




# **Riverina Water County Council** *Demand Management Plan*

**NOVEMBER 2012**

# Riverina Water County Council

Job Number A428

## Demand Management Plan

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# Executive Summary

This Demand Management Plan reviews Riverina Water County Council's (RWCC) existing and potential demand management measures and recommends further actions to achieve best-practice demand management and to satisfy the drivers of demand management for Riverina Water.

## Methodology and Background Data

Due to the large size and number of the RWCC water supply schemes, different demand analyses approaches were used (see section 4). The Wagga Wagga, Southern Trunk Main and Western Trunk Main Systems analyses included a climate corrected historical baseline water production and baseline demand forecast analyses with 1% customer growth (see section 5 and 6). The demand analyses of the independent villages (which have populations of less than 1500) were undertaken using historical demand records and local growth rate assumptions (see section 7). These analyses are derived from the RWCC's IWCM Detailed Strategy (November 2011).

## Demand Management Drivers

Some of the demand management drivers within RWCC serviced areas are:

- ❑ Peak Day Demand (PDD) infrastructure, including cost of infrastructure, high discretionary water use (PDD to average daily demand ratio in RWCC is very high)
- ❑ Only 20% of existing infrastructure is designed to supply 1 or 2 consecutive days of PDD
- ❑ Stringent groundwater sharing allocations
- ❑ Lack of water availability during drought
- ❑ Need to reduce capital works costs (i.e. new Wagga Wagga Water Treatment Plant)
- ❑ Increasing regulatory requirements

## Demand Management Planning

The demand management end use model prepared for the IWCM Detailed Strategy study was used to analyse the benefits of implementing demand management programs in RWCC serviced areas. Outcomes of the Integrated Resource Planning (IRP) for the Urban Water Project prepared by the Institute for Sustainable Futures, were also used in the preparation of this study. RWCC has implemented some programs that have been completed and is currently implementing some other programs. Some of the demand management measures that are currently in place such as public and schools education programs and water pricing change were also analysed to identify

their benefit. Council envisages implementing further demand management programs with the aim of reducing consumption and ensuring reliable and safe water supply services.

All the demand management measures are analysed and the financial pros and cons of implementing them and their potential water savings are provided in this report (see section 8.2).

As most of RWCC infrastructure is sized based on peak day demand (PDD), the analyses for the prioritization of the demand management options are focused on PDD projections and in demand management options that potentially reduce PDD (see section 8.2.1).

The outcomes of this study indicate the potential demand management measures to be implemented in RWCC serviced areas. The measures are provided below in order of the most cost-effective to the least:

- Outdoor Watering DCP
- Permanent Water Conservation Measures
- Residential Nature Strips Rebate Scheme and Outdoor Culture Change
- Residential Evaporative Coolers Education Campaign
- Commercial Nature Strips
- Water Audit – Industrial Customers
- Non-Revenue Leak And Pressure Management Program
- Showerhead Swap
- Water Audit – Schools
- Water Audit – Hotels/Motels
- Toilet Replacement Program
- Residential Water Fixtures Retrofit
- Residential Clothes Washer Rebate

Some other demand management measures, such as public and school education programs and water pricing change, were also analysed to identify their benefits. However these options are difficult to assess in regards to water reduction due to its implementation. A qualitative analyses was undertaken for each of them and is provided in section 8.2.

### **Implementation Plan**

This report contains a proposed implementation plan for all the water demand management measures listed in this study. RWCC will continue with the demand

management measures it has already implemented and, where practical, implement the further demand management measures as Council sees fit.

These actions can be considered by Council as opportunities arise and specifically as part of its 2013/14 Operational Plan. It is expected that Council will develop an assessment process to monitor and evaluate implementation and adjust the program to ensure the most appropriate balance to the community.

### **Conclusion**

The Riverina region has strong reasons for implementing demand management. RWCC is aware of the difficulties in supplying secure and reliable potable water supply in the existing circumstances. RWCC is eager to satisfy its customers, government and environmental regulations; therefore Council is acting in a proactive manner to ensure complete satisfaction.

Demand management is a useful tool to reduce consumption by using water more efficiently. RWCC has begun implementing demand management, however Council has utilised it to its full potential. Council advised that the community has recently responded very well to demand management needs. Thus Council is very confident that demand management will trigger water demand reduction, increasing water availability reliability, assisting with compliance of environmental and government requirements and allowing for capital expenditure delay.

This plan is expected to be used as a guide to assist RWCC in implementing feasible demand management measures appropriately.

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# 1 Introduction

## 1.1 Project Background

The NSW office of water (NOW) encourages all NSW Local Water Utilities (LWU) to continually improve their water supply businesses according to the NOW Guidelines for Best-Practice Management of Water Supply and Sewerage (2007). Riverina Water County Council (RWCC) has decided to develop this Demand Management Plan to comply with the guidelines and to ensure safe and secure supply of potable water.

The Riverina region is inherently dry and arid in summer and the community expects that their gardens and green public spaces will remain green during this seasons. RWCC is aware of the difficulties in maintaining the parks and gardens during the summer periods. This is mainly due to the higher water consumption and the lack of capacity in the water supply system to deliver the summer peak demand.

Demand management focuses on reducing consumption by using water more efficiently. RWCC has not yet fully implemented demand management, however Council has advised that the community has recently responded very well to demand management needs.

Some of the benefits expected in the Riverina region due to demand management are:

- ❑ Social: community satisfaction due to maintenance of a green oasis during hot summer periods; reduce the needs for severe restrictions
- ❑ Environmental: maintenance of Murrumbidgee River environmental flows; bores stress reduction
- ❑ Financial: capital works delay, operation and maintenance expenses reduction.

Riverina Water County Council prepared an IWCM Evaluation Study in March 2010. As part of the IWCM process RWCC carried out demand analyses of the RWCC water supply systems (See section 3). These demand analyses for RWCC's major supply systems involved climate correction of historical demand to account for climate variations impact on demand. They also involved demand forecasting using the NSW Office of Water Demand Trend Tracking Model DSS models (See section 4).

In 2011 RWCC decided to develop an IWCM Detailed Strategy study. During the development of the IWCM Strategy, RWCC identified the need to develop further, more detailed, demand analyses. The main reasons for further demand analyses included:

- ❑ Uncertainty of growth projections in different parts of the serviced areas
- ❑ High external water consumption
- ❑ Ageing assets
- ❑ Uncertainty of water availability
- ❑ Complexity of RWCC water distribution systems
- ❑ High number of rural customers connected to the trunk main systems

At the same time the Institute for Sustainable Futures prepared the Integrated Resource Planning (IRP) for Urban Water Project – Wagga Wagga Case Study for the National Water Commission (November 2010). This study also focused on the analytical aspects of demand forecasting and the development of demand management options for Wagga Wagga.

RWCC evaluated the demand management measures from both studies; IWCM (DSS model) and the IRP (ISDP model) and suggested that the demand management measures from the IRP study were more appropriate for the Wagga Wagga water supply system than the options from the IWCM study.

Furthermore, the following workshop and studies were undertaken to enhance the RWCC water supply systems demand analyses:

- ❑ **Growth Projections Workshop** – The workshop was undertaken with RWCC water engineers and Wagga Wagga City Council (WWCC) town planners (October 2010). The purpose of this workshop was to identify WWCC population growth estimations including the specific locations of the major developments within the RWCC water supply systems. This allowed the identification of growth areas and capacity analyses of the water supply systems.
- ❑ **Strategic Options Report for the Rural Trunk Main Systems** – This report was developed by Hunter Water Australia (November 2010) and it provided:
  - estimates of existing and projected demands,
  - a description of potential upgrade options and capital cost estimates of infrastructure improvements required to provide supply security and increased capacity to service the rural systems over the next 30 years.
- ❑ **Riverina Water Network Modelling** – Based on the growth projections workshop RWCC undertook in house network modelling of the Wagga Wagga distribution system. This modelling study used the outcomes of the IWCM and reviewed the numbers more critically including reduced demand anticipated from demand management.

For all these reasons RWCC decided to develop a customized Demand Management End Use Model to incorporate the outcomes of the studies mentioned above. The model was developed in 2011 and it incorporates demand from the Wagga Wagga and Southern Trunk Systems. The Demand Management End Use Model was used during the preparation of this demand management plan to enhance the RWCC demand analyses. Details regarding the model are provided in section 4.2.

The outcomes of the 2011 Demand Management End Use Model were assessed by the IWCM Project Reference Group (PRG) held in Wagga Wagga in September 2011 as part of the IWCM process. The PRG agreed on the preferred demand management package (Low level demand management package).

The outcomes of the 2011 Demand Management End Use Model were different from the outcomes of the best-practice demand analyses developed using the DSS model prepared by the NSW Office of Water. This was due to some errors found in the historical data, different water supply systems boundaries used in both analyses and different water demand management measures applied to each system.

After more detailed analyses of the demand management measures, some of the measures of the low level demand management package (from the IWCM Study) were found not to be as efficient as originally thought. Those have been removed from the recommended options list but are still listed in this plan for Council's consideration (see section 9). However the water savings expected from the revised list of demand management measures is expected to be at the same level.

RWCC recognizes the importance of implementing the same demand management measures across the Riverina region due to social and financial benefits. A summary of the impacts and benefits of implementing demand management in all RWCC water supply systems are provided in section 9.

The Western Trunk System demand analysis was undertaken separately using a demand forecasting climate corrected approach. Section 4.1 describes this approach.

Demand analyses were also performed for the independent villages of Tarcutta, Humula, Woomargama, Morundah, Walbundrie/Rand, Collingullie and Oura. Information on these analyses is provided in section 7.

## **1.2 This Demand Management Plan**

RWCC has developed this Demand Management Plan to ensure that water use in the RWCC service areas is efficient, appropriate and satisfies community expectations.

It has also been developed to address the NSW Office of Water's Best-Practice Management Guidelines (2007). According to the guidelines, a water conservation and demand management plan must cover four elements:

1. Demand monitoring
2. Demand forecasting
3. Demand management planning
4. Implementation

Element 1, demand monitoring, is done by Council. An outline of RWCC demand monitoring compliance with best-practice is provided in Section 2.

Element 2 was completed during the preparation of this report. The methodologies used to prepare the demand forecasting analyses are described in Section 4. The outcomes of the demand forecasting for each RWCC water supply system are provided in sections 5, 6 and 7.

Element 3 is the main outcome of this report. Section 8 provides a list of demand management measures recommended to RWCC, and some additional demand management measures for Council's consideration. It includes water savings and costs associated with each demand management measure. Demand management measures definitions and assumptions are provided in Appendices C, D and E.

Element 4, is the implementation plan of the demand management measures recommended to RWCC. Section 9 provides the estimated implementation costs, water savings, operational savings and water bills savings.

This demand management plan addresses the Demand Management Plan requirements of the NSW Office of Water Best-Practice Management. However due to the importance of demand management in the region this study goes further than these requirements. Some uncertainties with the data used in the historical analyses, RWCC required additional studies and demand analyses to be undertaken (as mentioned in section 1.1).

## 2 Demand Monitoring

The compliance of RWCC in regards to demand monitoring best-practice management compliance is provided below.

**Table 1: Compliance with Best-Practice Requirements for Water Conservation**

Requirements	Compliance	Comments
<b>Demand Monitoring</b>		
Bulk water production metered and recorded on a daily basis	Yes	
All free standing and multi-unit residential developments (both strata and non-strata) approved after 1 July 2004 must be separately metered.	Yes	
Customer water consumption billed at least three times a year and preferably quarterly.	Yes	RWCC has different billing systems for different customers' types. eg.: <ul style="list-style-type: none"> <li>▪ Residential and rural farms are billed quarterly</li> <li>▪ Hospitals are billed annually;</li> <li>▪ Hotels, Motels, RAAF Base, and Industries and are billed monthly</li> </ul>
Customers classified in accordance with the categories defined in the latest NSW Water Supply and Sewerage Performance Monitoring Report and consumptions reported annually.	Yes	

NSW Office of Water suggests that each LWU should review its demand management measures every 2 years to ensure that it has an appropriate balance between demand and supply-side investment. RWCC will review the demand management measures recommended in this report in 2 years.

### 3 Study Area

Riverina Water County Council is responsible for the water supply functions across towns and villages in Wagga Wagga City Council, Greater Hume, Lockhart and Urana Shire Council areas. For the purposes of this demand management analysis Riverina Water Supply System was divided into 3 major systems and 8 Independent Systems. The major systems are:

- ❑ Wagga Wagga System – including Wagga Wagga urban area, the villages of Brucedale, Currawarna and Ladysmith.
- ❑ Southern Trunk Main System – including Uranquinty, The Rock, French Park, Milbrulong (This system is physically connected to Western Trunk Main System by network assets but operationally they are separated by a closed valve) Mangoplah, Yerong Creek, Pleasant Hills, Henty, Culcairn, Walla Walla, Morven and all the rural customers between these towns and villages.
- ❑ Western Trunk Main System – including Lockhart, Boree Creek, Urana and Oaklands as well as rural customers between these towns and villages.

The independent systems are:

- ❑ Tarcutta,
- ❑ Humula,
- ❑ Woomargama,
- ❑ Morundah,
- ❑ Walbundrie/Rand,
- ❑ Collingullie,
- ❑ Oura,
- ❑ Holbrook.(although this can be connected to the Southern Trunk)

Figure 1 is a map of the RWCC area of supply showing the location of all the towns and villages within the RWCC water supply systems.

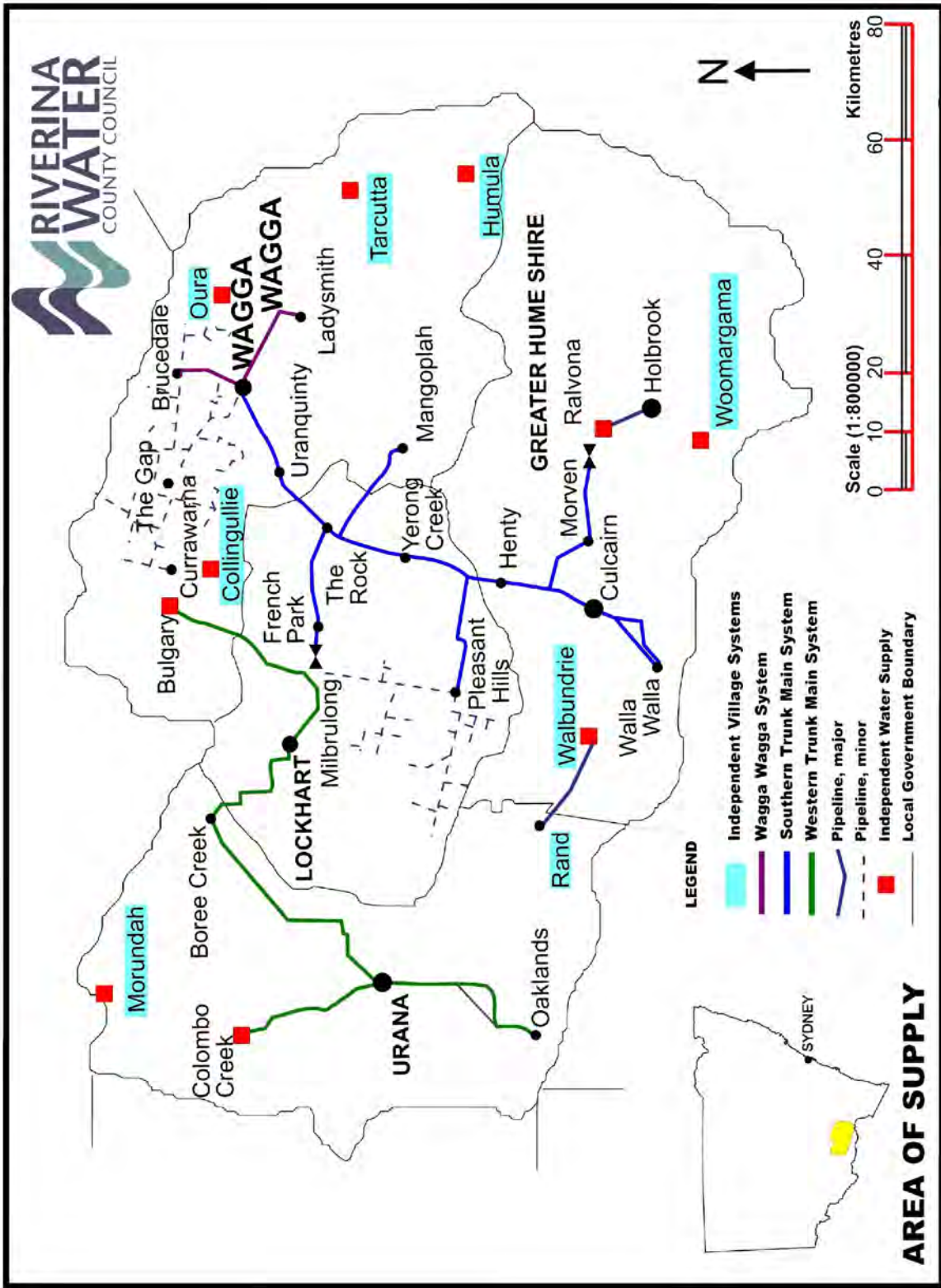


Figure 1: RWCC Water Supply Systems Map

## 4 Demand Forecasting

Demand forecasting was undertaken for all the systems described above. Different approaches were used and they are described in the following sections.

### 4.1 Climate Correction and Demand Forecasting

For the purposes of Demand Management Plans, systems with populations larger than 1500 people are required to have historical and forecasting demand analyses using the models developed by the NSW Office of Water:

- ❑ Water Demand Trend Tracking Model and Climate Correction: This model is used to track past trends in water production on a climate corrected basis and it estimates climate-corrected demand, based on per-capita demand and population growth. By climate correcting the demand a more realistic estimate of the water supplies normal demand can be ascertained.
- ❑ DSS Model: This model uses climate corrected historical demand to develop demand forecasts and preliminary evaluation of demand management measures as required by the Best-Practice Management planning framework. The modelling includes the development of demand management scenarios which test the impact of implementing additional demand management measures on water demand.

Historical climate corrected water production analysis and 30 year water demand forecasting were undertaken for the Wagga Wagga System, Southern and Western Trunk Main Systems. These analyses were prepared as part of the RWCC IWCM Evaluation Study process completed in March 2010 using the models listed above.

The approach and methodology used to run these models are outlined in the Water Demand Trend Tracking and Climate Correction (Version 10) Manual, May 2002 (Reformatted June 2006), and Demand Side Management Decision Support System – Simplified (Version S1.1) Manual, July 2006. Details of the methodology and outcomes of these models are described in Chapter 4 of RWCC’s Joint IWCM Evaluation Study report (March 2010).

The outcomes of the Wagga Wagga System climate corrected demand forecasting analysis were used in the Demand Management End Use Model developed for RWCC (see section 4.2).

As previously mentioned, RWCC engaged Hunter Water Australia (HWA) to undertake a detailed demand analysis using actual consumption records (i.e. not climate corrected) of the Southern and Western Trunk Main Systems. These systems supply potable water to villages and rural farming properties to the south and west of Wagga Wagga. HWA prepared a 30 Year Strategic Plan for the Rural Trunk Main System which includes estimates of existing and projected annual and peak day demands.



The outcome of the Southern Trunk Main System analyses and further refinement from RWCC staff was used in the Demand Management End Use Model. The combination of the Wagga Wagga and the Southern Trunk Main Systems demand is essential due to the combination of water sources and infrastructure (i.e. Waterworks WTP and West Wagga WTP) that service these two systems.

The Western Trunk Main System baseline forecast was calculated using the DSS model. The expected demand forecast is calculated based on the same reduction ratio from the Demand Management End Use Model for the Wagga Wagga and Southern Trunk Main System analyses.

## **4.2 Demand Management End Use Model**

This model was developed to provide estimated baseline demand projections and estimated demand reductions from implementing demand management actions within the Wagga Wagga and the Southern Trunk Systems only.

### **4.2.1 Objectives**

The major objectives of developing the model were to:

- Determine the need for RWCC water supply infrastructure upgrade, especially in relation to peak day demand,
- Analyse the impact of implementation of water demand management measures in Wagga Wagga and Southern Trunk Main Systems, and
- Provide a tool for the LWU to plan the secure supply of water to their customers.

### **4.2.2 Input Data**

The major inputs and parameters included in the model are listed below:

- Population growth and occupancy ratio analyses
- Residential growth by areas and sub-areas of water supply serviced area
- Industrial, commercial and public customers growth
- Parks future demand estimation
- Demand on the North and South of the Murrumbidgee River
- 3 growth scenarios: 0.7%, 1% (growth adopted) and 1.5%.
- Climate corrected annual demand forecast from the Wagga Wagga System DSS model (Refer to Joint IWCM Evaluation Study report, March 2010).
- Southern Trunk Main System PDD and annual forecasts from the Strategic Options Report - Rural Trunk Main System prepared by Hunter Water

(November 2010). The high growth scenario (1%) was chosen by RWCC as the preferred scenario.

- ❑ RWCC estimated groundwater allocations from the Mid-Murrumbidgee Water Sharing Plan (in progress)
- ❑ Demand management measures including estimated water savings and costs from the 'Integrated Resource Planning for Urban Water Project: Wagga Wagga Case study - Report, prepared for National Water Commission by the Institute for Sustainable Futures, University of Technology.

It is important to note that the costs and water savings assumptions are based on implementing the demand management measures in Wagga Wagga. RWCC assumes that the same assumptions are valid for the Trunk Main Systems and Independent Villages.

### 4.2.3 Assumptions

For the purposes of this model some assumptions have been made to accommodate the complexity of variables that affect demand in the system. These are:

- ❑ The Wagga Wagga Urban system was split into the north and the south of the Murrumbidgee River System. This was necessary due to the different water sources and infrastructure that provide water to these areas and the different growth expected in different parts of the RWCC area of supply.
- ❑ Due to the uncertainty of growth in the area, 3 population growth rate scenarios were assessed: 0.7%, 1% (growth adopted) and 1.5%.
- ❑ The percentage of commercial, public and parks growth in the north and south of the Murrumbidgee River is in the same proportion as the residential growth
- ❑ Some of the assumptions from the IRP study were modified for these demand management analyses by RWCC staff based on up to date information and local costs.

### 4.2.4 Calculation

The major outcomes derived from these analysis are:

- ❑ Peak Day Demand Baseline Forecast
- ❑ Peak Day Demand Forecast with Low and High Level Demand Management
- ❑ Annual Demand Baseline Forecast
- ❑ Annual Demand Baseline Forecast with Low and High Demand Management
- ❑ Prioritisation of demand management measures implementation

These outcomes were assessed against the capacity of the RWCC water supply systems to supply current and future predicted annual and peak day demand.

As previously mentioned the IWCM preferred scenario chosen to be implemented in the Wagga Wagga and the Southern Trunk Main Systems is the low demand management package. The demand management measures included in this package as well as the benefits associated with implementation of the demand measures in RWCC water supply systems are detailed in Section 8.

### **4.3 Demand Forecast Based on Growth Projections**

The population of the independent systems are each less than 1500 and therefore there was no need to undertake climate correction of historical demand records for them.

The Independent Villages demand forecasts were prepared by applying local growth rates for each village's historical daily water production records.

The expected demand reductions from implementing demand management were calculated using the same reduction ratio from implementing the demand management measures that was calculated for Wagga Wagga. The outcomes of these analyses are provided in section 7.

# 5 Wagga Wagga System and Southern Trunk Main System

## 5.1 Systems Overview

For the purposes of the demand management analyses the Wagga Wagga System is comprised of Wagga Wagga urban area and the villages of Brucedale, Currawarna and Ladysmith. The estimated 2010 population of each respective area was:

- ❑ Wagga Wagga urban: 54,392 people
- ❑ Brucedale: 138 rural properties  
58 people (occupancy ratio of 2.4 EP/ET)
- ❑ Currawarna: 80 people
- ❑ Ladysmith: 153 people

The Southern Trunk Main System is comprised of villages and rural farms along the Southern Trunk Main as described in section 3. The estimated 2008 population of this system was 4,672 people. (Source: Joint IWCM Evaluation Study, 2010).

The growth rate adopted for these systems was 1% growth and the estimated occupancy ratio was 2.4 EP/ET.

The water supply system consists of one surface water source and several bores; these are listed in Table 2.

**Table 2: Wagga Wagga and Southern Trunk Main Systems Raw Water Sources**

Raw Water Source	Location	Capacity	Licence (Water allocation)
<b>Surface Water</b>			
Murrumbidgee River	Wagga Wagga Waterworks	Pump No.1 – 120 L/s Pump No.2 – 100 L/s Pump No.3 – 60 L/s Pump No.4 – 100 L/s Pump No.5 – 180 L/s Pump No.6 – 180 L/s Pump No.7 – 110 L/s	7000 ML/year

Raw Water Source	Location	Capacity	Licence (Water allocation)
<b>Groundwater</b>			
East Wagga Wagga Bores	East Wagga	Bore No.1 Original – 60 L/s Bore No.2 Original – 80 L/s Bore No.3 Original – 100 L/s Bore No.1 Replacement – 110 L/s Bore No.2 Replacement – 110 L/s	14000 ML/year*
North Wagga Wagga Bores	North Wagga	Bore No.1 – 100 L/s Bore No.2 – 100 L/s Bore No.3 – 100 L/s	
West Wagga Wagga Bores	West Wagga	Bore No.1 – 80 L/s Bore No.2 – 160 L/s Bore No.3 – 180 L/s (not commissioned) Bore No.4 – 150 L/s Bore No.5 – 150 L/s	
Walla Walla Bores	Walla Walla	Bore No.1 – 23 L/s Bore No.2 – 23 L/s (only one bore at the time)	200 ML/year (only during summer months)

Note: \*The NSW Office of Water is currently developing a new groundwater sharing plan for the Mid-Murrumbidgee (expected completion in 2014). If the water sharing plan extraction limits is set to the LTAAEL, being the highest 5 year rolling average over the past 10 years, then the RWCC groundwater annual yield will be 12,731 ML/a. For the purposes of this demand management analysis we have used this figure as the groundwater sustainable yield.

RWCC operates several treatment plants within the Wagga Wagga and Southern Trunk Main System. A brief description of the treatments processes, capacities and supply area of each plant that services both systems is provided in Table 3.

**Table 3: Wagga Wagga and Southern Trunk Main Systems Water Treatment Plants**

Water Treatment Plant	Raw Water Source	Water Treatment Process	Capacity	System Supply
Wagga Wagga Filtration Plant	Murrumbidgee River and East Wagga Wagga Bores	Treatment at the filtration plant consists of chemical treatment and sedimentation prior to filtration. Chlorine and fluoride are introduced in the filtration stage. Treatment at the East Wagga Wagga bores consists of chlorination prior to aeration.	64.91 ML/day	Wagga Wagga and Southern Trunk Main
North Wagga Wagga Water Source Works	North Wagga Wagga Bores	Treatment consists of aeration process only.	25 ML/day	Wagga Wagga
West Wagga Wagga Water Works	West Wagga Wagga Bores	Treatment consists of aeration including chlorination and fluoridation.	30 ML/day*	Wagga Wagga and Southern Trunk Main
Gardeners Crossing Treatment Plant	Walla Walla Bores	Treatment consists of aeration and chlorination.	2.6 ML/day **	Southern Trunk Main (operates during summer months only)

Note: A detailed description of the treatment plants is provided in section 4 of the RWCC Description of Water Supply Systems report, (2010).

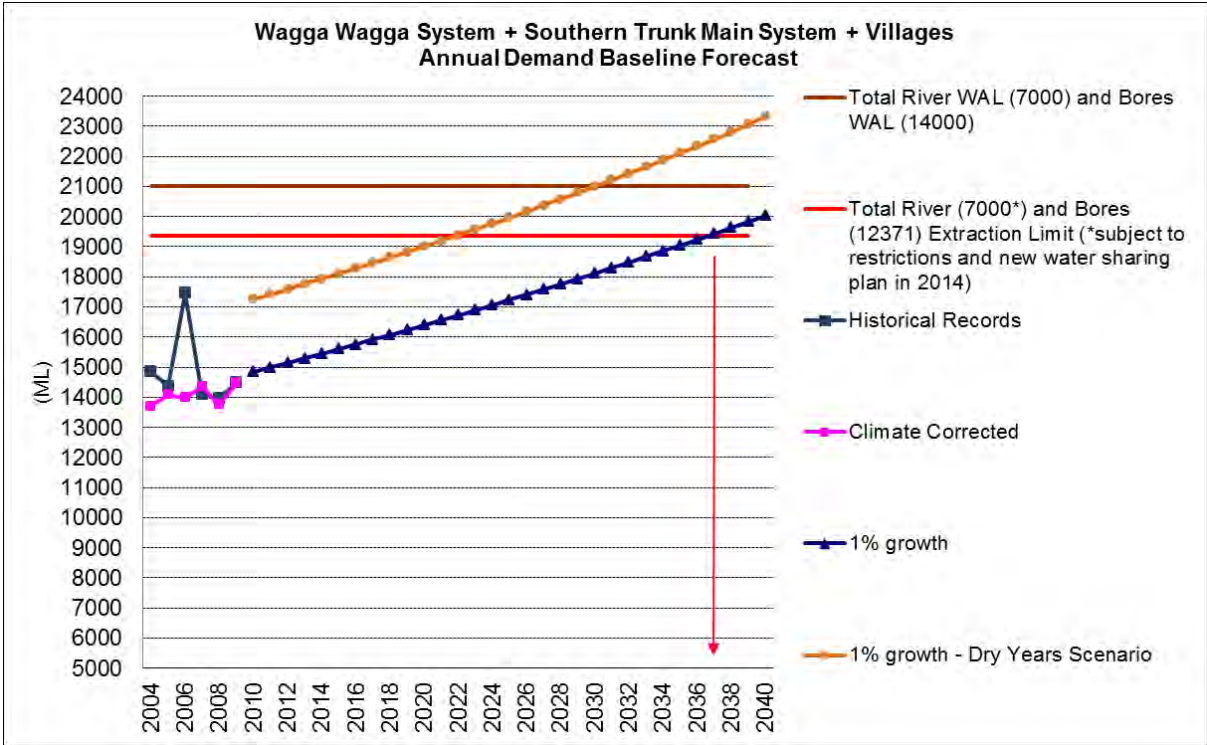
\* 10.2 ML/d is the peak day contribution from the West Wagga Wagga Works to the Southern Trunk Main based on historical analyses of demand records undertaken by RWCC staff.

\*\* The Gardeners Crossing Treatment Plant capacity of 2.6 ML/d is estimated using the hydraulic model developed by Hunter Water Australia (Source: email from G.Grant 25 May 2011).

## 5.2 Annual Demand Analyses

A historical demand analysis was performed for the combined Wagga Wagga System (including Brucedale, Currawarna and Ladysmith) and Southern Trunk Main System. The analysis included climate correction of the historical production data to correct for the effects of climate. Figure 2 shows the outcome of the historical demand analyses and the predicted annual demand of these systems. It also shows the current licence allocation and water availability for these systems. The start year of the demand projections is the average of 6 years of climate corrected annual demand.

RWCC is concerned about security of water supply around the Riverina region due to the recent drought impact on water demand. A 'dry year scenario' was developed to illustrate the impact of drought on annual demand (see Figure 2). This approach was not used for demand management decision making. It only highlights the need for demand management in the Riverina region. The expected annual demand in the Wagga Wagga System in 30 years on a dry year scenario is approximately 3,300ML higher than the expected annual demand on a 'normal' year.

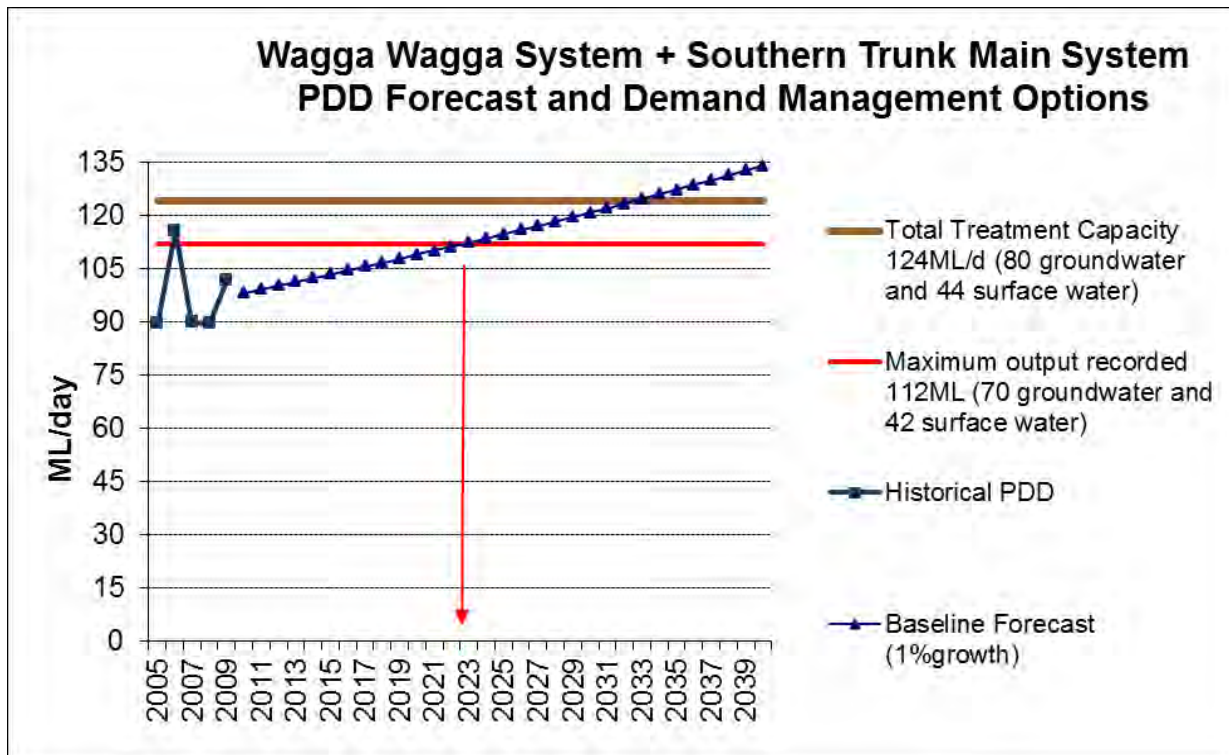


**Figure 2: Wagga Wagga and Southern Trunk Main Systems Climate Corrected Annual Demand Forecast including a Dry Year Scenario**

(Source: Joint IWCM Evaluation Study, March 2010).

