal operational changes at Humula to utilize the alternative water source (i.e. ground water bore located in the Humula recreational grounds) when the wells are affected by flood water inundation. Remote monitoring of well raw water turbidity and treated water chlorine is being investigated.

Investigation is also currently underway to replace the wells with closed bores, or to protect the wells with a levee system.

WQ Risk 5: One of the bores that supply water to the Oura water supply has high levels of iron and manganese *that could impact the water clarity*.

Management

Relying solely on the duty bore (with better raw water quality) creates a supply reliability risk. The management of this risk is found under Supply Reliability Risk 18 and 19.

Note: he duty bore has been lined with stainless steel and the replacement pump and motors are readily available and are able to be installed with minimal disruption.

Investigate further:

- another bore to find suitable quality water
- water treatment plant upgrade/replacement to treat and remove iron
- alternate supply from adjacent water supply systems e.g. Brucedale system, Goldenfields Water bulk supply, High Level System (Forest Hill)
- accept current water quality risk and reduce LOS

WQ Risk 6: Yanco Creek is currently being investigated as part of the 'Sustainable Diversion Limit Project in the Murrumbidgee River' water recovery program, and there is a risk the outcome could lead to reduced connectivity between the Murrumbidgee River and Yanco Creek. This could be an issue *affecting water quality and quantity to the town of Morundah*.

Management

Maintain watching brief and relationship with Yanco Creek and Tributaries Advisory Council Inc (YACTAC) and initiate advocacy regarding WaterNSW's operations that may affect water quality. Options to manage the risk could be:

- additional water treatment processes as part of Morundah WTP replacement works
- pipeline from Urana Raw Water pump station may provide an alternative water source

Refer also to Knowledge Gap 12 under Drought Reliability above.

WQ Risk 7: There is a risk of the Morundah *filtered water clarity being impacted* due to the filter performance.

Management

Filtered water turbidities and chlorination levels at Morundah WTP Clear Water Storage were within the Critical Control Point (CCP). The reticulation water turbidities were due to sediment build up in the distribution system. Riverina Water will:

- Schedule the Morundah WTP's replacement in its capital works programme
- Maintained chlorination dosages for effective disinfection above what's required.
- Digitize and upgrade control systems at the Morundah WTP to ensure the plant will shut down and alarm the operator if the CCPs are not met.
- Arrange mains flushing and scouring to reduce sediment deposits in the reticulation

WQ Risk 8: The Aeration Tanks at the WTPs are not covered, and there is a *risk of microbial contamination* from outside.

Management

Riverina Water has an existing programme to install covers over existing aeration basins. The aeration basins yet to be covered are:

- Bulgary aeration basin – commenced 2019/20, to be completed in 2020/21
- West Wagga aeration basin – being replaced with a cover that encompasses the 4x aeration towers and basin.

WQ Risk 9: Inspection of the Tarcutta bore screen conditions indicate the presence of iron bacteria that is reducing the extraction rate and could *impact on the supply reliability*.

Management

Tarcutta Bore 5 is scheduled to be replaced in 2022/23.

WQ Risk 10: Low free chlorine residuals are found in Woomargama and Morundah water supply which may lead to a *risk of re-contamination* in the distribution system.

Management

This will be addressed with the WTP replacement upgrades.

5.4 Supply reliability review and risks

Riverina Water's customer satisfaction survey (3) had a 'satisfied' rating of 96% and 70% for reliability of water supply and water pressure respectively, and a dissatisfied rating of 4% and 14% respectively. Urban residents gave a 'High' level mean satisfaction rating to both the attributes whereas rural residents gave a 'High' level satisfaction rating to reliability of water supply and a 'Low' level satisfaction rating for water pressure.

The following supply reliability issues and risks were identified during the study:

Major users

Supply Reliability (SR) Risk 1: There are no Service Level Agreements (SLAs) between Riverina Water *and* its major customers. These customers may exert a very large demand on the system during peak days, leading to water pressure issues and restrictions for other customers.

Many of Riverina Water's major customers were previously connected under various arrangements that are not well defined in terms of agreed levels of service.

Management

Riverina Water will undertake historical demand analysis of its major water users and establish:

- Thresholds for triggering developer contributions for increased demands
- Maximum allowable instantaneous flowrates, peak day volumes
- Reliability and interruption LOS
- Communication/notification protocols

The above information will be used to establish service level agreements with the major users.

An SLA with Goldenfields Water County Council (GWCC) will also be developed and included in the MoU between councils.

Integrated Systems

Growth in many of the major systems will lead to the demand during peak periods exceeding the current system capacity with the resulting risk of not meeting the target water pressure and flow, and risk of not meeting the response time target from maintaining continuity and quality of supply.

A complex relationship exists between the major water supply systems comprising of source works, treatment works and transfers between water supply systems and sub-systems. Riverina Water completed an integrated water supply systems modelling to determine the infrastructure needs to meet the supply reliability objectives during peak demand periods. This involved the development of a 30-year water source and pumping "game plan" to supply the integrated water system. The objectives of the analysis were to:

- Optimise current sourcing, treatment & pumping capacities of each facility
- Identify treatment and pumping shortfalls into the integrated system
- Identify key water transfers between systems
- Assess solutions for the supply reliability issues that were identified

The 2050 water source and pumping "game plan" is shown in Figure 5.3.

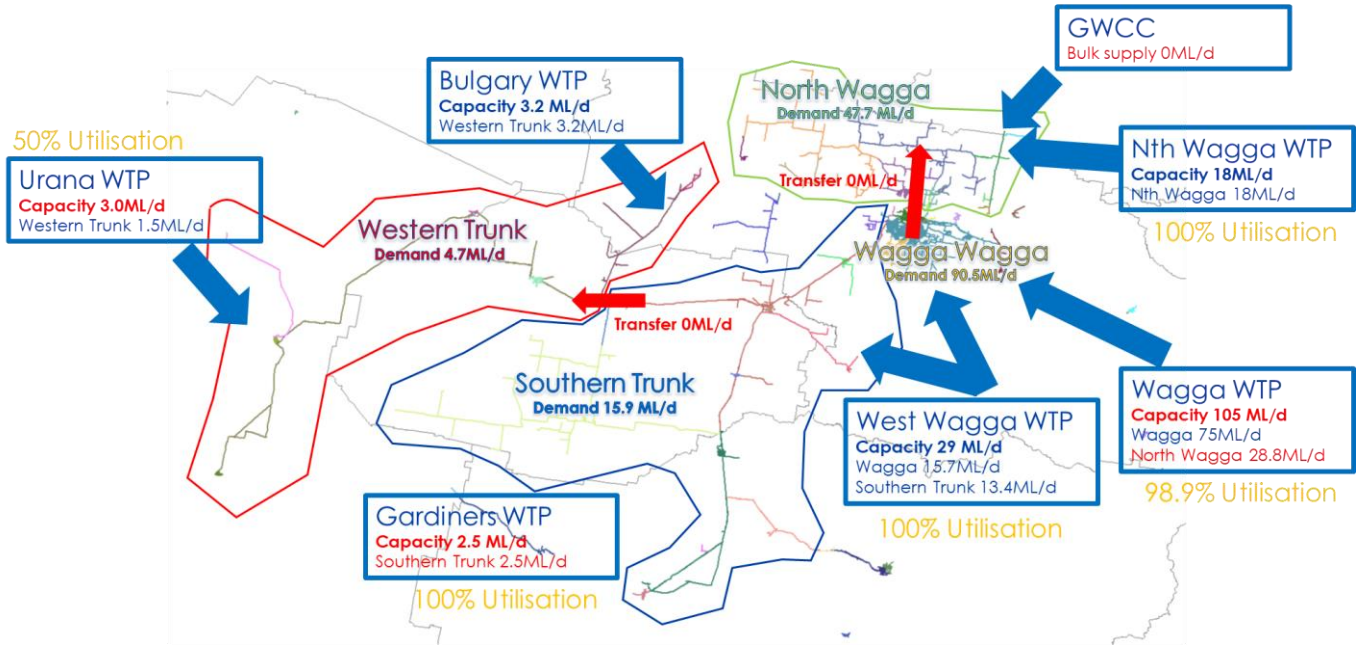


Figure 5.3: 2050 water source and pumping game plan

The analysis determined the infrastructure needs for the 10, 20 and 30 year planning horizons which were inputs to the TAMP. The water treatment plant augmentations required to meet the 2050 demands are:

- Augment the capacity of the Wagga Wagga WTP from 75 ML/day to 105 ML/day
- Augment power supply at West Wagga WTP to pump into Wagga and Southern Trunk simultaneously
- Augment bore, treatment and pumping capacity at Gardiners Crossing WTP from 1.5ML/d to 2.5ML/d.
- Augment the treatment capacity of Urana WTP from 0.7-1.0 ML/day to 1.2 ML/day in Stage 1 and 2.8 ML/day in Stage 2. Upgrade Urana CWS pumps from 1.4 ML/day to 2.7 ML/day

A summary of the 2050 water balance regarding where the water is sourced from is given in Table 5.2.

Table 5.2: 2050 Water Balance

	Peak Day Demand ML/day in 2019	Peak Day Demand ML/day in 2050	Subtotal Pumping Capacities per system	Water Source	Wagga WTP & East Wagga WTP	West Wagga WTP & Gardiners Crossing WTP	North Wagga WTP	Goldenfields CC Bulk	Bulgary WTP	Urana WTP
				Total Current Treatment & Pumping Capacities ML/d						
					80 + 25 (future expansion) = 105	31.5	18	0	3.2	1.4
				2050 Pumping Targets ML/d						
Wagga Wagga LL System	9.1	18.9	20.8		33.7					
				Transfer to Wagga HL from Wagga LL	-12.9					
Wagga Wagga HL & Bellevue Systems	58.5	71.6	69.9		41.3	15.7				
				Transfer to Wagga HL from Wagga LL	+12.9					
North Wagga/ Bomen System	17.7	47.7	46.8		28.8		18	0		
Southern Trunk System	11	15.9	15.8			15.8				
Western Trunk System	4.1	4.7	4.6						3.2	1.4
				Total 2050 Production Utilisation ML/d	103.8	31.5	18	0	3.2	1.4

The “game plan” which resulted from the integrated systems model maximises use of existing infrastructure capacity to supply the 2050 demands. This plan follows on from the previous IWCM, which recommended the Wagga Wagga WTP be constructed with provision to be upgraded to a higher capacity, which now will occur as part of the 30-year game plan.

The next iteration of IWCM strategy in 8 years time would need to consider additional treatment and pumping.

Integrated Systems Risks

The following risks could be addressed by changes to the water supply.

SR Risk 2: Some existing rural consumers are experiencing pressure issues when the transfer from The Rock (in the Southern Trunk system) to Milbrulong Balance Tank (in the Western Trunk system) is in use.

Management

No supply to the Western Trunk from the Southern Trunk. The Integrated Systems Hydraulic Model confirmed supply from Southern Trunk is not required for growth, though it’s still available with respect to reliability of supply.

SR Risk 3: If the supply from West Wagga WTP to Southern Trunk were to be interrupted (because of such reasons as power failure, flood, fire, dirty water at the treatment plant) , there would be a risk to supply reliability for the Southern Trunk as there is no supplementary source

Management

Riverina Water to investigate an alternate water supply with the preference from surface water sources e.g. from the Wagga Wagga systems via Wagga Filtration Plant (Murrumbidgee River).

SR Risk 4: Pressure issues in the Western Trunk system.

SR Risk 5: West Wagga WTP pumps will require upgrade if Western Trunk continues to be supplied by Southern Trunk

SR Risk 6: The maximum extraction from Bulgary bores may be limited by the sustainable yield, which may impact the Western Trunk system production capacity to meet 2050 demands

Management

Analysis results from the Integrated Systems Hydraulic are tabulated in Table 5.3.

Model Urana WTP and the Clear Water Storage Pump to supply both Urana and Oaklands, whilst Bulgary bores supply the rest of the Western Trunk

The Integrated Systems Hydraulic Model confirmed supply from Southern Trunk is not required.

Several risks related to supply reliability have been identified for the sub-systems of the Integrated Systems. Each of these risks is managed with the infrastructure identified as a result of the integrated systems hydraulic model. The risks and upgrades to reservoir storage, pump station capacity or trunk mains are shown in Table 5.3. Further detail of the upgrades is given in Appendix A.

Table 5.3: Supply Reliability Risks and Upgrades identified from Integrated Systems models to address risks

Sub system	Supply Reliability Risks	Reservoir Upgrades	Pump Station Upgrades	Trunk main upgrades
Wagga System				
Low Level		2x11ML enclosed reservoirs commissioned 2020, to replace open/uncovered 45ML reservoir		1.0km 600DN by 2030
High Level		One new 6.2 ML reservoir by 2030 and another 6.2 ML by 2040	Upgrade 10 MG HL PS to 14.3 ML/d by 2040	0.8km 600DN from WTP to Copland by 2040 0.5km 450DN from 10 MG HL PS by 2030 0.2km 300DN replacement of Gregadoo suction main by 2040 9.4km 375DN from Forest Hill Res by 2040
Bellvue-Glenoak	**SR7:** Pressure issues in the Bellvue-Glenoak subsystem	New Glenoak & Res No3 – 6.2 ML in 2037/38	Upgrade Glenoak PS to 10.5 ML/d and Bellvue PS to 10.2 ML/d by 2040	
Gregadoo		New Gregadoo Res No2 – 2.1 ML by 2030	Upgrade Gregadoo PS to 4.0 ML/d by 2030	0.2km 300DN Gregadoo PS Suction Main by 2030 3.6km 300DN Gregadoo PS Rising Main by 2040
Ladysmith		New Ladysmith HL Res No2 – 0.5 ML by 2050	Upgrade Ladysmith PS to 0.8 ML/d by 2050	1.8km 200DN rising main from Ladysmith PS by 2040 2.6km 200DN main from Ladysmith Res by 2040
North Wagga System			New North Wagga PS at Wagga WTP – 28.5 ML/d by 2030	

Sub system	Supply Reliability Risks	Reservoir Upgrades	Pump Station Upgrades	Trunk main upgrades
Brucedale	**SR8:** Pressure issues in the Brucedale subsystem	New Brucedale Res No2 – 1.5 ML in 2025/26	Upgrade Brucedale PS to 1.5 ML/d by 2040	4.7km 200DN rising main from Brucedale PS by 2030
North Wagga/ Bomen		New Bomen Res No3 – 1.4 ML by 2050		2.4km 150DN Brucedale Suction Main duplication by 2030 0.9km 450DN main to Bomen Res by 2030 1.1km 450DN suction main to East Bomen Res by 2030 0.7km 450DN rising main to Bomen Res by 2030 0.4km 600DN rising main from WTP after 2050 3.5km 375DN trunk main by 2030 and additional 2.0km after 2050
Downside - new suburb		New Downside Res No1 – 4.0 ML by 2050	New Downside PS – 3.6 ML/d after 2050	2.1km 300DN rising main to Downside after 2050
East Bomen	**SR9:** Pressure issues in the East Bomen subsystem	New East Bomen Res No3 – 6.0 ML in 2032/33	Upgrade East Bomen PS to 12.0 ML/d in by 2040	0.6km 450DN rising main to E Bomen Res by 2030 1.2km 450DN rising main to E Bomen Res by 2040 2.0km 375DN trunk main from E Bomen Res by 2040
Estella	**SR10:** Pressure issues in the Estella subsystem	New Estella Res No2 – 11 ML in 2028/29	Upgrade Estella PS to 20.7 ML/d by 2030	1.5km 450DN rising main from Estella PS by 2030 0.5km 300DN existing main duplication by 2040
Southern Trunk			New The Rock Booster PS – 5.9 ML/d by 2050	
The Rock	**SR11:** Part of The Rock which supplied directly from the Sth Trunk, is directly affected in the event of an interruption to supply from the Sth Trunk	New The Rock Res – 2 ML to supply all of The Rock in 2021/22	New The Rock PS – 1.6 ML/d which will pump to the new reservoir in 2021/22	0.3km 200DN offtake from The Rock Res, after 2050 2.0km 200DN main from the Rock Res after 2050
San Isadore	**SR12:** San Isadore is directly affected in the event of an interruption to supply from the Sth Trunk	Consideration for a potential new water supply system adjacent to Mt Moorong with a supply reservoir at a higher elevation		New Trunk mains from West Wagga WTP to Sth Trunk Res.

Sub system	Supply Reliability Risks	Reservoir Upgrades	Pump Station Upgrades	Trunk main upgrades
Henty	**SR13:** Henty is directly affected in the event of an interruption to supply from the Sth Trunk			Henty is supplied by large storage – the Henty BT. Trunk main has recently been renewed so risk of main breakage is low
Uranquinty		New Uranquinty Res No2 – 2.0 ML by 2040		17.5km 450DN Trunk Main from Uranquinty to the Rock Res, after 2050
Mangoplah		New Mangoplah Res No2 – 2.0 ML by 2050	Upgrade Mangoplah PS to 0.5 ML/d by 2050	19km 200DN trunk main from Mangoplah PS
South of Henty BT		New 2.2 ML additional storage for Sth Trunk South of Henty BT	Upgrade Gardiners Crossing PS to 2.5 ML/day by 2040	17.5km 450DN Trunk Main from The Rock Res to the Henty BT, after 2050 8.8km 250DN trunk main replacement from Henty to Jennings Rd by 2030 19.7km 200DN trunk main replacement from Culcairn to Walla Walla by 2030 8.8km 200DN trunk main duplication from Jennings Rd to Culcairn by 2040 3.5km 200DN trunk main duplication from Culcairn to Gardiners Crossing WTP by 2050
Western Trunk System			Upgrade Urana CWS pumps from 1.4 to 2.7 ML/d in 2021/22	
Oaklands and Urana	**SR14:** Pressure issues in the Oaklands and Urana subsystems	New Urana Terminal Res – 1.0 ML by 2030, New Oaklands Terminal Res – 0.5 ML after 2050	Upgrade to Urana WTP and CWS pumps from 1.4 to 2.7 ML/d in 2021/22 New Urana Terminal Storage Transfer PS – 1.7 ML/day by 2030 Upgrade Oaklands PS to 0.7 ML/d in 2028/29	
Lockhart	**SR15:** Risk of reduced pressure and meeting the response time supply interruption due to insufficient reservoir capacity.	New Lockhart Res replacement – 2.5 ML by 2030		10.0km 100DN reticulation

Independent Schemes

The following supply reliability risks were identified for the independent schemes.

SR Risk 16: The Collingullie system production capacity is estimated to be exceeded by 2035 due to licence conditions and availability of power supply, affecting the supply reliability.

Management

Riverina Water will investigate further:

- augmentation of existing source works, treatment, storage and pumping capacities
- supply from other systems (San Isadore, The Southern Trunk via Uranquinty or The Rock)
- Increasing peak day's storage capacities

SR Risk 17: The Woomargama WTP is susceptible to flood and extreme wet weather events may lead to an interruption of supply.

Management

Both treatment plant and pumps are scheduled to be replaced and be relocated onto the reservoir site above the township within 4 years. Construction of a second bore is scheduled in 2021/22 to replace the existing spear points and to maintain reliability of supply if a duty bore fails.

SR Risk 18: The supply reliability of the Oura scheme will be affected if one bore cannot be used due to the high iron content in the bore.

SR Risk 19: The response time for the Oura scheme may not be met during a supply interruption due to insufficient capacity of the Oura Reservoirs.

Management

Reservoir storage to be augmented. Suggested options are 1.2ML storage in 2020-2030, or alternatively, staging two 600kL reservoirs (in 2020-2030 and then 2040-2050). Consideration for an alternate reservoir site that's more accessible.

The duty bore (with minimal iron concentrations) has been relined in stainless steel casing and the pump and motors are readily available to replace if required (with minimal disruption to supply).

SR Risk 20: The two 105 kL concrete reservoirs at Oura are in poor condition and leak along cold joints. This reduces effective storage, leading to lower water pressure and reduced supply reliability

Management

Riverina Water are planning for replacement and upgrading of the existing reservoirs. The storage size of the new reservoir has been determined to meet the supply reliability. The following two options are being considered:

- a new 1.2ML of storage constructed in 2020-2030, or
- staging two 600kL reservoirs in 2020-2030 and then 2040-2050

Riverina Water will also consider an alternate reservoir site that's more accessible.

5.5 Environmental sustainability

Riverina Water – Solar PV Distributed Energy Resource

Riverina Water has been investigating the feasibility of installing Solar Photovoltaic (PV) generation and batteries at the East Wagga WTP. As part of applying to the Australian Renewable Energy Agency (ARENA) for support, Riverina Water have engaged The Energy Project (TEP) and TEP's research partners at the University of Adelaide, to provide an independent assessment of the opportunity for onsite DER and to identify areas for further optimisation and research.

The Solar PV generation and batteries will allow Riverina Water to reduce their operating costs by shifting their pumping and other energy intensive activities to daylight hours. Riverina Water currently schedules pumping to occur overnight to avoid peak energy rates. By installing battery storage Riverina Water will reduce their reliance on the grid, and Riverina Water hope to become an active participants or 'prosumers' in the new and emerging wholesale electricity and ancillary services markets – harnessing smart controls and optimisation logic to pursue these price signals, maximising the use of renewable energy and, consequently, minimising costs to their water customers.

This work is to be incorporated with council's Environmental sustainability objective above.

5.6 Asset and financial performance review and risks

A summary of Riverina Water's financial position as at 30 June 2020 is provided in Table 5.4.

Table 5.4: Riverina Water's financial position - 30 June 2020

Net Operating Result Before grants and contributions provided for capital purposes	$9,757m
Net Assets	$405,967m
Debt service cover ratio Benchmark >2.00x	7.69x
Cash expense cover ratio Benchmark > 3 months	18.3 months
Own source operating revenue ratio Benchmark >60.00%	92.59%

A summary of Riverina Water's capital investment over the last five years is summarized below and presented in Figure 5.4:

- $95m in capital works has been delivered
- In 2019 Riverina Water delivered $15.39m in capital works, which was the second highest in the State.
- This equated to approximately $487 of capital expenditure on the provision of water supply services per connected property.
- Current replacement cost of assets per assessment is $15,422. This is the 5th lowest in the state of major water utilities

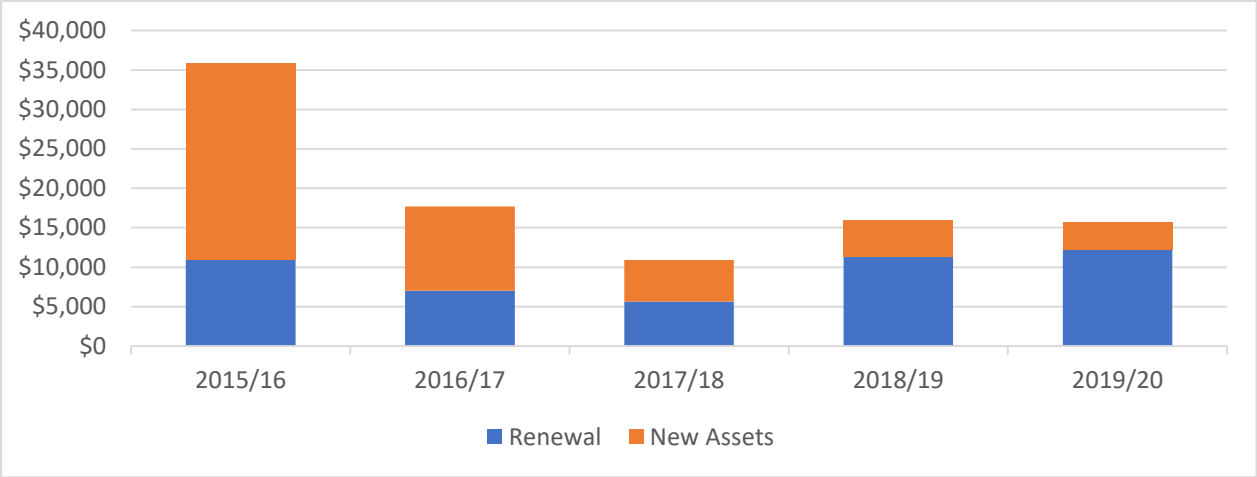


Figure 5.4: Riverina Water's capital expenditure in the last five years ($'000)

The following risks have been identified from a review of Riverina Water's asset and financial performance:

Asset and Financial (A&F) Risk 1: Inadequate and inappropriately targeted asset renewal program may impact levels of service. The condition rating of many assets is based off age, rather than any recent inspection and this may result in inadequate renewals.

Management

The asset management system is being reviewed in conjunction with council's digital strategy, namely the ERP system. Riverina Water aims to Develop condition ratings for all asset classes and update as assets are replaced in a central asset management system.

A&F Risk 2: Riverina Water's Customer Relationship Management (CRM) System is not being used by staff and has the following issues:

- There is no formal policy or procedure
- There is a lack of training contributing to inaccurate/under reporting
- There is no feedback loop to the customer
- The system is not linked to other information systems such as Civica Authority, GIS and the asset management system.

Management

In line with Riverina Water's digitization strategy (Figure 5.5), work has been initiated, including reassessment of existing information systems such as Enterprise Resource Planning (ERP) systems comprising of asset management, GIS, finance, customer management systems, human resources, document management systems, etc.

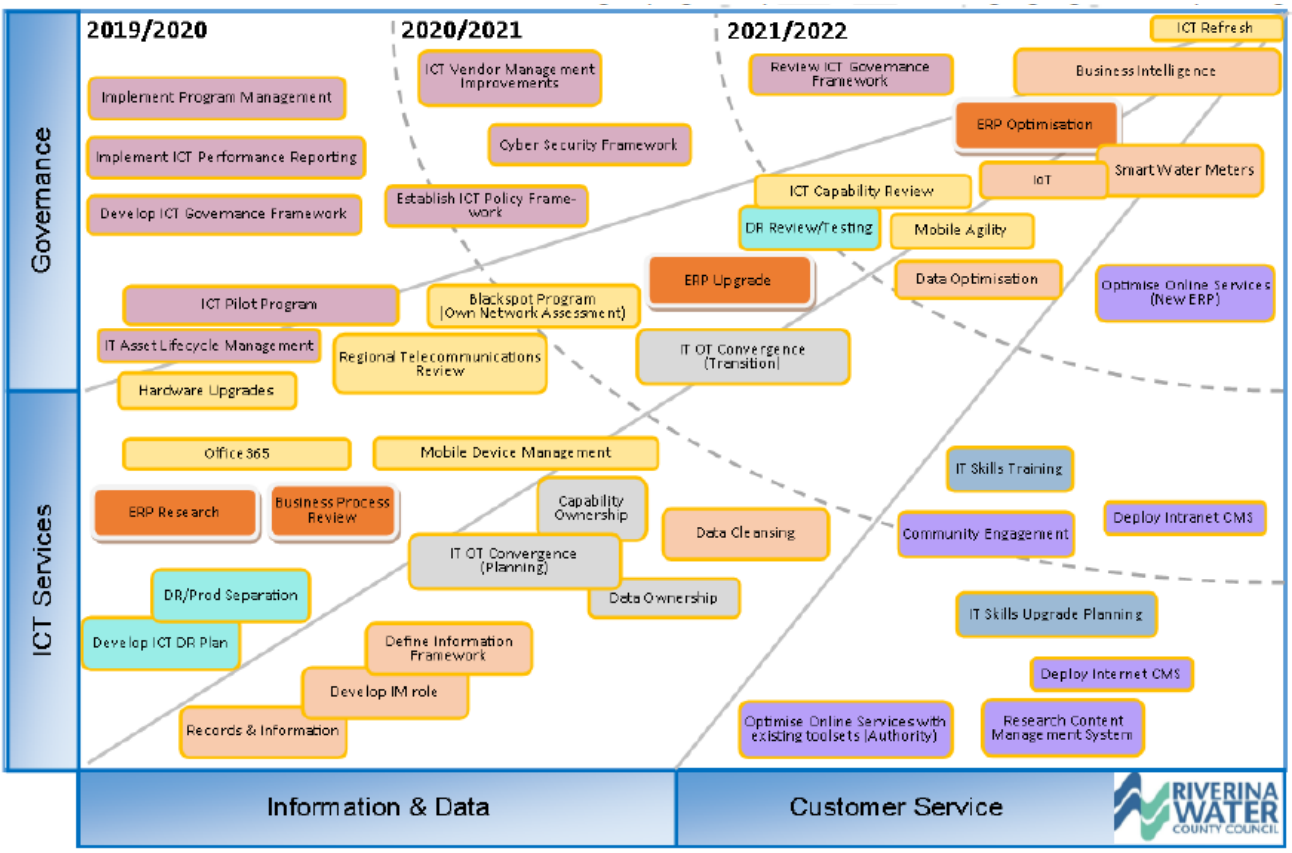


Figure 5.5: Riverina Water's Digital Strategy Action Plan 2019-2023

6. The strategy

6.1 Management actions and non-build solutions

A list of the Management actions and non-build solutions that form part of the IWCM Strategy, is provided in Table 6.1.

Table 6.1: List of management actions and non-build solutions

Issue/Risk	Action
Potential for LTAAEL to be exceeded	Riverina Water to manage its annual groundwater extraction up to its LTAAEL. If LTAEEL is to be exceeded, consult with Goldenfields. Prepare a Memorandum of Understanding (MoU) with Goldenfields
Proposed replacement WSP	Maintain watching brief on changes to legislation, and consider acquiring further water entitlements and seek to maintain a buffer for variable climatic conditions.
Fluoridation plants do not comply with COP	Continue to work with NSW Health to minimize risk of replacing fluoridation plants that may be inconsistent with future changes to the Code of Practice (COP).
Surface water entitlement expected to be exceeded	Initiate the process to acquire additional town water supply surface water entitlements and seek to obtain additional high security licenses to supply new industries. Implement demand management strategies to reduce demand.
Wagga Wagga SAP will greatly increase water demand; which Riverina Water will not be able to supply within its current license entitlements	Require developers provide their own water entitlement, which Riverina Water will use to extract water on their behalf, then treat and supply it.
The sustainable yield and drought resilience of the groundwater source outside of Wagga Wagga are not known	Undertake secure yield assessments of the groundwater sources outside of Wagga Wagga.
Yanco Creek weir update	Maintain a 'watching brief' on the Yanco weir upgrade project to determine whether it impacts drought reliability and raw water quality at Yanco Creek (Morundah water supply system.)
Drought resilience of the Wagga Wagga aquifer	Investigate the impact of the extraction over the last decade on the sustainable yield and drought resilience of the Wagga Wagga alluvial groundwater source
MIB and Geosmin causing taste	Investigate catchment source of MIB if it reoccurs at Wagga Murrumbidgee River intakes, and suitable management options.
PFAS in Lachlan aquifer	Continue annual PFAS testing and investigate water treatment removal options. Undertake a 30-year assessment of production/demand water balance with less/no input from East Wagga Bores and investigate options to supplement/replace the source.