**5.3 Peak Day Demand Analyses**

A historical peak day demand (PDD) and forecast analysis was performed for the Wagga Wagga and Southern Trunk Main Systems. Figure 3 shows the historical and predicted PDD, the design capacity of the systems and the maximum output ever recorded.



**Figure 3: Wagga Wagga System Peak Day Demand**

The current total treatment capacity of these systems is 124 ML/day. However RWCC staff have advised that based on historical records, the maximum output from the groundwater sources is 70 ML/day and from surface water is 42 ML/day.

The starting year (2010) for PDD calculations is 88ML/d which is the average of the last 6 years PDD. RWCC will need to address the significance of actual historical peaks when undertaking acute infrastructure designs. That will then determine if the starting point for the growth projection should be the average figure or the peak figure. The acute design that RWCC is currently undertaken shows little difference between the average line projection show in figure above and the projection from the adjusted actual peak day analyses for the past 12 years of 88 ML/d.

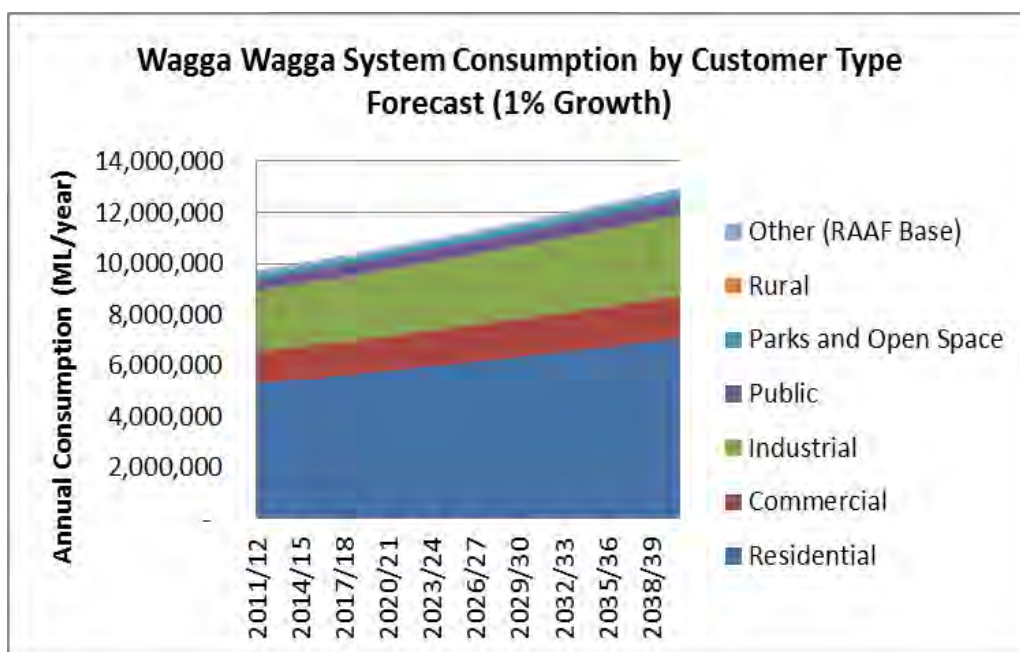
#### 5.4 Demand Forecast for Each Customer Category

A demand forecast analysis for each customer type within Wagga Wagga and Southern Trunk Main Systems have been prepared using 2010/11 observed annual consumption data from Council's billing data base and assuming a growth rate of 1% for the next 30 years. It is assumed that the current ratios between each customer type's water consumption will remain the same over the 30 year planning horizon. The outcomes of each system analysis are provided separately below.



**Table 4: Wagga Wagga System Consumption by Customer Type**

Customer Type	2010/11 (actual)	2040/41 (estimated)	% of Total Water Consumed
Residential	5,248,380	7,074,023	55%
Commercial	1,235,652	1,665,472	13%
Industrial	2,358,746	3,179,233	25%
Public	452,563	609,987	4.7%
Parks and Open Space	184,180	248,247	1.9%
Rural	2,706	3,647	0.03%
Other (RAAF Base)	139,304	187,761	1.4%
<b>Total water consumption (kL)</b>	<b>9,621,531</b>	<b>12,968,370</b>	<b>100%</b>

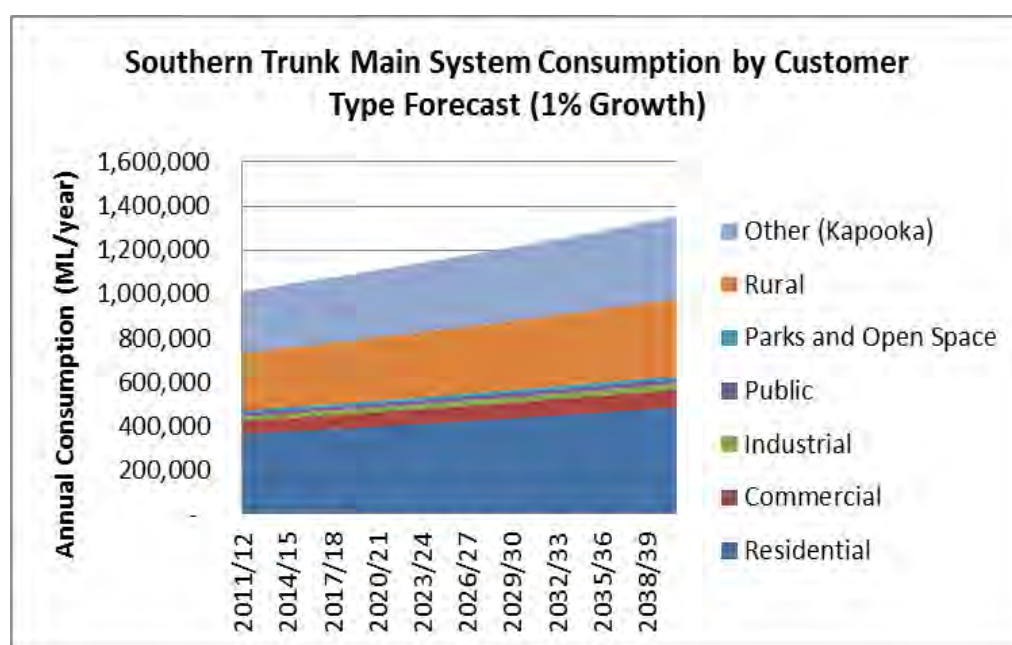


**Figure 4: Wagga Wagga System Consumption by Customer Type**

As shown in Figure 4 the residential and industrial customers are the highest water users within the Wagga Wagga System. RWCC should take this into consideration when determining which demand management measures should be implemented.

**Table 5: Southern Trunk Main System Consumption by Customer Type**

Customer Type	2010/11 (actual)	2040/41 (estimated)	% of Total Water Consumed
Residential	361,436	487,161	36%
Commercial	59,398	80,060	5.9%
Industrial	19,832	26,731	2%
Public	15,176	20,455	1.5%
Parks and Open Space	12,400	16,713	1.2%
Rural	259,956	350,381	26%
Other (RAAF Base)	275,735	371,649	27%
<b>Total water consumption (kL)</b>	<b>1,003,933</b>	<b>1,353,150</b>	<b>100%</b>



**Figure 5: Southern Trunk Main System Consumption by Customer Type**

As shown in Figure 5 residential and rural customers are the highest water users within the Southern Trunk Main System. At this stage, there is little information about the rural customers water use, therefore a demand management measure for the rural customers is difficult to define. See further information in section 8.2.19.

## 6 Western Trunk Main System

### 6.1 System Overview

The Western Trunk Main System is comprised of villages and rural farms along the Southern Trunk Main as described in section 3. The growth rate adopted for this study was 0.6% growth. The estimated 2008 population of this system is 3,194 people. (Source: Joint IWCM Evaluation Study, 2010).

Raw water sources that supply water to this system are listed in Table 6.

**Table 6: Western Trunk Main System Raw Water Sources**

Raw Water Source	Location	Capacity	Licence (Water allocation)
<b>Surface Water</b>			
Colombo Creek	Urana	Pump No – 90 L/s	195 ML/year
<b>Groundwater</b>			
Bulgary Bores	Bulgary	Bore No.1 – 38 L/s Bore No.2 – 38 L/s Bore No.3 – 7 L/s	1000 ML/year

**RWCC operates two water supply facilities within this system; they are listed in**

Table 7.

**Table 7: Western Trunk Main System Water Treatment Plants**

Water Treatment Plant	Raw Water Source	Water Treatment Process	Capacity
Urana Filtration Plant	Colombo Creek	Treatment consists of sedimentation process, chlorination and fluoridation.	1 ML/day
Bulgary Source Works	Bulgary Bores	Treatment consists of aeration and chlorination.	3.24 ML/day

### 6.2 Annual Demand Analyses

The Western Trunk Main System historical annual demand analysis was climate corrected to account for climate variability. The historical and predicted annual demand forecasts are shown in Figure 6.

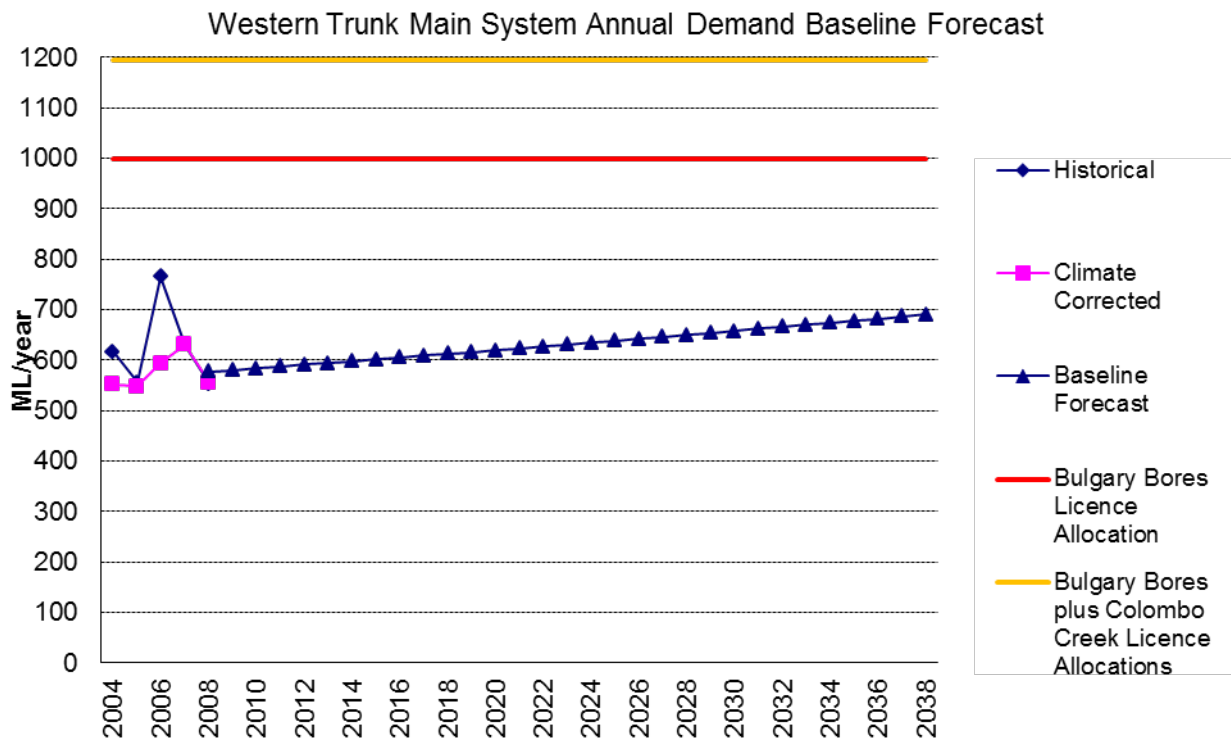


Figure 6: Western Trunk Main System Annual Demand Forecast

### 6.3 Peak Day Demand Analyses

A historical peak day demand (PDD) and forecast analysis was performed for the Western Trunk Main System. Figure 7 shows the Western Trunk Main System historical and predicted PDD. The starting year chosen for this analysis is the average PDD in the past 5 years.

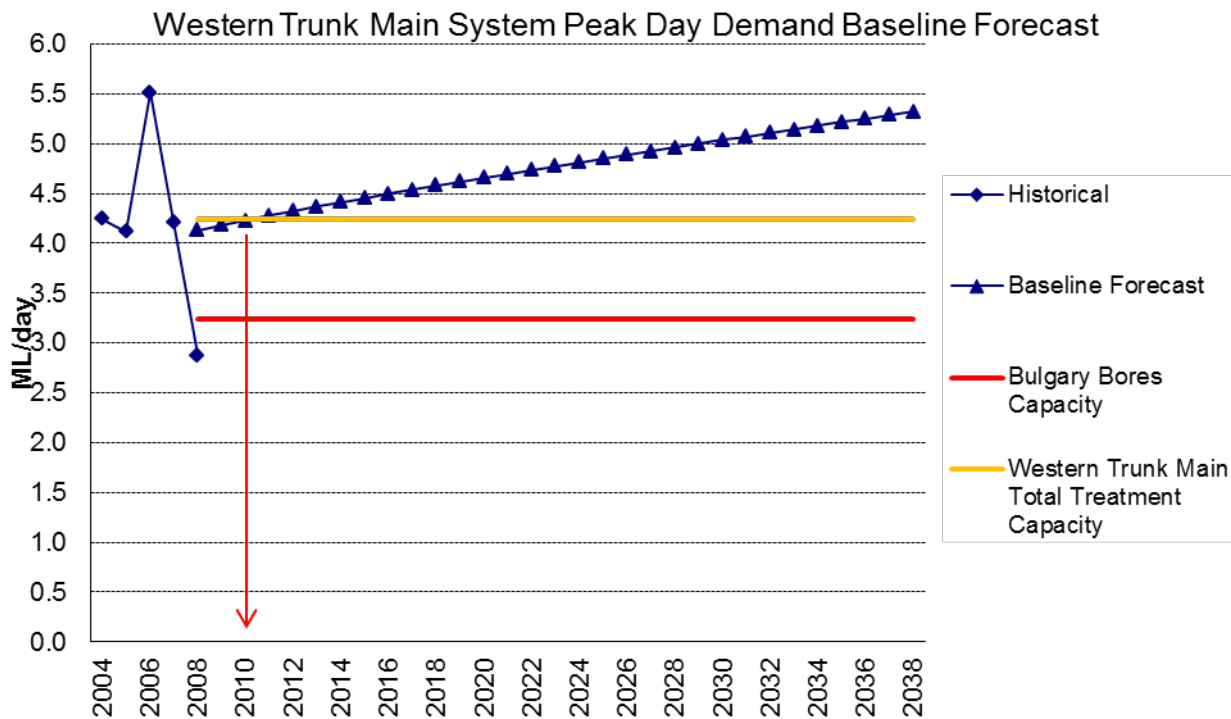


Figure 7: Western Trunk Main System PDD Analyses

The graph shows that the capacity of the system to supply PDD is strained. The total capacity of the system to supply 4.2 ML/d occurs during summer when the Urana Filtration Plant is also operated. This analyses show the importance of implementing demand management in the Western Trunk Main System.

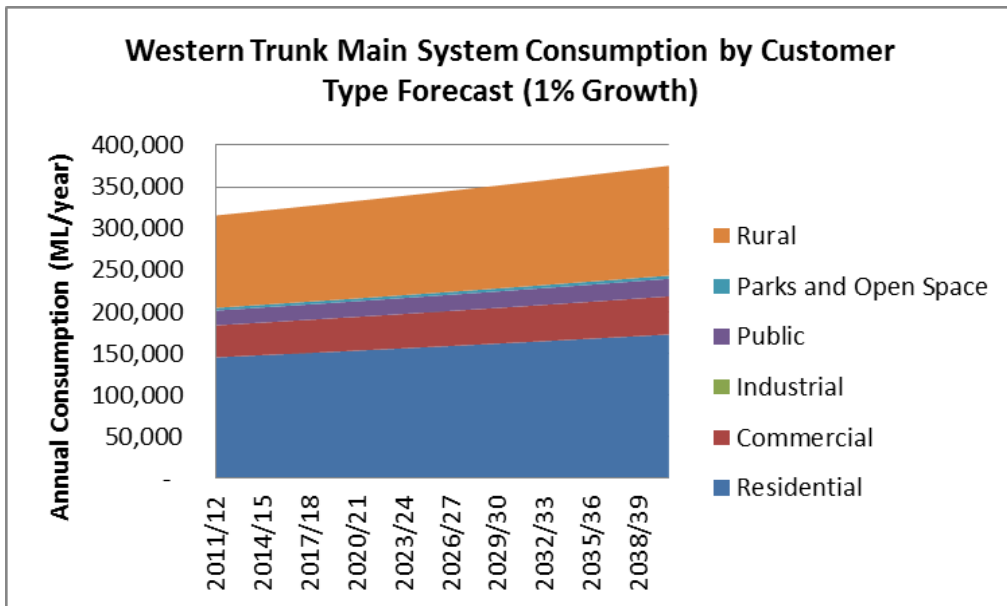
The starting year for PDD is the average of the last 5 years of PDD. However RWCC will need to address the significance of actual historical peaks when undertaking acute infrastructure designs. That will then determine if the starting point for the growth projection should be the average of the last 5 years of PDD or the actual PDD from the last 5 years.

#### 6.4 Demand Forecast for Each Customer Category

A demand forecast analysis for each customer type within Western Trunk Main System has been prepared using 2010/11 observed annual consumption data from Council's billing data base and assuming a growth rate of 0.6% for the next 30 years. It is assumed that the current ratios between each customer type's water consumption will remain the same over the 30 year planning horizon.

**Table 8: Western Trunk Main System Consumption by Customer Type**

Customer Type	2010/11 (actual)	2040/41 (estimated)	% of Total Water Consumed
Residential	144,480	172,881	46%
Commercial	38,189	45,696	12%
Industrial	-	-	0%
Public	17,697	21,176	5.6%
Parks and Open Space	3,192	3,819	1.0%
Rural	110,187	131,847	35%
Other (RAAF Base)	144,480	172,881	46%
<b>Total water consumption (kL)</b>	<b>313,745</b>	<b>375,419</b>	<b>100%</b>



**Figure 8: Western Trunk Main System Consumption by Customer Type**

As shown in Figure 8 residential and rural customers are the highest water users within the Western Trunk Main System. At this stage, there is little information about the rural customers water use, therefore a demand management measure for the rural customers have not been defined. See further information in section 8.2.19.

## 7 Independent Villages

RWCC operates 8 Independent Village’s water supply systems. Details of each system including its infrastructure capacity, annual demand, PDD and demand by customer type are provided in Appendix A. Analyses of the impact of demand management measures in each system are provided in section 9.

# 8 Demand Management Planning

## 8.1 Demand Management Drivers

For this study the main drivers of demand management in Riverina are considered to be:

- ❑ Peak Day Demand (PDD) infrastructure, including:
  - cost of infrastructure,
  - high discretionary water use (PDD to average daily demand ratio in RWCC is very high)
- ❑ Only 20% of existing infrastructure is designed to supply more than 1 consecutive days of PDD
- ❑ Stringent groundwater sharing allocations
- ❑ Lack of water availability during drought or hot weather conditions
- ❑ Need to reduce demand and environmental impact
- ❑ Need to reduce capital works costs (i.e. new Wagga Wagga Water Treatment Plant(WTP))
- ❑ Need to ensure the new WTP capacity will be sufficient to supply growth in demand in the next 30 years
- ❑ Competition for water through water trading
- ❑ Increasing regulatory requirements
- ❑ Community will need to and expect to use water more efficiently

### 8.1.1 Unaccounted for Water (UFW)

#### 8.1.1.1 Definition

The International Water Association (IWA) terminology for unaccounted for water is: "The difference between the volume of water entering a reticulated system and the recorded use, due to system leaks, (e.g. leakage, bursts and reservoir overflows) and un-metered uses (e.g. unauthorised consumption and under-registration of customer meters)." (i.e. difference between the metered water production and the metered water consumption). (Source: AWA website, accessed 11 April 2012)

Unbilled water supplied (fire fighting and mains flushing) is not considered unaccounted for water but is a component of non-revenue water." (Source: 2010/11 NSW Water Supply and Sewerage Performance Monitoring Report, March 2012, NSW Office of Water).

#### **8.1.1.2 RWCC's UFW Analyses Limitations**

The RWCC water supply systems' UFW analyses have some limitations due to the complexity of the water supply network systems and the difficulty in breaking down the production data records and the billing system data into the same boundaries. This means that when comparing production against consumption data the physical boundaries could be different. The following inaccuracies should be taken into consideration when analysing RWCC water supply systems' UFW analyses:

- ❑ The normal meter reading data is associated with their respective Route Code, however, corrections to misread meters, special reads, etc, are allocated to a special generic Route Code table (9999). The data within this special generic Route table is very difficult to geocode unless undertaken line-by-line analysis in order to allocate into respective systems.
- ❑ Significant effort has been done to geocode the list of Route Codes to each respective system. Unfortunately, not all Route Code tables can explicitly define a system. For example, the Route Codes describing Brucesdale, The Gap-Downside, and Currawarna could not be separated easily without a line-by-line analysis.
- ❑ Recoding customer types over the years due to improvements, corrections etc. For example, reclassification of Residential customers to rural customers.
- ❑ If any attempt to compare with Annual Report Statistics for some of the systems, discrepancies exist due the fact the Annual Report Statistics are based on bulk meters leaving the WTP's, compared to actual billing via customers meters.

#### **8.1.1.3 UFW Results**

Below is a summary of RWCC water supply systems unaccounted for water results? Detailed analyses are provided in Appendix B.



**Table 9: RWCC Water Supply Systems' UFW Outcomes**

	2007/08	2008/09	2009/10	2010/11
Wagga Wagga System	10%	11%	15%	-9%
Southern Trunk Main System	19%	14%	3%	16%
Western Trunk Main System	5%	0.2%	9%	4%
Tarcutta System	32%	19%	3%	4%
Humula System	2%	13%	14%	11%
Woomargama System	13%	28%	4%	11%
Morundah System	31%	27%	24%	39%
Walbundrie/Rand System	13%	9%	11%	4%
Collingullie System	6%	3%	2%	8%
Oura System	17%	15%	16%	18%

Note: There appears to be errors in the Wagga Wagga System 2010/11 data records. Council will review the data and ensure the records are appropriate.

#### 8.1.1.4 RWCC Benchmarking Report on Water Losses

The 2009/10 NSW Benchmarking Report states that water loss is recommended by International Water Association as the best traditional basic technical indicator for real losses, although it does not account for other factors such as length of main or operating pressure. RWCC's real loss (leakage) according to the benchmarking report is 50 L/connection/day or 0.9 kL/km of water mains/day (Source: 2009/10 NSW Water Supply and Sewerage, Benchmarking Report, July 2011, by NSW Office of Water). The average state wide median is 70 L/connection/day. Thus, in the overall system, RWCC performs well in this parameter.

"The Infrastructure Leakage Index (ILI) has been proposed as an indicator which measures how effectively real losses are being managed at current operating pressure while accounting for other influential factors such as length of mains, number of service connections and customer meter location." RWCC ILI is 1.0. ILI values of less than about 1.5 indicate excellent management of real losses, while an ILI close to 1.0 means that the real losses are close to the unavoidable or technical minimum losses. Such low ILI values are only likely to be economically justified where marginal costs of water supply are relatively high (e.g. desalination) or where water is scarce (Source: 2009/10 NSW Water Supply and Sewerage, Benchmarking Report, July 2011, by NSW Office of Water).

### 8.1.1.5 Conclusion

A water loss management program has been implemented in some areas within the RWCC boundaries in the past 2 years. Section 8.2.18 has further information about the benefits of this demand management measure.

The information available at this stage does not provide enough arguments to say that UFW is an issue in the Riverina region. However RWCC has a proactive approach with regards to water loss and Council has maintenance and replacement plans in place to continually improve the water supply systems and maximise water efficiency.

## 8.2 Demand Management Measures

### 8.2.1 Prioritization

This section provides a list of potential water demand management measures for RWCC. Some of these measures are currently implemented and some measures have been implemented in the past, but were found not very valuable at that stage. Further measures that are considered appropriate for RWCC implementation are also included.

Some of these measures are requirements from the NSW Government, such as BASIX and best-practice pricing structure. Others are ongoing activities to encourage RWCC customers to use water wisely. The list of demand management measures and their implementation status are provided below.

	Status
Permanent Water Conservation Measures	Currently in place
Residential nature strips and outdoor culture change	Currently in place
Public education programs	Currently in place
BASIX program	Currently in place
Full pay-for-use pricing	Currently in place
Monitoring program	Currently in place
Meter replacement program	Currently in place
Water loss management program	No longer in place
Toilet replacement program	No longer in place
Outdoor watering DCP	Recommended
Non-revenue leak and pressure management program	Recommended
Water audit – industrial customers	Recommended
Showerhead swap	Recommended

	Status
Evaporative cooling education campaign	Recommended
Residential water fixtures retrofit	Recommended
Commercial nature strips	Recommended
Water audit – hotels	Recommended
Water audit - schools	Recommended

Two scenarios of demand management (i.e. high and low levels) were analyzed for application in the Wagga Wagga and Southern Trunk Main Systems. The two packages were analyzed and discussed in meetings with Council staff and the preferred demand management package recommended is the low level demand management package.

RWCC recognizes the importance of implementing the same demand management measures across all of the Riverina water supplied region due to social and financial benefits. The impacts of implementing demand management are expected to be at the same ratio in all water supply systems. The results of implementing the low demand management package in each of the RWCC water supply systems are provided in section 9.

In order to prioritise the demand management measures implementation the demand measures benefits have been assumed to be the cost saved from not treating the water in 2022 (i.e. demand management measure cost is the cost of saving production (kL/day) in 2022).

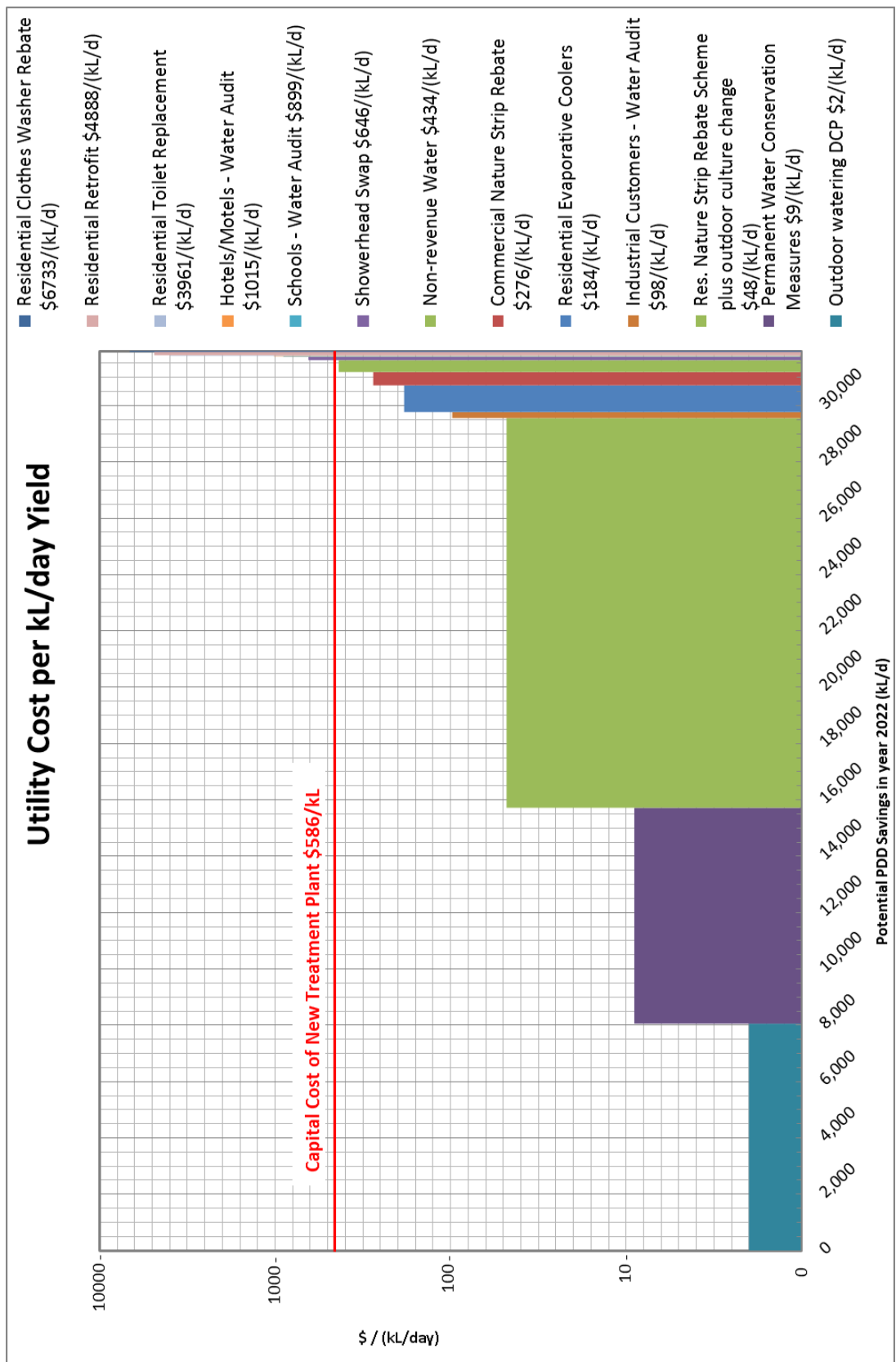
This is compared to the production cost of treating an additional kL/day of potable water in 2022. The production cost per kilolitre is calculated using the Net Present Value (NPV) (\$586) of the total cost of the new water treatment plant (this cost excludes the infrastructure costs to store and pump) and the maximum daily capacity of the treatment plant (55ML/d).

The cost/benefit of each demand management measure is calculated using the net present value (NPV) of the direct implementation cost of the option to the LWU divided by the potential PDD savings in 2022. The unit cost of water (kL/day) of each measure is provided in the Figure 9 legend. This is referred to as the utility implementation cost per PDD saving. The graph also shows which demand management measures have better cost/benefit than the cost of producing a kilolitre of potable water.

Based on the assumptions used in these analyses and the outcomes shown in the graph all the options below the red line are considered to be economically and

environmentally feasible for implementation in RWCC. However, some other demand management measures may be found to be feasible when the full cost of building a new WTP, including storage, pumps, pipes, etc, is taken into consideration. This prioritization of the demand management measures is just a guideline to assist RWCC in the demand management decision making process.

Each of the demand management measures and their benefits are described in the following sections. The demand management measures are listed in priority order based on cost/benefit ratio. Appendix C provides further information about the demand management measures that are currently implemented by RWCC. Appendices D and E provide further description, take up rates, costs and savings assumptions about the recommended demand management measures.



**Figure 9: Cost/Benefit Analyses of Demand Management Measures**

Note: The graph is plotted in logarithmic format to enhance the presentation of the analyses outcomes. The actual cost/benefit outcomes of each demand measure are listed in the legend.

### 8.2.2 Outdoor Watering DCP

This measure assumes that Wagga Wagga City Council (WWCC) will include in their Development Control Plans (DCP) an item prohibiting irrigated lawns on nature strips in new developments. RWCC is expected to advertise this program for a period of 3 years. Major outcomes of implementing this measure in the Wagga Wagga and Southern Trunk Main Systems are:

- ❑ Utility Implementation cost per PDD saving: \$2/(kL/day)
- ❑ Utility NPV of implementation cost: \$14,544
- ❑ Potential PDD savings in 2022: 8 ML/d
- ❑ Potential annual water saved in 2022: 367 ML
- ❑ 30 years average water savings: 518 ML/year

If RWCC decides to implement this measure, Council will have to negotiate with WWCC to include a clause in the DCP in regards to this demand management measure. This measure is not applicable to water supply systems outside Wagga Wagga LGA.