Issue/Risk	Action
	Engage with NSW EPA and NSW DPIE to develop PFAS management strategies in line with Riverina Water's future IWCMs
Risk of contamination at Humula wells	Develop a Standard Operating Procedure (SOP) to utilize alternate water source in Humula (Humula Bore) when the wells are affected by flood water inundation. Investigate replacing the Humula wells with closed bores, or to protect the wells with a levee system.
Water clarity at Oura due to iron and manganese in the bore.	Investigate another bore source, water treatment options, supply from adjacent systems or reduced level of service.
Water quality to Morundah due to Yanco weir upgrade.	Maintain watching brief on the Yanco weir update project. Investigate additional water treatment processes or alternate supply from Urana raw water pumps.
Morundah filtered water clarity impacted	Maintained chlorination dosages for effective disinfection above what's required Digitisation and upgrade of control systems at the Morundah WTP Morundah WTP upgrade to include filter replacements.
No Service Level Agreements (SLAs) with Major Users	Establish service level agreements (SLAs) with the major users and GWCC, based on the outcome of historical demand analysis.
No supplementary supply to Southern Trunk, in case there was a supply interruption	Investigate an alternate water supply considering surface water surface e.g. from the Wagga Wagga system.
Supply reliability in San Isadore	Investigate a potential new water supply system adjacent to Mt Moorong with a supply reservoir located at a higher elevation.
Condition rating is not based on recent inspection.	Asset management system is being reviewed in conjunction with council's digital strategy, namely the ERP system. Develop condition ratings for all asset classes and update as assets are replaced in a central asset management system
Customer Relationship Management (CRM) system does not capture data effectively and is not linked	Update the CRM system in line with Riverina Water's digitization strategy.

6.2 Works

A list of infrastructure works that form part of the strategy is provided in Table 6.2.

Table 6.2: List of infrastructure works and their timing

Issue/Risk	Action	Timeframe
Yield constraint of Bulgary bores	Augment the supply from the Urana Filtration Plant to both Urana and Oaklands to reduce the requirement from Bulgary Bores.	2020-2030
Dirty water originating from rising mains	Install access points into North Wagga and East Wagga bore rising mains for water jetting.	2020-2030
WQ Risk to Woomargama bores	Upgrade the Woomargama Treatment Plant, together with online turbidity/ chlorine meters and develop SOPs.	2020-2030
Oura bore water quality, and reservoir capacity and condition	Replace Oura reservoirs: • New 1.2ML of storage or • Two 600 kL reservoirs	2020-2030 2020-2030 and 2040-2050
WQ Risk due to Yanco weir upgrade	• Replace Morundah WTP or • Construct pipeline from Urana Raw Water pump station	2020-2030
WQ Risk due to Morundah plant performance	Upgrade/replace Morundah WTP	2020-2030
WQ Risk due to uncovered aeration tanks	Cover Bulgary aeration basin, and the four aeration towers and basin at West Wagga WTP	2020-2030
WQ Risk due to iron bacteria in Tarcutta bore	Replace Tarcutta bore 5	2022/2023
Supply from Southern Trunk to Western Trunk causing low pressure	Stop supply to the Western Trunk from the Southern Trunk	by 2030
Pressure issues in Western Trunk. Capacity of Bulgary Bores and West Wagga WTP pumps insufficient	Urana WTP and the Clear Water Storage Pump to supply both Urana and Oaklands, whilst Bulgary bores supply the rest of the Western Trunk Stop supplying Western Trunk from Southern Trunk.	by 2030
Supply reliability risks	Bellvue-Glenoak • New 6.2 ML Glenoak Reservoir • Upgrade Bellvue PS to 10.2 ML/day • Upgrade Glenoak PS to 10.5 ML/day	2037/2038 2035/2036 2029/2030
	North Wagga system • Augment capacity of the Wagga Wagga WTP from 75ML/day to 105ML/day, with around 30 ML/day transferred to the North Wagga System.	2020-2030
	Estella • New 11 ML Estella Reservoir • Upgrade Estella PS to 20.7 ML/day	2028/2029 by 2030
	Brucedale • New 1.5 ML Brucedale Reservoir • Upgrade Brucedale PS to 1.5 ML/day	2025/2026 by 2040

Issue/Risk	Action	Timeframe
	East Bomen • New 6.0 ML East Bomen Reservoir • Upgrade East Bomen PS to 12.0 ML/day	2032/2033 by 2040
	Western trunk • Upgrade Urana WTP to 3.2 ML/day and upgrade Clear Water Storage pumps to 2.7 ML/day.	2021/2022
	Oaklands and Urana • New 0.5 ML Oaklands Reservoir. • New 1.0 ML Urana Reservoir • Upgrade Oaklands PS to 0.7 ML/day • New Urana Reservoir PS 1.7 ML/day	after 2050 by 2030 2028/2029 by 2030
	Lockhart • New 2.5 ML Lockhart Reservoir	by 2030
	The Rock • Supply from a new 2.0 ML reservoir to be constructed at The Rock, with new 1.6 ML/day PS	2021/2022
	Collingullie • New 1.5 ML Collingullie Reservoir	2035
	Woomargama • Replace WTP and pump station. • Construct a second bore.	2024/2025 2021/2022

6.3 Risks to Strategy

6.3.1 Wagga Wagga SAP

The Wagga Wagga (Bomen) SAP will potentially require very large amounts of water, depending on the future industries, and will require significant upgrades to Riverina Water's distribution network to supply the demand. The Wagga Wagga SAP will be located in the North Wagga System.

A preliminary estimate into the total water demand from the SAP estimated that ultimate water demand could be around four times the total current demand on the North Wagga System, which already includes large users like the Teys Abbatoir and Charles Sturt University. The water needs of the SAP should be reviewed once the planning approvals are obtained to ensure that there is no strain on Riverina Water's systems.

There is a risk that development and demand will be less than what is forecast, and Riverina Water will have constructed oversized assets which are not used. This impacts negatively on intergenerational equality.

Riverina Water will manage this by minimising installing infrastructure in advance as much as practically possible.

6.3.2 PFAS in groundwater source

Riverina Water has advised that per- and poly-fluoroalkyl substances (PFAS) have been identified in the Lachlan Aquifer, upstream of East Wagga Borefield. The source of PFAS has been identified as the RAAF base and detailed investigation is continuing. It's been estimated (via computer particle

trace modelling) that the travel time to East Wagga Bores is conservatively 55 years, not taking into account any dilution or degradation. Some PFAS may be harmful to human health.

Research into PFAS remediation and treatment in drinking water is occurring worldwide. Riverina Water may eventually be required to construct additional treatment processes to remove PFAS from the source water, however it is expected that any costs would be covered by the Department of Defence as they are the source of the pollutant.

Further advice to be sought from NSW DPIE Water and NSW EPA.

6.3.3 Population Growth

Population growth in Wagga Wagga is the most significant reason for increased demand for water on Riverina Water's systems. The IWCM Strategy assumes a certain level of growth over the next 30 years in different areas of Wagga Wagga, and a small amount of growth in some of the surrounding towns.

The growth nominated for projections is based off the best available knowledge, however actual growth is certain to differ given the many factors that contribute to migration patterns. To account for this uncertainty, Riverina Water liaise with the planners from the council's they supply water to, and growth assumptions are reviewed every four years. Riverina Water will update their TAMP and LTFP accordingly.

6.3.4 Health Based Targets

Microbial health-based targets (HBT) are used to provide a quantitative definition of microbiological safety of drinking water. Reference organisms that represent the major groups of pathogens (bacteria, viruses and protozoa) can be used. While achieving zero health risk from the consumption of treated drinking water is unrealistic, HBT provides a definition for a low level of acceptable risk

The Australian Government National Health and Medical Research Council (NHMRC) proposes to include into the ADWG a microbial health-based targets regime for drinking water supplies. Local water utilities would be subject to the proposed regime by way of the requirement of the Public Health Act (NSW) 2010 for local water utilities to have in place drinking water quality management systems in accordance with the ADWG.

If and when HBTs are included into the ADWG, Riverina Water will likely have to add additional treatment processes at several of the WTPs, which will come at a cost. It is currently unknown when and if this will occur.

7. Total Asset Management Plan (TAMP)

The aim of total asset management is to provide, operate, and maintain physical assets over their whole life cycle to achieve the required Levels of Service at the least cost while still satisfying statutory and regulatory requirements. The TAMP is developed from Council's capital works program, the operating cost and the maintenance and renewals cost. This total asset management plan presents the details of the projected capital works and recurrent (operation, maintenance and management – OMA) expenditure schedules for the next 30 years, which are significant parameters for financial planning.

The capital works and the OMA details used in the financial models ensure forecasting funds required to implement the scheduled capital works as planned and help develop effective funding/financing strategies to moderate any adverse financial impact on customers and the Council.

7.1 Capital Works

The adopted IWCM strategy enables Council to develop a schedule of expected capital works into the future to satisfy the forecast service demands in terms of growth, improved levels of service and replacement of existing assets.

Growth works	Works required to increase the capacity of facilities, to service new release areas/ subdivisions.
Improved level of service works - ILOS (including backlog works)	Works to provide better public health and environmental standards, better service, higher reliability, or an extension of services to unserviced existing development. Works in this category may be eligible for Government grants.
Asset renewal	Renewal/ replacement of existing assets, which have aged and reached the end of their economic service life

The adopted IWCM strategy develops the growth and ILOS capital works over the planning horizon based on the adopted options to address the identified IWCM issues. Additionally, anticipating the need and timing for asset renewal/ replacement is vital given the significant capital investment requirements and the need to ensure availability of funds.

Prioritising and planning for renewal and replacement capital works is then undertaken in consideration of meeting service level objectives and minimising infrastructure service risks based on the current hierarchy of critical assets so identified. Council typically undertakes asset renewal to either:

- ensure the reliability of the existing infrastructure to deliver the service it was constructed to facilitate, or
- ensure the infrastructure is of sufficient quality to meet the service requirements

Riverina Water's asset management plan (5) identifies the estimated maintenance and capital expenditure required by matching the projected asset renewals to provide an agreed level of service to the community with the planned renewal works program. The asset register is continually reviewed and refined for the useful lives and remaining lives of asset components that improves the confidence level of the assessment of the renewal expenditure requirement.

The 30-year capital works programs and the Total Asset Management Plan for the IWCM strategy are presented in Figure 7.1 and Figure 7.2 respectively.

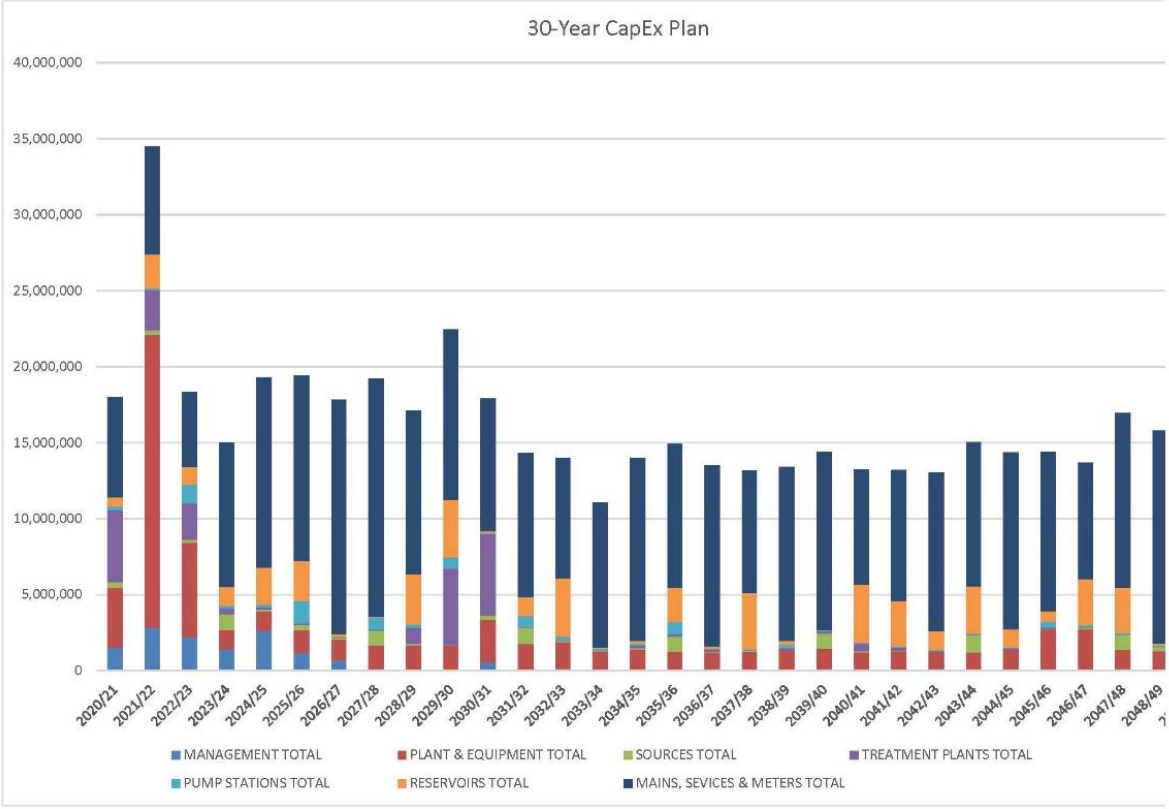


Figure 7.1: 30-Year Capital Works Schedule

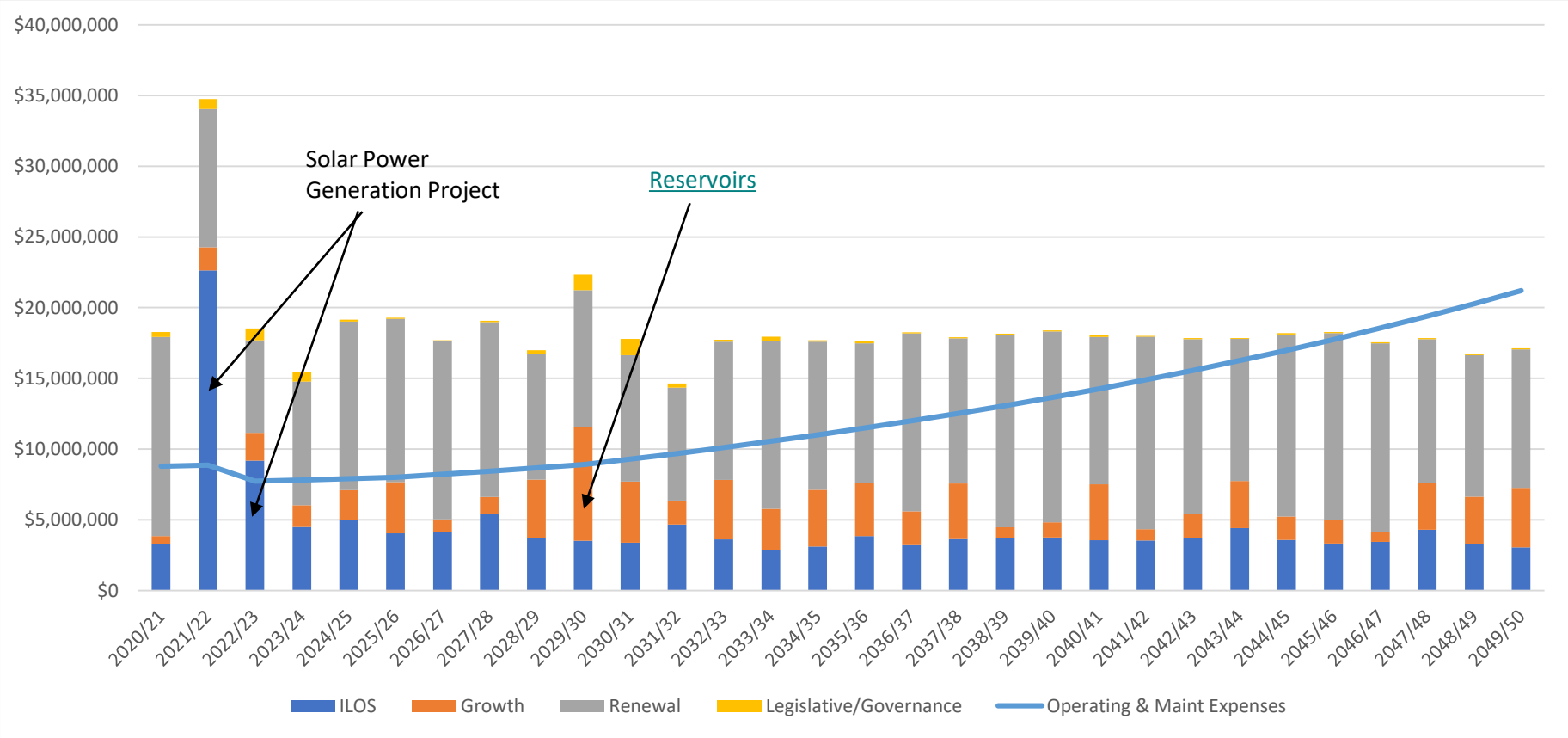


Figure 7.2: 30-year Total Asset Management plan Expenditure

8. Financial Plan

8.1 Overview

This section presents the details of the long-term financial plans for the IWCM strategy. The water fund for this purpose is consolidated across the community and is not based on individual water supply systems or schemes. The overall goal of financial planning is to determine the lowest, sustainable price path for the water supply services on which to base Riverina Water's tariff structure. The details of assumptions, input data and output financial forecasts for the IWCM strategy are presented in this plan. The plan also presents the sensitivity of financial forecasts to possible changes in key model variables.