### 8.2.3 Permanent Water Conservation Measures

RWCC implemented permanent water conservation measures in January 2010. All residential, commercial and public customers are required to participate. This measure prohibits irrigation using fixed sprinklers between the hours of 10am and 5pm.

The DSS Model from the NSW Office of Water was developed for the Wagga Wagga System using 2008/09 climate corrected production data. The model estimated water use reduction from implementing such water conservation measure of 8% of total production. This was then applied to the Demand Management End Use Model to calculate the estimated water savings and costs of implementing this measure in the Wagga Wagga and Southern Trunk Main Systems.

Major outcomes of implementing this measure in the Wagga Wagga and Southern Trunk Main Systems are:

- ❑ Utility Implementation cost per PDD saving: \$9/(kL/day)
- ❑ Utility NPV of implementation cost: \$66,718
- ❑ Potential PDD savings in 2022: 7.6 ML/d
- ❑ Potential annual water saved in 2022: 350 ML
- ❑ 30 years average water savings: 367 ML/year

## 8.2.4 Residential Nature Strips Rebate Scheme and Outdoor Culture Change

In December 2011 RWCC commenced the implementation of the Nature Strip Rebate Scheme. The scheme provides rebates for customers replacing irrigated lawn on nature strips with an approved water efficient design (i.e. ban watering of nature strips).

In 1<sup>st</sup> July 2012 RWCC expanded this scheme to all Riverina Water customers with kerb and gutter outside of Wagga Wagga. The scheme is 50% funded through RWCC and the Australian Government's "Water for the Future" initiative through the "Strengthening Basin Communities program".

Initially it is expected that approximately 5% of the 21,000 residential customers in Wagga Wagga will participate. The water savings per customer are expected to be approximately 52kL per customer per annum. This is based on an irrigation water balance model which assumes substitution of 50m<sup>2</sup> of grass nature strip with hardy native plants that don't require watering.

RWCC has advised that the unit cost of implementing this program is approximately \$1,200 per customer. The marketing cost of the program excluding staff costs is \$17.5K per year for 2 years. The program administration and evaluation is expected to be \$120K per year for 2 years. (Source: RWCC staff, personal communication, 05 June 2012).

RWCC has advised that the residential nature strips program will create a flow-on effect within Wagga Wagga customers. This is referred to as the Outdoor Culture Change program which identifies that based on the original program customers copy each other and re-landscape their nature strips, front lawns and back lawns to save water or use water more efficiently. RWCC expects to spend \$50K in marketing per year for 8 years. RWCC expects that an extra 50% of the Wagga Wagga System customers will take up the 'outdoor culture change' over another 8 years.

The water savings per customer is expected to be 52kL per annum. This is based on the irrigation water balance model substituting 50m<sup>2</sup> of grass nature strip with hardy native plants. The flow-on effect is expected to happen voluntarily. This means the customer will have to pay for the full cost of implementation. At this stage the extent of the cost is unknown because it is hard to determine how much grass will be replaced voluntarily.

Major outcomes of implementing this measure in the Wagga Wagga and Southern Trunk Main Systems are:

- ❑ Utility Implementation cost per PDD saving: \$48/(kL/day)
- ❑ Utility NPV of implementation cost: \$663,848
- ❑ Potential PDD savings in 2022: 13.8 ML/d
- ❑ Potential annual water saved in 2022: 631 ML
- ❑ 30 years average water savings: 505 ML/year

### 8.2.5 Water Audit – Industrial Customers

This measure assumes that industrial customers will undergo water audits over a 2 year period to identify and replace inefficient water fixtures with water efficient fixtures. The hotels and motels are also expected to carry out air-conditioning maintenance.

Major outcomes of implementing this measure in the Wagga Wagga and Southern Trunk Main Systems are:

- ❑ Utility Implementation cost per PDD saving: \$398/(kL/day)
- ❑ Utility NPV of implementation cost: \$84,611
- ❑ Potential PDD savings in 2022: 213 kL/d
- ❑ Potential annual water saved in 2022: 52 ML
- ❑ 30 years average water savings: 36 ML/year

### 8.2.6 Residential Evaporative Coolers Education Campaign

This measure involves 5 years of maintenance visits and an education campaign to educate customers to turn the coolers down and when not at home to turn them off.

Major outcomes of implementing this measure in the Wagga Wagga and Southern Trunk Main Systems are:

- ❑ Utility Implementation cost per PDD saving: \$184/(kL/day)
- ❑ Utility NPV of implementation cost: \$174,565
- ❑ Potential PDD savings in 2022: 948 kL/d
- ❑ Potential annual water saved in 2022: 43 ML
- ❑ 30 years average water savings: 26 ML/year

### 8.2.7 Commercial Nature Strips Rebate

Council will provide rebates for a period of 4 years for commercial customers re-landscaping their properties. Major outcomes of implementing this measure in the Wagga Wagga and Southern Trunk Main Systems are:

- ❑ Utility Implementation cost per PDD saving: \$276/(kL/day)
- ❑ Utility NPV of implementation cost: \$130,280
- ❑ Potential PDD savings in 2022: 472 kL/d
- ❑ Potential annual water saved in 2022: 22 ML
- ❑ 30 years average water savings: 14 ML/year

This measure is not applicable to water supply systems outside Wagga Wagga LGA, due to the size of the commercial customers outside Wagga Wagga.



### 8.2.8 Non-Revenue Water - Leak and Pressure Management Program

This is expected to be an ongoing program which includes leak detection and repair, and pressure management program. Major outcomes of implementing this measure in the Wagga Wagga and Southern Trunk Main Systems are:

- ❑ Utility Implementation cost per PDD saving: \$434/(kL/day)
- ❑ Utility NPV of implementation cost: \$183,638
- ❑ Potential PDD savings in 2022: 423 kL/d
- ❑ Potential annual water saved in 2022: 155 ML
- ❑ 30 years average water savings: 155 ML/year

### 8.2.9 Showerhead Swap

Council will provide \$18 per showerhead for a period of 4 years. Household holders will take their old showerhead to a shopfront location and swap for a new one. Major outcomes of implementing this measure in the Wagga Wagga and Southern Trunk Main Systems are:

- ❑ Utility Implementation cost per PDD saving: \$646/(kL/day)
- ❑ Utility NPV of implementation cost: \$71,144
- ❑ Potential PDD savings in 2022: 110 kL/d
- ❑ Potential annual water saved in 2022: 40 ML
- ❑ 30 years average water savings: 25 ML/year

### 8.2.10 Water Audit - Schools

This measure assumes that schools will undergo water audits for 4 years. The audit will include installation of alarm systems for monitoring leaks and facilitating education programs. Major outcomes of implementing this measure in the Wagga Wagga and Southern Trunk Main Systems are:

- ❑ Utility Implementation cost per PDD saving: \$899/(kL/day)
- ❑ Utility NPV of implementation cost: \$19,093
- ❑ Potential PDD savings in 2022: 21 kL/d
- ❑ Potential annual water saved in 2022: 5 ML
- ❑ 30 years average water savings: 3 ML/year

### 8.2.11 Water Audit – Hotels/Motels

This measure assumes that hotels and motels will undergo water audits over a 2 year period to identify and replace inefficient water fixtures with water efficient fixtures. The hotels and motels are also expected to carry out air-conditioning maintenance.

Major outcomes of implementing this measure in the Wagga Wagga and Southern Trunk Main Systems are:

- ❑ Utility Implementation cost per PDD saving: \$1,015/(kL/day)
- ❑ Utility NPV of implementation cost: \$23,051
- ❑ Potential PDD savings in 2022: 23 kL/d
- ❑ Potential annual water saved in 2022: 6 ML
- ❑ 30 years average water savings: 4 ML/year

### 8.2.12 Toilet Replacement Program

In 2010 RWCC implemented the toilet replacement program which involved complete toilet replacement. This was the Caroma Scheme taken up by ACTEW and numerous councils in NSW.

The scheme required plumbers to be members of the NSW Master Plumbers Association. Less than 10% of Wagga Wagga plumbers are members, thus only 26 retrofits were completed with negligible impact on water savings. Council decided to discontinue the program. (Source: Riverina Water County Council 2011/12 Operational Plan - Draft)

For the purposes of this demand management analyses the toilet replacement program has been modelled to identify the benefits of future implementation. Major outcomes of implementing this measure in the Wagga Wagga and Southern Trunk Main Systems are:

- ❑ Utility Implementation cost per PDD saving: \$3,961 / (kL/day)
- ❑ Utility NPV of implementation cost: \$81,208
- ❑ Potential PDD savings in 2022: 21 kL/d
- ❑ Potential annual water saved in 2022: 7 ML
- ❑ 30 years average water savings: 6 ML/year

### 8.2.13 Residential Water Fixtures Retrofit

Council will implement a program to pay a plumber to visit residential customers and replace showerheads, install tap flow regulators (kitchen & bathroom), install a cistern weight in single flush toilets, check for leaks and provide advice over a period of 4 years. Major outcomes of implementing this measure in the Wagga Wagga and Southern Trunk Main Systems are:

- ❑ Utility Implementation cost per PDD saving: \$4,888 /(kL/day)
- ❑ Utility NPV of implementation cost: \$577,927
- ❑ Potential PDD savings in 2022: 118 kL/d
- ❑ Potential annual water saved in 2022: 43 ML
- ❑ 30 years average water savings: 27 ML/year

#### **8.2.14 Residential Clothes Washer Rebate**

Council will provide rebates over a period of 4 years, for customers replacing top loaders machines with 5 star front loaders. The major outcomes of implementing this measure in the Wagga Wagga and Southern Trunk Main Systems are:

- ❑ Utility Implementation cost per PDD saving: \$6,733 /(kL/day)
- ❑ Utility NPV of implementation cost: \$229,411
- ❑ Potential PDD savings in 2022: 34 kL/d
- ❑ Potential annual water saved in 2022: 12 ML
- ❑ 30 years average water savings: 8 ML/year

#### **8.2.15 Public and School Education Programs**

RWCC gives strong support to wise use of water by involvement with relevant programmes and through publicity in advertising and editorial contributions when water is featured in the regional press. Council staff is available to give advice on household plumbing, water use and leak detection. A range of helpful and supportive fact sheets are available on RWCC's website, these include:

- ❑ Be waterwise indoors
- ❑ Be waterwise outdoors & in the garden
- ❑ Be waterwise in the workplace
- ❑ Water tips
- ❑ How to detect a leak & how much water is lost from a leaking tap?

Fact sheets about these programs are provided in Appendix C. The annual cost to run this program is approximately \$60K per year. Some of the expenses included are promotional materials, ongoing advertising, administration cost, and sponsorship of events and membership of Water Save Alliance. Council will also provide education at schools about water savings. RWCC advised that the cost of providing a teacher every 5 years for 2 consecutive years will be approximately \$100 K per year.

Estimation of water saved due to education programs cannot be quantified. However RWCC is confident that these types of programs have a great impact on the community perspectives about the importance and the value of water.

### **8.2.16 BASIX – Rainwater Tanks**

Since July 2004 the NSW Government implemented the Building Sustainability Index (commonly referred to as BASIX) with the purpose of reducing the use of potable water and to produce less greenhouse gas emissions. One of the BASIX requirements is installation of a rainwater tank in new developments.

A rainwater tank assessment was prepared in the IWCM Evaluation Study (2010). The outcomes of the analyses shown that if 50% of the existing customers and all new developments installed a 5 kL rainwater tank, it would provide 11% of the total demand. The reduction was considered average and recognized not to be sufficient specifically during dry years when there are lower rainfall events and the demand increases due to higher temperature. Also the financial analysis had proven that the cost of water from rainwater tanks is not viable, being significantly higher (\$2.10/kL) than the actual usage charge (\$0.95/kL in 2011/12).

Council has advised that very few customers in Wagga Wagga install rainwater tanks to get their BASIX points and that the established homes built under BASIX (e.g. in new parts of Glenfield) show no evidence of reduced usage.

### **8.2.17 Pricing**

The NSW Government Best-Practice Management of Water Supply and Sewerage Guidelines require LWUs with over 4,000 connections to have:

- ❑ Residential water usage charges set to recover at least 75% of residential revenue.
- ❑ A two-part tariff with an appropriate water usage charge/kL based on the long-run marginal cost. High water consuming residential customers should be subjected to a step price increase of at least 50% for incremental usage above a specified threshold.
- ❑ Customer water consumption billed at least three times a year (and preferably quarterly)

Approximately 79% of RWCC's residential income was generated from its water usage charge in 2010/11. RWCC water charges are summarized below.

**Table 10: RWCC Water Charges**

RWCC Availability & Usage Charges		2011/12	2012/13
<b>Access Charge</b>			
Built upon or connected property	Wagga Wagga	\$25 per quarter	\$30 per quarter
	rural, towns & villages	\$30 per quarter	\$30 per quarter
<b>Water Usage Charge</b>		<b>\$/kL</b>	
Residential properties	First 125 kL per quarter	\$0.95	\$1.10
	Balance	\$1.42	\$1.66
Non-residential - Industrial	First 41 kL per month	\$0.95	\$1.10
	42 to 3,000 kL per month	\$1.42	\$1.66
	Balance	\$1.42	\$1.66
Commercial	First 125kL per quarter	\$0.95	\$1.10
	Balance	\$1.42	\$1.66

(Source: RWCC Operational Plan 2012/13)

In 2010/11 the threshold volume for the second tier was 150kL. RWCC has adopted the 2012/13 water charges provided above. A decrease in the threshold amount and the increase in water bills are expected to cause reduction in water consumption.

### 8.2.18 Water Loss Management Program

RWCC joined the NSW Water Directorates Water Loss Management Program in November 2009. The program was subsidised under a federally funded grant. In October 2010 RWCC commenced an active leakage detection and repairs program at Walla Walla, Oaklands, Lockhart, Boree Creek and Gregadoo.

The leak detection was undertaken by a specialist contractor. The repairs were carried out by RWCC staff as well as a post-rehabilitation monitoring program.

The water saved in each of the locations is listed below:

- ❑ Walla Walla: 6 ML/year
- ❑ Oaklands: 7.9 ML/year
- ❑ Boree Creek: 2.2 ML/year
- ❑ Gregadoo Zone: 4.7 ML/year
- ❑ Lockhart: post rehabilitation data was not captured due to equipment failure. However leak detection only found 1 leak

This program has been completed; however to complement the water loss program and also to improve water accounting, RWCC will continue the installation of accurate mag-flow bulk meters. RWCC will also continue to replace water meters once they have exceeded 10 years in age. (Source: Riverina Water County Council 2011/12 Operational Plan – Draft).

RWCC expects to spend approximately \$200K per year for 5 years, starting in 2013/14. The costs for the continuation of this program will include night testing, installation of zone valves and bulk meters to identify zones that need further work and fixing the problems identified. UFW analyses were undertaken for all RWCC water supply systems. Section 8.1.1 shows a summary of the estimated water losses in all RWCC water supply systems.

### **8.2.19 Demand Management with Rural Customers**

In 2010/11 the Southern Trunk System had 523 rural connections who used approximately 26% of the total water supplied in that system. 1,703 residential customers used 36% of the total water supplied.

The Western Trunk System had 183 rural connections who used approximately 35% of the total water supplied in that system. 765 residential customers used 46% of the total water supplied.

Information about each rural customers water use is not currently available. Due to the high rural water usage of some of the RWCC customers, RWCC should consider starting a selective audit process to identify how much water each rural customer uses. This would assist Council in identifying demand management measures to target the high rural water users.

It is recommended that RWCC undertake demand end use analyses of the rural customers. The outcome of this analysis would allow Council to determine appropriate water demand management measures for the rural customers. RWCC estimates that approximately \$50,000 would be required for this study. Source: Demand Management workshop at RWCC, 13 February 2012.

RWCC shall address the high rural customers' consumption within the next 5 years.

### **8.3 Summary of Demand Management Measures Outcomes**

All the demand management measures listed above are summarized in Table 11 for comparison. The comparison analysis also includes the percentage of expected water savings from total demand forecast in 2022. It also includes customer and utility financial savings related to reduction in water consumption and production, based on RWCC's current charges and operational costs, respectively.

**Table 11: Demand Management Measures Comparison**

Demand Management Measures	30 year Average Annual Savings (ML/yr)	Cost/PDD saved (\$/(kL/day) (2012\$)	Potential Annual water saved in 2022 (ML)	% of Water Savings from total demand in 2022	Customers 30 year average savings (\$/year)*	Utility 30 year average savings (\$/year)*
Outdoor Watering DCP	518	2	367	2.2%	\$569,947	\$440,414
Permanent Water Conservation Measures	367	9	350	2.1%	\$403,461	\$311,766
Residential Nature Strips Rebate Scheme and Outdoor Culture Change	505	48	631	3.7%	\$555,371	\$429,150
Water audit – industrial customers	36	398	52	0.31%	\$39,584	\$30,588
Evaporative Cooling Education Campaign	26	184	43	0.26%	\$28,051	\$21,676
Commercial Nature Strips	14	276	22	0.13%	\$15,333	\$11,848
Non-revenue water - leak and pressure management program	155	434	155	0.92%	\$170,811	\$131,990
Showerhead swap	25	646	40	0.24%	\$27,252	\$21,058
Water audit – schools	3	899	5	0.03%	\$3,504	\$2,707
Water audit – Hotels/Motels	4	1,015	6	0.03%	\$4,227	\$3,267
Toilet Replacement	6	3,961	7	0.04%	\$6,821	\$5,271
Residential Water Fixtures Retrofit	27	4,888	43	0.26%	\$29,246	\$22,599
Residential Clothes Washer Rebate	8	6,733	12	0.07%	\$8,478	\$6,551

\*Customer average savings is calculated based on 2012/13 usage charge of \$1.10 and utility average savings is calculated based on 2010/11 operational cost per kilolitre of \$0.85. (Source: RWCC Operational Plan 2012/13 and 2010/11 TBL Performance Report). The usage charge and the operational costs are multiplied by the 30 years average water savings from implementing demand management.

Section 9 provides the implementation costs of all the demand management measures listed above. The implementation plan only includes the measures that are considered cost-effective which are recommended for implementation in the near future.

## 9 Proposed Implementation Plan

This section presents the proposed implementation plan of the water demand management measures recommended for implementation in the next 10 years. Council should monitor and review the demand management measure benefits and costs every two years to ensure the reductions expected are being achieved.

The demand management measures recommended to be implemented are the measures that are the most cost-effective when compared to the capital cost of the new water treatment plant for production of one kilolitre of potable water (i.e. all the measures that are under the red line in Figure 9). This does not indicate that the other demand management measures are not feasible or appropriate because in this analysis we are only including the capital cost of the treatment plant. The infrastructure costs to store and pump the water have not been taken into consideration.

The demand management measures recommended to be implemented are listed in Table 12. This Demand Management Plan's recommendation differs from the IWCM Detailed Strategy in that the number of measures that are included in the "low level" demand management package. However, the total water savings aims to achieve the same levels of reduction.

This implementation plan supersedes the low level demand management package outcomes and recommendations from the IWCM Detailed Strategy. The implementation plan sets out the timeframe for implementation of the demand management measures and their estimated costs.

At this stage it is assumed that all demand management measures are implemented in year one. The costs are estimated using the best available data at the time and they are provided for comparison purposes. Further investigation and ongoing review of the systems is needed to confirm the actual costs. The final implementation is determined by RWCC in its annual Management Planning process.

RWCC proposes to implement demand management measures to all Riverina Water customers, including urban and rural customers. As previously mentioned, there are two demand management measures that will not be implemented in the rural areas (i.e. Non Wagga urban), these are Outdoor Watering DCP (banning of irrigated laws) and Commercial Nature Strips Rebate (rebates for re-landscaping nature strips). Source: Demand Management workshop at RWCC, 13 February 2012.

Other than the measures described in the paragraph above the implementation costs provided below are related to the implementation of the demand management measures across all the water supply schemes operated by RWCC.



**Table 12: Recommended Demand Management Measures Implementation Plan**

Demand Management Measure		NPV (2012\$)	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22
Outdoor Watering DCP (in Wagga Wagga only)	LWU	\$14,544	\$5,000	\$6,000	\$1,000	\$5,000	-	-	-	-	-	-
	Customer	-	-	-	-	-	-	-	-	-	-	-
Permanent Water Conservation Measures	LWU	\$39,791	\$10,000	\$5,000	\$5,000	\$5,000	\$5,000	\$5,000	\$5,000	\$5,000	\$5,000	\$5,000
	Customer	-	-	-	-	-	-	-	-	-	-	-
Residential Nature Strips Rebate Scheme	LWU	\$453,425	\$95,373	\$417,078	-	-	-	-	-	-	-	-
	Customer	\$626,607	\$35,745	\$679,155	-	-	-	-	-	-	-	-
Residential Outdoor Culture Change	LWU	\$260,778	-	-	\$ 50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000
	Customer	\$1,050,090	-	-	\$194,323	\$196,548	\$198,775	\$201,004	\$203,237	\$205,471	\$207,708	\$209,948
Water Audit – Industrial Customers	LWU	\$25,569	\$7,212	\$12,212	\$10,000	-	-	-	-	-	-	-
	Customer	\$3,999	\$2,212	\$2,212	-	-	-	-	-	-	-	-

Demand Management Measure		NPV (2012\$)	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22
Residential Evaporative Coolers Education Campaign	LWU	\$205,394	\$43,605	\$55,605	\$48,605	\$48,605	\$48,605	\$7,000	\$-	\$-	\$-	\$-
	Customer	-	-	-	-	-	-	-	-	-	-	-
Commercial Nature Strips (in Wagga Wagga only)	LWU	\$130,280	\$32,500	\$42,500	\$37,500	\$37,500	\$5,000	-	-	-	-	-
	Customer	\$46,574	\$13,750	\$13,750	\$13,750	\$13,750	-	-	-	-	-	-
Non-revenue Leak and Pressure Management Program	LWU	\$184,038	\$13,345	\$26,956	\$40,839	\$54,997	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000
	Customer	-	-	-	-	-	-	-	-	-	-	-
<b>Total costs</b>	<b>LWU</b>	<b>1,313,818</b>	<b>\$207,034</b>	<b>\$565,350</b>	<b>\$192,944</b>	<b>\$201,101</b>	<b>\$128,605</b>	<b>\$82,000</b>	<b>\$75,000</b>	<b>\$75,000</b>	<b>\$75,000</b>	<b>\$75,000</b>
	<b>Customer</b>	<b>1,727,270</b>	<b>\$51,707</b>	<b>\$695,117</b>	<b>\$208,073</b>	<b>\$210,298</b>	<b>\$198,775</b>	<b>\$201,004</b>	<b>\$203,237</b>	<b>\$205,471</b>	<b>\$207,708</b>	<b>\$209,948</b>

The following demand management measures are not as cost-effective as the measures provided above. Their implementation costs are provided in this plan for Council's consideration.

**Table 13: Additional Optional Demand Management Measures Implementation Plan**

Demand Management Measure		NPV (2012\$)	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22
Showerhead Swap	LWU	\$83,403	\$27,519	\$23,519	\$23,519	\$23,519	-	-	-	-	-	-
	Customer	\$76,278	\$22,519	\$22,519	\$22,519	\$22,519	-	-	-	-	-	-
Residential Water Fixtures Retrofit	LWU	\$683,009	\$198,023	\$203,023	\$ 203,023	\$203,023	-	-	-	-	-	-
	Customer	\$163,452	\$48,256	\$48,256	\$48,256	\$48,256	-	-	-	-	-	-
Residential Toilets Replacement Program	LWU	\$94,192	\$49,681	\$54,681	-	-	-	-	-	-	-	-
	Customer	\$188,497	\$104,256	\$104,256	-	-	-	-	-	-	-	-
Water Audit – Hotels/Motels	LWU	\$32,722	\$14,360	\$18,360	\$4,000	-	-	-	-	-	-	-
	Customer	\$740,383	\$409,500	\$409,500	-	-	-	-	-	-	-	-
Water Audit - Schools	LWU	\$24,682	\$ 6,350	\$8,350	\$6,350	\$6,350	\$2,000	-	-	-	-	-
	Customer	\$103,141	\$ 30,450	\$ 30,450	\$30,450	\$30,450	-	-	-	-	-	-
Residential Clothes Washer Rebate	LWU	\$458,823	\$83,192	\$79,192	\$79,192	\$79,192	-	-	-	-	-	-
	Customer	-	-	-	-	-	-	-	-	-	-	-
Public	LWU	\$421,415	\$60,000	\$60,000	\$60,000	\$60,000	\$60,000	\$60,000	\$60,000	\$60,000	\$60,000	\$60,000

Demand Management Measure		NPV (2012\$)	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22
Education	Customer		-	-	-	-	-	-	-	-	-	-
Education at schools	LWU	\$270,514	-	-	\$100,000	\$100,000	-	-	-	\$100,000	\$ 100,000	-
	Customer		-	-	-	-	-	-	-	-	-	-
Water Loss Program	LWU	\$766,392	-	\$200,000	\$200,000	\$200,000	\$200,000	\$200,000	-	-	-	-
	Customer		-	-	-	-	-	-	-	-	-	-

## Summary of Outcomes

If RWCC resolves to implement all the recommended demand management measures listed in Table 12, the NPV of the LWU and customers implementation costs for implementing demand management in the next 10 years will be \$1,3M (2012 \$) and \$1.7M respectively. The expected 30 year average annual savings in Wagga Wagga and outside Wagga Wagga will be approximately 1.600 ML per year and 680 ML per year, respectively. The expected PDD saving in 2022 for each water supply system are:

- ❑ Wagga Wagga and Southern Trunk Main System ~ 6 ML/day
- ❑ Western Trunk Main System ~0.2 ML/day
- ❑ Humula ~ 7 kL/day
- ❑ Oura ~ 19 kL/d
- ❑ Collingullie ~ 22 kL/d
- ❑ Walbundrie/Rand ~ 28 kL/d
- ❑ Morundah ~ 4 kL/d
- ❑ Woomargama ~ 9 kL/d
- ❑ Tarcutta ~ 16 kL/d

Some of the water demand management measures recommended require higher investment than others. However they have higher long term savings from lower operational costs and lower water bills. Furthermore, the financial benefits are also included in the ability to delay capital works, such as the augmentation of the water treatment plant. Some other benefits of implementing demand management measures in RWCC are:

- ❑ Provide additional capacity for growth
- ❑ Lower water extraction, providing environmental benefits

# 10 Impact of Demand Management Measures

RWCC recognizes the importance of implementing the same demand management measures across the Riverina region due to social and financial benefits. The impacts of implementing demand management in the Wagga Wagga and Southern Trunk Systems are expected to be at the same ratio in the other systems.

RWCC staff has advised that almost all the demand management measures that will be implemented in Wagga Wagga urban area will also be implemented in other parts of Riverina water service area except for Outdoor Watering DCP and Commercial Nature Strips. The Independent Systems demand management impact analyses (sections 10.3 to 10.10) exclude these two measures.

The reductions expected in each water supply system from implementing demand management measures are shown in the following sections.

## 10.1 Wagga Wagga and Southern Trunk Main Systems

The Wagga Wagga and Southern Trunk Main Systems annual demand analyses were undertaken for a 'normal' year and for a dry year (see section 10.1). The annual forecast demand for the 'normal' case starts with the average of the past 6 years of annual demand. The annual forecast demand for the dry year case starts with the highest historical annual consumption recorded in the past 6 years. The purpose of this analysis is to provide Council with an insight of the potential risks related to water supply and availability, taking into consideration climate variability.

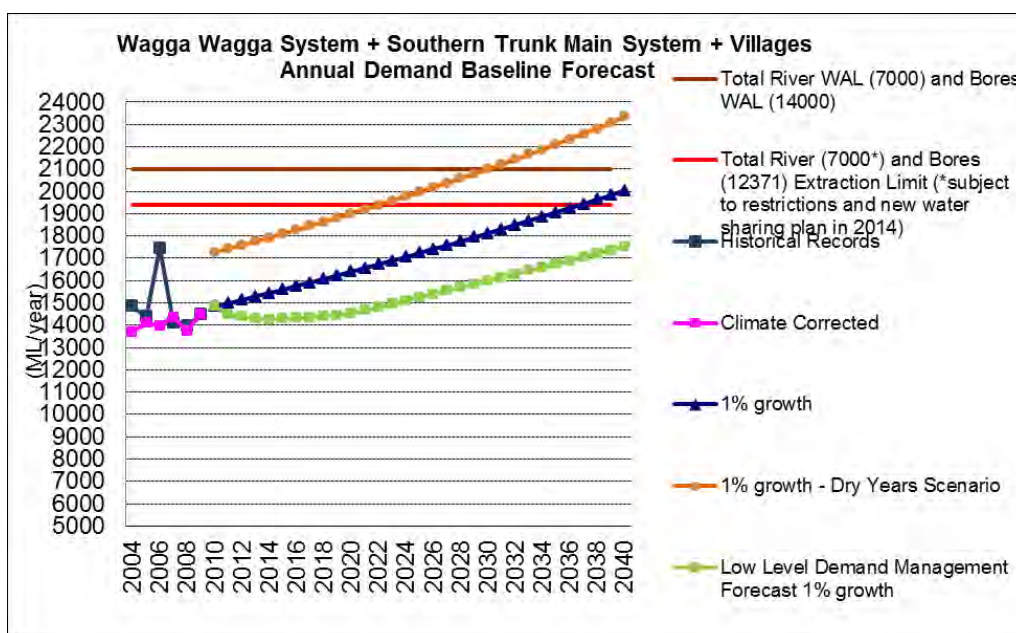


Figure 10: Annual Demand Baseline and Demand Management Forecasts

Figure 11 shows the Wagga Wagga and Southern Trunk Systems predicted baseline PDD and the expected PDD (green line) if Council implements the recommended demand management measures (see Table 12). If Council decides to implement additional demand management measures (see Table 13) the PDD is expected to reduce. Furthermore the public and school educational programs are expected to promote the demand management programs and to increase the community awareness about demand management and water savings. This is expected to reduce PDD further.

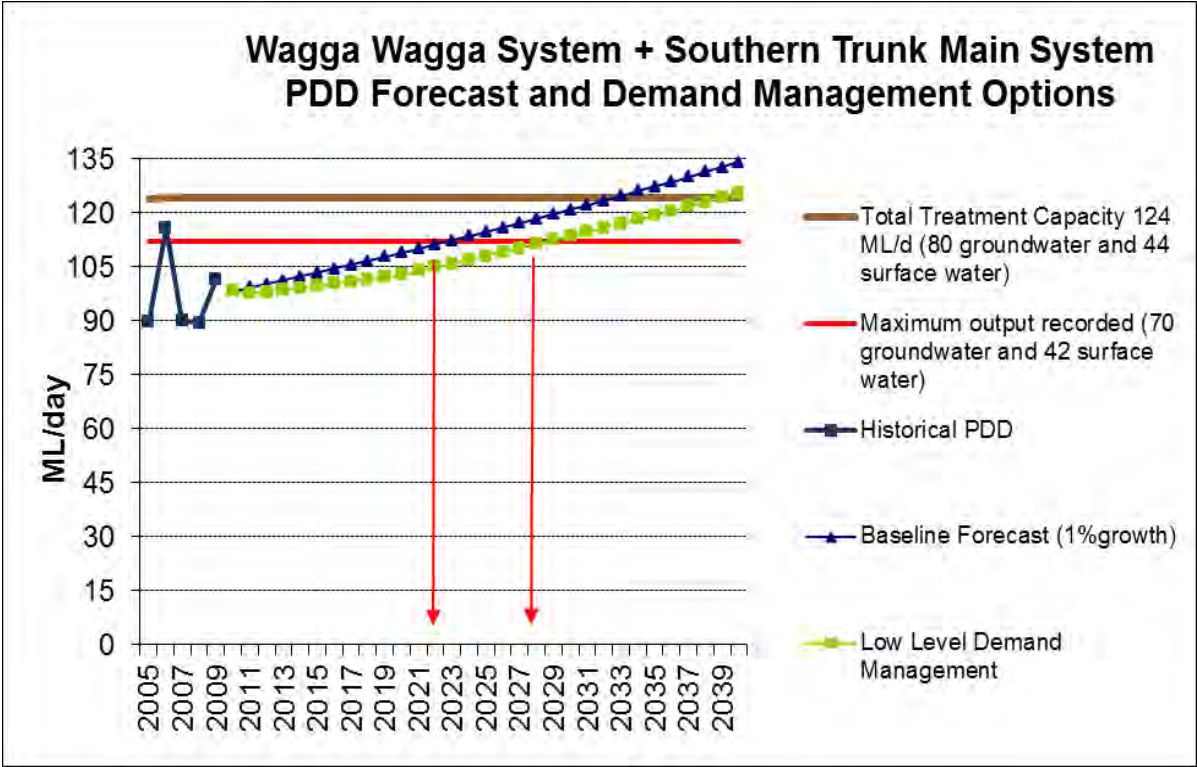
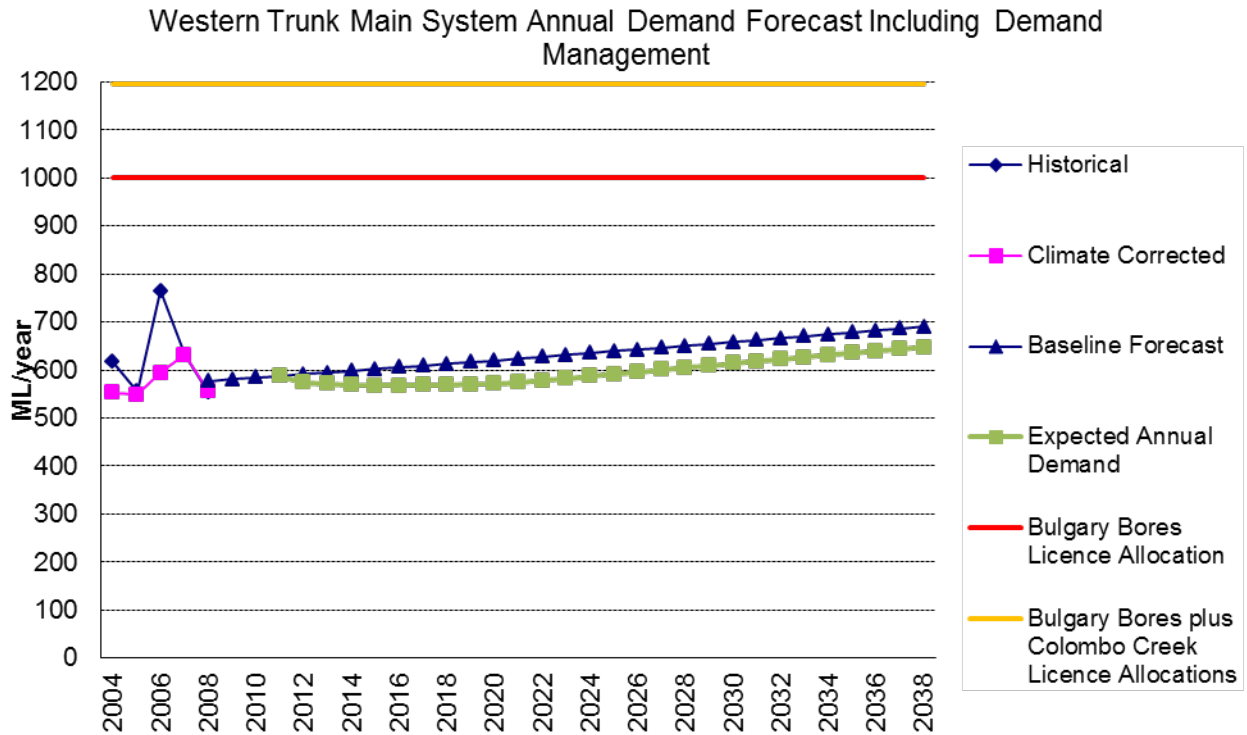


Figure 11: PDD Baseline and Demand Management Forecasts

## 10.2 Western Trunk Main System

Figure 12 shows the impact in annual demand expected from implementing low level demand management in the Western Trunk Main System. Figure 13 shows that even if RWCC implement demand management in the Western Trunk Main System, the existing infrastructure will still be limited to supply PDD. RWCC will have to address this matter by other means, such as augment the treatment capacity.



**Figure 12: Annual Demand Baseline and Demand Management Forecasts**

Figure 13 shows the Western Trunk System predicted baseline PDD and the expected PDD (green line) if Council implements the recommended demand management measures (see Table 12). PDD is expected to reduce further due to public and schools educational programs and if Council decides to implement additional demand management measures (see Table 13).



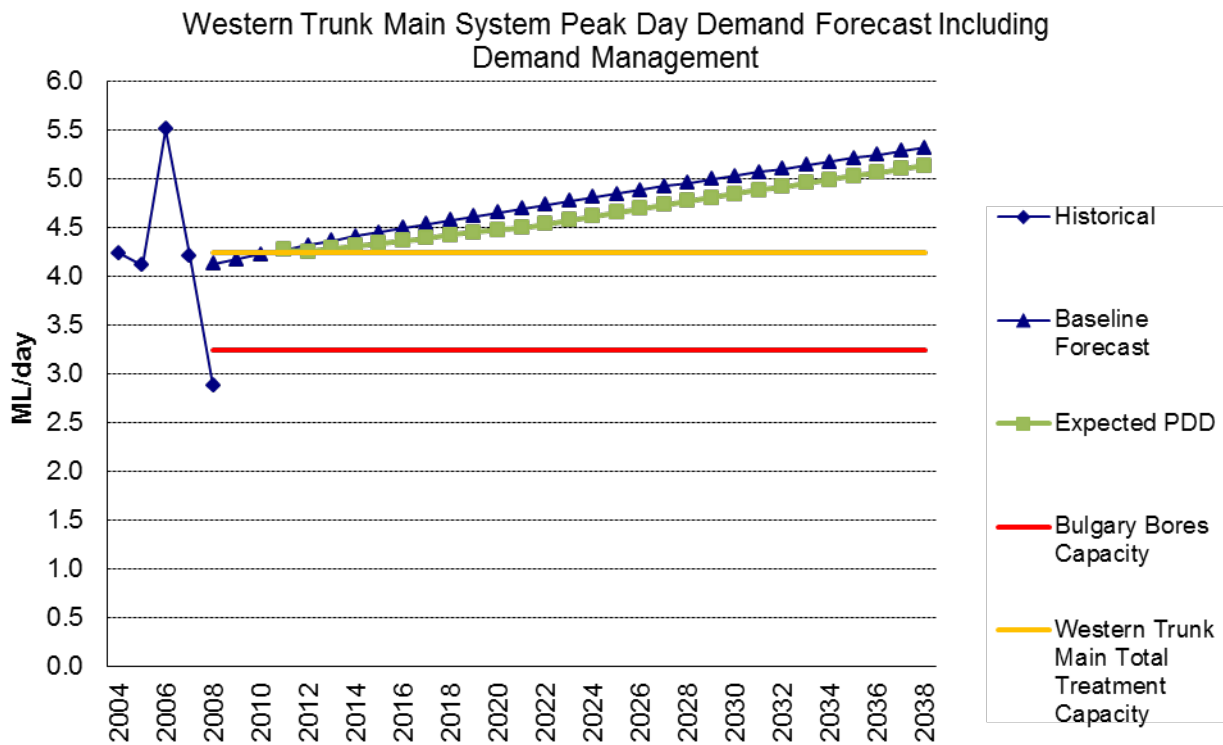
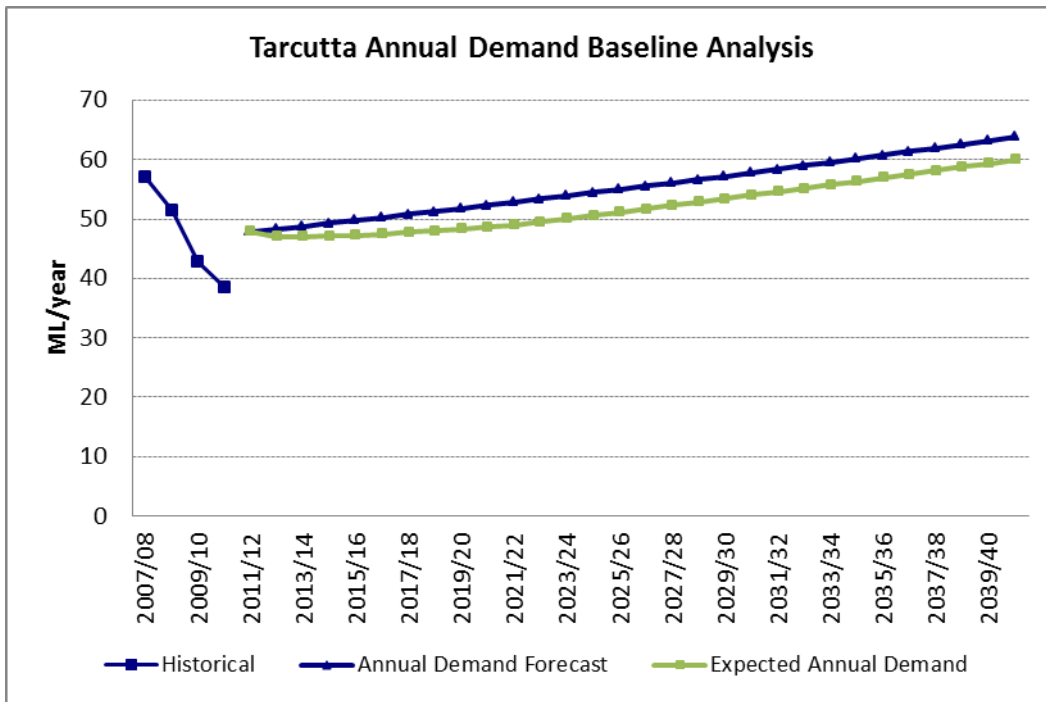


Figure 13: PDD Baseline and Demand Management Forecasts

### 10.3 Tarcutta System

Tarcutta's infrastructure capacity, annual demand, PDD and demand by customer type are provided in Appendix A. The analyses show that Tarcutta System has sufficient water allocations to supply forecast annual demand and that Tarcutta treatment plant capacity has sufficient capacity to supply forecast PDD.

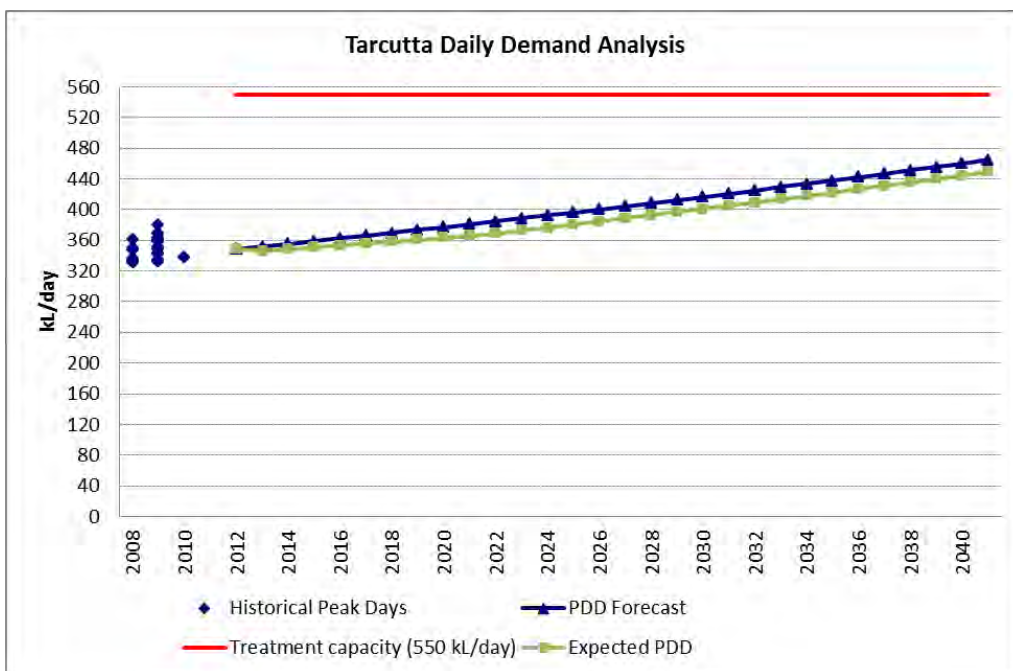
If RWCC decides to implement demand management (Low Level Demand Management Package except for Outdoor Watering DCP and Commercial Nature Strips), the expected annual demand and PDD are as show in Figure 14 and Figure 15, respectively.



**Figure 14: Annual Demand Baseline and Demand Management Forecasts**

Figure below shows the Tarcutta System predicted baseline average daily demand and the expected demand (green line) if Council implements the recommended demand management measures (see Table 12). PDD is expected to reduce further due to public and schools educational programs and if Council decides to implement the additional demand management measures (see Table 13).

This applies to all the independent villages daily demand analyses provided in the following sections.



**Figure 15: Daily Demand Baseline and Demand Management Forecasts**

## 10.4 Humula System

Humula's infrastructure capacity, annual demand, PDD and demand by customer type are provided in Appendix A. The analyses show that Humula System has sufficient water allocations to supply forecast annual demand and that Humula treatment plant capacity has sufficient capacity to supply forecast PDD.

If RWCC decides to implement demand management (Low Level Demand Management Package except for Outdoor Watering DCP and Commercial Nature Strips), the expected annual demand and PDD are as show in Figure 16 and Figure 17, respectively.

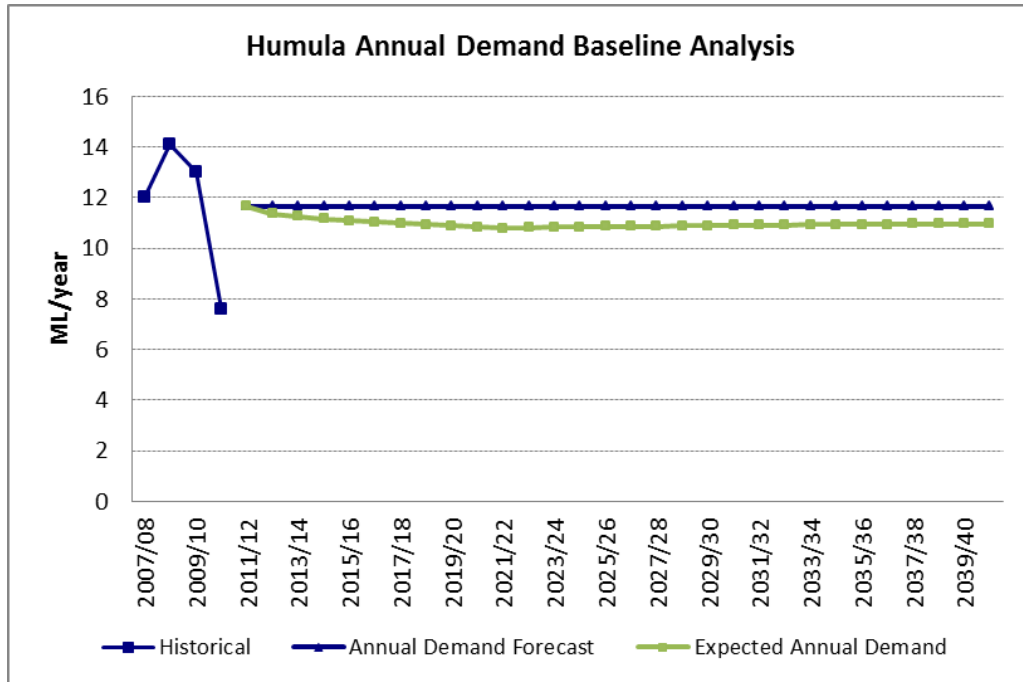


Figure 16: Annual Demand Baseline and Demand Management Forecasts

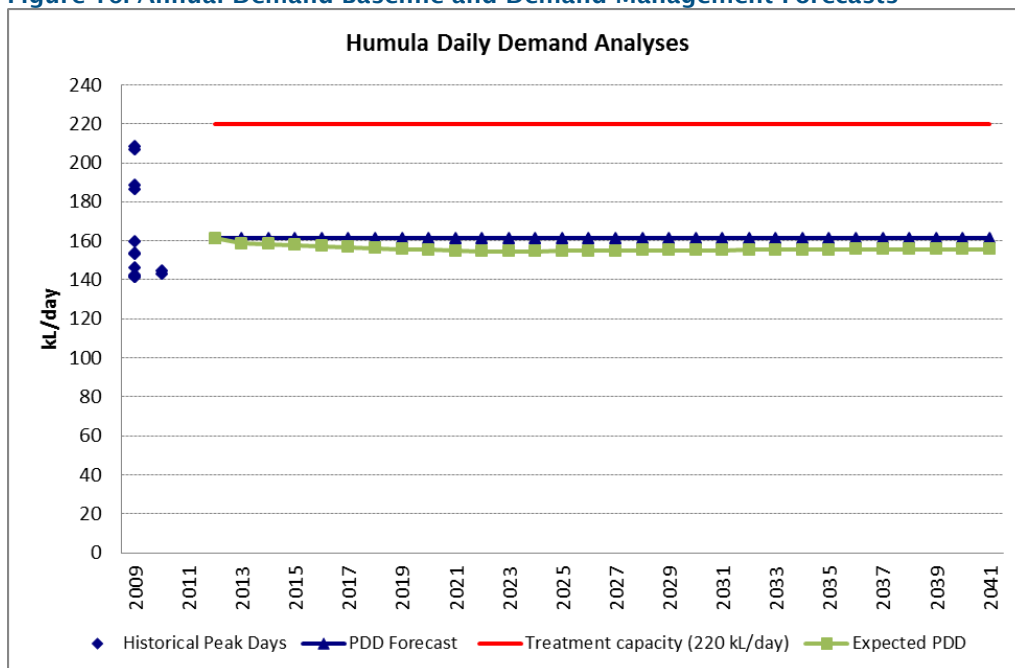


Figure 17: Daily Demand Baseline and Demand Management Forecasts

### 10.5 Woomargama System

Woomargama’s infrastructure capacity, annual demand, PDD and demand by customer type are provided in Appendix A. The analyses show that Woomargama System has sufficient water allocations to supply forecast annual demand and that Woomargama treatment plant capacity has sufficient capacity to supply forecast PDD.

If RWCC decides to implement demand management (Low Level Demand Management Package except for Outdoor Watering DCP and Commercial Nature Strips), the expected annual demand and PDD are as show in Figure 18 and Figure 19, respectively.

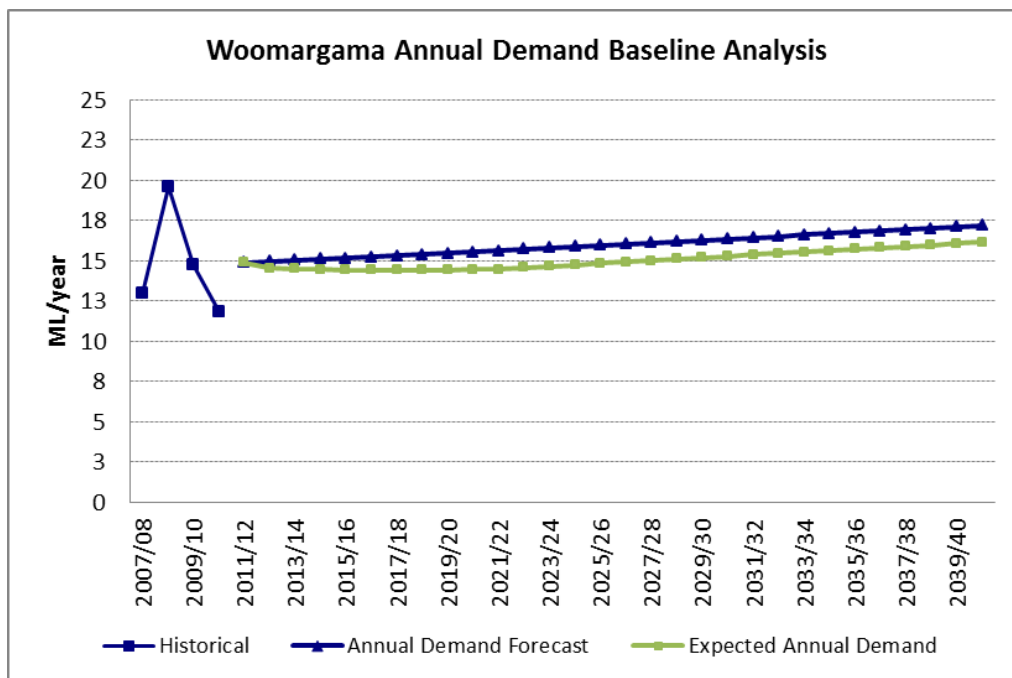


Figure 18: Annual Demand Baseline and Demand Management Forecasts

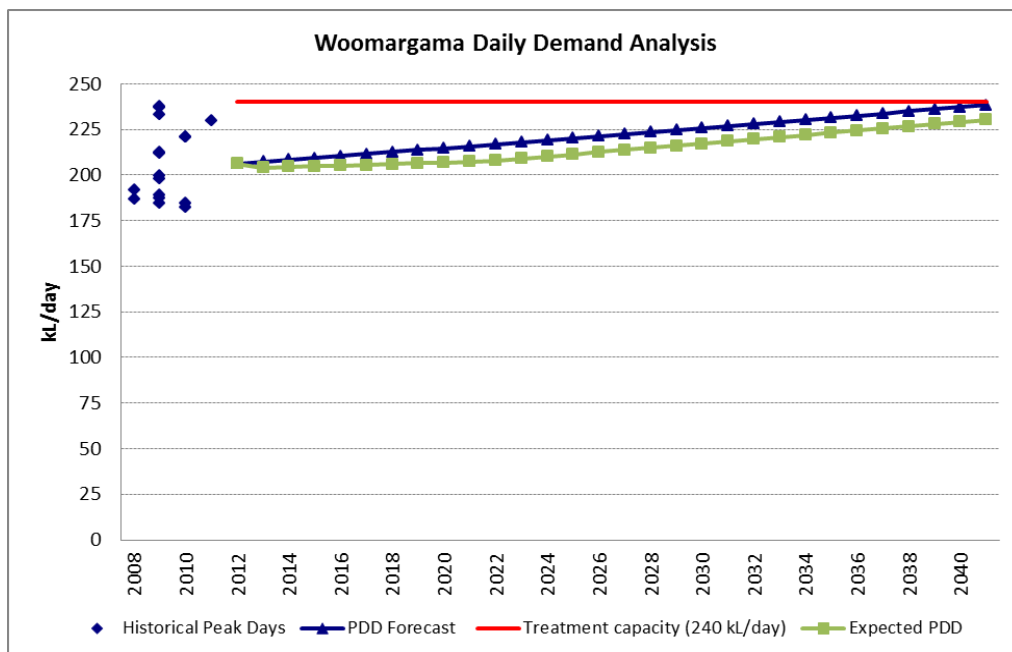


Figure 19: Daily Demand Baseline and Demand Management Forecasts

## 10.6 Morundah System

Morundah’s infrastructure capacity, annual demand, PDD and demand by customer type are provided in Appendix A. The analyses show that Morundah System has sufficient water allocations to supply forecast annual demand and that Morundah water filtration plant capacity has sufficient capacity to supply forecast PDD.

If RWCC decides to implement demand management (Low Level Demand Management Package except for Outdoor Watering DCP and Commercial Nature Strips), the expected annual demand and PDD are as show in Figure 20 and Figure 21, respectively.

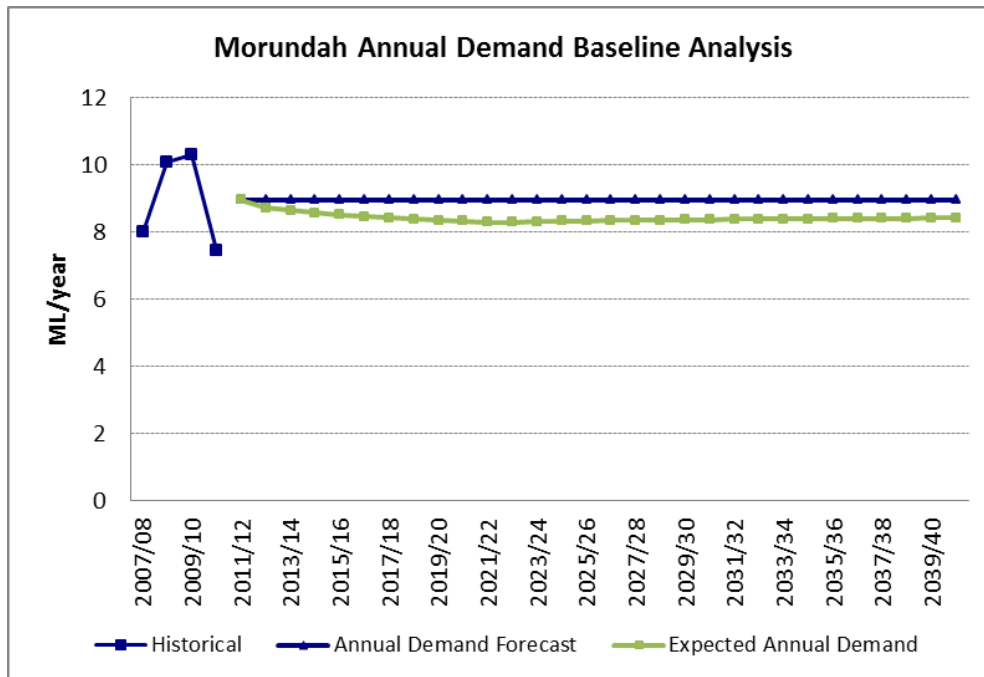


Figure 20: Annual Demand Baseline and Demand Management Forecasts

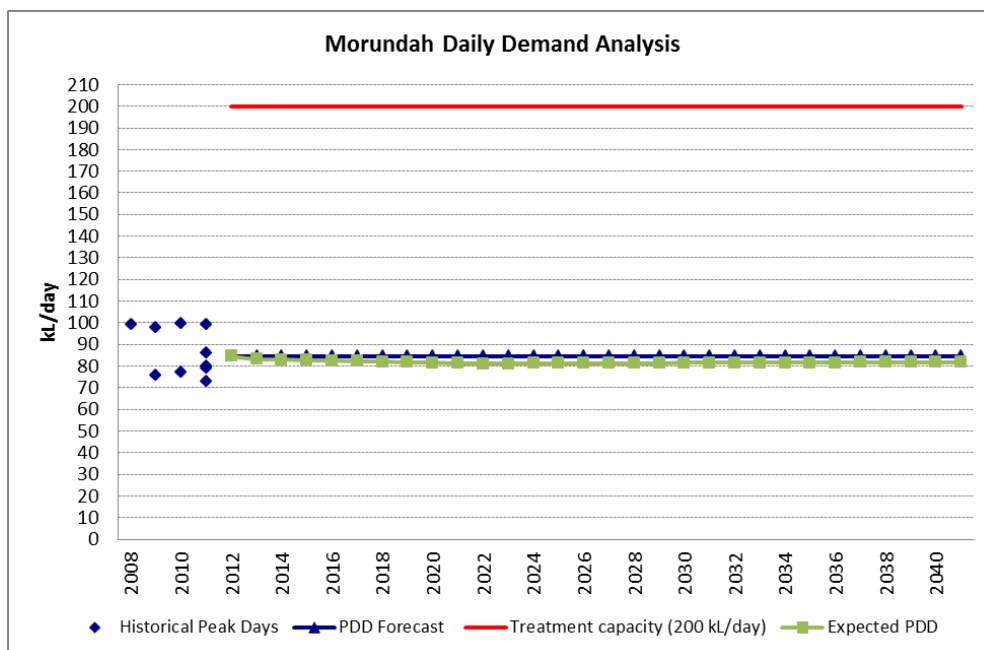


Figure 21: Daily Demand Baseline and Demand Management Forecasts

## 10.7 Walbundrie/Rand System

Walbundrie/Rand's infrastructure capacity, annual demand, PDD and demand by customer type are provided in Appendix A. The analyses show that Walbundrie/Rand System has sufficient water allocations to supply forecast annual demand. The data shows that Walbundrie/Rand treatment plant capacity is below the demand. Council has advised that there are errors in the records and that the data will be revisited in the near future to ensure that the system has sufficient capacity to supply demand.

If RWCC decides to implement demand management (Low Level Demand Management Package except for Outdoor Watering DCP and Commercial Nature Strips), the expected annual demand and PDD are as show in Figure 22 and Figure 23, respectively.

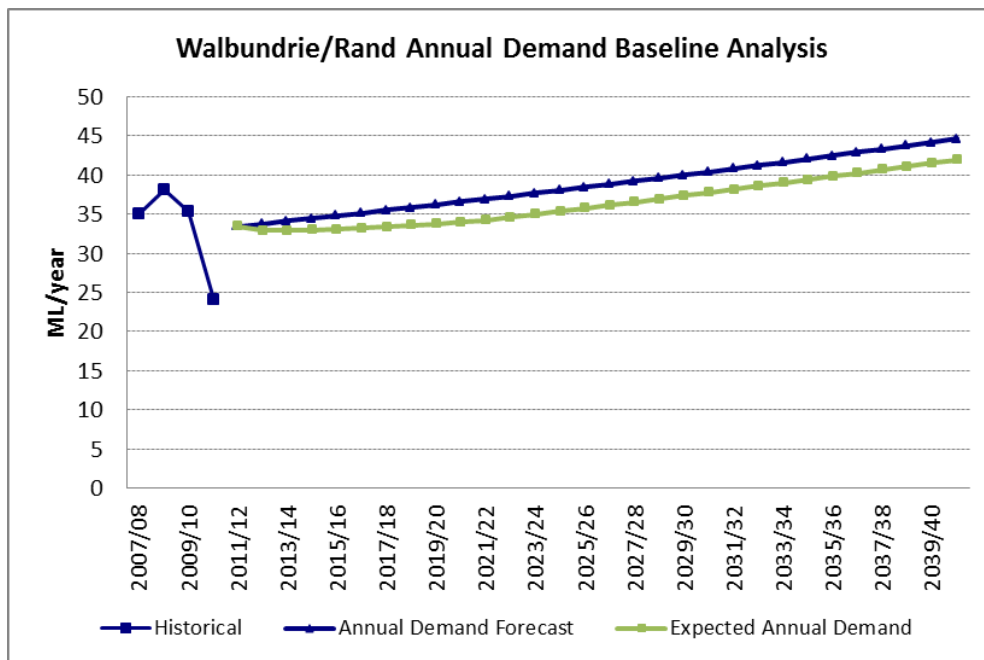


Figure 22: Annual Demand Baseline and Demand Management Forecasts

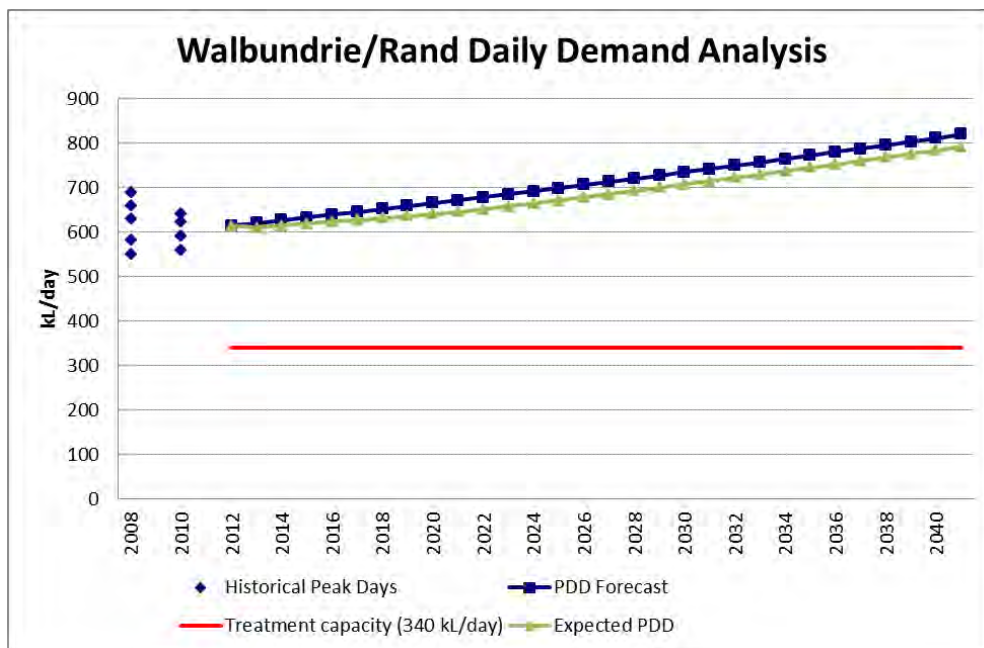


Figure 23: Daily Demand Baseline and Demand Management Forecasts

## 10.8 Collingullie System

Collingullie’s infrastructure capacity, annual demand, PDD and demand by customer type are provided in Appendix A. The analyses show that Collingullie System has sufficient water allocations to supply forecast annual demand and that Collingullie treatment plant capacity has sufficient capacity to supply forecast PDD until 2026. However, if RWCC decides to implement demand management, the treatment plant capacity may be sufficient to supply demand up to 2037.

If RWCC decides to implement demand management (Low Level Demand Management Package except for Outdoor Watering DCP and Commercial Nature Strips), the expected annual demand and PDD are as show in Figure 24 and Figure 25, respectively.