8.2 Financial Modelling Methodology

FINMOD 4.0, the software developed by the DPIE WaterDPIE Water WaterDPIE Water was used to develop the financial models. For a particular Level of Service (LOS), FINMOD enables an examination of a range of funding options to determine the best mix of borrowing and internal funding.

A stable level of annual residential charges for water supply has been achieved using Finmod by optimising the long-term funding strategy in meeting the demands of the capital works program and day-to-day operations, while ensuring a minimum level of cash liquidity. The financial models have been developed for a 30-year planning horizon.

The financial model balances the forecast income and expenditure for each service delivery option over the projected modelling period. (Figure 8.1) illustrates the main elements, which affect the financial modelling.

The goals of the financial modelling task are to:

- optimise long term funding strategy
- meet the demands of the capital works programme and other life cycle costs of the system assets
- ensure a minimum level of cash liquidity
- provide a forecast of the average residential annual charges over the long term.

The long-term financial plans demonstrate the sustainability of future actions and also to show the sensitivity of model outcomes to some of the key assumptions made.

Funding is usually from a mix of borrowing and direct revenue and can also be offset by receiving Government subsidies where applicable. Renewal campaigns would usually be funded from revenue, and some cash would be accumulated in anticipation of major projects, to reduce the need for borrowing.

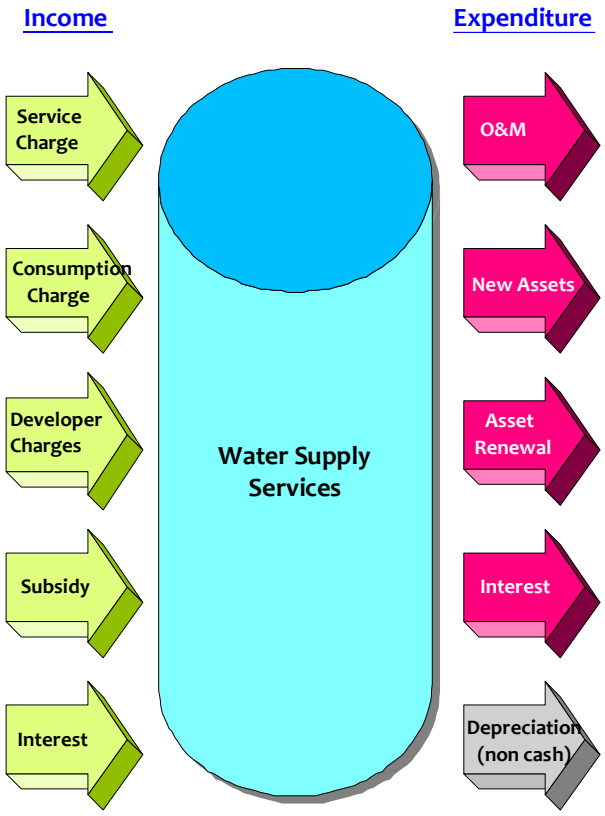


Figure 8.1 – Elements of Financial Modelling

The DPIE WaterDPIE Water WaterDPIE Water encourages the use of long-term loans because they support the idea of intergenerational equity and this will reduce the demand for funds in the short term

If the resulting annual charges are considered unacceptable or unaffordable, some input variables (levels of service) can be adjusted to arrive at a satisfactory projection of annual charges. For example, to reduce the level of annual charges, Riverina Water may delay some of the capital works, may increase developer charges, or may take long-term or structured loans.

While the preferred model reflects the expected performance of the systems, it does not give any indication of the sensitivity of the proposed solution should the basic assumptions used prove significantly different in practice.

For this reason, a sensitivity analysis is carried out if it is perceived that a variable may change significantly in the future. The value of a sensitivity analysis is that it shows:

- The sensitivity of the results to assumptions (uncontrollable variables); and
- The impact of changing controllable variables.

Riverina Water's charging (pricing) policies will also take into account corporate policies, approach to risk and the acceptability of charges to the community. Some of these risks are evident from the sensitivities presented in this Plan.

On-going Review

Over time, changes in model variables can have a significant impact on the model's accuracy and this has implications for forward planning. It is recommended that the models be reviewed annually, and the financial plan revised regularly preferably on a 3-yearly basis.

8.3 Financial Model Inputs

Several variables and assumptions have been used in the development of the financial models and are summarised in Table 8.1. The model assumptions have been grouped into five main policy areas and are discussed below:

- Charges
- Revenues and Expenditures
- Service Provision
- Funding/ Financing Capital Works
- Performance Measures

Table 8.1: Key Input Parameters for the Financial Models

	Input Data/ Assumption/ Source
Financial Data	Average annual long-term inflation rate: 0 % p.a. Annual Borrowing Interest Rate: 5 % p.a. Annual Investment Interest Rate: 2 % p.a.
Demographic Base Data (2019/20)	No. of Residential Assessments: 30,454 (Vacant – 1,438) No. of Non-Residential Assessments: 2,772 (Vacant – 0) Pensioner Assessments: 4,281 Assessment growth rate: 1 % p.a. (Long-term average)

	Input Data/ Assumption/ Source
Current Charges (from Revenue Policy 2019/20)	All customers: Access Charge*: $ 160 p.a Usage Charge+: $ 1.46 / Kl (up to 125 KL) $ 2.19 / KL (above 125 KL) Typical Residential Bill: $ 660 p.a. Residential Revenue: 70.76 % Non-residential Revenue: 25.70 % Sec.64 Developer Charges: $5,053 /ET
Opening Balances (June 2020)	Outstanding Loan: $7,266,000 Cash and Investments: $13,218,000 Minimum operating cash: $0

8.3.1 Charges

Charging Structure

The projection of typical residential bills (TRBs) is made in 2019/20 dollars and demonstrates the lowest long-term practical price path that can be achieved based on assumptions made. Where feasible the price path is maintained level in real terms and it is assumed that on an annual basis these charges are increased in line with the inflation/ CPI (consumer price index).

Developer Charges

Current (2019/20) Section 64 developer charges for the new developments are $5,053 /ET. A First Cut 30-year Developer Charge estimate was forecast in accordance with the 2016 Developer Charges Guidelines. This estimate needs to be confirmed and finalised following the adoption of the IWCM Strategy by Riverina Water.

Cash and Investments

Minimum cash levels of $5,000,000 has been considered.

8.3.2 Revenues and Expenditures

Inflation

Average long-term inflation rate of 0% p.a. for general and capital works financial activities has been adopted for the water supply models.

Interest Rates

The interest rates adopted in this analysis are 5% p.a. for all new borrowing from 2018/19 onwards and 2.0% p.a. for all investments.

Capital Works

The capital work expenses form a significant component of the inputs. The capital works program adopted for financial modelling includes all the capital works identified for the IWCM Strategy and in the Riverina Water's asset renewal program.

Recurrent Costs

The financial models consider a number of ongoing recurrent costs from historic input details. By default, the modelling increases historical operation and maintenance expenses on a pro-rata basis with respect to growth.

8.3.3 Service Provision

Growth Projections

A long-term average residential assessment growth rate of 1.0% p.a. as forecast for the development of the IWCM strategy has been adopted for the financial models.

Expected life of assets

The default average life of the system assets is based on the weighted average of long-lived structures and shorter-lived mechanical plant. These average lives are currently estimated to be 70 years for system assets and 10 years for plant and equipment.

Depreciation is a non-cash expense, which is dependent upon asset lives. The age of assets directly affects the level of future asset renewal works, which are part of the capital works program.

8.3.4 Funding Capital Works

Some, or all, capital works can be funded directly from accumulated cash reserves. To overcome intergenerational equity issues, it is general practice to fully fund renewals programs out of internally generated cash (where practical) and to borrow against capital acquisitions.

Funds, which are surplus to requirements, can be used to further reduce or eliminate borrowing requirements and reduce interest payments.

Loans are taken out as required to finance the capital works and to maintain the adopted minimum cash level.

Revenue – Typical Residential Bills maintained at constant level in real terms, unless where an increase is required for the long term financial viability.

Subsidies/Grants for Capital Works

Financial assistance in the form of grants for capital works may be received under various funding programs by the State and Federal Governments such as the Restart NSW or the National Stronger Regions Fund (NSRF). The Program's guidelines, published by the Department of Industries and Infrastructure NSW at the State level and Commonwealth Department of Infrastructure and Regional Development, define the extent of the available grants/ subsidies.

The financial models for the water fund assume that no government grant/ subsidy for any of the planned capital works.

8.4 Assumptions and Limitations of the Model

The projections of the financial models are mainly based on the previous two years (historical) financial records. Allowance is made for new initiatives, future rate forecasts, and maintenance of sustainable Levels of Service (LOS) as identified and adopted by Riverina Water through the IWCM process.

The net operating results and other financial performance indicators such as the economic real rate of return (ERRR) etc., in the financial projections should be seen in light of the fact that the depreciation of existing assets shown in the operating statement is not a cash item. FINMOD specifically models Riverina Water's asset renewal program as the fully internally funded component of the capital works program. A modest negative operating result is often sustainable as conventional depreciation of assets is conservative in comparison with an asset renewal program that has been rigorously evaluated and adopted for the financial projections.

The financial model manages the cash flow and keeps a running tally of the cumulative depreciation so that the Council can appreciate the potential future liability for maintaining the value in the system and the LOS. By planning ahead and making optimum use of existing assets, a more cost effective and efficient service should result.

Typical Residential Bills are used as the performance indicators representing overall revenue requirements from residential customers. This should not be confused with pricing structure. Pricing,

i.e. distribution of the charges according to consumption or special customer groups, is the subject of a separate revenue planning exercise. Tariff structure for the services will need to take into account corporate policies, approach to risks such as lower than adopted growth rates, increase in interest rates and the acceptability of charges to the community.

The financial model is not a substitute for normal budgeting, (i.e. short-term financial planning). The model assumes that all expenses and income occur at the beginning of the year and is therefore not appropriate to track cash flow throughout the year. It is important, however, that the budgeting process is carried out within the framework of the long-term financial plan.

The TAM Plan shows the expenditure based on the current estimates for the long-term capital, operational and maintenance and are used in the models for projecting the financial position over the next 30 years. Models will require updating as more accurate expenditure schedules become available. Annual update and 3 to 4 yearly review of the model projections with the up to date level of expenditure is recommended.

8.5 Financial Model Outcomes

8.5.1 Projected Financial Position

The impact of three variables were assessed in the financial modelling. These were:

- A percentage increase in the annual Typical Residential Bill (TRB)
- The reduction in annual energy costs from the Photovoltaic (PV) energy generation project
- The forecast annual growth rate.

Riverina Water's preferred Scenario includes a 1.5% annual increase in the TRB, $1.3M annual reduction in energy costs and a 1.0% forecast growth rate.

All costs and revenues in the input data and the model outcomes are in 2019/20 dollars unless stated otherwise. The first year of model projections is 2019/20 and CPI should be applied accordingly. The financial projections need to be reviewed annually with respect to material changes to the proposed capital works program and/or changes to any of the underlying assumptions.

The projected level of charges is sufficient to maintain liquidity with a minimum of $1,000 K of cash in hand over the period.

The model forecasts demonstrate that with the adopted price path, upgrade works need to be funded through a mix of cash reserves and external borrowing and there will not be any need for external borrowing for other planned capital works throughout the forecast period. The outstanding loan will reach a maximum of $19.2M in 2019/20 and will be gradually retired during the remaining forecast period. The typical residential bill, levels of cash and investments, and borrowing outstanding during the forecast period are depicted in Figure 8.2.

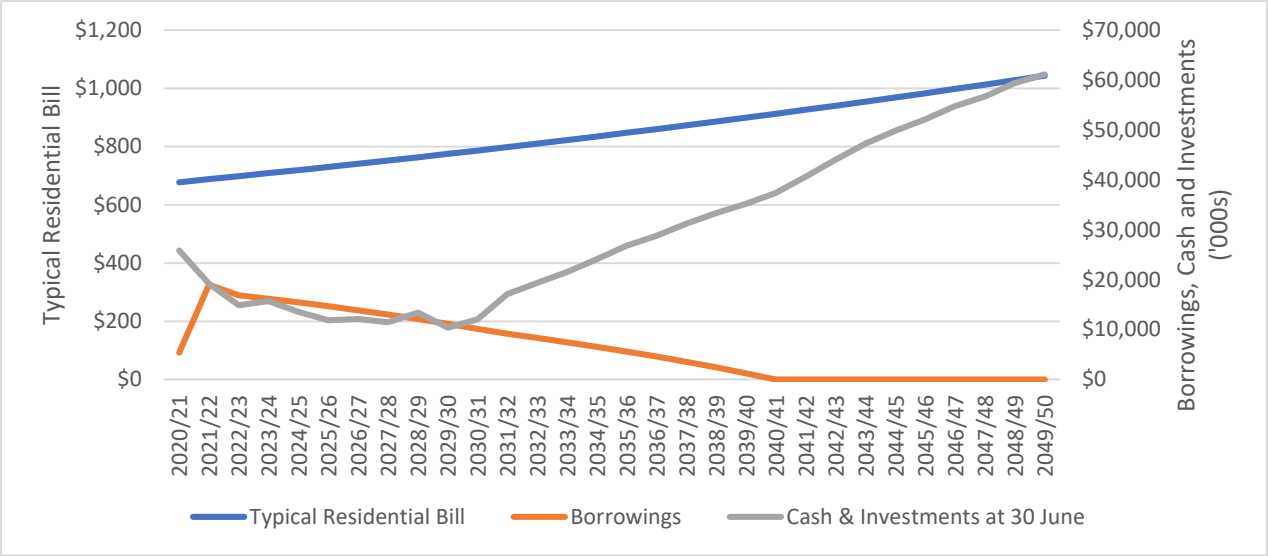


Figure 8.2: Cash & Borrowing Projections 1.5% TRB increase, $1.3m electricity reduction, 1% annual growth

The forecast Developer charge, and its percentage of the total revenue is shown in Figure 8.3.