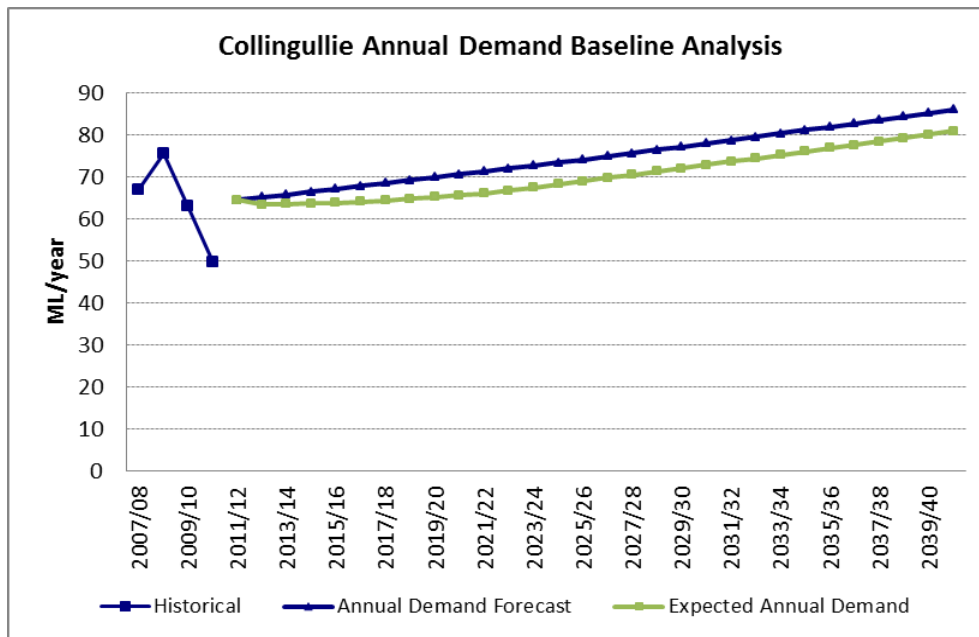


Figure 24: Annual Demand Baseline and Demand Management Forecasts

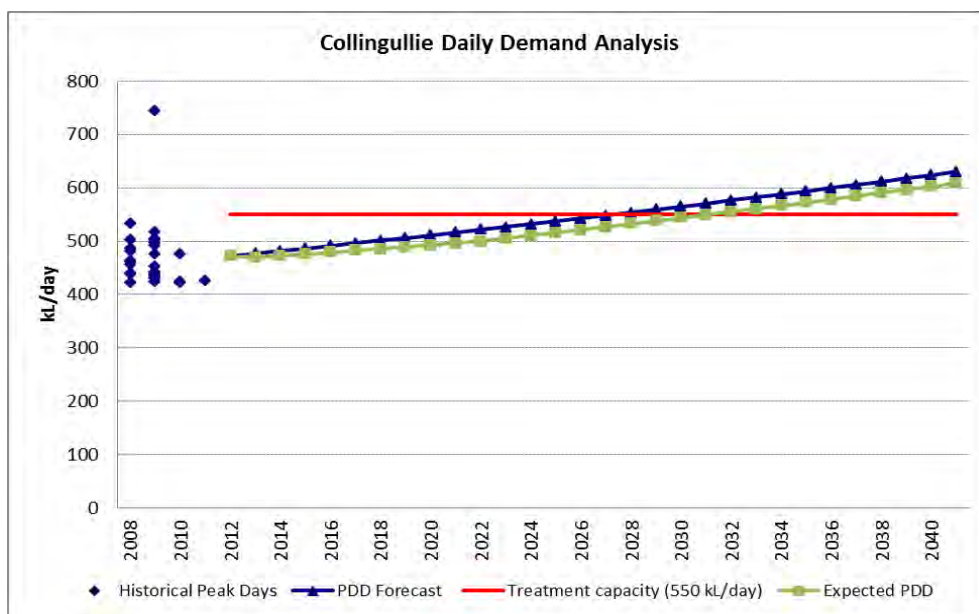


Figure 25: Daily Demand Baseline and Demand Management Forecasts

## 10.9 Oura System

Oura's infrastructure capacity, annual demand, PDD and demand by customer type are provided in Appendix A. The analyses show that Oura System has sufficient water allocations to supply forecast annual demand and that Oura treatment plant capacity has sufficient capacity to supply forecast PDD until 2030. However, if RWCC decides to implement demand management, the treatment plant capacity may be sufficient to supply demand up to 2036.

If RWCC decides to implement demand management (Low Level Demand Management Package except for Outdoor Watering DCP and Commercial Nature Strips), the expected annual demand and PDD are as show in Figure 26 and Figure 27, respectively.

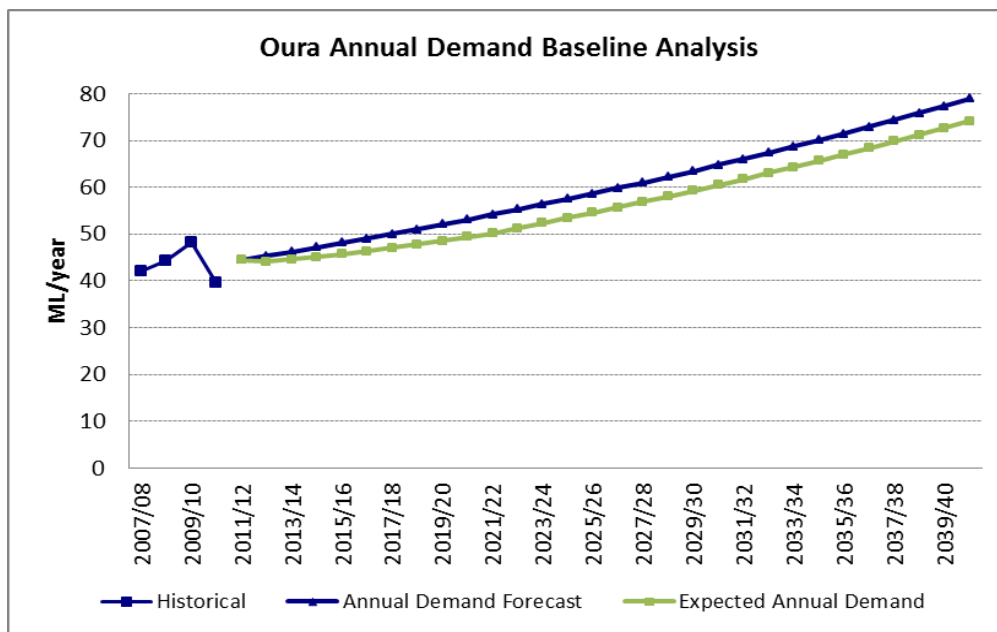


Figure 26: Annual Demand Baseline and Demand Management Forecasts

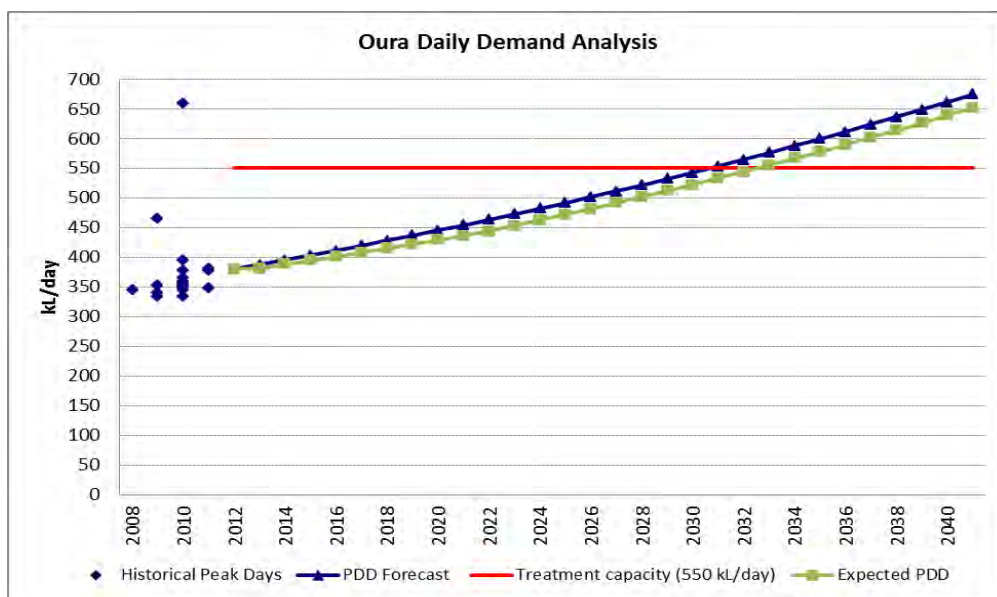


Figure 27: Daily Demand Baseline and Demand Management Forecasts



## 10.10 Holbrook System

Holbrook’s infrastructure capacity, annual demand, PDD and demand by customer type are provided in Appendix A. The analyses show that Holbrook System has sufficient water allocations to supply forecast annual demand and that Holbrook treatment capacity (3.8ML/d) has sufficient capacity to supply forecast PDD until 2040.

If RWCC decides to implement demand management (Low Level Demand Management Package except for Outdoor Watering DCP and Commercial Nature Strips), the expected annual demand and PDD are as show in Figure 28 and Figure 29, respectively.

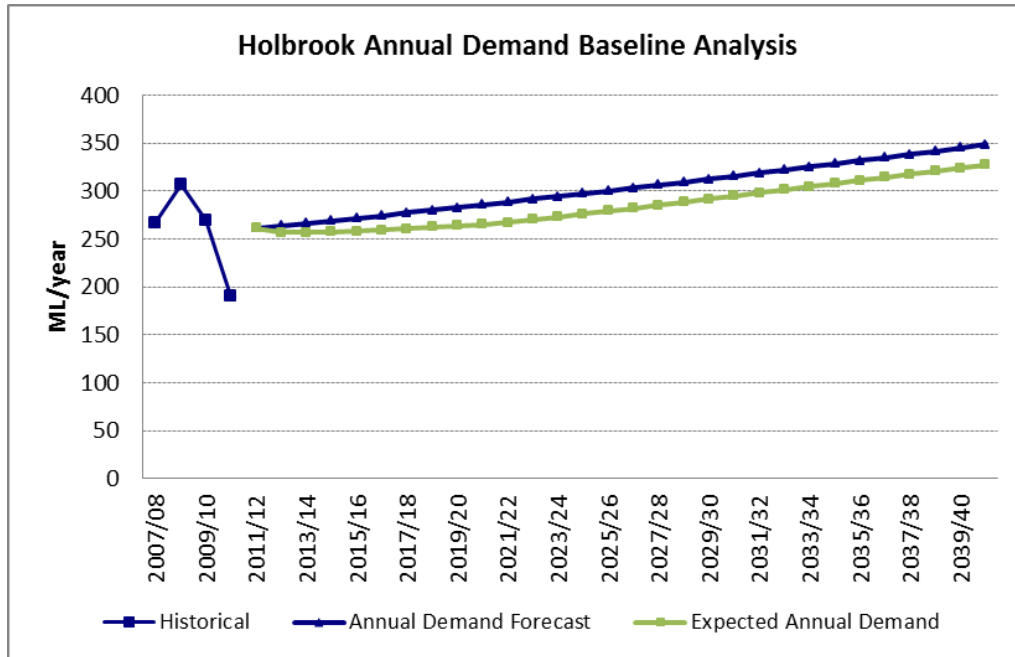


Figure 28: Annual Demand Baseline and Demand Management Forecasts

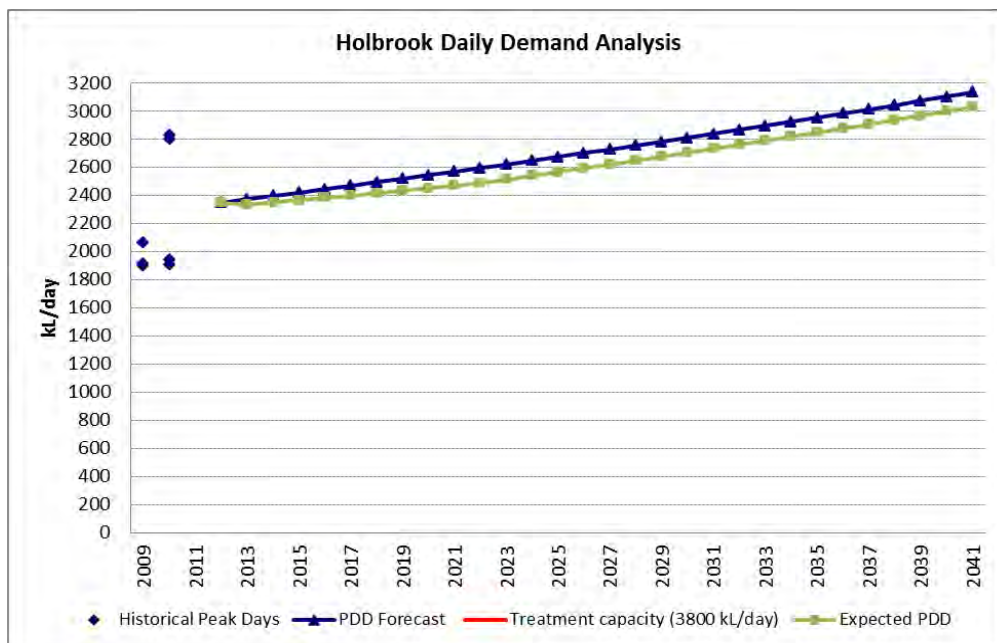


Figure 29: Daily Demand Baseline and Demand Management Forecasts

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# Appendix A

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## Independent Villages Analyses

## Tarcutta

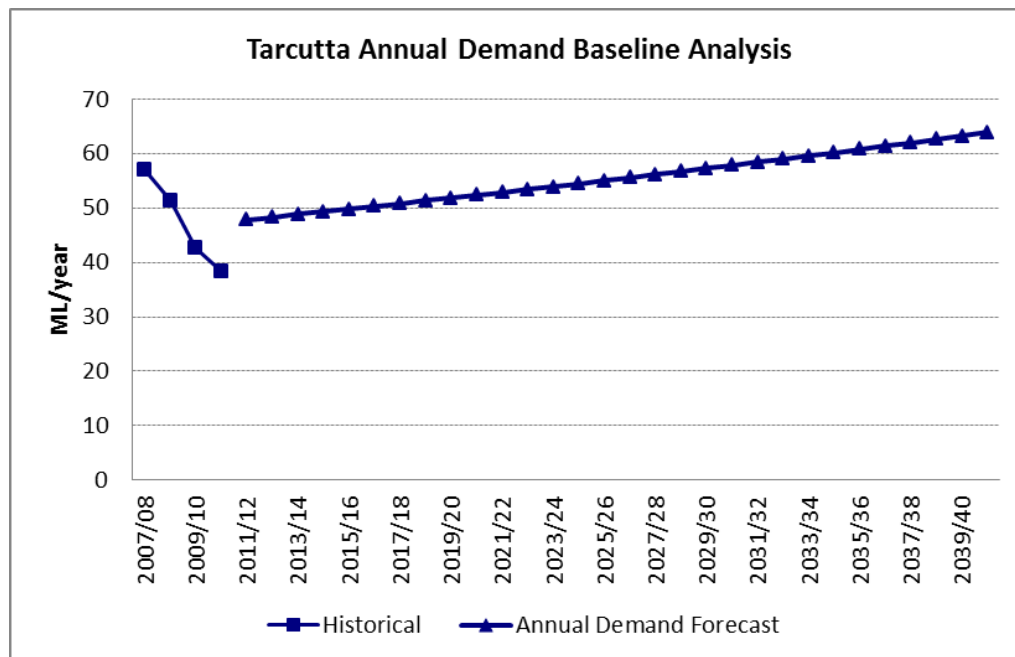
The Tarcutta System population in 2008 was 350. (Source: Joint IWCM Evaluation Study, 2010). The growth rate adopted for this study is 1% growth. Raw water source and treatment used are listed in Table 14.

**Table 14: Tarcutta System Water Source and Treatment**

	Capacity	Licence (Water allocation) / capacity
Water Source: Tarcutta Bores	Bore No.1 – 3 L/s Bore No.2 – 2 L/s Bore No.2 – 6 L/s	100 ML/year
Tarcutta Treatment Plant	Treatment consists of aeration and to stages of filtration (Fe and Mn removal)	0.55 ML/day (assuming 22hrs operation)

## Tarcutta Annual Demand Analysis

The annual baseline demand forecast was calculated using historical records and the growth rate. The first year of the forecast is the average of 4 years of annual demand records. The existing licence allocation of 100 ML/year is sufficient to supply Tarcutta's foreseen annual demand.



**Figure 30: Tarcutta Annual Demand Analysis**

## Tarcutta Peak Day Demand Analysis

Tarcutta daily production records were checked to identify the historical highest daily demand. Daily production figures are available from 2008 to 2011. Figure 29 shows the historical daily demand above 310 kL/day and the PDD forecast is calculated based

on the growth rate. The starting year of the forecast is the average of the highest (above 310 kL/d) daily production records.

Tarcutta treatment plant capacity has sufficient capacity to supply the foreseen PDD.

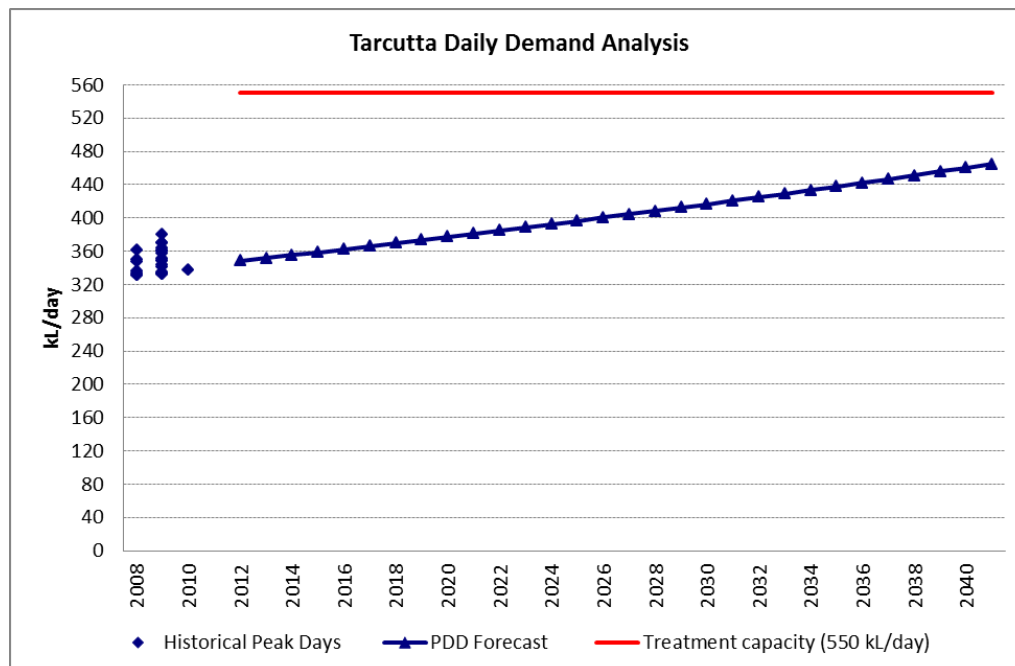


Figure 31: Tarcutta Average Daily Demand Forecast

#### Tarcutta Demand Forecast for each Customer Category

A demand forecast analysis for each customer type within Tarcutta System has been prepared using 2010/11 observed annual consumption data from Council’s billing data base and 1% growth rate for the next 30 years. It is assumed that the current ratios between each customer type’s water consumption will remain the same over the 30 year planning horizon.

Table 15: Tarcutta System Consumption by Customer Type

Customer Type	2010/11 (actual)	2040/41 (estimated)	% of Total Water Consumed
Residential	18,494	24,927	50%
Commercial	10,419	14,043	28%
Industrial	-	-	0%
Public	922	1,243	2.5%
Parks and Open Space	854	1,151	2.3%
Rural	6,004	8,092	16%
Other	-	-	0%
<b>Total water consumption (kL)</b>	<b>36,693</b>	<b>49,457</b>	<b>100%</b>

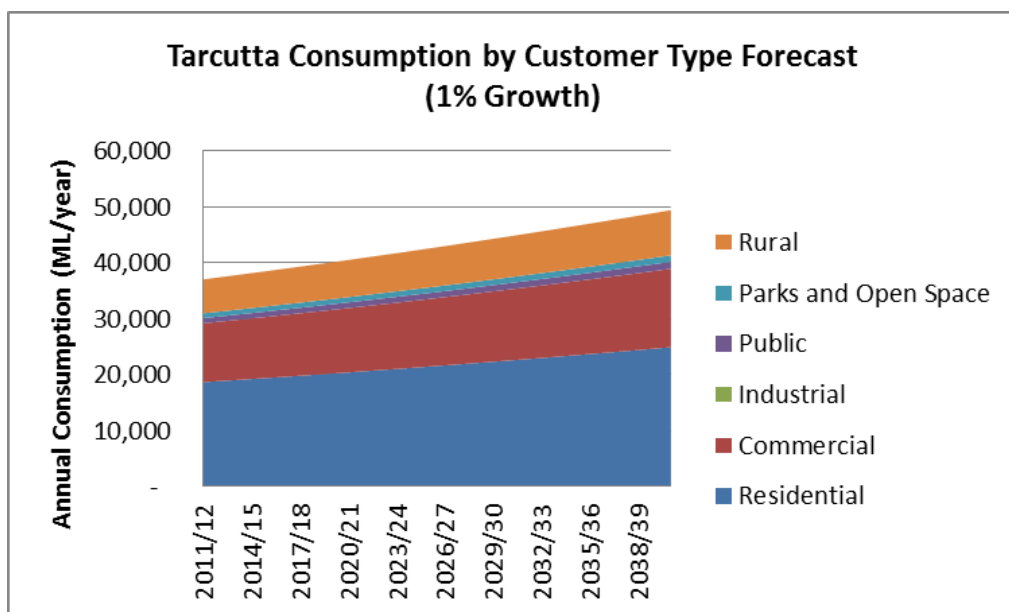


Figure 32: Tarcutta System Consumption by Customer Type

### Humula

The Humula System population in 2008 was 145. (Source: Joint IWCM Evaluation Study, 2010). There is no growth expected in this system. Raw water source and treatment used are listed in Table 16.

Table 16: Humula System Water Source and Treatment

	Capacity	Licence (Water allocation) / capacity
Water Source: 1-Umbango and Carabost Creek	Well – 2.6 L/s	30 ML/year
2-Humula Bore	Bore – 1.5 L/s	Aquifer very limited
Humula Treatment Plant	Well water – chlorination only Bore water - aeration and chlorination	0.22 ML/day

### Humula Annual Demand Analysis

The annual baseline demand forecast is not expected to increase due to zero growth in town. The first year of the forecast is the average of 4 years of annual demand records. The existing licence allocation of 30 ML/year is sufficient to supply Humula foreseen annual demand.

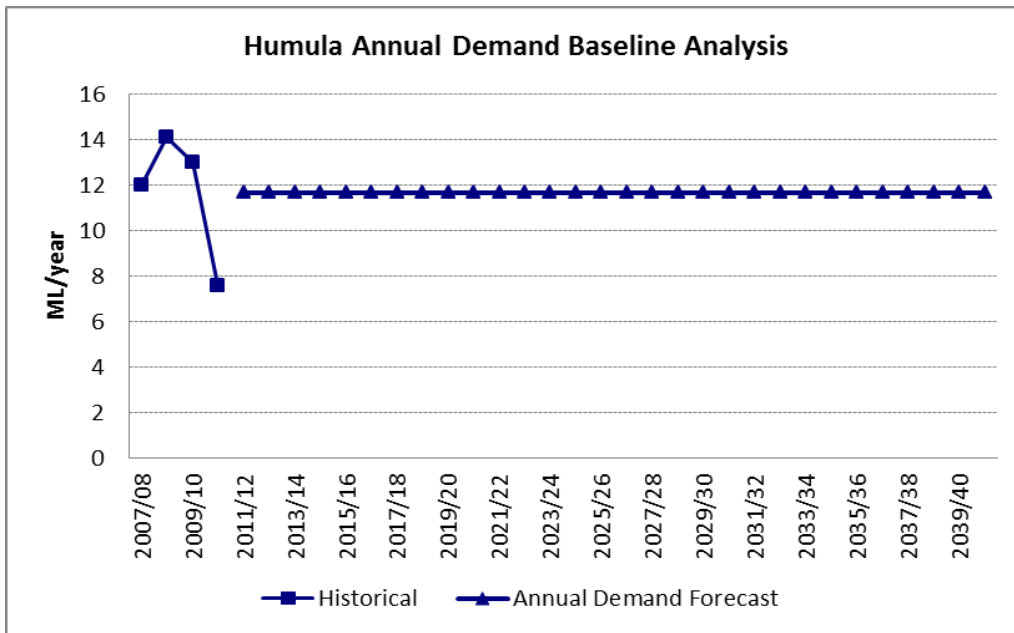


Figure 33: Humula Annual Demand Analysis

### Humula Peak Day Demand

Humula daily production records were checked to identify the historical highest daily demand. Daily production figures are available from 2008 to 2011. Figure 32 shows the historical daily demand above 140 kL/day and the PDD forecast, which is expected to remain the same. The starting year of the forecast is the average of the highest (above 140 kL/d) daily production records.

Humula treatment plant capacity has sufficient capacity to supply the foreseen PDD.

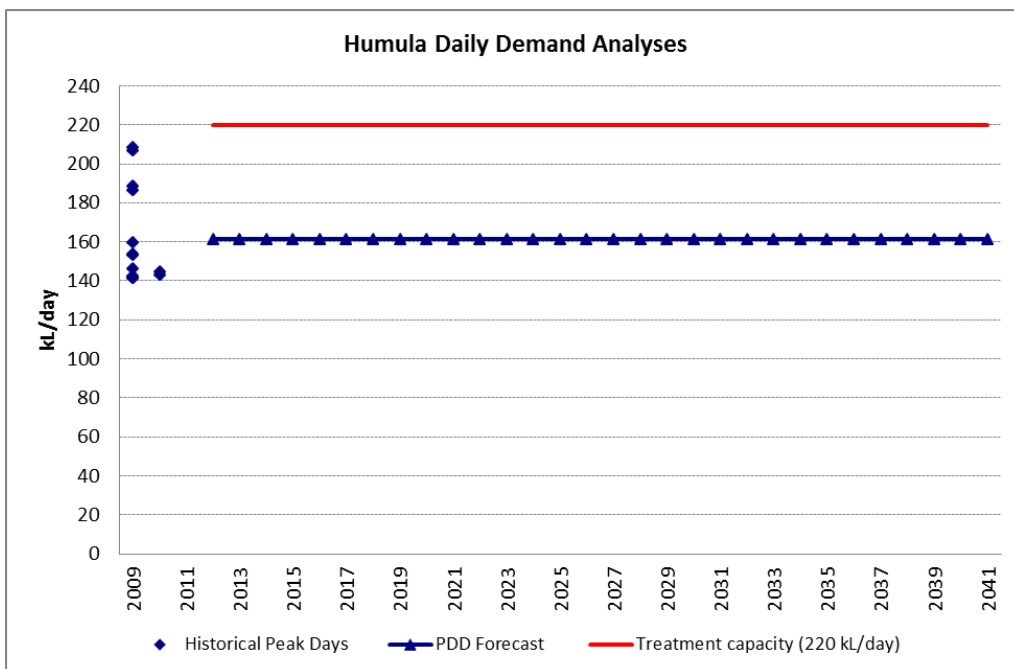


Figure 34: Humula Average Daily Demand Forecast

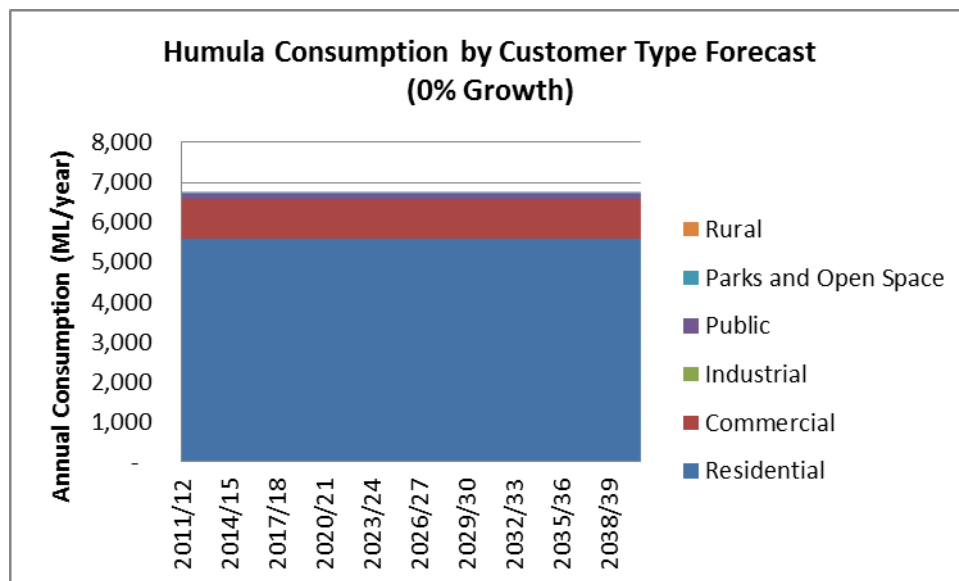
### Humula Demand Forecast for each Customer Category

A demand forecast analysis for each customer type within Humula System has been prepared using 2010/11 observed annual consumption data from Council’s billing data

base. Due to the 0% growth the consumption by customer type in Humula is not expected to change. It is assumed that the current ratios between each customer type's water consumption will remain the same over the 30 year planning horizon.

**Table 17: Humula System Consumption by Customer Type**

Customer Type	2010/11 (actual)	2040/41 (estimated)	% of Total Water Consumed
Residential	5,587	5,587	83%
Commercial	1,001	1,001	15%
Industrial	-	-	0%
Public	148	148	2.2%
Parks and Open Space	28	28	0.4%
Rural	-	-	0%
Other	-	-	0%
<b>Total water consumption (kL)</b>	<b>6,764</b>	<b>6,764</b>	<b>100%</b>



**Figure 35: Humula System Consumption by Customer Type**

**Woomargama**

The Woomargama System population in 2008 was 120. (Source: Joint IWCM Evaluation Study, 2010). The growth rate adopted for this study is 0.5% growth. Raw water source and treatment used are listed in Table 18.

**Table 18: Woomargama System Water Source and Treatment**

	Capacity	Licence (Water allocation) / capacity
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	Capacity	Licence (Water allocation) / capacity
Water Source: Woomargama Bores	Bore No.1 – 1.5 L/s Bore No.2 – 2.5 L/s	40 ML/year
Woomargama Treatment Plant	Treatment consists of chlorination	0.24 ML/day (assuming 22hrs operation)

### Woomargama Annual Demand Analysis

The annual baseline demand forecast was calculated using historical records and the growth rate. The first year of the forecast is the average of 4 years of annual demand records. The existing licence allocation of 40 ML/year is sufficient to supply Woomargama’s foreseen annual demand.

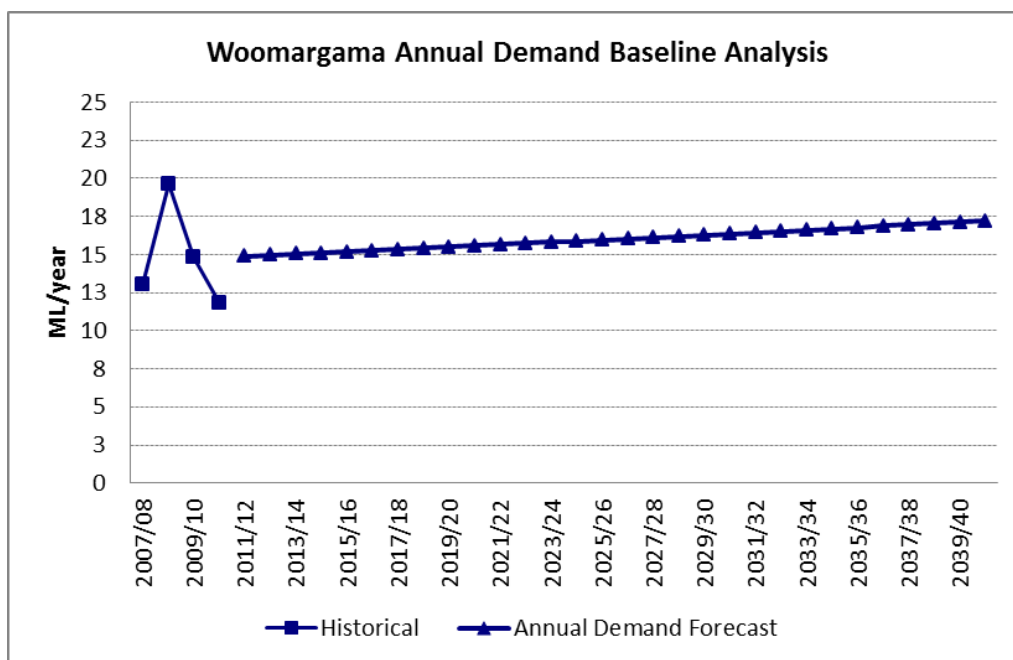


Figure 36: Woomargama Annual Demand Analysis

### Woomargama Peak Day Demand

Woomargama daily production records were checked to identify the historical highest daily demand. Daily production figures are available from 2008 to 2011. Figure 35 shows the historical daily demand above 180 kL/day and the PDD forecast is calculated based on the growth rate. The starting year of the forecast is the average of the highest (above 180 kL/d) daily production records.

Woomargama treatment plant capacity has sufficient capacity to supply the foreseen PDD.

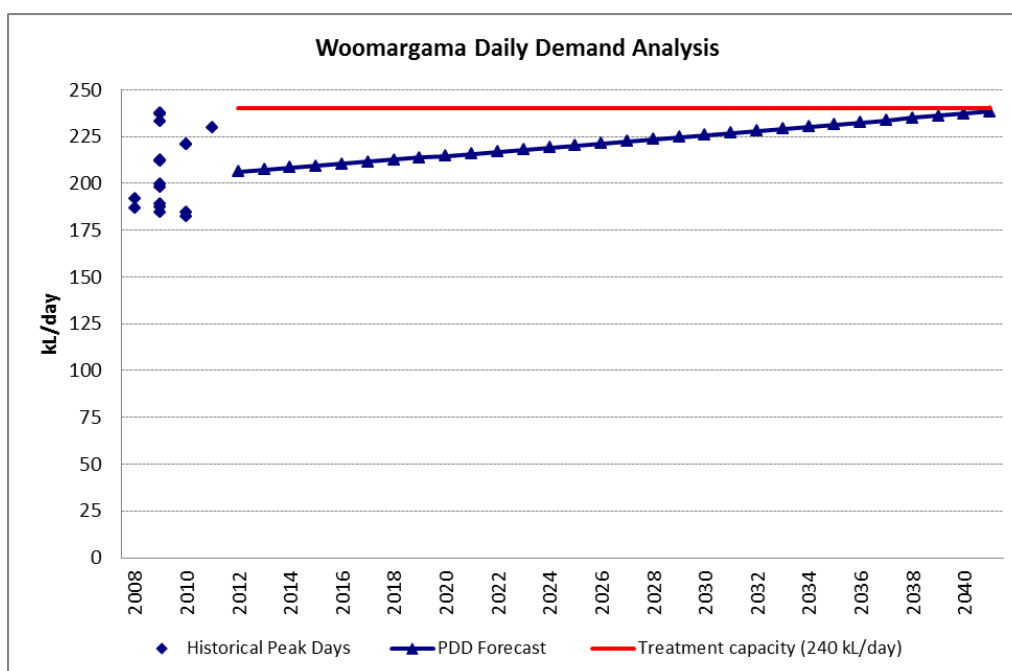


Figure 37: Woomargama Average Daily Demand Forecast

### Woomargama Demand Forecast for each Customer Category

A demand forecast analysis for each customer type within Woomargama System has been prepared using 2010/11 observed annual consumption data from Council's billing data base and 0.5% growth rate for the next 30 years. It is assumed that the current ratios between each customer type's water consumption will remain the same over the 30 year planning horizon.

Table 19: Woomargama System Consumption by Customer Type

Customer Type	2010/11 (actual)	2040/41 (estimated)	% of Total Water Consumed
Residential	8,747	10,159	83%
Commercial	1,614	1,874	15%
Industrial	-	-	0%
Public	-	-	0.0%
Parks and Open Space	115	134	1.1%
Rural	-	-	0%
Other	-	-	0%
<b>Total water consumption (kL)</b>	<b>10,476</b>	<b>12,167</b>	<b>100%</b>

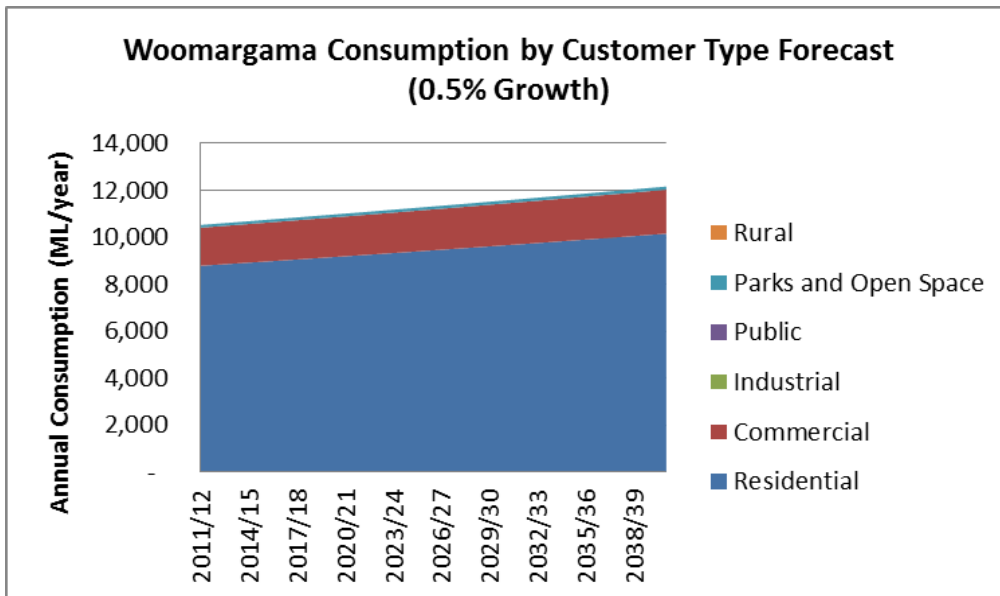


Figure 38: Woomargama System Consumption by Customer Type

### Morundah

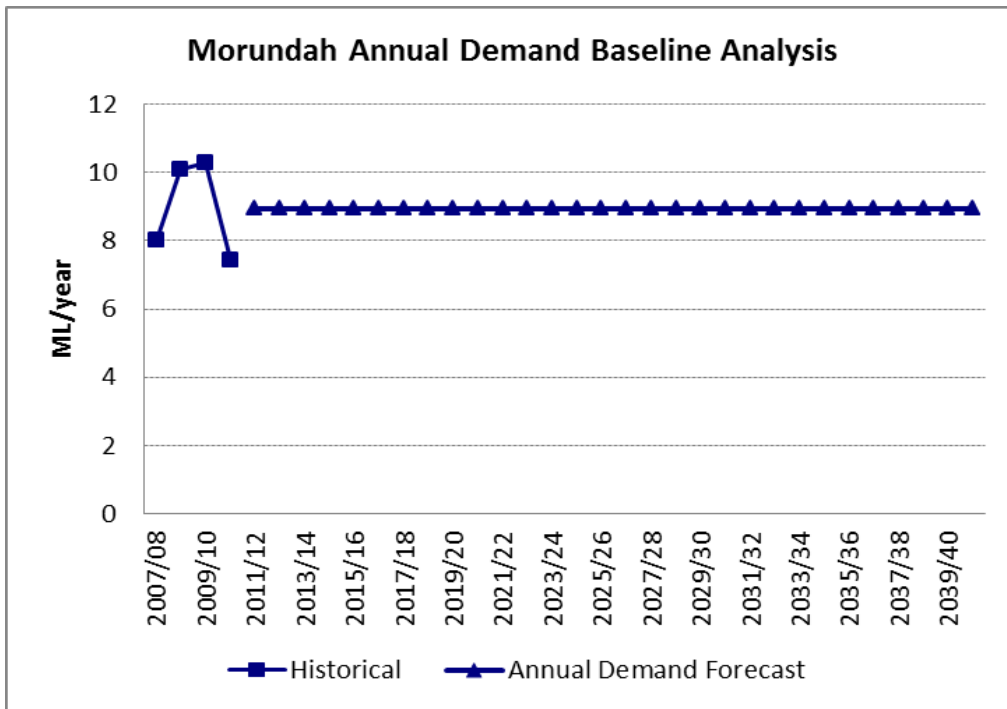
The Morundah System population in 2008 was 30. (Source: Joint IWCM Evaluation Study, 2010). There is no growth expected in this system. Raw water source and treatment used are listed in Table 20.

Table 20: Morundah System Water Source and Treatment

	Capacity	Licence (Water allocation) / capacity
Water Source: Colombo Creek	Pump – 3.5 L/s	13 ML/year
Morundah Water Filtration Plant	Treatment consists of sedimentation process including chlorination	0.2 ML/day

### Morundah Annual Demand Analysis

The annual baseline demand forecast is not expected to increase due to zero growth in town. The first year of the forecast is the average of 4 years of annual demand records. The existing licence allocation of 13 ML/year is sufficient to supply Morundah's foreseen annual demand.

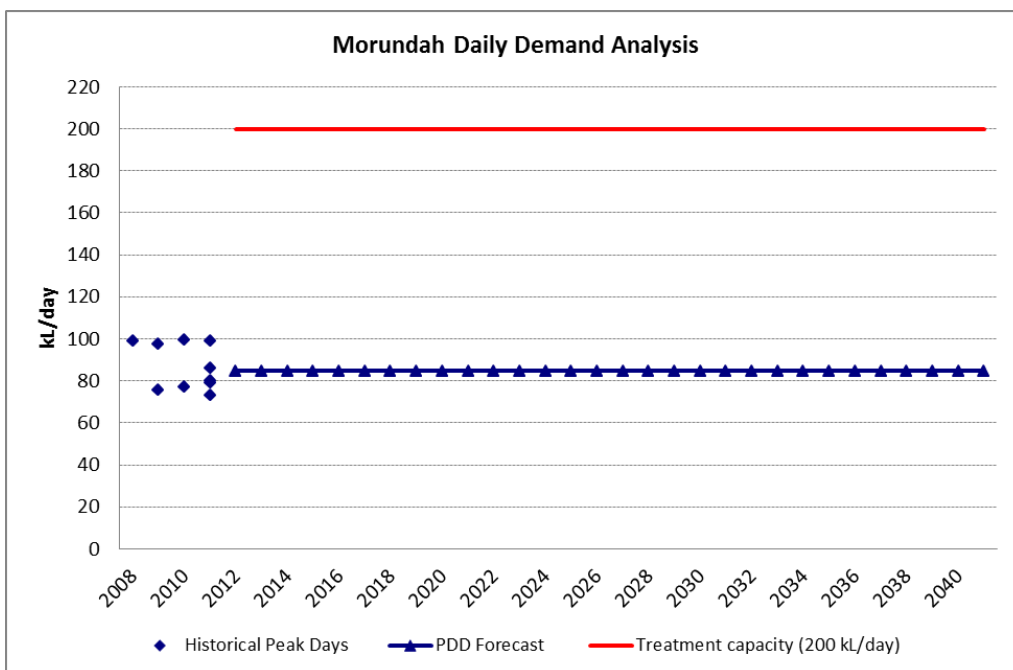


**Figure 39: Morundah Annual Demand Analysis**

**Morundah Peak Day Demand**

Morundah daily production records were checked to identify the historical highest daily demand. Daily production figures are available from 2008 to 2011. Figure 38 shows the historical daily demand above 70 kL/day and the PDD forecast, which is expected to remain the same. The starting year of the forecast is the average of the highest (above 70 kL/d) daily production records.

Morundah treatment plant capacity has sufficient capacity to supply the foreseen PDD.



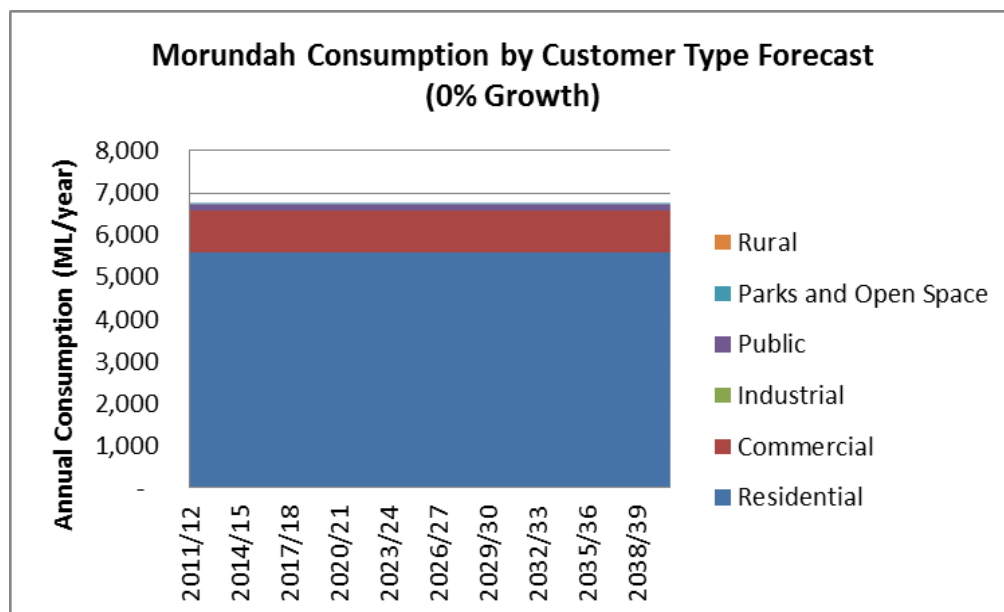
**Figure 40: Morundah Average Daily Demand Forecast**

### Morundah Demand Forecast for each Customer Category

A demand forecast analysis for each customer type within Morundah System has been prepared using 2010/11 observed annual consumption data from Council’s billing data base and 0% growth rate for the next 30 years. It is assumed that the current ratios between each customer type’s water consumption will remain the same over the 30 year planning horizon.

**Table 21: Morundah System Consumption by Customer Type**

Customer Type	2010/11 (actual)	2040/41 (estimated)	% of Total Water Consumed
Residential	2,891	2,891	64%
Commercial	262	262	5.8%
Industrial	-	-	0%
Public	-	-	0%
Parks and Open Space	1,373	1,373	30%
Rural	-	-	0%
Other	-	-	0%
<b>Total water consumption (kL)</b>	<b>4,526</b>	<b>4,526</b>	<b>100%</b>



**Figure 41: Morundah System Consumption by Customer Type**

### Walbundrie/Rand

The Walbundrie/Rand System total population in 2008 was 160 (Walbundrie has 40 people and Rand has 120 people). (Source: Joint IWCM Evaluation Study, 2010). The

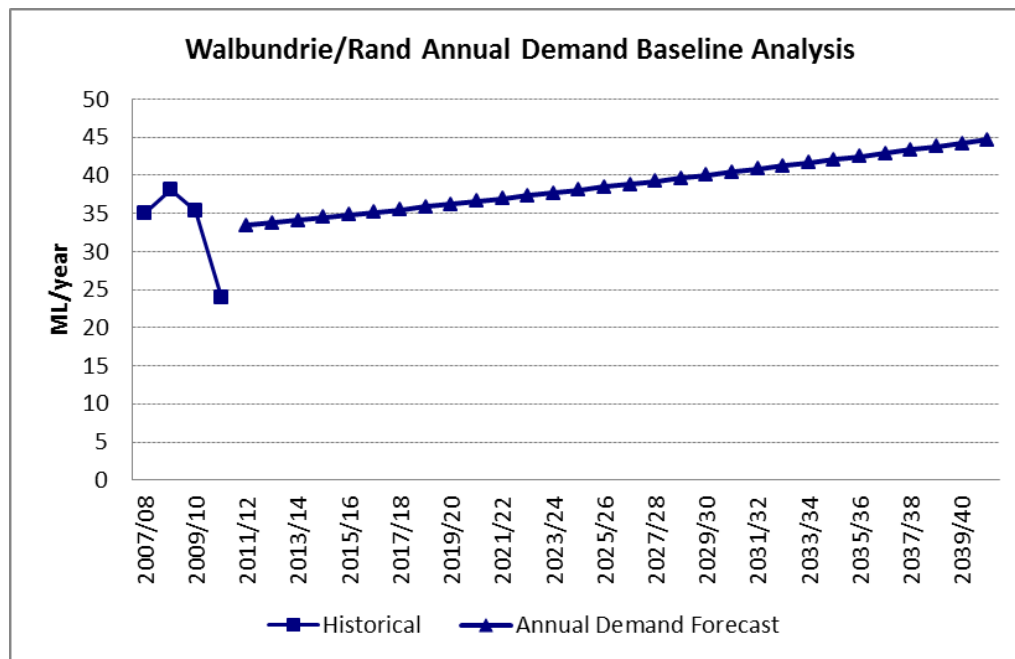
growth rate adopted for this study is 1% growth. Raw water source and treatment used are listed in Table 22.

**Table 22: Walbundrie/Rand System Water Source and Treatment**

	Capacity	Licence (Water allocation) / capacity
Water Source: Walbundrie Bores	Bore No.1 – 1.5 L/s Bore No.2 – 2.5 L/s	125 ML/year
Walbundrie/Rand Treatment Plant	Treatment consists of aeration and chlorination	0.34 ML/day

**Walbundrie/Rand Annual Demand Analysis**

The annual demand forecast was calculated using historical records and the growth rate. The first year of the forecast is the average of 4 years of annual demand records. The existing licence allocation 125 is sufficient to supply Walbundrie/Rand’s foreseen annual demand.



**Figure 42: Walbundrie/Rand Annual Demand Analysis**

**Walbundrie/Rand Peak Day Demand**

Walbundrie/Rand daily production records were checked to identify the historical highest daily demand. Daily production figures are available from 2008 to 2011. Figure 41 shows the historical daily demand above 550 kL/day and the PDD forecast is calculated based on the growth rate. The starting year of the forecast is the average of the highest (above 550 kL/d) daily production records.

RWCC staff have advised that the Walbundrie/Rand daily demand records (average of 600 kL/day) are higher than expected. In fact, when analysing it against the treatment capacity of this system (340 kL/day) it is clear that there are some errors in

the records. RWCC will revisit this data records in the near future to ensure the system is sized to supply the forecast demand.

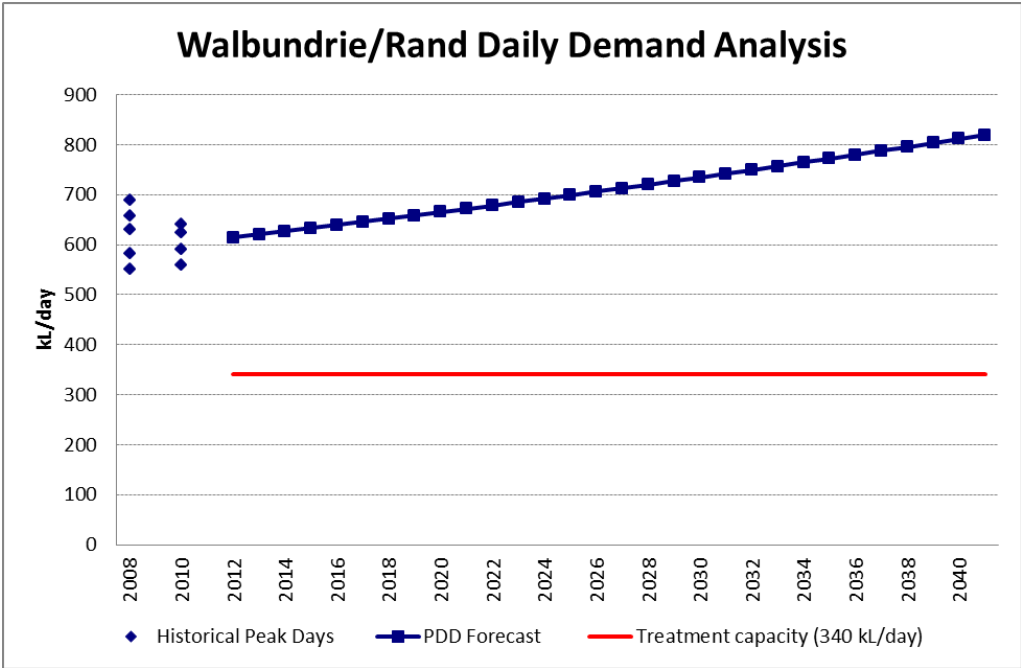


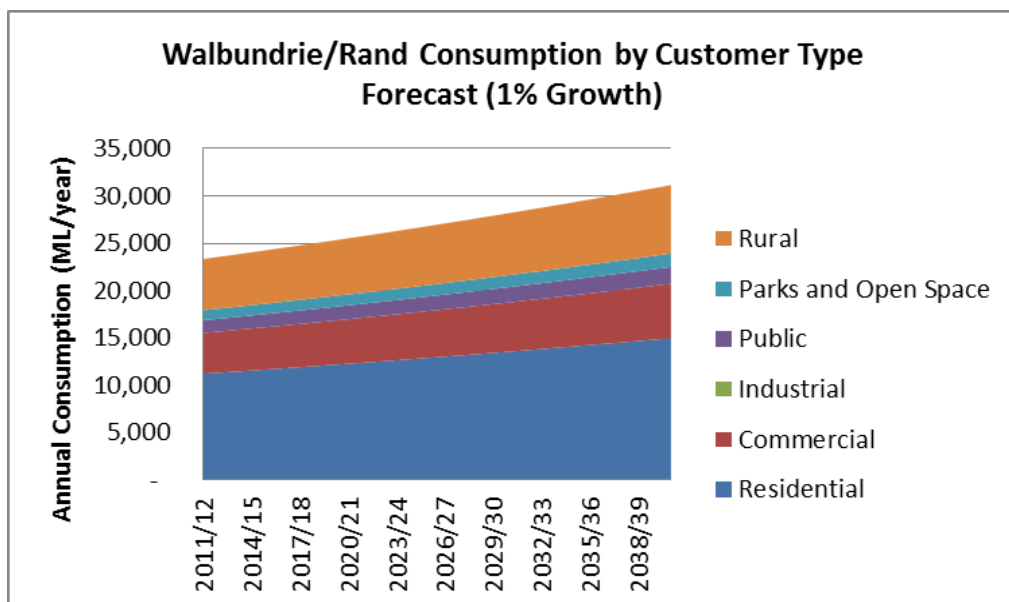
Figure 43: Walbundrie/Rand Average Daily Demand Forecast

Walbundrie/Rand Demand Forecast for each Customer Category

A demand forecast analysis for each customer type within Walbundrie/Rand System has been prepared using 2010/11 observed annual consumption data from Council’s billing data base and 1% growth rate for the next 30 years. It is assumed that the current ratios between each customer type’s water consumption will remain the same over the 30 year planning horizon.

Table 23: Walbundrie/Rand System Consumption by Customer Type

Customer Type	2010/11 (actual)	2040/41 (estimated)	% of Total Water Consumed
Residential	11,119	14,987	48%
Commercial	4,259	5,740	18%
Industrial	-	-	0%
Public	1,324	1,785	5.7%
Parks and Open Space	1,042	1,404	4.5%
Rural	5,365	7,231	23%
Other	-	-	0%
<b>Total water consumption (kL)</b>	<b>23,109</b>	<b>31,147</b>	<b>100%</b>



**Figure 44: Walbundrie/Rand System Consumption by Customer Type**

### Collingullie

The Collingullie System population in 2008 was 140. (Source: Joint IWCM Evaluation Study, 2010). The growth rate adopted for this study is 1% growth. Raw water source and treatment used are listed in Table 24.

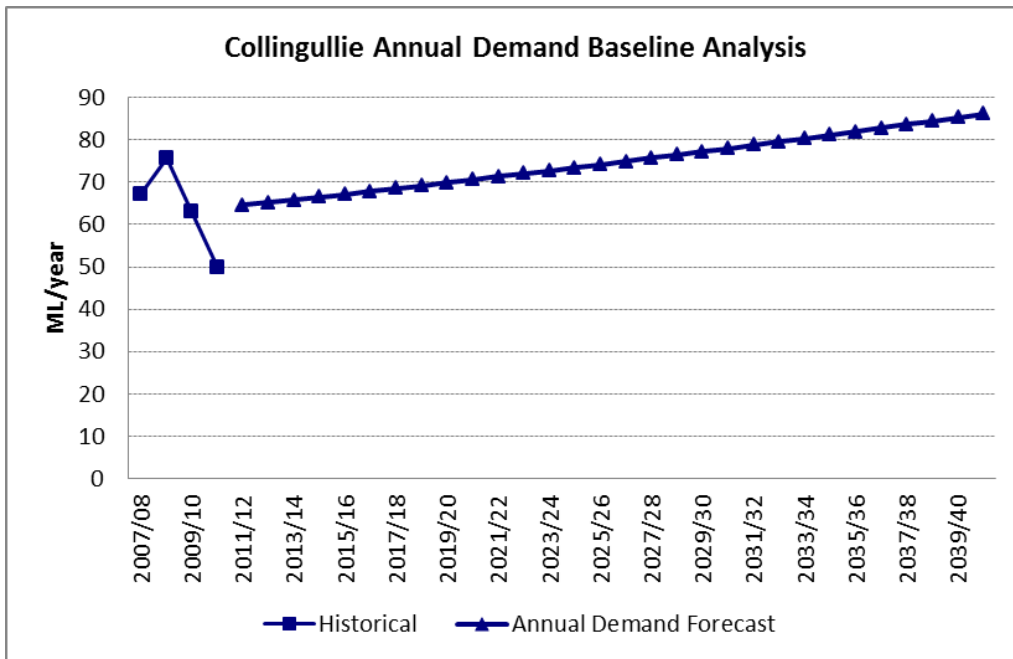
**Table 24: Collingullie System Water Source and Treatment**

	Capacity	Licence (Water allocation) / capacity
Water Source: Collingullie Bores	Bore No.1 – 7 L/s Bore No.2 – 7 L/s Only one bore at the time	150 ML/year
Collingullie Treatment Plant	Treatment consists of aeration, chlorination and filtration	0.55 ML/day (assuming 22hrs operation)

### Collingullie Annual Demand Analysis

The annual demand forecast was calculated using the historical records and growth rate. The first year of the forecast is the average of 4 years of annual demand records. The existing licence allocation 150 ML/year is sufficient to supply Collingullie’s foreseen annual demand.

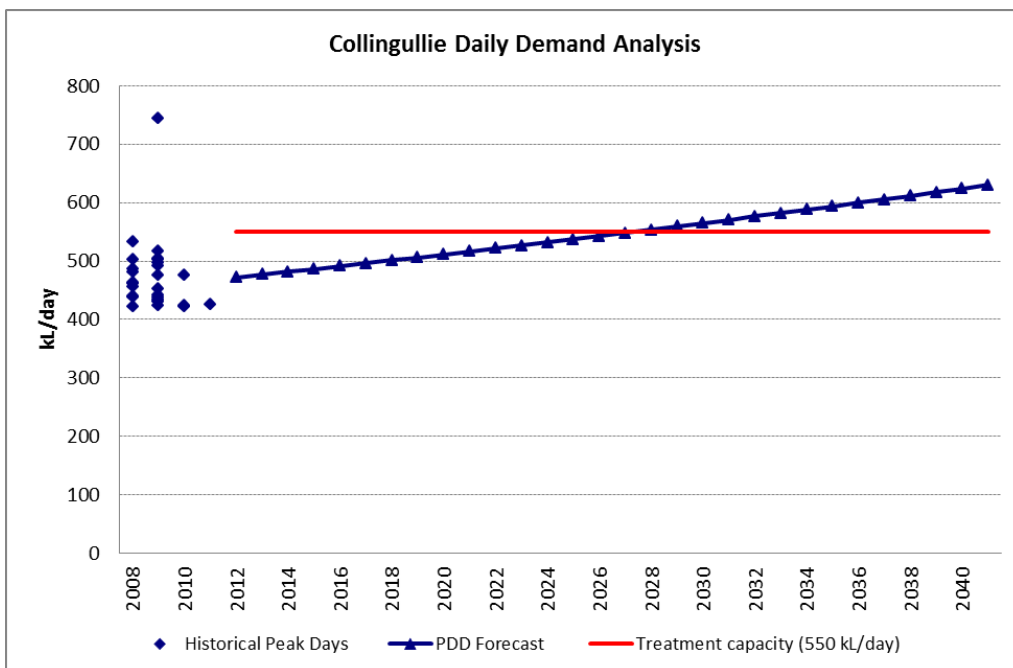




**Figure 45: Collingullie Annual Demand Analysis**

**Collingullie Peak Day Demand**

Collingullie daily production records were checked to identify the historical highest daily demand. Daily production figures are available from 2008 to 2011. Figure 44 shows the historical daily demand above 420 kL/day and the PDD forecast is calculated based on the growth rate. The starting year of the forecast is the average of the highest (above 420 kL/d) daily production records. Figure 44 show that Collingullie treatment plant capacity has sufficient capacity to supply demand up to 2026.



**Figure 46: Collingullie Average Daily Demand Forecast**

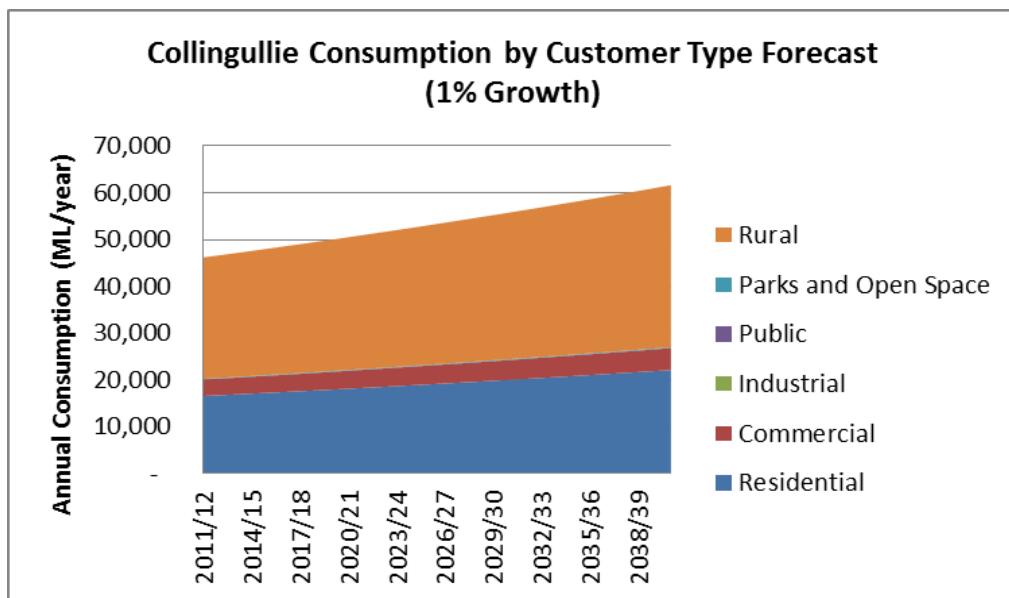
**Collingullie Demand Forecast for each Customer Category**

A demand forecast analysis for each customer type within Collingullie System has been prepared using 2010/11 observed annual consumption data from Council’s billing data

base and 1% growth rate for the next 30 years. It is assumed that the current ratios between each customer type's water consumption will remain the same over the 30 year planning horizon.

**Table 25: Collingullie System Consumption by Customer Type**

Customer Type	2010/11 (actual)	2040/41 (estimated)	% of Total Water Consumed
Residential	16,426	22,140	36%
Commercial	3,476	4,685	7.6%
Industrial	-	-	0%
Public	-	-	0.0%
Parks and Open Space	143	193	0.3%
Rural	25,678	34,610	56%
Other	-	-	0%
<b>Total water consumption (kL)</b>	<b>45,723</b>	<b>61,628</b>	<b>100%</b>



**Figure 47: Collingullie System Consumption by Customer Type**

Based on the average daily demand analysis shown in Figure 44, it is recommended that Council implement demand management in Collingullie. Figure 45 show that rural and residential customers are the highest water users within the Collingullie System. Therefore Council should opt for demand management measures that target rural and residential customers.

## Oura

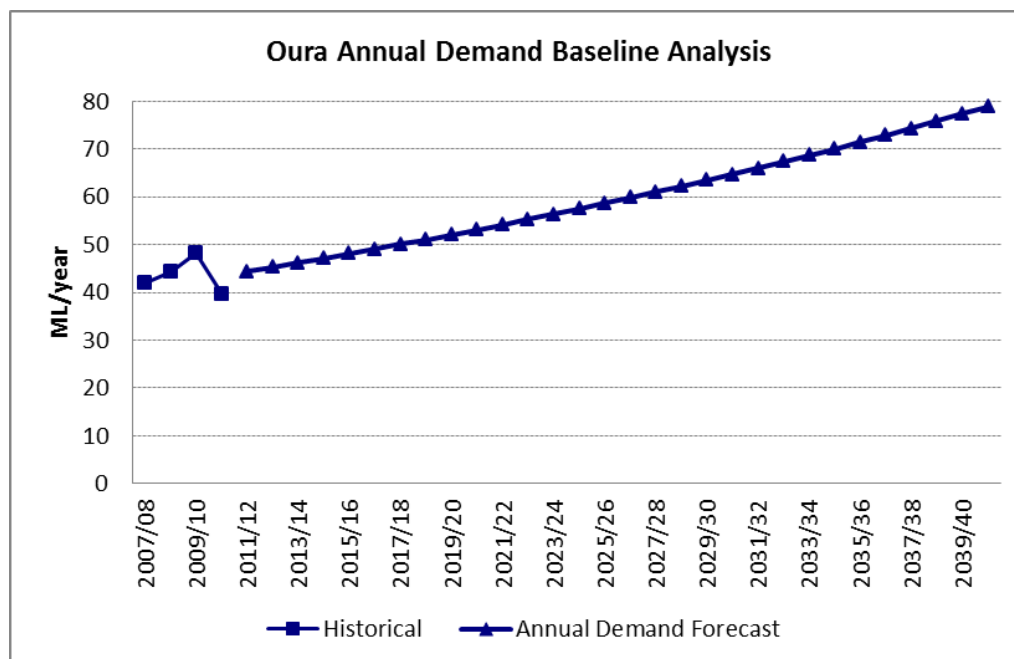
The Oura System population in 2008 was 25. (Source: Joint IWCM Evaluation Study, 2010). The growth rate adopted for this study is 2% growth. Raw water source and treatment used are listed in Table 26.