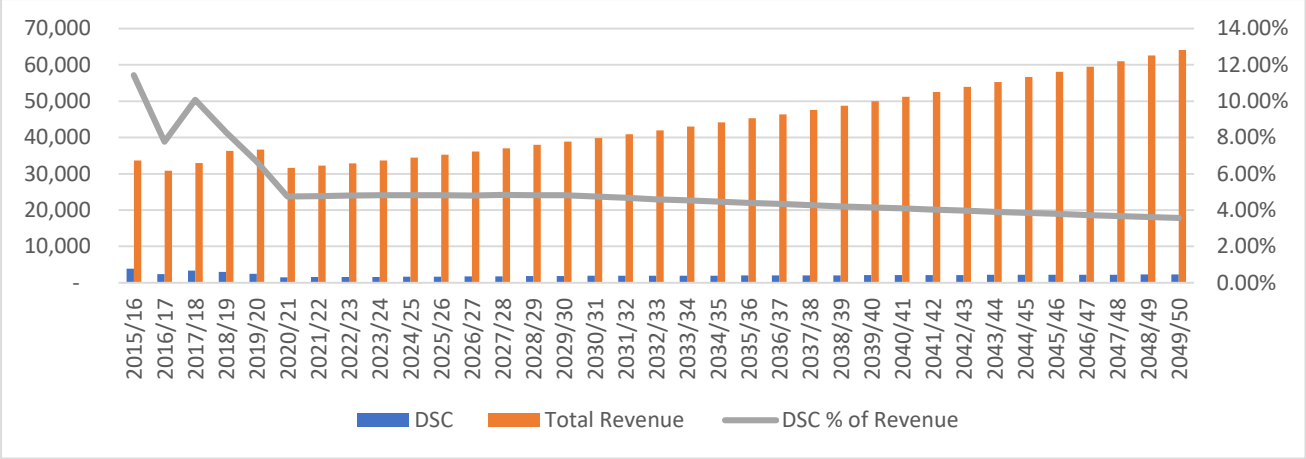


Figure 8.3: Forecast Developer Charge and its percentage of total revenue

8.5.2 Sensitivity of Financial Projections

The financial model does not involve any grant/ subsidy, hence, does not warrant sensitivity analysis for a 'no subsidy scenario'. Sensitivity of the model forecasts were analysed for higher capex estimates and lower growth rates and the impact of these variables on the water supply TRB forecasts are summarised in Table 8.2 and presented in Figure 8.4 and Figure 8.5.

Table 8.2: Sensitivity Analysis

Sensitivity	Values of Variables for Analysis	Effect on TRB compared to the adopted IWCM Scenario
Annual increase in Typical Residential Bill	1.0% and 2.0%	<u>For 2% annual increase</u> No difference in 2020/21 $3.39 increase in 2021/22 $159.92 increase in 2049/50

Sensitivity	Values of Variables for Analysis	Effect on TRB compared to the adopted IWCM Scenario
Annual reduction in energy costs	$1.0M and $1.6M from 2022/23	For $1m reduction $300,000 increase in expenses each year Cash on hand decrease of $11,228,000 at 2049/50

The results of the sensitivity analysis are presented in Figure 8.4 to Figure 8.7.

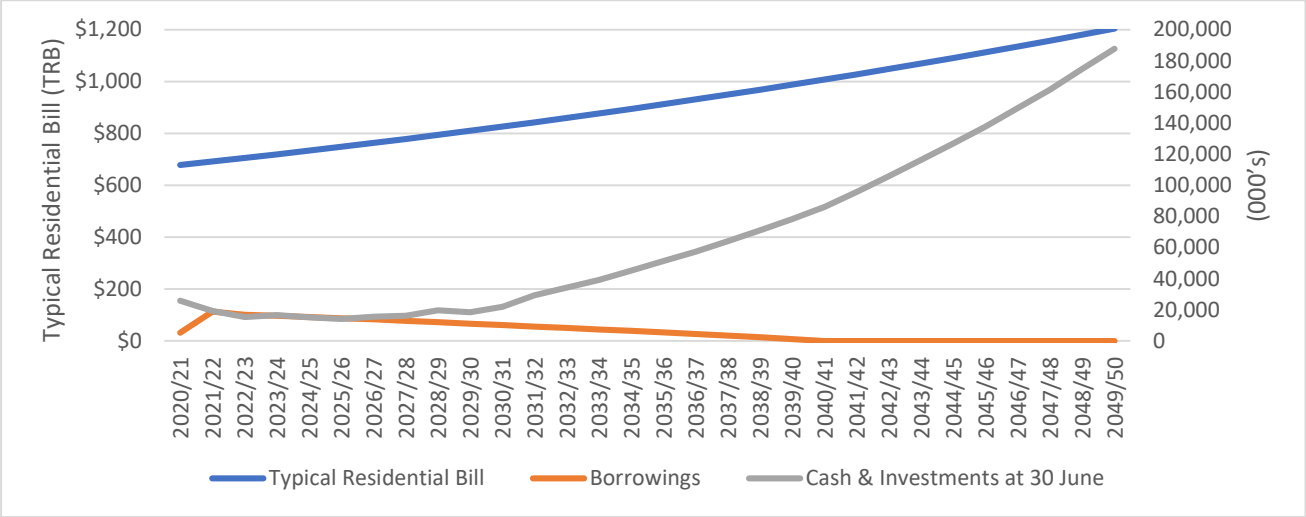


Figure 8.4: Sensitivity of 2.0 % increase in Typical Residential Bill for Water Supply

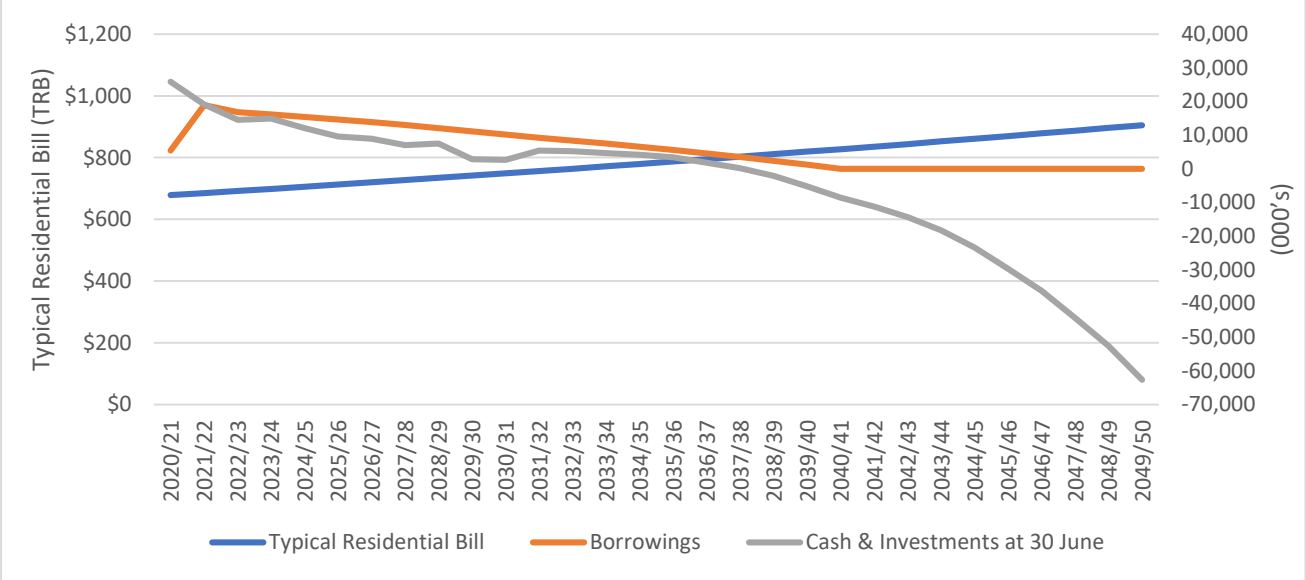


Figure 8.5: Sensitivity of 1.0 % increase in Typical Residential Bill for Water Supply

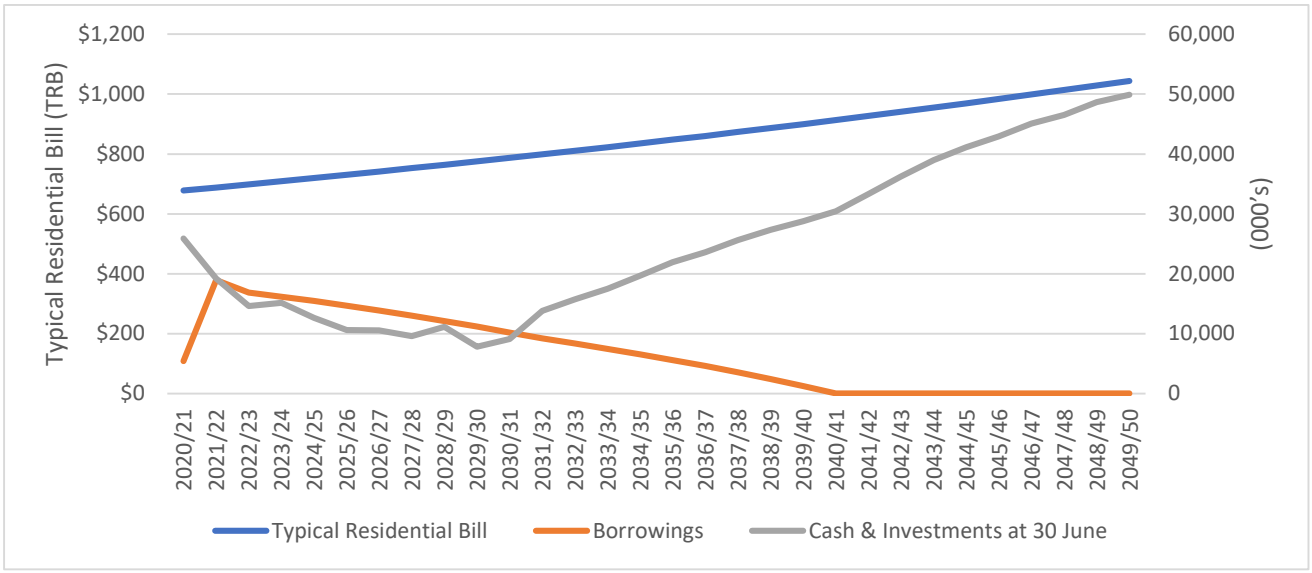


Figure 8.6: Sensitivity of $1.0 M electricity reduction with 1.5% increase in TRB

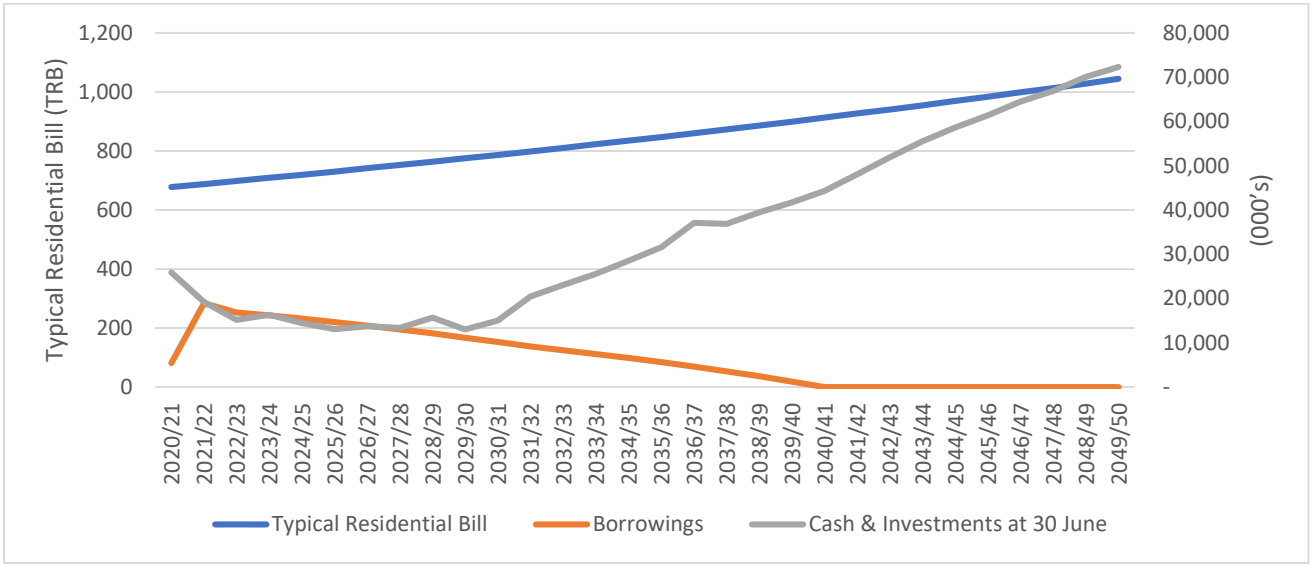


Figure 8.7: Sensitivity of $1.6 M electricity reduction with 1.5% increase in TRB

9. References

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11. **Riverina Water County Council.** *RWCC Water Quality Management System - HACCP Manual.* 2017.

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16. **Department of Primary Industries - Office of Water.** *Rules Summary Sheet - Wagga Wagga Alluvial Groundwater Source.* 2012.

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Appendices

Appendix A Riverina Water's Proclamation

LOCAL GOVERNMENT ACT 1993 - PROCLAMATION

(L.S.) GORDON SAMUELS, Governor.

I, the Honourable Gordon Samuels A.C., Governor of the State of New South Wales, with the advice of the Executive Council, and in pursuance of section 387 of the Local Government Act 1993, establish on and from 2 May 1997 a county council with the name, area of operations, number of persons to be elected by each constituent council to the county council's governing body, and functions set out in Schedule "A" hereto, and make provisions with regard to the county council as set out in Schedules "B", "C" and "D" hereto.

For the purposes of this proclamation a reference to Great Southern Energy is a reference to the corporation constituted as an energy distributor with that corporate name under section 7 of the Energy Services Corporations Act 1995.

By His Excellency's Command

ERNIE PAGE

E. T. Page, B.E., B.Comm., M.P.,
Minister for Local Government.

GOD SAVE THE QUEEN!

SCHEDULE A

Constitution of Riverina Water County Council

Name

1. The name of the County Council is Riverina Water County Council.

Area of operations

2. The area of operations of Riverina Water County Council is -

   (a) the City of Wagga Wagga which was constituted as the Municipality of Wagga Wagga and proclaimed as the City of Wagga Wagga under the Local Government Act 1919 and continued as an area and as that City and taken to be constituted under the Local Government Act 1993 by clause 21 of Schedule 7 to that Act; and

(c) the areas of Culcaim, Holbrook, Lockhart and Urana being in each case an area which was constituted as a Shire having the same name under the Local Government Act 1919 and which was continued as an area and taken to be constituted under the Local Government Act 1993 by clause 21 of Schedule 7 to that latter Act.

Governing body

3. Subject to Schedule B, the governing body of Riverina Water County Council shall consist of 9 members, and the number of persons to be elected by each of the Councils of the areas coming within the area of operations of Riverina Water County Council to be members of the governing body of the County Council shall be as shown respectively opposite the name of each area in the table below:

Name of area	*Number of members*
Culcaim	1
Holbrook	1
Lockhart	1
Urana	1
Wagga Wagga City	5

Functions

4. Commencing on 1 July 1997 the functions of Riverina Water County Council are to comprise the functions of a council for the provision, care, control and management of water supply works, services and facilities within its area of operations subject to the provisions of Schedules C and D hereto.

5. Prior to 1 July 1997 the functions of Riverina Water County Council are as described in paragraph 3 of Schedule B.

SCHEDULE B

Provisions relating to the provisional governing body of Riverina Water County Council

Appointment of provisional governing body

1. There shall be a provisional governing body of the County Council who shall be a person nominated and appointed by the Minister for Local Government. Such person has all the powers, functions, duties and responsibilities of the governing body of the County Council.