**Table 26: Oura System Water Source and Treatment**

	Capacity	Licence (Water allocation) / capacity
Water Source: Oura Bores	Bore No.1 – 7 L/s Bore No.2 – 7 L/s	200 ML/year
Oura Treatment Plant	Treatment consists of aeration and chlorination	0.55 ML/day (assuming 22 hrs operation)

## Oura Annual Demand Analysis

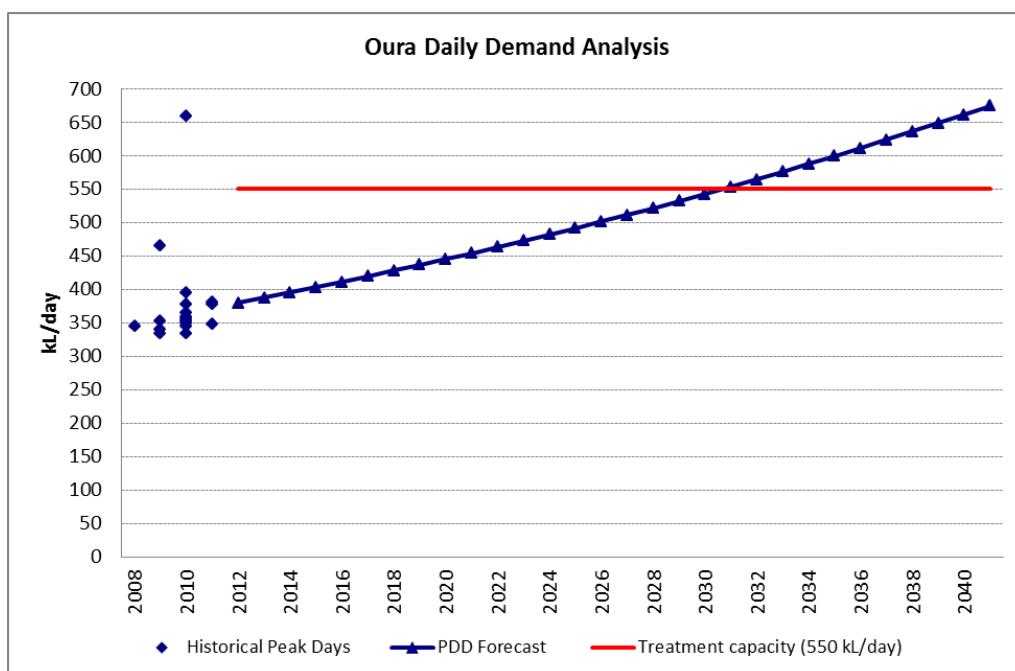
The annual demand forecast was calculated using the historical records and growth rate. The first year of the forecast is the average of 4 years of annual demand records. The existing licence allocation of 200 ML/year is sufficient to supply Oura's foreseen annual demand.



**Figure 48: Oura Annual Demand Analysis**

## Oura Peak Day Demand

Oura daily production records were checked to identify the historical highest daily demand. Daily production figures are available from 2008 to 2011. Figure 41 shows the historical daily demand above 330 kL/day and the PDD forecast is calculated based on the growth rate. The starting year of the forecast is the average of the highest (above 330 kL/d) daily production records. Figure 47 show that Oura treatment plant capacity has sufficient capacity to supply demand up to 2030.



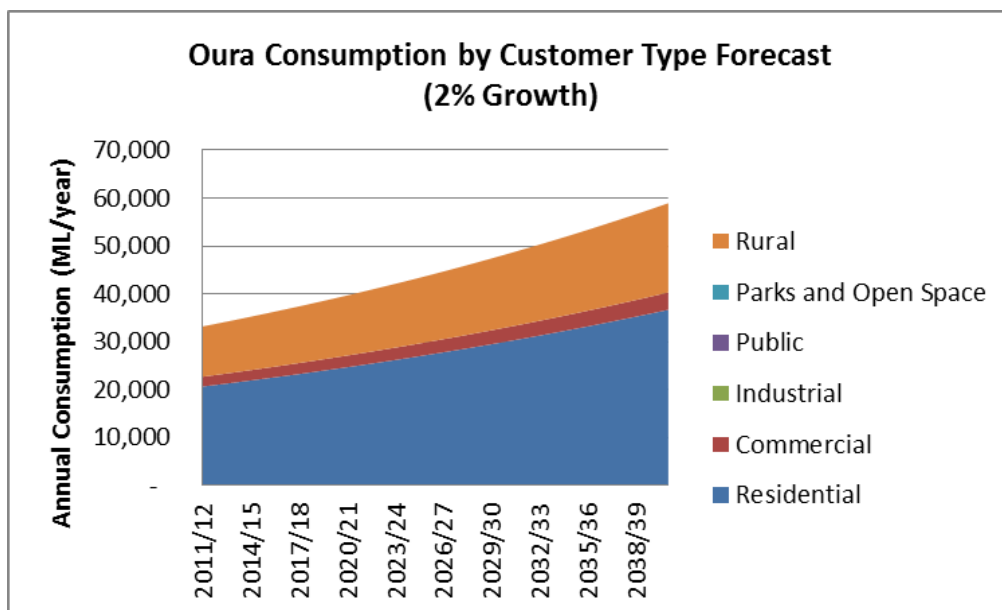
**Figure 49: Oura Average Daily Demand Forecast**

**Oura Demand Forecast for each Customer Category**

A demand forecast analysis for each customer type within Oura System has been prepared using 2010/11 observed annual consumption data from Council’s billing data base and 2% growth rate for the next 30 years. It is assumed that the current ratios between each customer type’s water consumption will remain the same over the 30 year planning horizon.

**Table 27: Oura System Consumption by Customer Type**

Customer Type	2010/11 (actual)	2040/41 (estimated)	% of Total Water Consumed
Residential	20,258	36,695	62%
Commercial	1,997	3,617	6.1%
Industrial	-	-	0%
Public	-	-	0%
Parks and Open Space	-	-	0%
Rural	10,290	18,639	32%
Other	-	-	0%
<b>Total water consumption (kL)</b>	<b>32,545</b>	<b>58,951</b>	<b>100%</b>



**Figure 50: Oura System Consumption by Customer Type**

Based on the average daily demand analysis shown in Figure 47, it is recommended that Council implement demand management in Oura. Figure 48 show that residential and rural customers are the highest water users within the Oura System. Therefore Council should opt for demand management measures that target residential and rural customers.

### Holbrook

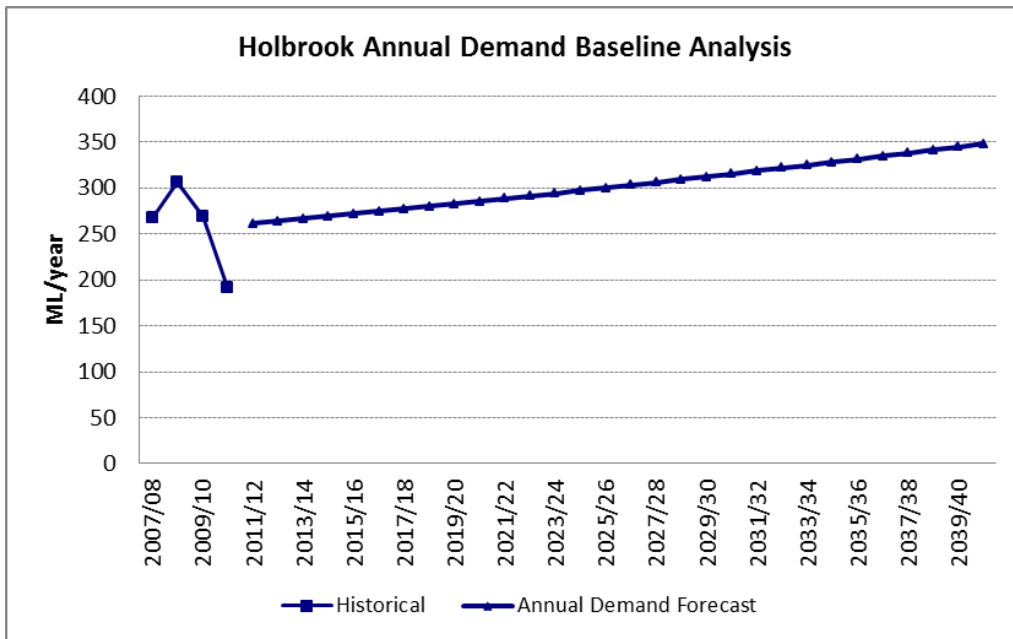
The Holbrook System population in 2008 was 1400. (Source: Joint IWCM Evaluation Study, 2010). The growth rate adopted for this study is 1% growth. Raw water source and treatment used are listed in Table 26.

**Table 28: Oura System Water Source and Treatment**

	Capacity	Licence (Water allocation) / capacity
Water Source: Ralvona Bores	Bore No.1 – 19 L/s Bore No.2 – 18 L/s Bore No.3 – 10 L/s	500 ML/year
Holbrook Source Works	Treatment consists of aeration and pre-chlorination	3.8 ML/day

### Holbrook Annual Demand Analysis

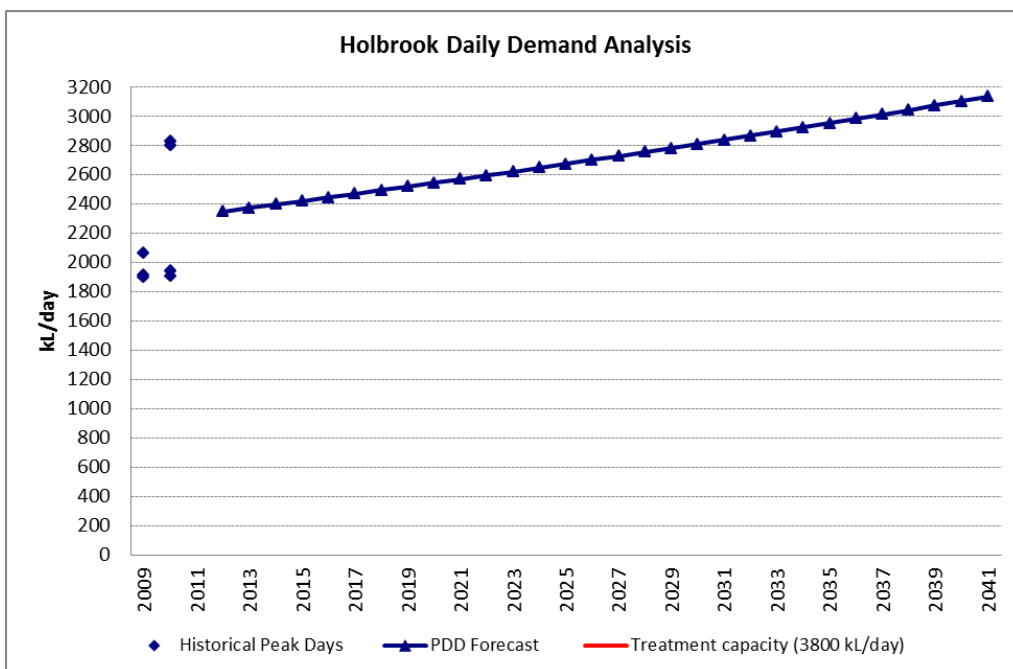
The annual demand forecast was calculated using the historical records and growth rate. The first year of the forecast is the average of 4 years of annual demand records. The existing licence allocation of 500 ML/year is sufficient to supply Holbrook's foreseen annual demand.



**Figure 51: Holbrook Annual Demand Analysis**

**Holbrook Peak Day Demand**

Holbrook daily production records were checked to identify the historical highest daily demand. Daily production figures are available from 2008 to 2011. Figure 47 shows the historical daily demand above 1900 kL/day and the PDD forecast is calculated based on the growth rate. The starting year of the forecast is the average of the highest (above 1900 kL/d) daily production records. Holbrook Source Works has sufficient capacity to supply demand up to 2041.



**Figure 52: Holbrook Average Daily Demand Forecast**

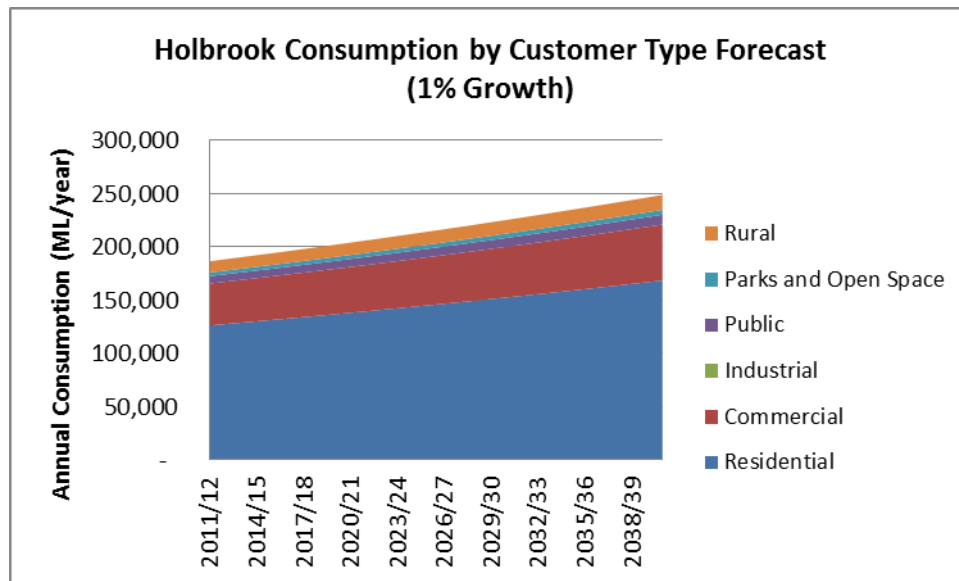
**Holbrook Demand Forecast for each Customer Category**

A demand forecast analysis for each customer type within Holbrook System has been prepared using 2010/11 observed annual consumption data from Council’s billing data

base and 1% growth rate for the next 30 years. It is assumed that the current ratios between each customer type's water consumption will remain the same over the 30 year planning horizon.

**Table 29: Holbrook System Consumption by Customer Type**

Customer Type	2010/11 (actual)	2040/41 (estimated)	% of Total Water Consumed
Residential	125,055	168,555	67.7%
Commercial	38,957	52,508	21.1%
Industrial	-	-	0%
Public	6,857	9,242	3.7%
Parks and Open Space	3,410	4,596	2%
Rural	10,426	14,053	5.6%
Other	-	-	0%
<b>Total water consumption (kL)</b>	<b>32,545</b>	<b>58,951</b>	<b>100%</b>



**Figure 53: Holbrook System Consumption by Customer Type**

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# Appendix B

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## Unaccounted For Water Analyses



## Introduction

The level of unaccounted for water (UFW) is the difference between the metered water production and the metered water consumption. This difference could be water losses and/or non-revenue water. UFW definition and general information about RWCC benchmarking performance on water losses is provided in section 8.1.1. The detailed analyses of each RWCC water supply system UFW figures are presented below.

## Wagga Wagga System

**Table 30: Wagga Wagga System UFW Analysis**

	2007/08	2008/09	2009/10	2010/11
Residential	7,308,627	8,513,598	6,732,980	5,248,380
Commercial	1,362,617	1,689,416	1,495,067	1,235,652
Industrial	1,056,808	1,107,433	1,019,304	2,358,746
Public	589,635	594,302	543,312	452,563
Parks and Open Space	363,138	441,724	387,896	184,180
Rural	7,512	8,378	5,620	2,706
Other (RAAF Base)	85,396	190,878	195,642	139,304
Total water consumption (kL)	10,773,733	12,545,729	10,379,821	8,141,186
Total water production (kL)	11,818,724	13,890,740	11,953,351	8,705,618
<b>UFW (kL)</b>	<b>1,130,387</b>	<b>1,535,889</b>	<b>1,769,172</b>	<b>564,432</b>
<b>% of water production</b>	<b>9%</b>	<b>10%</b>	<b>13%</b>	<b>6%</b>

Table 28 shows that UFW in the Wagga Wagga System from 2007/08 to 2009/10 is below the average leakage from 40 LWUs' distribution systems of 17% of annual consumption. 2010/11 UFW is very low and it is probably the result of the water loss management program undertaken in the previous year.

## Southern Trunk Main System

**Table 31: Southern Trunk Main System UFW Analysis**

	2007/08	2008/09	2009/10	2010/11
Residential	500,206	589,852	544,142	356,890
Commercial	67,016	89,485	85,422	57,763
Industrial	3481	21443	25,942	19,832
Public	24,510	27,327	24,406	14,934
Parks and Open Space	15,153	26,461	21,005	12,400

	2007/08	2008/09	2009/10	2010/11
Rural	389,544	398,544	429,689	259,871
Other (Kapooka)	353,085	398,553	377,787	275,735
Total water consumption (kL)	1,352,995	1,551,665	1,508,393	997,425
Total water production (kL)	1,666,852	1,801,472	1,547,135	1,193,293
<b>UFW (kL)</b>	<b>313,857</b>	<b>249,807</b>	<b>38,742</b>	<b>195,868</b>
<b>% of water production</b>	<b>19%</b>	<b>14%</b>	<b>3%</b>	<b>16%</b>

Based on the data above, the percentage of UFW in the Southern Trunk Main System dropped significantly in 2009/10 and increased to 16% in 2010/11. This is similar to the average leakage from 40 LWUs' distribution systems of 17% of annual consumption.

### Western Trunk Main System

**Table 32: Western Trunk Main System UFW Analysis**

	2007/08	2008/09	2009/10	2010/11
Residential	230,398	267,843	232,957	144,480
Commercial	61,529	64,768	64,399	38,189
Industrial	-	-	-	-
Public	20,040	30,808	26,474	17,697
Parks and Open Space	7,559	8,501	8,110	3,192
Rural	205,019	240,946	174,657	110,187
Total water consumption (kL)	524,545	612,866	506,597	313,745
Total water production (kL)	549,847	614,032	555,677	326,919
<b>UFW (kL)</b>	<b>25,302</b>	<b>1,166</b>	<b>49,080</b>	<b>13,174</b>
<b>% of water production</b>	<b>5%</b>	<b>0.2%</b>	<b>9%</b>	<b>4%</b>

Based on the data above the percentage of UFW in the Western Trunk Main System is very low and below the average leakage from 40 LWUs' distribution systems of 17% of annual consumption.

## Tarcutta System

**Table 33: Tarcutta System UFW Analysis**

	2007/08	2008/09	2009/10	2010/11
Residential	23,755	24,514	25,173	18,494
Commercial	9,817	11,729	10,275	10,419
Industrial	-	-	-	-
Public	654	1,040	845	922
Parks and Open Space	2,707	2,084	1,973	854
Rural	1,698	2,246	3,159	6,004
Total water consumption (kL)	38,631	41,613	41,425	36,693
Total water production (kL)	57,000	51,410	42,750	38,350
<b>UFW (kL)</b>	<b>18,369</b>	<b>9,797</b>	<b>1,325</b>	<b>1,657</b>
<b>% of water production</b>	<b>32%</b>	<b>19%</b>	<b>3%</b>	<b>4%</b>

Based on the data above the percentage of UFW in Tarcutta has reduced every year in the past 4 years. The latest years show very low UFW.

## Humula System

**Table 34: Humula System UFW Analysis**

	2007/08	2008/09	2009/10	2010/11
Residential	6,800	7,782	9,169	5,587
Commercial	3,937	3,713	1,118	1,001
Industrial	-	-	-	-
Public	468	345	468	148
Parks and Open Space	552	488	421	28
Total water consumption (kL)	11,757	12,328	11,176	6,764
Total water production (kL)	12,000	14,100	13,000	7,570
<b>UFW (kL)</b>	<b>243</b>	<b>1,772</b>	<b>1,824</b>	<b>806</b>
<b>% of water production</b>	<b>2%</b>	<b>13%</b>	<b>14%</b>	<b>11%</b>

Based on the data above the percentage of UFW in Humula has increased in the past 4 years. However according to the 2010/11 NSW Benchmarking Report, it is still below the average leakage from 40 LWUs' distribution systems of 17% of annual consumption.

## Woomargama System

**Table 35: Woomargama System UFW Analysis**

	2007/08	2008/09	2009/10	2010/11
Residential	9,387	12,649	12,416	8,747
Commercial	1,905	1,498	1,605	1,614
Industrial	-	-	-	-
Public	-	-	-	-
Parks and Open Space	39	33	163	115
Total water consumption (kL)	11,331	14,180	14,184	10,476
Total water production (kL)	13,000	19,640	14,790	11,810
<b>UFW (kL)</b>	<b>1,669</b>	<b>5,460</b>	<b>606</b>	<b>1,334</b>
<b>% of water production</b>	<b>13%</b>	<b>28%</b>	<b>4%</b>	<b>11%</b>

Based on the data above the percentage of UFW in Woomargama has decreased from 2007/08 to 2009/10 and increased in 2010/11. However according to the 2010/11 NSW Benchmarking Report, it is still below the average leakage from 40 LWUs' distribution systems of 17% of annual consumption.

## Morundah System

**Table 36: Morundah System UFW Analysis**

	2007/08	2008/09	2009/10	2010/11
Residential	4,227	5,417	5,797	2,891
Commercial	678	725	406	262
Industrial	-	-	-	-
Public	-	-	-	-
Parks and Open Space	608	1,261	1,623	1,373
Total water consumption (kL)	5,513	7,403	7,826	4,526
Total water production (kL)	8,000	10,090	10,280	7,430
<b>UFW (kL)</b>	<b>2,487</b>	<b>2,687</b>	<b>2,454</b>	<b>2,904</b>
<b>% of water production</b>	<b>31%</b>	<b>27%</b>	<b>24%</b>	<b>39%</b>

Based on the data above the percentage of UFW in Morundah has been higher than the average leakage from 40 LWUs' distribution systems of 17% of annual consumption in the past 4 years.

## Walbundrie/Rand System

**Table 37: Walbundrie/Rand System UFW Analysis**

	2007/08	2008/09	2009/10	2010/11
Residential	19,407	21,213	16,391	11,119
Commercial	2,656	3,460	3,736	4,259
Industrial	-	-	-	-
Public	1,351	1,771	1,777	1,324
Parks and Open Space	1,567	523	808	1,042
Rural	5,319	7,876	8,652	5,365
Total water consumption (kL)	30,300	34,843	31,364	23,109
Total water production (kL)	35,000	38,160	35,290	24,010
<b>UFW (kL)</b>	<b>4,700</b>	<b>3,317</b>	<b>3,926</b>	<b>901</b>
<b>% of water production</b>	<b>13%</b>	<b>9%</b>	<b>11%</b>	<b>4%</b>

Based on the data above the percentage of UFW in Walbundrie/Rand has reduced every year in the past 4 years. The latest years show a very low UFW.

## Collingullie System

**Table 38: Collingullie System UFW Analysis**

	2007/08	2008/09	2009/10	2010/11
Residential	23,892	32,115	25,655	16,426
Commercial	3,652	4,551	4,941	3,476
Industrial	-	-	-	-
Public	-	-	-	-
Parks and Open Space	2	-	19	143
Rural	35,399	36,571	31,041	25,678
Total water consumption (kL)	62,945	73,237	61,656	45,723
Total water production (kL)	67,000	75,620	63,090	49,750
<b>UFW (kL)</b>	<b>4,055</b>	<b>2,383</b>	<b>1,434</b>	<b>4,027</b>
<b>% of water production</b>	<b>6%</b>	<b>3%</b>	<b>2%</b>	<b>8%</b>

Based on the data above the percentage of UFW in Collingullie has been lower than the average leakage from 40 LWUs' distribution systems of 17% of annual consumption in the past 4 years.

## Oura System

**Table 39: Oura System UFW Analysis**

	2007/08	2008/09	2009/10	2010/11
Residential	32,255	35,029	37,912	20,258
Commercial	2,496	2,816	2,526	1,997
Industrial	-	-	-	-
Public	-	-	-	-
Parks and Open Space	-	-	-	-
Rural	-	-	-	10,290
Total water consumption (kL)	34,751	37,845	40,438	32,545
Total water production (kL)	42,000	44,400	48,150	39,730
<b>UFW (kL)</b>	<b>7,249</b>	<b>6,555</b>	<b>7,712</b>	<b>7,185</b>
<b>% of water production</b>	<b>17%</b>	<b>15%</b>	<b>16%</b>	<b>18%</b>

Based on the data above the percentage of UFW in Oura has been the same as the average leakage from 40 LWUs' distribution systems of 17% of annual consumption in the past 4 years.

## Holbrook System

**Table 40: Holbrook System UFW Analysis**

	2007/08	2008/09	2009/10	2010/11
Residential	160,499	197,004	175,983	125,055
Commercial	48,820	52,795	48,377	38,957
Industrial	-	-	-	-
Public	5,075	7,463	8,351	6,857
Parks and Open Space	9,570	11,081	10,530	3,410
Rural	28,585	25,991	14,789	10,426
Total water consumption (kL)	252,549	294,334	258,030	184,705
Total water production (kL)	267,000	306,260	269,220	191,190
<b>UFW (kL)</b>	<b>14,451</b>	<b>11,926</b>	<b>11,190</b>	<b>6,485</b>
<b>% of water production</b>	<b>5%</b>	<b>4%</b>	<b>4%</b>	<b>3%</b>

Based on the data above the percentage of UFW in Holbrook has been lower than the average leakage from 40 LWUs' distribution systems of 17% of annual consumption in the past 4 years.

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# Appendix C

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## Fact Sheets



# FACT SHEET



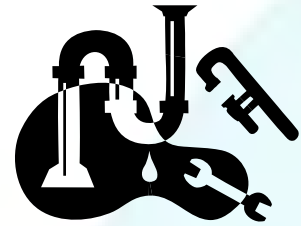
## F 8

(Revised 1/7/2009)

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E-mail: admin@rwcc.com.au

## HOW TO DETECT A LEAK & HOW MUCH WATER IS LOST FROM A LEAKING TAP?

*A simple check can be made by following these steps:*

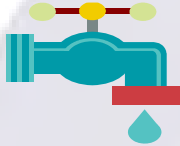

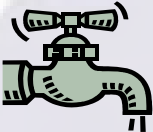

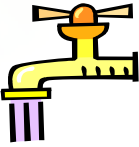


- 1 TURN OFF** everything in your house that uses water.
- 2 LOOK AT YOUR METER** and note down the numbers on the RED dials.
- 3 WAIT FOR AT LEAST 1 HOUR** (with all taps still turned off).
- 4 RELOOK AT YOUR METER:** Any movement on the red dials indicates you have a leak.

*NEW STYLE METERS are even easier to detect a leak:*

- 1 TURN OFF** everything in your house that uses water.
- 2 LOOK AT YOUR METER.** There is a small triangle in the centre of the face. This triangle is called a low-flow indicator.
- 3 CHECK TO SEE IF THE TRIANGLE IS TURNING.** The low-flow indicator SHOULD NOT be moving. Any movement of the triangle indicates you have a leak.
- 4 CHECK YOUR HOUSE FOR DRIPPING TAPS,** dribbling cisterns, or unusual damp patches in the garden. Consult a plumber for assistance if needed.

## HOW MUCH WATER IS LOST FROM A LEAKING TAP ??

WATER LOSS RATE	WATER LOSS VOLUME
<p>One drop per second</p> 	<p>2.9 ml/min 4.176 litres/day 117 litres/month 1,513 litres/year</p>
<p>Two drops per second</p> 	<p>8.9 ml/min 12.82 litres/day 385 litres/month 4,678 litres/year</p>
<p>Drops breaking into a stream</p> 	<p>61ml/min 88.32 litres/day 2,649 litres/month 32,327 litres/year</p>
<p>3.2mm Stream</p> 	<p>683 ml/min 984 litres/day 29,523 litres/month 359,160 litres/year</p>
<p>6.4mm Stream</p> 	<p>2431ml (2.43litres)/min 3501 litres/day 105,034 litres/month 1,277,865 litres (1.278ML)/year</p>

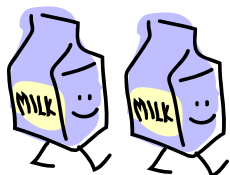
# FACT SHEET



**F 15**  
(Issued 1/7/2008)

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## BEING WATERWISE INDOORS



Imagine 900 one-litre milk cartons filled with water sitting on your doorstep each morning!  
Astonishingly, that's how much water is used every day by the average Australian household.



Inside the house alone, we each use an average of 160 litres of water daily. But research shows that we require much less than this for our needs.

### HOW MUCH WATER DO WE USE INDOORS ?

An average tap flows at a rate of up to 20 litres per minute, depending on how far it's turned on. Apply this to how we use water in different rooms in the house (see below) and the figures are surprising.

#### In the bathroom

Brushing teeth	5 litres
Washing hands	5 litres
Flushing toilet	12 litres
Shower (10 minutes)	200 litres
Bath	100 litres

#### In the laundry

Washing machine	150 litres
-----------------	------------



#### In the kitchen

Drinking, cooking, & cleaning	per person
	10 ltrs/day
Dishwashing by hand	20 ltrs/day
Dishwasher	50 ltrs/use
Garbage disposal unit	10 ltrs/use

We can reduce community demand for this precious resource if we all use water more carefully.

### SAVE WATER, SAVE MONEY, SAVE THE ENVIRONMENT

Reducing your demand for water will eliminate or defer the need for new dams and supply systems, reduce operating costs for treating and distributing water and contain your household water charges.

*The aim of Water Wise is to help you achieve a balance between what you pay in water bills and the benefits you obtain from the water supply.*

### BE WATERWISE INDOORS

How can we avoid wasting water without affecting our lifestyle?. It's easy - read on and just follow the simple tips in this fact sheet.

#### In the bathroom:

We use more water in our bathrooms than in any other part of the house. It's a great place to start when looking for ways to save water, money and the environment.



- Install a dual flush toilet. Modern toilets give the option to flush either half or all the cistern's water. Traditional toilets can usually be converted to dual flush.

Single flush cisterns have a capacity of between 9 and 12 litres. Dual flush cisterns are mostly 3 and 6 litres flush.

If each person in the house flushes five times per day:

Single – 5 @ 10 litres = 50 litres

Dual – 1 @ 6 litres )

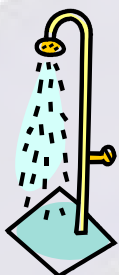
4 @ 3 litres ) = 18 litres

daily saving 32 litres per person

**Tips for the bathroom:** A leaking toilet can waste more than 60,000 litres of water per year. Check for leaks by putting a little food colouring in the tank. If within 10 minutes the colouring begins appearing in the bowl without flushing, get the cistern repaired immediately.

**Don't turn the taps on quickly. Adding cold water to balance hot water is wasteful**

- Remember, the average household spends \$300 a year on baths and showers, including water and heating costs. Take shorter showers. Limit showers to the time it takes to soap up, wash down, and rinse off.



- Install a water-saving shower rose or flow restrictor. Many showers put out 20 litres of water per minute, however, 10 litres is enough for a refreshing, cleansing

shower. Install a shower with an efficiency star rating of three stars or more, save around \$50-\$100 in water and energy costs every year.

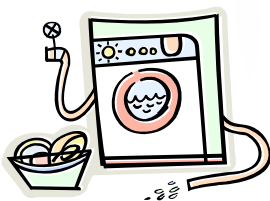
**Tip for the bathroom:** Shower to your favourite song. This will ensure your shower is only three minutes long.

- There is no need to run water down the plughole while brushing your teeth. Wet your brush and fill a glass for rinsing.
- Don't rinse your razor under a running tap. Fill the sink with a little warm water for rinsing.

## In the Laundry

Each washing machine or dishwasher load costs you \$1.00 in water, energy, detergent and machine wear costs. So fill up before you wash!

**Save those suds** – Washing machines are major users of water in the home. As with dishwashers, try not to operate them with small loads. If you are buying a new machine look for the “Star” rating. Consider buying a front

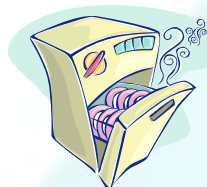


loading machine. They generally use less water than top loaders.

## In the Kitchen

When washing dishes by hand, don't rinse them under a running tap. If you have two sinks, fill the second one with rinsing water. If you have only one sink, stack washed dishes in a dish rack and rinse them with a pan of hot water.

- Wait till you have a full load before using your dishwasher. Another load, another dollar!.



- Keep a bottle of drinking water in the refrigerator. This avoids wasting water while waiting for the water to cool down, and also gets rid of any chlorine taste.
- Install aerating taps. These are inexpensive and can reduce water flow by 50%.
- Garbage-disposal units use about 10 litres of water per use and send a lot of extra rubbish into sewers. This places an additional load on sewerage treatment works and impacts on our rivers and beaches. Put your organic food scraps in the compost bin for a better garden.
- When buying a new appliance that uses water, be sure it has a high water conservation rating.