2. The term of office of the provisional governing body appointed under paragraph 1 above shall commence on 2 May 1997 and shall terminate on 30 June 1997.

Preliminary functions of the County Council

3. From 2 May 1997 to 30 June 1997 the functions of Riverina Water County Council are -

(a) the provision of temporary office accommodation for the County Council;

(b) the preparation, performance and carrying into effect of all such acts, matters and things as in the opinion of the County Council are necessary or expedient to enable that Council to undertake its functions as described in paragraph 4 of Schedule A as from 1 July 1997, including the preparation of a draft management plan under section 402 of the Local Government Act 1993 and the making of rates and/or charges for the County Council for the year commencing on 1 July 1997;

(c) the making of necessary arrangements for the first election of the County Council.

Appointment of acting General Manager

4. The provisional governing body of the County Council may employ on a temporary basis an acting General Manager who may hold office until the General Manager is appointed by the governing body of the County Council after the election of such governing body as provided in Schedule C.

5. The acting General Manager may be but is not limited to being an employee of one of the councils of the areas within the County Council's area of operations other than any Council or Councils which by arrangement or agreement with the County Council has or have functions which have the effect of making such Council or Councils the principal provider or providers of services within the County Council's area of operations, or one of the employees of a corporation or other body which for the time being is providing water supply services within the County Council's area of operations.

Appointment of temporary employees

6. The provisional governing body may but is not required to appoint employees to the county council's staff to assist it in carrying out its functions as described in paragraph 3 above, but shall not appoint any employee on any other than a temporary basis.

Operating funds and other resources

7. Pending the transfer of assets, rights and liabilities to the County Council on or after 1 July 1997 as referred to in paragraph 6 of Schedule C the provisional governing body may enter into arrangements with Great Southern Energy for the provision of funds, employees and other resources and assistance necessary to enable the County Council to undertake its functions both before and after 1 July 1997, and may receive and utilise such funds, employees, resources and assistance for the purpose of undertaking such functions.

8. Funds and resources provided to Riverina Water County Council by arrangement as referred to in paragraph 7 above shall be taken into account in the determination of assets, rights, liabilities and obligations to be transferred to the County Council as referred to in paragraph 6 of Schedule C.

9. The provisions of sections 345, 413, 422, 425, 428 and 440 of the Local Government Act 1993 do not apply to Riverina Water County Council from 2 May 1997 to 30 June 1997 inclusive.

SCHEDULE C

Provisions concerning the election, functions and operation of Riverina Water County Council

First election of the County Council

1. The first election of the governing body of Riverina Water County Council must be held before 1 July 1997.

2. The term of office of a member elected at the first election of the governing body of the County Council shall commence on 1 July 1997 and shall terminate on the day appointed for the next ordinary election of members.

Appointment of General Manager

3. The General Manager of the County Council may, but is not required to be selected from among the General Managers of any of the Councils of areas within the County Council's area of operations other than any Council or Councils which by arrangement or agreement with the County Council has or have functions which have the effect of making such Council or Councils the principal provider or providers of services within the County Council's area of operations.

Transfer of employees

4. Employees of Great Southern Energy who agree to become employees of Riverina Water County Council or who are transferred to the employment of Riverina Water County Council consequent upon the County Council assuming water supply functions formerly provided by Great Southern Energy become, on the date on which such agreement or transfer takes effect, employees of the County Council.

5. As from the date upon which a person becomes an employee of the County Council as provided in paragraph 4 above that person must, until other provision is duly made under any Act, law or agreement between such person and the County Council, and subject to any Act or other legislation concerning superannuation rights entitlements and obligations applicable or which becomes applicable to that person, be employed by the County Council under the same terms and conditions and with such entitlements as were applicable to such person as an employee of Great Southern Energy immediately before that person's transfer.

Assets, rights and liabilities

6. The assets, rights, liabilities and obligations of Great Southern Energy relating to water supply functions within the area of operations of Riverina Water County Council shall, on the date on which they are transferred to the County Council from Great Southern Energy consequent upon the County Council assuming water supply functions formerly provided by Great Southern Energy vest in and belong to the County Council.

Continuation of water services

7. If the assets, rights and liabilities of Great Southern Energy relating to its water supply functions within the area of operations of Riverina Water County Council are not transferred to the County Council on 1 July 1997 the County Council is responsible for and must undertake the provision, care, control and management within its area of operations of the water services formerly operated by Great Southern Energy pending transfer of such assets rights and liabilities.

Operating funds and other resources

8. Pending the transfer of employees, assets, rights, liabilities and obligations from Great Southern Energy to the County Council as referred to in paragraphs 4 and 6 above the County Council may enter into or continue with arrangements with Great Southern Energy for the provision of funds, employees and other resources and assistance necessary to enable the County Council to undertake its functions on and after 1 July 1997, and may receive and utilise such funds, employees, resources and assistance for the purpose of undertaking such functions.

Additional provisions as to functions

9. Riverina Water County Council shall not undertake the functions of the provision, care, control or management of headworks, distribution and reticulation of water in the town of Culcaim.

10. Culcaim Shire Council shall undertake the functions of the provision, care, control and management of headworks, distribution and reticulation of water in the town of Culcaim.

11. Riverina Water County Council must review the relative efficiencies and economies of the functions referred to in paragraphs 9 and 10 above being undertaken by Culcaim Shire Council as compared with the undertaking of those functions by the County Council and make a report to the Minister for Land and Water Conservation not later than 3 years after the date of constitution of the County Council and thereafter at not more than 3 yearly intervals for so long as the arrangement set out in paragraphs 9 and 10 above continues.

12. Riverina Water County Council shall not exercise any of its functions in relation to works controlled and administered by the Administrator under the South-west Tablelands Water Supply Administration Act 1941 before or after such works are transferred to and become vested in and belong to Goldenfields Water County Council as constituted under the Local Government Act 1993 or in relation to the supply of water within the area of operations of Riverina Water County Council from such works to land which received water from such works immediately before such works are so transferred to Goldenfields Water County Council.

13. Upon transfer of assets, rights and liabilities arising from or in connection with the care, control and management of the South-west Tablelands Water Supply to Goldenfields Water County Council, and subject to any arrangement or agreement between Goldenfields Water County Council and Riverina Water County Council made on or after the date of this proclamation, Goldenfields Water County Council may continue to obtain and convey water from and through former South-west Tablelands Water Supply works in the City of Wagga Wagga and to supply water to land within the City which received water from such works immediately before the date of transfer of such assets, rights and liabilities and make and levy rates and charges in respect of such supply as though that land was within the area of operations of the Goldenfields Water County Council.

SCHEDULE D

Additional provisions concerning the administration and objectives of Riverina Water County Council

1. Riverina Water County Council shall develop, implement and maintain strategic business plans to facilitate the efficient provision and operation of water supply services. It shall have due regard for:

   - Principles of commercial performance;
   - integrated resource management; and
   - community involvement.

2. Riverina Water County Council is to:

   - Establish a customer advisory committee;
   - establish after community consultation levels of service acceptable to the community; and
   - conduct annual customer surveys.

3 Riverina Water County Council shall make maximum endeavour to contract in, or franchise out, to constituent councils and others, management, administration and accounting functions to ensure least-cost implementation of the County Council's strategic business objectives.

4. For the first five years of its operations or for such lesser period as the Minister for local Government after consultation with the Minister for Land and Water Conservation may determine, Riverina Water County Council shall publish annually separate financial statements according to Special Schedules 3 and 4 of the Local Government Code of Accounting Practice for the provision of water supply services within

   - the City of Wagga Wagga; and
   - the remainder of its area of operations.

5. The principal objectives of Riverina Water County Council are as follows:

   (a) To be a successful business and, to this end -

   (i) to operate at least as efficiently as any comparable business; and

   (ii) to exhibit a sense of social responsibility by having regard to the interests of the community in which it operates;

SCHEDULE D

Additional provisions concerning the administration and objectives of Riverina Water County Council

1. Riverina Water County Council shall develop, implement and maintain strategic business plans to facilitate the efficient provision and operation of water supply services. It shall have due regard for:

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   - Establish a customer advisory committee;
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   - conduct annual customer surveys.

3 Riverina Water County Council shall make maximum endeavour to contract in, or franchise out, to constituent councils and others, management, administration and accounting functions to ensure least-cost implementation of the County Council's strategic business objectives.

4. For the first five years of its operations or for such lesser period as the Minister for local Government after consultation with the Minister for Land and Water Conservation may determine, Riverina Water County Council shall publish annually separate financial statements according to Special Schedules 3 and 4 of the Local Government Code of Accounting Practice for the provision of water supply services within

   - the City of Wagga Wagga; and
   - the remainder of its area of operations.

5. The principal objectives of Riverina Water County Council are as follows:

   (a) To be a successful business and, to this end -

   (i) to operate at least as efficiently as any comparable business; and

   (ii) to exhibit a sense of social responsibility by having regard to the interests of the community in which it operates;

OFFICIAL NOTICES

Appointments

ABORIGINAL LAND RIGHTS ACT 1983

Election of a Councillor to Represent the Western Metropolitan Region on the N.S.W. Aboriginal Land Council

FOLLOWING the close of the poll on Saturday, 19 April 1997 and pursuant to section 27AA of the Aboriginal Land Rights Act 1983, Robert LESTER is declared elected.

Dated 24th April, 1997.

E. I. DICKSON,
Electoral Commissioner
for New South Wales.

State Electoral Office,
Level 2, 1 Francis Street, Darlinghurst.

LOCAL GOVERNMENT ACT 1993

NOTICE is hereby given that I have appointed Tim ROGERS, Deputy Director General of the Department of Local Government, as the provisional governing body of Goldenfields Water County Council, MidCoast County Council and Riverina Water County Council. The appointments are made by authority of and in accordance with proclamations published in the *Government Gazette* on 2 May 1997, establishing those County Councils.

E. T. PAGE, B.E., B.Comm., M.P.,
Minister for Local Government.

PUBLIC SECTOR MANAGEMENT ACT 1988

Appointment of Director

Attorney General's Department

Community Justice Centre

HIS Excellency the Governor, with the advice of the Executive Council, pursuant to section 13 of the Public Sector Management Act 1988, has appointed Wendy FAULKES, Director, Community Justice Centre, from 8 April 1997 to 30 June 1997.

J. W. SHAW, Q.C., M.L.C.
Attorney General.

UNIVERSITY OF WESTERN SYDNEY ACT 1988

Notification of Appointments to the Board of Governors of Charles Sturt University

I, JOHN JOSEPH AQUILINA, Minister for Education and Training, Minister Assisting the Premier on Youth Affairs in pursuance of section 9 (5) of the Charles Sturt University Act 1989, appoint the following persons:

Susan Elizabeth BENEDYKA
John Kevin James MAHON
Gavin O'MEARA
John SUTTON

as members of the Board of Governors of Charles Sturt University for a term of office commencing on the date of publication in the *Government Gazette* and expiring on 18 October 1998.

Dated 23rd April, 1997.

J. AQUILINA, M.P.,
Minister for Education and Training.

VETERINARY SURGEONS ACT 1986

Appointment of Consumer Member
Veterinary Surgeons Disciplinary Tribunal

I, RICHARD AMERY, M.P., Minister for Agriculture, pursuant to section 25 (2) (c) of the Veterinary Surgeons Act 1986, am pleased to appoint Yolande DUBOW to the Veterinary Surgeons Disciplinary Tribunal for a period from the date hereof to 13 March 2000.

Dated this 14th day of April, 1997.

R. AMERY, M.P.,
Minister for Agriculture.

VETERINARY SURGEONS ACT 1986

Appointment of Member to the
Veterinary Surgeons Investigating Committee

I, RICHARD AMERY, M.P., Minister for Agriculture, pursuant to section 24 (3) (d) of the Veterinary Surgeons Act 1986, has been pleased to appoint Marilyn Anne MCKENZIE to the Veterinary Surgeons Investigating Committee for a period from 1 April 1997 to 31 March 1998.

Dated this 19th day of March, 1997.

R. AMERY, M.P.,
Minister for Agriculture.

HOMEFUND COMMISSIONER ACT 1993

Appointment of HomeFund Commissioner

GORDON SAMUELS, Governor.

I, GORDON SAMUELS, A.C., Governor of the State of New South Wales, with the advice of the Executive Council and pursuant to section 5 (1) of the HomeFund Commissioner Act 1993, hereby appoint Terrence LYNCH as HomeFund Commissioner for the period 9 April 1997 to 30 June 1997, both dates inclusive.

Dated at Sydney this 9th day of April, 1997.

G. SAMUELS, A.C.,
Governor.

By His Excellency's Command,

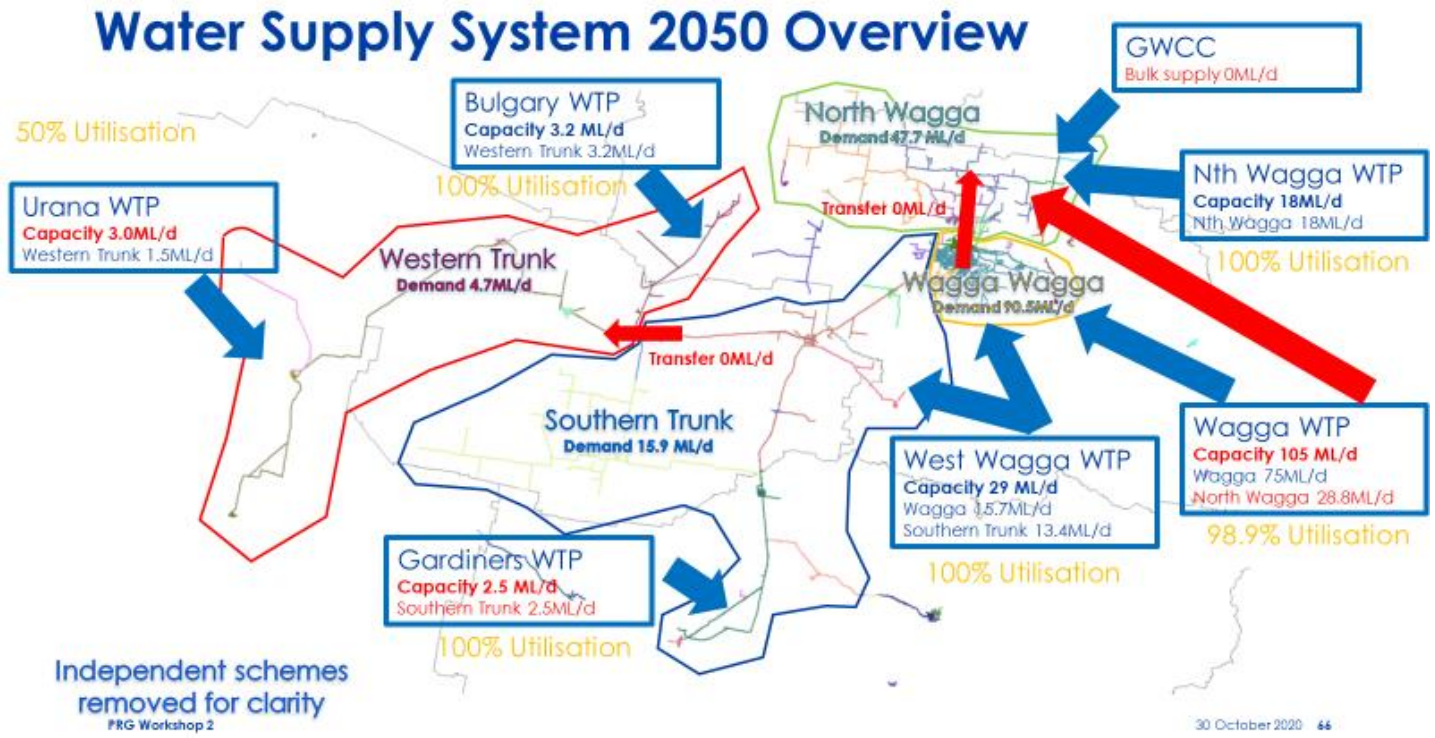
FAYE LO PO', M.P.,
Minister for Fair Trading.

Appendix B Summary of findings from Hydraulic Model

2050 Water Balance

Riverina Water undertook a strategic planning prior to starting the options development, which considered major factors such as the current network deficiencies and operational issues on peak day demands, the future demands and distribution, the efficient use of existing WTP production capacities. This established the model's 2050 water balance (or boundary conditions) to programme the inputs and water transfers between the various water supply systems.

Appendix Figure B-1 below shows the relationship of the source capacities and demand requirements in 2050.



Appendix Figure B-1: 2050 water balance overview

The 2050 water balance is given in Appendix Table B-1

Appendix Table B-1: 2050 Water Balance

	Peak Day Demand ML/day in 2019	Peak Day Demand ML/day in 2050	Subtotal Pumping Capacities per system	Water Source	Wagga WTP & East Wagga WTP	West Wagga WTP & Gardiners Crossing WTP	North Wagga WTP	Goldenfields CC Bulk	Bulgary WTP	Urana WTP
				Total Current Treatment & Pumping Capacities ML/d						
					80 + 25 (future expansion) = 105	31.5	18	0	3.2	1.4
				2050 Pumping Targets ML/d						
Wagga Wagga LL System	**9.1**	**18.9**	20.8		33.7					
				Transfer to Wagga HL from Wagga LL	-12.9					
Wagga Wagga HL & Bellevue Systems	**58.5**	**71.6**	69.9		41.3	15.7				
				Transfer to Wagga HL from Wagga LL	+12.9					
North Wagga/ Bomen System	**17.7**	**47.7**	46.8		28.8		18	0		
Southern Trunk System	**11**	**15.9**	15.8			15.8				
Western Trunk System	**4.1**	**4.7**	4.6						3.2	1.4
				Total 2050 Production Utilisation ML/d	**103.8**	**31.5**	**18**	**0**	**3.2**	**1.4**

Infrastructure needs and Staging

The infrastructure needs were first determined to meet the system demands for the 30-year ultimate 2050 scenario. The staging of the works was then determined by

Outcomes was resulted through three scenarios modelled for demands 2050, 2040 and 2030. Riverina Water elected the methodology 'Top Down' to start 2050 then 2040 and 2030 scenarios to avoid unnecessary reversal of proposed works, which aligns the future infrastructures among three scenarios to meet the demands required respectively.

A summary of the system upgrades/augmentations to meet the 2050, 2040 and 2030 demands, are presented in Appendix Table B-2 to Appendix Table B-4.

Appendix Table B-2: Reservoir Summary 2019 - 2050

System	Sub System	Existing reservoirs	2019 PDD (ML/d)	2050 PDD (ML)	Current Storage (ML)	Additional Reservoir Storage Required (ML)	Staged Works 2030 (ML)	Staged Works 2040 (ML)	Staged Works 2050 (ML)	Staged Works beyond 2050 (ML)	Total Reservoir Storage In 2050 (ML)
North Wagga Sub-Total			17.7	46.2	28.4	21.0	1.5	17.0	1.4	4.0	52.3
North Wagga	Brucedale	Brucedale Res	1.5	0.0	0.75	0.75	1.5				2.25
	Downside	Proposed reservoir		3.6	0.0	3.6				4.0	4.0
	Bomen	Bomen Res No.2	6.0	10.4	9.0	1.4			1.4		10.4
	East Bomen	East Bomen Res No.1&2	1.1	12.0	6.2	5.8		6.0			12.2
	Estella	Estella No.1	8.0	19.0	11.0	8.0		11.0			22.0
	The Gap	The Gap, Tooyal, Cottee &Currawarra reservoirs	1.1	1.2	1.48	1.48					1.48
Low Level Sub-Total			9.1	18.9	22.0	0.0	0.0	0.0	0.0	0.0	22.0
Low Level		LL system 2x11 ML reservoirs	9.1	18.9	22.0	0.0	0.0				22.0

System	Sub System	Existing reservoirs	2019 PDD (ML/d)	2050 PDD (ML)	Current Storage (ML)	Additional Reservoir Storage Required (ML)	Staged Works 2030 (ML)	Staged Works 2040 (ML)	Staged Works 2050 (ML)	Staged Works beyond 2050 (ML)	Total Reservoir Storage In 2050 (ML)
High Level Sub-Total			58.5	71.6	50.8	20.8	8.3	12.4	0.5	0.0	72.0
High Level	High Level	Mt Austin, Glenfield, Red Hills & proposed Forest Hill reservoirs	46.6	52.3	40	12.3	6.2	6.2			52.4
	Bellevue-Glenoak	Glenoak & Bellevue reservoirs	8.0	15.0	8.8	6.2		6.2			15.04
	Gregadoo	Gregadoo Res No.1	3.4	3.6	1.5	2.1	2.1				3.6
	Ladysmith	Ladysmith Res No.1	0.5	0.7	0.5	0.2			0.5		1.0
Southern Trunk Sub-Total			8.1	10.6	30.6	4.8	2.2	2.0	0.2	2.2	36.1
Southern Trunk		The Shires Res			5.0						5.0
	Uranquinty	Uranquinty Res No.1	1.5	2.8	1.2	1.6		2.0			3.2
	The Rock	The Rock Res	1.5	1.9	1.135	0.7				2.0	2.0
	Milbrulong	Milbrulong Res 0.225 ML	0.4	0.4	0.225	0.175				0.2	0.4
	Yerong Creek	Yerong Creek Res	0.5	0.5	0.45	0.0					0.45
	Mangoplah	Mangoplah Res	0.2	0.3	0.135	0.1			0.2		0.335
	Henty	Morven, Mountain View, Pleasant Hills, Walla Walla reservoirs & Henty BT	4.0	4.7	22.49	2.2	2.2				24.69
Western Trunk Sub-Total			4.1	4.7	6.8	3.0	3.5	0.0	0.0	0.8	10.6
		Ludwig reservoirs			0.4						0.4

System	Sub System	Existing reservoirs	2019 PDD (ML/d)	2050 PDD (ML)	Current Storage (ML)	Additional Reservoir Storage Required (ML)	Staged Works 2030 (ML)	Staged Works 2040 (ML)	Staged Works 2050 (ML)	Staged Works beyond 2050 (ML)	Total Reservoir Storage In 2050 (ML)
Western Trunk	Milbrulong	Milbrulong BT			4.54						4.54
	Lockhart	Lockhart Res	2.0	2.5	0.45	2.0	2.5				2.5
	Boree Creek	Boree Creek Res	0.5	0.5	0.225	0.275				0.3	0.5
	Urana	Urana Res No.1	1.0	1.1	0.45	0.6	1.0				1.45
	Coorabin	Coorabin Res			0.272						0.272
	Oaklands	Oaklands Res	0.6	0.6	0.45	0.1				0.5	0.95
Total			97.5	152.0	138.7	49.7	15.5	31.4	2.1	7.0	193.1

Appendix Table B-3: Pumps Summary 2019 - 2050

PUMP HOUSE	Type	2019 PDD Pumping (ML/d)	2050 PDD Pumping (ML/d)	Duty Flow (l/s)	Duty Head (m)	Staged Works 2030	Staged Works 2040	Staged Works 2050	Staged Works beyond 2050
SUB-TOTAL NORTH WAGGA		27.3	83.6						
BRUCEDALE PS	Non VSP	1.2	1.5	21.0	140.0		Yes		
PROPOSED DOWNSIDE PS	Non VSP		3.6	49.3	115.0				Yes
EAST BOMEN PS	Non VSP	3.0	11.5	150.4	36.4		Yes		
ESTELLA PS	VSP	9.0	20.7	259.8	45.8	Yes			
NORTH WAGGA PS	Non VSP	14.1	17.8	210.0	70.2				
PROPOSED WAGGA WTP PS (NORTH WAGGA)	VSP		28.5	337.8	109.1	Yes			

PUMP HOUSE	Type	2019 PDD Pumping (ML/d)	2050 PDD Pumping (ML/d)	Duty Flow (l/s)	Duty Head (m)	Staged Works 2030	Staged Works 2040	Staged Works 2050	Staged Works beyond 2050
SUB-TOTAL LOW LEVEL		26.2	34.1						
WAGGA WTP PS (LL)	VSP	26.2	34.1	410.5	51.0				
SUB-TOTAL HIGH LEVEL		76.0	89.6						
WAGGA WTP PS (HL)	VSP	29.7	42.9	560.7	105.3				
WEST WAGGA (HL)	Non VSP	17.8	14.3	174.7	122.6				
10 MIL PS	Non VSP	10.5	12.6	165.3	70.2	Yes			
BELLEVUE PS	Non VSP	10.1	5.8	98.9	60.2		Yes		
GLENOAK PS	Non VSP	3.1	9.6	121.7	41.6		Yes		
GREGADOO PS	Non VSP	4.2	3.7	46.4	25.9	Yes			
LADYSMITH PS	Non VSP	0.6	0.7	9.7	59.9			Yes	
SUB-TOTAL SOUTHERN TRUNK		18.0	23.3						
WEST WAGGA PS (SHIRES)	Non VSP	11.4	14.4	235.4	155.0				
MANGOPLAH PS	VSP	0.4	0.5	7.1	77.3			Yes	
THE ROCK PS	Non VSP	4.3	5.9	86.0	70.0			Yes	
GARDINERS PS	Non VSP	1.9	2.5	28.9	78.3		Yes		
SUB-TOTAL WESTERN TRUNK		7.0	6.3						
BULGRY PS	Non VSP	2.9	3.2	39.9	123.6				
LOCKHART PS	VSP	2.1	1.0	19.1	72.8				
URANA PS	Non VSP	0.6	1.3	18.8	35.0	Yes			
PROPOSED URANA TERMINAL STORAGE				30.0	35.0	Yes			
OAKLANDS PS	Non VSP	0.9	0.7	10.5	79.6				
COORABIN PS	Non VSP	0.5							
TOTAL		154.5	236.8						

Section labels are as shown in Appendix Figure B-2 to Appendix Figure B-4.

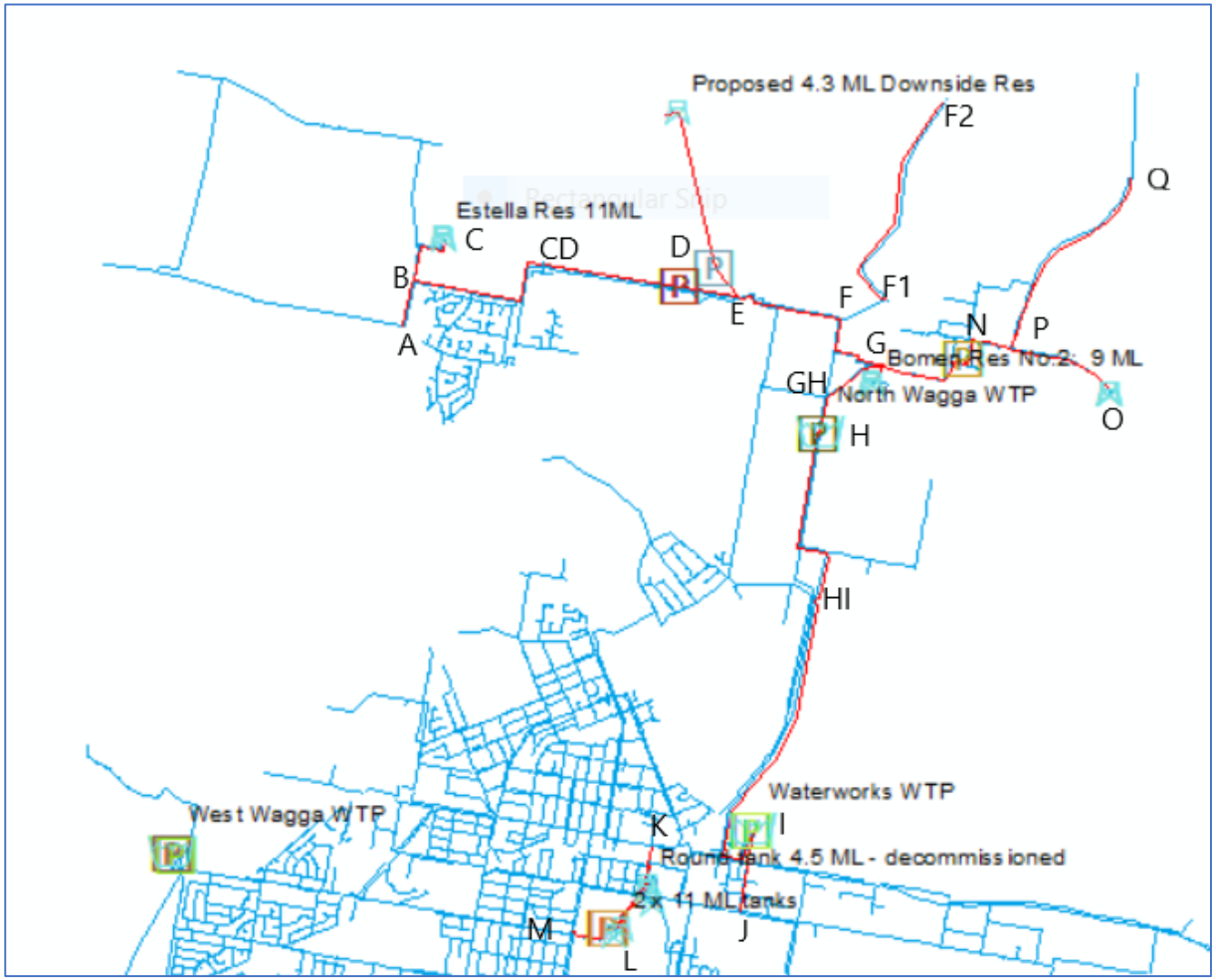
Appendix Table B-4: Summary of Trunk Main Upgrades and Staging

No.	*Section	System	Existing Main Description	Proposed Diameter (mm)	Quantity (m)	Staged Works 2030	Staged Works 2040	Staged Works 2050	Staged Works beyond 2050	Note
North Wagga sub-total					23,850					
1	A - B	Estella	300mm OPVC (2007); open in modelling	300	480		Yes			1x300 mm (existing) 1x300 mm (2040)
2	CD - D	Estella	450mm AC (1980) & 250mm AC (1976); open in modelling	450	1,450	Yes				Estella PS rising main 1x450 mm (2030)
3	E - R	Downside	None	300	2,080				Yes	1x300 mm (>2050)
4	Brucedale PS to Res	Brucedale		200	4,720	Yes				Brucedale PS rising main 1x200 mm (2030)
5	F1 - F2	Bomen	150mm DICL (2003); open in modelling	200	2,440	Yes				Brucedale PS suction main 1x150 mm (existing) 1x200 mm (2030)
6	F - G	Bomen	375mm AC (1975); open in modelling	450	920	Yes				Estella PS suction main 1x450 mm (2030) (high unit head loss)
7	G - N	Bomen	300mm AC (1975); open in modelling	450	1,130	Yes				East Bomen PS suction main 1x450 mm (2030)
8	G – GH	Bomen	375mm DICL (2006; open in modelling	450	720	Yes				Bomen Res rising main 1x375 mm (existing) 1x450 mm (2030)
9	GH – H	Bomen	375mm AC (1975); closed in modelling	600	400	Yes				Bomen Res rising main 1x600 mm (2030)
10	Bomen Res - G	Bomen	375mm DICL (2006); open in modelling	450	170				Yes	Bomen Res inlet 1x450 mm (>2050)
11	H – HI	Bomen	375mm DICL (2006); open in modelling	375	2,080			Yes		Wagga WTP PS rising main to North Wagga

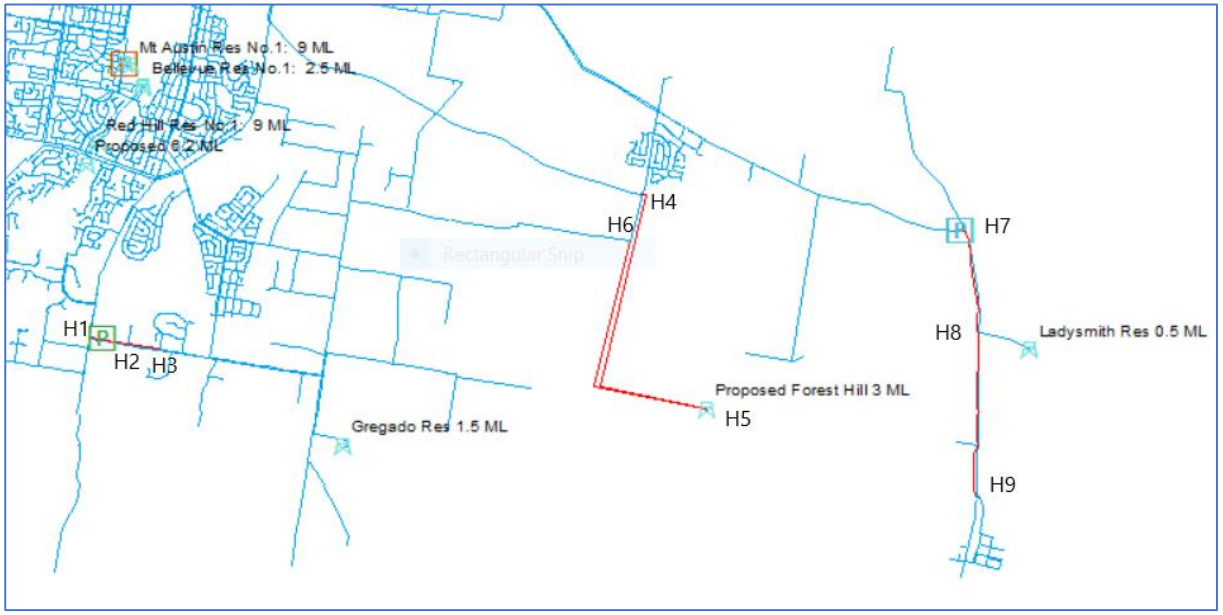
No.	*Section	System	Existing Main Description	Proposed Diameter (mm)	Quantity (m)	Staged Works 2030	Staged Works 2040	Staged Works 2050	Staged Works beyond 2050	Note
										1x375 mm (existing) 1x375 mm (2050)
12	HI - I	Bomen	375mm DICL (2016); open in modelling	375	3,480	Yes				Wagga WTP PS rising main to North Wagga 1x375 mm (existing) 1x375 mm (2030)
13	N – P	East Bomen	300mm & 100mm AC (1975); open in modelling	450	630	Yes				East Bomen Res rising main 1x450 mm (2040)
14	P - O	East Bomen	300mm AC (1980); open in modelling	450	1,180		Yes			
15	P - Q	East Bomen	300mm & 200mm AC (1980); open in modelling	375	1,970		Yes			East Bomen trunk main 1x375 mm (2040)
Low Level sub-total					980					
16	K – 22 ML Res	Low Level	250mm & 2x375mm CICLIS (1946); closed in modelling	600	980	Yes				Wagga WTP PS to 2x11 ML Res 1x600 mm (2030); connected to reticulation in modelling
High Level sub-total					20,700					
17	I – J	High Level	500mm CICL (1971); closed in modelling	600	840		Yes			Wagga WTP PS to HL system 1x600 mm (2040)
18	L - M	High Level	300mm CICL (1946); closed in modelling	450	460	Yes				10 MIL PS to HL system 1x450 mm (2030)
19	H1 - H2	High Level	250mm AC (1982); closed in modelling	300	230		Yes			Gregadoo PS suction main 1x300 mm (2040)
20	H2 - H3	Gregadoo	250mm AC (1982); closed in modelling	300	920		Yes			Gregadoo PS to Gregadoo system 1x300 mm (2040)

No.	*Section	System	Existing Main Description	Proposed Diameter (mm)	Quantity (m)	Staged Works 2030	Staged Works 2040	Staged Works 2050	Staged Works beyond 2050	Note
21	H4 - H5	High Level	None	375	5,040		Yes			Forest Hill Res Trunk Main Elizabeth Ave to Res 1x375 mm (2040)
22	H5 - H6	High Level	None	375	4,310		Yes			Forest Hill Res to Forest Hill reticulation 1x375 mm (2040)
23	H7 – H8	High Level	100mm AC (1974); open in modelling	200	6,300		Yes			Ladysmith PS to offtake to Res 1x200 mm (2040)
24	H8 – H9	High Level	100mm AC (1974); open in modelling	200	2,600		Yes			Ladysmith Res offtake to town 1x200 mm (2040)
Southern Trunk sub-total					94,080					
25	S - T	Southern Trunk	300mm CICL (1940); closed in modelling	450	17,540				Yes	The Rock suction main 1x450 mm (>2050)
26	The Rock Res offtake - Reservoir	Southern Trunk	300mm CICL (1940); open in modelling	250	290				Yes	For The Rock Res & system 1x250 mm (>2050)
27	The Rock Res to Town	Southern Trunk	300mm CICL (1940); open in modelling	250	2,000				Yes	For The Rock Res & system 1x250 mm (>2050)
28	T - U - W	Southern Trunk	300mm CICL (1950); open in modelling	300	26,600		Yes			The Rock PS to Henty 1x300 mm (2040)
29	U - V	Southern Trunk	100mm WUPVC (1986); open in modelling	200	19,000				Yes	Mangoplah PS to Res 1x200 mm (>2050)
30	W - X	Southern Trunk	200mm AC (1940); closed in modelling	250	8,800	Yes				Henty BT to Jennings Road 1x250 mm (2030)

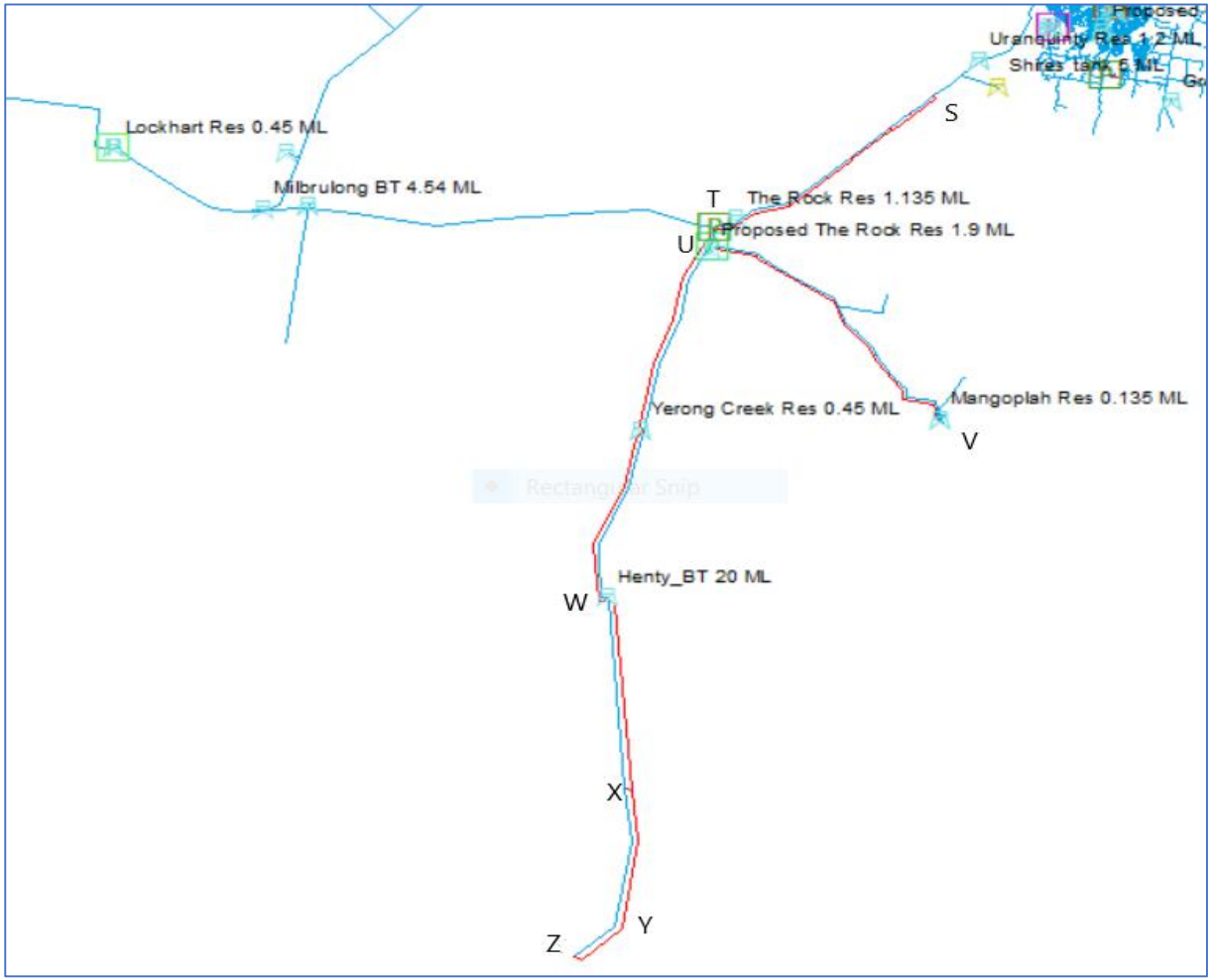
No.	*Section	System	Existing Main Description	Proposed Diameter (mm)	Quantity (m)	Staged Works 2030	Staged Works 2040	Staged Works 2050	Staged Works beyond 2050	Note
31	X - Y	Southern Trunk	150mm PVC (1968-1999); open in modelling	200	8,400		Yes			Jennings Road – Culcairn 1x200 mm (2040)
32	Y - Z	Southern Trunk	150mm AC (1978)	200	840			Yes		Culcairn - Gardiners Crossing WTP 1x200 mm (2050)
33	Culcairn - Walla Walla (Berembee Road)	Southern Trunk	100mm OPVC (2015) - partial	200	19,700	Yes				Culcairn - Walla Walla (Berembee Road) 1x200 mm (2030)
Total					139,610					
Reticulation	Brookdale Road	Lockhart	50mm PE open in modelling	100	9,970					
Reticulation	Lockhart The Rock Road	Milbrulong	100mm open in modelling	100	9,460					Not included in trunk main total



Appendix Figure B-2: Proposed Trunk mains Urban Systems in 20–0 - A



Appendix Figure B-3: Proposed Trunk mains Urban Systems in 20–0 - B



Appendix Figure B-4: Proposed Trunk mains Rural Systems in 2050

Appendix C Riverina Water's Fluoridation Policy

Riverina Water

Policy 2.5 Fluoridation

Purpose

To ensure compliance with NSW Health's legislation regarding the fluoridating of existing water supply systems outlined below.

To ensure the safe and effective management and operation of Riverina Water's fluoridation processes.

Policy Statement

Supported by NSW Health and endorsed by Council Resolution #69/316 (25th June 1969), Riverina Water is committed to continuing its fluoridation programme noting that such programme is limited to the following drinking water supply systems:

- Wagga Wagga including Ladysmith system
- North Wagga and associated rural systems
- Southern Trunk Main and associated rural systems
- Western Trunk Main and associated rural systems

Specific water treatment plants approved and regulated by NSW Health to add fluoride to the above-mentioned drinking water supply systems are:

- Wagga Filtration (River) Water Treatment Plant
- East Wagga Aeration (Bore) Water Treatment Plant
- West Wagga Aeration (Bore) Water Treatment Plant
- North Wagga Aeration (Bore) Water Treatment Plant
- Bulgary Aeration (Bore) Water Treatment Plant
- Urana Filtration (River) Water Treatment Plant
- Gardiners Crossing/Walla Walla (Bore) Water Treatment Plant

Scope

Riverina Water County Council (Riverina Water) is committed to continue its current fluoridation obligations and requirements under the Fluoridation of Public Water Supplies Act 1957, the NSW Code of Practice for Fluoridation of Public Water Supplies, and as directed by NSW Health.

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Riverina Water

Definitions

DWMS – Drinking Water Management System

Principles

To achieve this commitment, and in partnership with NSW Health and other relevant agencies, Riverina Water will:

- Retain regular monitoring of the quality of drinking water and effective reporting mechanisms to provide relevant and timely information and promote confidence in the water supply and its management to consumers, public and to NSW Health.
- Adhere to the NSW Code of Practice for Fluoridation of Public Water Supplies
- Ensure the safety of the public and employees with respect to the management, operation and maintenance of fluoridation processes and equipment
- Maintain an appropriate contingency planning and incident response capability
- Ensure that employees and contractors involved in the fluoridation of drinking water are appropriately trained and understand their responsibility for ensuring safety to the public, customers and the workplace.

Policy Implementation

Consistent with Riverina Water's Drinking Water Management System (DWMS), Riverina Water will implement this Policy by:

- Maintaining Council's Drinking Water Quality Management System (DWMS).
- Implementing appropriate operations and management procedures for water supply.
- Reporting on the supply of fluoridated drinking water to NSW Health and NSW Department of Planning Industry and Environment
- Actively engaging with key stakeholders (customers and regulators) and with industry peak organisations (e.g. NSW Water Directorate)
- Ensuring relevancy and currency of appropriate fluoridation training to employees
- Promoting awareness of employee's responsibilities and accountabilities with regards to water quality

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Riverina Water

- Actively seeking capital costs from NSW Health for replacements and upgrading existing fluoridation facilities

Non Compliance

Non-compliance with Acts, Regulations and Standards, Guidelines and Procedures associated with Riverina Water's fluoridation programme may lead to:

1) NSW Health's direct intervention into Riverina Water's management and water supply operations
2) Compromising safety to Riverina Water's customers and its employees
3) May be considered a breach under the Code of Conduct and as such, any suspected or known non-compliance will be reported to the General Manager.

References

- Fluoridation of Public Water Supplies Act 1957: https://www.legislation.nsw.gov.au/#/view/act/1957/58
- Fluoridation of Public Water Supplies Regulation 2017: https://www.legislation.nsw.gov.au/#/view/regulation/2017/419
- NSW Code of Practice for Fluoridation of Public Water Supplies: https://www.health.nsw.gov.au/environment/water/Documents/code-of-practice.pdf
- Riverina Water County Council's Resolution 69/316 (previously known as Southern Riverina County Council)

Policy number	Insert policy number here
Responsible area	Director of Engineering
Approved by	Riverina Water Board Members
Approval date	Council Resolution #69/316, 25th June 1969

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Riverina Water

Legislation or related strategy	Fluoridation of Public Water Supplies Act 1957 Fluoridation of Public Water Supplies Regulation 2017 NSW Code of Practice for Fluoridation of Public Water Supplies NSW Public Health Act 2010 NSW Public Health Regulation 2012 Riverina Water Drinking Water Management System (DWMS)
Documents associated with this policy	Riverina Water Drinking Water Management System (DWMS)
Policy history	**Policy 2.5 Fluoridation**

This Policy and associated management plans will be reviewed every 2 years, or in response to changes in legislation, guidelines or as management information dictates.

END OF POLICY STATEMENT

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