## INSTALL TAP AERATORS OR FLOW CONTROL VALVES

A tap aerator can save you about half the amount of water you would use with a standard tap.

A flow control valve can reduce the flow of water through a tap to a more manageable level.

Install water control devices:

- for the laundry and bathroom taps (12 litres per minute recommended)
- for the kitchen taps (9 litres per minute recommended)
- for handbasin taps (6 litres per minute recommended).

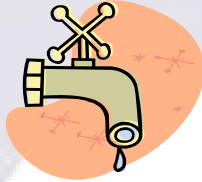
## SAVE HOT WATER

Make sure your hot water system thermostat is not set too high. Adding cold water to cool too-hot water is wasteful.

If you have a spa, ensure it is well insulated to keep water warm for longer.

## CHECK FOR LEAKS

- Use your water meter to check for leaks. Turn all taps off before you go to bed one night and take a meter reading. Check the meter next morning before any water is used. If the meter reading has advanced, and no-one used any water during the night, you have a leaking pipe, tap or toilet cistern. Locate the problem and repair it.
- A continuously dripping tap can waste 600 litres of water per day. Turn taps off properly and check washers for wear.
- A continuously running toilet can waste more than 200 kilolitres of water per year. To check for leaks, put a little food colouring in the tank. If, without flushing, the colouring begins to appear in the bowl, the cistern should be repaired immediately.



## HOT WATER PIPES

Insulate hot water pipes. This saves energy and avoids wasting water while waiting for hot water to flow through.

## RENOVATING

When renovating select products with a high water-efficient star rating.

The National Water Efficiency Labelling and Standards Scheme rates the efficiency of products on a scale of zero to six stars. The more stars the more efficient the appliance so – “reach for the stars”.

## SUMMARY

There is no need for you to stop your essential uses of water because your savings would be small in comparison with the benefits you would lose. All you need to do is look at areas where you might be wasting water and use the tips in this sheet to help you use water efficiently.

By using water wisely, you will:

- Reduce the need for new dams and supply systems
- Keep your water bills down
- Make large savings on your energy bills for water heating
- Reduce the risk of water restrictions
- Reduce your impact on the environment



# FACT SHEET



**F 16**  
(Issued 1/7/2008\_

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## BE WATERWISE OUTDOORS & IN THE GARDEN

Can you imagine 900 one-litre milk cartons each filled with water being delivered to your doorstep every morning?. Astonishingly, that's how much water is used every day by the average Australian household.

Just outside, the average household uses 170,000 litres of water every year. That's enough to fill four backyard swimming pools. All this water is sprinkled, squirted, dropped, gushed and quite often wasted.

### HOW MUCH WATER DO WE USE OUTDOORS ? (Average values)

An average tap flows at up to 20 litres per minute depending on how far it's turned on. Apply this to all your outdoor watering activities (see below) and you'll be surprised at how much is actually used.

Filling swimming pool	40,000 litres
Sprinkler	1000 litres/hour
Garden dripper	4 litres/hour
Washing car with a running hose	200 litres
Continuously dripping tap	600 litres/day
Hand-held hose	20 litres/min.
Hosing driveway	100 litres

### SAVE WATER, SAVE MONEY, SAVE THE ENVIRONMENT

By using water sensibly and efficiently, we can all contribute to reducing community demand for this precious resource. Saving water will eliminate or defer the need for new dams and supply systems, and reduce operating costs. This will contain household water bills and reduce impact on our environment.

*The aim of WaterWise is to help you achieve a balance between what you pay in water bills and the benefits you obtain from the water supply.*



### BE WATERWISE OUTDOORS

How can we stop wasting water without affecting our lifestyle?. It's easy, just follow the simple tips in this fact sheet.

#### LEAKS

Regularly check taps, washers, pipes and cisterns for leaks.

- Turn all taps off before you go to bed one night and take a reading of the water meter. Check the meter next morning before any water is used. If the meter has advanced, and you are sure no-one used any water during the night, there is a leaking pipe, tap or toilet cistern. Locate the problem and repair it.
- A continuously dripping tap can waste 600 litres per day. Turn off all hoses with spray and watergun nozzles at the tap.

#### THE LAWN

A lawn can use more water per square metre than any other area in your garden.

- Experiment to see how much water your garden really needs. Most lawns need no more than 25mm a week in summer. Only half this amount is needed in coastal areas. If your lawn needs, say, 15mm a week, check the output of your sprinkler by placing a few tins in the area covered by the sprinkler and timing how long it takes to collect 15mm. Then, if you water twice a week, halve this time to get the time needed for each watering. It is better to water

thoroughly but only once or twice a week, as this encourages deep root growth and strong plants.

- Use efficient sprinklers that produce a fairly even water distribution. Avoid those that produce a fine mist spray which blows away in the wind.
- Don't water in the heat of the day, when a lot of water will simply evaporate and will be wasted. Water in the evening so that the water gets down to the root level for the heat of the next day.
- Avoid watering when it's windy. Not only does the wind blow the water away from the plants, it also increases evaporation.
- Water your lawn only when it needs it. A good way to see if your lawn needs watering is to step on the grass. If it springs back up when you move, it doesn't need water. If it stays flat, it may need watering.
- Reduce lawn area. This has the additional benefit of reducing your mowing. Check at your local nursery for a suitable drought-tolerant lawn grass for your area.
- Let the lawn go brown during very dry times. When the rain comes, the transformation to green will be dramatic.
- Give the lawn a feed - but do not over-fertilise.
- Aerate the soil to allow water to be absorbed more easily.



- Do not mow to a height less than 2cm. Taller grass holds water better.
- Use a timer with your sprinkler. A forgotten sprinkler wastes more

than 1000 litres per hour; leave it overnight and it could cost you \$10 each time. A timer will help you avoid wastage.

## THE GARDEN

- Design water-efficient gardens and outdoor areas, including directing drainage from paved areas for watering garden beds.
- Plant drought-resistant native trees and plants. Many natives are both attractive and thrive with far less watering than do other species.
- Don't over-water, as this takes nutrients as well as water past the root zone. This deprives your plants of nourishment and wastes water.
- Use a good mulch. Mulches can prevent up to 75% of evaporation loss and therefore are a cheap, easy and effective technique to make the most of water in the garden. Additionally, mulches prevent excessive runoff, restrict weed

growth, keep the soil cool in summer and warm in winter, improve soil structure and help put valuable nutrients back into the soil. The best mulch is a well-rotted compost. When mulching around trees, place the mulch away from the trunk to prevent collar rot occurring.

- Group plants according to how much water they need. By grouping plants into high or low water users, a watering pattern can be designed to prevent waste on plants that don't need a lot of water.
- Toughen up your plants. Too many plants are pampered to the point where they are so dependent on water they do not go out of their way to find any water themselves. Wait until the soil dries out before watering and use a plant such as bamboo as an indicator - when the leaves start to droop, then water.
- Water the highest parts of the garden first. This ensures that any runoff water soaks into lower, dry areas rather than being wasted.
- Remove weeds. Weeds compete for water and nutrients. A good mulch will help prevent weeds growing.
- Install a drip system. Drip watering, sometimes called drip irrigation or micro-irrigation, uses a permanently laid plastic pipe with dripper outlets to deliver the right amount of water to each plant at a rate the soil can readily absorb. Drip systems are both economical and easy to install, and are effective on trees, shrubs and some garden beds. They are not suitable for lawns, which require an even spread of water.
- Use micro-sprays on garden beds and small areas of lawn, if you have a lot of annuals and ferns where a drip system is not appropriate.
- Dig a small trench around trees. This will give the water a chance to soak in and reduces water lost at runoff.
- Water your pot plants by dunking them in a bucket of water. Wait a few seconds. When the bubbles disappear, do the next pot. This saves water and ensures pot plants get a thorough drink.
- Water the roots not the leaves. Contrary to popular belief, watering the leaves of trees and shrubs is not beneficial. It increases water loss through evaporation, and chlorine in the water can damage the leaves. Water drops on leaves can act as lenses, concentrating the sunlight and can burn the leaves.
- Don't water the road or pathways. Position your sprinklers so water lands on the lawn or garden, not on paved areas.
- Water carefully to avoid runoff. Soil and dissolved nutrients are carried away with runoff,

which increases the need for expensive fertiliser and pollutes nearby streams. If you soil is clay, use clay-breaking agents and compost to improve the soil's water absorption characteristics.

- Use a trigger hose. This allows you to be in control and water is not wasted when moving the hose around, but remember to turn the tap off when finished in case the pressure build-up causes the nozzle to pop off.

## THE YARD

- Keep a close eye on any playing with the hose. Squirting water around pointlessly can waste over 1000 litres per hour.
- Use a broom, not a hose, to clean paths and driveways. Cleaning a path with a broom is quicker and more efficient than using a hose, which wastes 200 litres of water every 10 minutes. Sweeping paths also improves the quality of our urban runoff and is better for our environment.
- Every house should have a compost bin. Compost improves the structure of your soil. This increases the moisture holding capacity of sandy soils and allows better penetration of water into heavy clay soils.



## WASHING THE CAR, BOAT OR CARAVAN

Use a bucket and sponge to wash the car, boat or caravan on the lawn.

Use the hose only for rinsing and turn it off between rinses. The water and the detergent are beneficial to the garden.



## GENERAL

Use the tips in this sheet to help you use water efficiently. Make careful water use, both indoors and outdoors, part of your family way of life.

By using water wisely, you will:

- Reduce the need for new dams and supply systems
- Keep your water bills down
- Make large savings on your energy bills for water heating
- Reduce the risk of water restrictions
- Reduce the impact on the environment.

***Be WaterWise.....it's worth it !***

## SWIMMING POOL

- Cover your pool to reduce evaporation, retain warmth and keep out leaves and dirt. Up to 200 litres of water per day can be lost because of evaporation.
- Accept some fluctuation in pool level due to evaporation and rainfall. They will often compensate for each other, meaning topping up with the hose can be avoided or reduced.
- Check the pool for leaks.





# WATERWISE GUIDE TO GARDENS



## Overall Design

These are generally high water use plants which need a sunny position. Site very tough shrubs on the exposed side to act as a windbreak and protect them. Slowing down the hot dry winds is a very important water saving feature. It will also prevent

damage to the more delicate plants.

## Planning

Before planting you will need to investigate and analyse:

- Orientation, sun and shade, the prevailing winds.
- Topography, water run off.
- Soil types, water holding capacity compaction, water repellence, fertility levels.
- Availability of accessible ground water.
- Views both inwards and outwards.
- Overall area available for the garden.

## And consider your other needs for:

- Utility spaces (clothes drying, compost and storage areas).
- Outdoor living spaces (barbecues, seating areas).
- Special needs (vegetable garden, swimming pool; etc).
- Functional and aesthetic requirements.
- Plant preference and design styles (native/exotic, formal/informal etc.).
- Maintenance expectations.
- Budget available.

## General design principles

- Do not plant areas unless it is necessary for functional or aesthetic reasons.
- Maximise the use of non-planting treatments such as paving and mulches.
- At the same time, beware of excessive unshaded paving which can be hot and glaring.
- Vary materials and arrange planting to frame and shade paved areas.
- Make use of windbreaks, pergolas, screen lattice, shadecloth and vines to shelter the house, outdoor living areas and plants.
- Keep planted areas dense and consolidated. Sparse scattered plants are more difficult to water efficiently than ones that are in defined areas.
- Keep lawn to the minimum consistent with functional and aesthetic requirements.
- Avoid planting lawn on slopes or in narrow necks or paths which are difficult to water efficiently and maintain.
- Garden design blueprints in a variety of themes are available from leading nurseries.

## Hydrozoning

Apply the principles of hydrozoning to plant selection and arrangement:

- A broad selection of plants may be used, but keep high water-demand plants to a minimum.
- Arrange plants having similar water requirements together (hydrozoning) and take this into account when deciding soil improvement and mulching, and when managing irrigation.

Some leading nurseries label their plants with drop icons signifying the appropriate hydrozone, described in three categories:

- Primary (3 drops) high water use plants.
- Secondary (2) drops; moderate water use plant.
- Elemental (1 drop); low water use plants

## Garden Practices

### Soil improvement in the garden:

Adding organic matter to the soil improves both its moisture and nutrient holding capacity thus saving on water and fertilizer. It is particularly important to improve the top 15-20 cm of soil where the feeder roots of plants will develop. Old animal manures, compost and proprietary products are ideal soil improvers. Mix them in equal parts with the soil prior to planting out.

Use these points as a guide:

- Shrubs, groundcovers and climbers 30cm in depth and up to half a metre across.
- Trees 40cm deep and 1 metre across and bedding plants 25cm deep for the whole bed.
- Garden soils are just as prone to becoming non-wettable as are lawn areas.
- A regular application of a soil wetting agent in spring is recommended.

### Soils for containers (including hanging baskets)

- Choose the best quality potting mix you can afford, preferably one approved by the Australian Standards Association.
- The water and nutrient holding capacity of potting mixes can be further enhanced by the use of water absorbent polymers. Some potting mixes already contain them.
- Most plants are now grown in soil-less mixes which become non-wettable if allowed to dry out. Soil wetting agents are also very useful, and may need to be applied more than once a year.
- A regular application of a soil wetting agent in spring is recommended.

## Mulching

Mulching is enormously beneficial for all plants. The mulch should be spread over the entire planted area to a minimum thickness of 50mm.

Organic mulches are preferred because they:

- Break down over time and feed the plants.
- Improve the soil organic matter content as they break down.
- Reduce evaporation loss from the surface.
- Encourage earthworms and soil microbial activity.
- Restrict weed growth. Any weeds which do germinate are easy to remove.
- Prevent wind and water erosion.
- Protect the roots from daily temperature fluctuations.
- Improve the appearance of the garden area.

## Mulching material

- Raw water materials like woodchips, chipped tree waste or similar, whether bought-in or homemade, are ideal mulching materials. However, if the mulch is watered regularly you may need to add some extra nitrogen in the form of animal manures, blood and bone etc, to prevent the natural breaking down process from drawing nitrogen away from the plants.
- Materials such as Lucerne hay, pea straw, seaweed and compost can be used for mulch, but since they are more expensive and break down quicker, they are best used within the drip zone of plants.
- Lawn clippings do not make a good mulch, they are best composted. However, if mixed with a coarser material like chipped prunings or woodchips they can be used as mulch.
- Old newspapers can be used under a mulch as a weed control layer, however, thick overlapping layers of newspapers may prevent water penetration.

## Applying mulches

- For general garden use mulches should be spread at 50-75mm thick.
- Always leave a breathing space of 50mm around stems and trunks of plants.
- Organic mulches enriched with animal manures are enormously beneficial when applied thickly (to 30cm) around the drop zone of fruit trees. They should be topped up as necessary during spring, summer and autumn to maintain a minimum thickness (after settling) of 15 cm.
- Vegetable gardens should be mulched with "softer" mulches such as compost, pea, hay or Lucerne straw or seaweed.
- In garden areas mulches should be topped up as necessary; perhaps twice a year in both autumn and spring.
- Mulches should never be raked up, turned over, dug in or disturbed in any way. To do so will damage the fine feeder roots which plants develop in the zone between the mulch and the soil.

## Changing an established garden

If your garden has grown like topsy with little bits all over the place you can change it round.

- Most of the high water plants have shallow root systems and can be easily transplanted in winter into their respective groups.
- Hardy, low water and drought tolerant species cannot normally be moved because of their very deep root systems.
- The type, area and location of lawn in the garden can be reconsidered. If you choose to convert some areas of lawn to a lower water use treatment make sure that the replacement plants or ground treatments are more water efficient than grass. Check with your local member of the Nursery Industry Association.

## Maintenance

- Do not force plants on with large amounts of strong fertilizers. These produce lush growth that has a high water transpiration rate and is more prone to insect and fungal attack.
- Slow release fertilisers, including animal manures, are the best type. They produce steady, healthy growth and minimal leaching of nutrients into the ground water.

## Bedding plants

- Plan your flower beds to be mass displays.
- Do not place a few plants here or there in odd spaces all over the garden, but rather group your flowers together in a suitable area which can be watered independently of other areas of the garden.



# TWENTY TIPS FOR A WATERWISE GARDEN

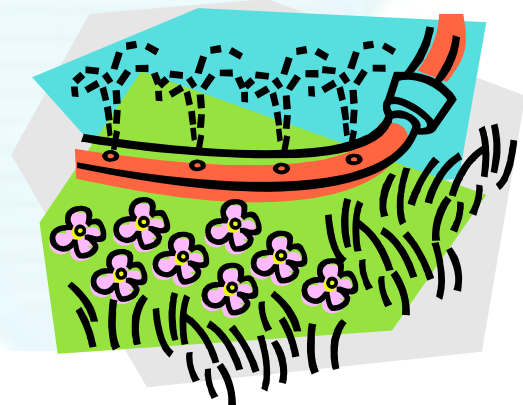


Appreciating the economic, environmental and psychological benefits of plants is easy. Just imagine a world without them. These assets, and the time and money already invested in landscapes, are reason enough to preserve them. Water Wise gardening has advantages of its own: stronger plants, less maintenance, lowered water bills and decreased demand on natural resources. Even in drought-free conditions, these principles make good gardening sense.

1. Group plants according to water requirements to avoid over-or-under-watering.
2. Use plants that need less water. Plenty of attractive varieties meet this definition.
3. Install new plants when reliable rainfall is expected. In many regions, Autumn is the best time to plant.
4. Build basins around shrubs and trees to limit runoff.
5. Mulch to reduce moisture evaporation.
6. Fertilize properly-too much stimulates thirsty new growth.
7. Pruning keeps plants strong and less water dependent.
8. Prioritize watering. New plants need more frequent watering than established trees and shrubs.
9. Irrigate lawns only when needed. If grass springs back up after you walk on it, it doesn't need water. Or, let your lawn go dormant; most grasses rebound when rains return.



10. Mow higher and less often. Longer leaf surfaces encourage deeper rooting and shade roots. Mowing puts grass under additional stress that requires more water.
11. Water plants when the soil is dry, not before.
12. Use a spring-loaded hose spray or hose-end turn-off device.
13. Adjust sprinklers so water reaches lawns and gardens, not pavement.
14. Inspect sprinkler systems for leaks.
15. Time -your-watering. Water early to decrease evaporation. Avoid windy days for the same reason.
16. Water infrequently, deeply, and thoroughly. This stops wasteful runoff and encourages deeper root development. Plants with deep roots develop greater tolerance to dry spells.
17. Install a drip irrigation system. You'll save up to 60 percent of the water used by sprinklers.
18. Move container plants to shady areas. Watering them over the root area of a tree puts excess water to good use.
19. Remove weeds. Weeds rob water and nutrients from valuable plants.
20. Watch the weather. Don't irrigate if rain is predicted. Skip at least one watering after a good rain. Cut back watering times and frequencies in cool and/or humid weather.



# FACT SHEET



## F 17

(Issued 1/7/2008)

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## BE WATERWISE IN THE WORKPLACE



*Have you ever stopped to think about how much water is used at work?. For every person 150 litres per day of treated water are used in workplace environments. That's 16 buckets per person per day, which is 30% of our total water usage. This Fact Sheet describes how reducing our water usage in the workplace will save money and reduce impact on our environment.*

Most of the water used in factories, commercial buildings, educational institutions and other workplaces goes in air conditioning, food processing and manufacturing processes. A significant portion is used for cleaning, food and drink preparation, gardening, and in toilets and washrooms.

We all have a community responsibility to use water carefully in the workplace by adopting water efficient practices, and ensuring that work processes do not waste water.

### THE ADVANTAGES OF BEING WATERWISE IN THE WORKPLACE

By saving water, we create a more efficient and environmentally friendly workplace.

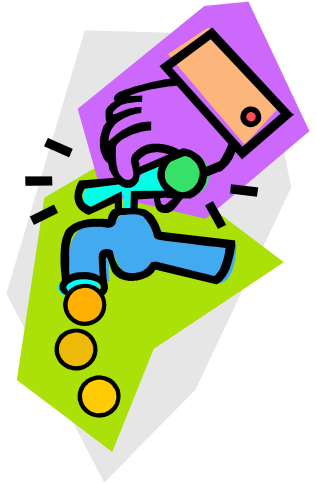
By using water wisely you will immediately:

- Reduce your water bills and increase profits
- Make large savings on your energy bills for water heating
- Reduce your waste-water and trade wastes discharges.

There are also major benefits in the longer term.

By reducing our water usage, we can eliminate or defer the need for new dams and supply systems. This results in:

- Lower costs to the community
- a better environment.



Studies have shown that major savings can be made by individuals using water sensibly and efficiently, and by employers installing a range of water-efficient appliances. For example, as part of a project for State Rail, NSW Public Works has installed water-saving devices and appliances at Sydney's Central Station and achieve at 40% reduction in water use.

In most workplaces, a 20% reduction in water use is readily achievable.

### WATER-EFFICIENT DESIGN

Designing a new facility with water-efficiency in mind will enable you to save water and money with little effort. Consider the following.

- Designing water-efficient buildings and air conditioning systems.
- Designing water-efficient gardens and outdoor areas, including directing drainage from paved areas for watering garden beds.
- Use of recycled water for industrial processes where appropriate and developing opportunities for cost-effective re-use of water in your operations.

## SAVING WATER IN THE WORKPLACE

The following are examples of where you can save water in your workplace.

- Report leaking taps to maintenance personnel or your supervisor. Continuously damp areas may indicate leaks and should also be reported. One drop per second wastes 30 litres per day, and a continuously dripping tap wastes 600 litres per day.
- When using a tap for cleaning purposes, don't allow water to flow continuously down the drain. Put the plug in and run enough water into the sink for the job. A running tap uses 20 litres per minute.
- Shorter showers save water and energy. A 10 minute shower uses up to 200 litres.
- Use the urinal rather than the toilet when appropriate. Toilets use up to 12 litres per flush.
- Encourage your workmates to save water.
- In processing operations, follow the correct procedures to ensure water is not wasted.
- Look for areas where water can be recycled, for example, for use on lawns and garden beds.
- Use a broom rather than a hose to clean outdoor paths and paved areas. A hose uses 1000 litres per hour.
- Water garden beds and lawns only once or twice week. This will encourage the roots to go deeper and make plants hardier. Plant drought-tolerant, low water requirement species.

## WATER-SAVING DEVICES AND APPLIANCES

Many devices and appliances can help reduce water consumption. These include:-

- Water-saving shower roses or flow restrictors
- Dual flush toilets
- Individual, sensor-operated urinals
- Self-closing, aerated, sensor operated or 1/4 turn ceramic disk taps
- Water-efficient dishwashers and washing machines, and
- Tap timers, micro-irrigation systems, trigger nozzles etc.

Encourage management to install these devices, and ensure that they are used effectively. A WaterWise Technical information Sheet called WaterWise in the workplace for Employers is available, which alerts employers to the importance of sensible and efficient water use. It also gives detailed information on the suitability and effectiveness of the various devices and appliances available.

A water Conservation Rating and Labelling Scheme is being developed by Standards Australia to allow simple comparison of the water efficiency of appliances.

### ***BE WATERWISE.... IT'S WORTH IT !***

For water-saving techniques to have a significant impact in the workplace, the co-operation of all individuals is needed. Remember that by ensuring water-efficient practices and processes are carried out in your workplace, your water bills are reduced, increasing your profitability and reducing your impact on the environment.

*Be Waterwise.....it's Worth it !*



# FACT SHEET



## F 24

(Issued 1/5/1999  
Updated 29/10/2009)

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## WATER TIPS

### Evaporative Coolers



Evaporative coolers are a popular form of cooling in the Riverina. Where installed it is important that they are maintained according to the manufacturer's instruction manual.

The coolers should be cleaned and pads cleaned and replaced as required to maintain efficient cooling. Evaporative coolers require water to be bled off to waste so that excessive amounts of salts do not accumulate in the cooler. If the bleed off water is not set properly, the excessive concentration of salts cause unsightly build up on the cooler and reduces efficiency. Consult the cooler's instruction manual for further details.

### Use Water Wisely !



Use a bucket and sponge to wash the car, and if possible wash it on the lawn. Use the hose only for rinsing and turn it off between rinses. The water and detergent are beneficial to the garden. Avoid

washing the car in direct sunlight and dry it off with a chamois to avoid unsightly watermarks.

With the sudden onset of very hot weather everyone should be particularly careful that they are drinking enough fluids. The Department of Health advise that we should be drinking at least 6 - 8 cups of water per day. Water is the best drink to avoid de-hydration.

Does your Garden hose run longer than needed because someone forgets to turn it off?. A timer on your garden tap can prevent this and save you water and money. It also makes it easier for someone to water your garden when you are on holidays.

### Saving water outside your home

- Fit tap timers to all your garden water taps. Tap timers automatically turn off your drippers even if you forget!
- When washing your car, try using your tap timers to control the flow time.
- Don't mow your lawn too short? A longer lush lawn develops a deeper root system and requires less water to look great.
- Talk to your nursery about water friendly plants. There are thousands of waterwise plants to choose from, that look great even in tough dry conditions.
- Mulching not only helps to control weeds, it also prevents soil drying out! Compost, sawdust, straw, grass clippings, pebbles and woodchips are all excellent mulching solutions.
- When planting your garden try grouping your plants into high or low water users.
- Did you know small shrubs require more frequent watering than larger hard leaf varieties?

### Saving water inside your home

- Toilets can be checked for unseen leaks by adding a few drops of food dye in the cistern. If the colour is detected in the bowl, there is a leak which needs to be fixed.
- Install dual-flush cisterns on toilets
- Keep showers to approx 4 minutes by using a timer
- Install a water saving showerhead (3 star rating)
- Wipe off cookware, plates etc. before putting in dishwasher so a lighter wash can be done.
- Only run the dishwasher when there is a full load.
- Save rinse water from the washing machine for plants
- Run the washing machine with full loads and if replacing the machine, purchase a higher star rating model.
- Ensure taps are turned off properly to stop drips
- Repair/replace parts of taps are leaking
- Collect cold water while waiting for the hot, to put on plants.
- To check for any hidden leaks, turn ALL taps off on the property. If the water meter is still running there is a leak, which may need the services of a plumber.

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# Appendix D

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## Low and High Level Demand Management Packages Description and Assumptions

**Table 41: Low and High Level Demand Management (DM) Package Options Details**

Low Level DM Package Option	High Level DM Package Option*	Target groups	Estimated Water Savings (kL/customer/year)**	Percentage of customers take up		Estimated Costs
				Low Level DM	High Level DM	
1 - Showerhead swap		14,000 existing inefficient households	12	30%	50%	LWU unit cost: \$18; Customer unit cost: \$18; Initial mktg: \$5K; Ongoing mktg: \$1K
2 - Residential water fixtures retrofit		18,000 existing inefficient households	10	30%	50%	LWU unit cost: \$120; residential customer unit cost: \$30 Initial mktg: \$5K; Ongoing mktg: \$10K
3 - Toilets replacement program		5,000 existing inefficient households	22	10%	20%	LWU unit cost: \$350; residential customer unit cost: \$250; Initial mktg: \$5K; Ongoing mktg: \$10K
4 - Residential evaporative coolers education campaign		18,000 existing households with coolers	28	10%	40%	LWU unit cost: \$90; Initial mktg: \$5K; Ongoing mktg: \$10K



Low Level DM Package Option	High Level DM Package Option*	Target groups	Estimated Water Savings (kL/customer/year)**	Percentage of customers take up		Estimated Costs
				Low Level DM	High Level DM	
5 - Residential nature strips rebate scheme (currently underway in Wagga)		21,000 existing households	52	5%	25%	LWU unit cost: \$1,200 (50% Government funded); residential customer unit cost: \$600; Mktg: \$35K (over 2 yrs) Evaluation: \$120K (over 2 yrs)
6 - Outdoor watering DCP		New households and new commercial properties	122	100%	100%	Initial mktg: \$5K; Ongoing mktg: \$1K
7 - Permanent water conservation measures (currently underway in Wagga)		21,000 existing residential commercial and public customers	80	100%	100%	Initial mktg: \$10K; Ongoing mktg: \$5K; Evaluation: \$10K (over 2 yrs)
8 - Non-revenue water (Leak and pressure management program)			20% reduction in forecast Non Revenue Water	20%	20%	\$0.32/kL leak real losses avoided

Low Level DM Package Option	High Level DM Package Option*	Target groups	Estimated Water Savings (kL/customer/year)**	Percentage of customers take up		Estimated Costs
				Low Level DM	High Level DM	
9 - Water audit – hotels/motels		49 Hotels/motels	20% consumption reduction -566 kL (in 2012/11)	30%	80%	LWU unit cost: \$800; Ongoing mktg: \$5K; Evaluation: \$4K (over 2 yrs)
10 - Water audit - schools		36 Schools	600 / school	30%	100%	LWU unit cost: \$1K; School unit cost: \$7K; Ongoing mktg: \$2K Evaluation: \$4K (over 2 yrs)
11 - Water audit - Industrial customers		Large industrial users	20% consumption reduction	50%	100%	LWU unit cost: \$750; Industry unit cost:\$750K; Initial mktg: \$5K; Ongoing mktg: \$10K Evaluation \$5K
12 - Commercial nature strips rebate		1,100 Commercial properties with lawns	243	10%	20%	LWU unit cost: \$1K; Customer unit cost: \$500; Initial mktg: \$5K; Ongoing mktg: \$10K Evaluation: \$10K (over 2 yrs)

Low Level DM Package Option	High Level DM Package Option*	Target groups	Estimated Water Savings (kL/customer/year)**	Percentage of customers take up		Estimated Costs
				Low Level DM	High Level DM	
13 - Residential Outdoor Culture Change		21,000 Residential properties with lawns	52	50%	75%	Ongoing mktg: \$50K
<b>Additional options in the high level DM package</b>						
-	14 - Clothes Washer Rebate		15#	-	75%	Unit cost: \$200 Initial mktg: \$5K; Ongoing mktg: \$1K #
-	15 - Conservation Pricing		714 (average of 30 years of data)##	-	100%	\$5K set up + 20 cents per person##

(Source: Integrated resource planning for urban water project: Wagga Wagga Case study - Report, prepared for National Water Commission by the Institute for Sustainable Futures, University of Technology, Sydney).

Note\* major difference between low and high demand measures that apply to both demand management options is the take up rate  
Note\*\*For the purposes of the Peak Day Demand analyses the estimated annual water savings has been converted to average day water savings.  
Note# Clothes Washer Rebate is a demand management measure included by RWCC. Council has provided the estimated water saving figure.  
Note## Sourced from Decision Support System - Demand Side Management (DSS) model prepared in the IWCM Evaluation study.

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# Appendix E

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## Demand Management Measures Definition

Source: Integrated Resource Planning For Urban Water Project- Wagga Wagga Case Study - Report

## DETAILED TABLE OF OPTION ASSUMPTIONS

Components in Wagga Wagga	Description	Assumptions
DS Residential Shower Swap S1	Householders bring their old showerhead to a shopfront location and swap their old one for a new one free	<ul style="list-style-type: none"> <li>The proportion of the targeted customers that participate in the program is assumed to be 0.5; internal estimate</li> <li>The component of the unit costs incurred per participant that is provided by the utility (excluding the contribution from the participant) is assumed to be 40 dollars per unit; assumes full subsidy by utility</li> <li>Water yield per installed unit is assumed to be 12 kilolitres per participant per annum; based on review of evaluated programs implemented in Melbourne (Fyfe et al 2009; Gan 2008; Lee, Plant &amp; White 2007)</li> <li>Proportion of an administrator's annual working time assigned to the option is assumed to be 0.2 full time equivalent; internal estimate</li> <li>Proportion of a project manager's annual working time assigned to the option is assumed to be 0.1 full time equivalent; internal estimate</li> <li>Defined initial cost of marketing the program excluding ongoing and staff costs is assumed to be 5000 dollars; internal estimate</li> <li>Defined ongoing cost of marketing the program each year excluding initial and staff costs is assumed to be 10000 dollars per annum; internal estimate</li> <li>Share of water savings that are also wastewater savings is assumed to be 1; assumes all potable water savings also occur as wastewater savings</li> <li>Share of water savings that are also hot water savings is assumed to be 0.463414634146341; based on assumed operating temperature in baseline assumptions</li> </ul>
DS Residential Toilet Replacement S2	Complete toilet replacement	<ul style="list-style-type: none"> <li>The proportion of the targeted customers that participate in the program is assumed to be 0.2; internal estimate</li> <li>Water yield per installed unit is assumed to be 22 kilolitres per participant per annum; based on a review of evaluated programs implemented at the gold coast (Snelling et al 2006), and the ACT (Fyfe, May &amp; Turner 2009; Lee, Plant &amp; White 2008)</li> <li>Proportion of an administrator's annual working time assigned to the option is assumed to be 0.2</li> </ul>

Components in Wagga Wagga	Description	Assumptions
DS Residential Clotheswasher Rebate S1S2	Rebate program for replacing top loaders with 5 star front loaders	<p>full time equivalent; internal estimate</p> <ul style="list-style-type: none"> <li>• Proportion of a project manager's annual working time assigned to the option is assumed to be 0.1 full time equivalent; internal estimate</li> <li>• Defined initial cost of marketing the program excluding ongoing and staff costs is assumed to be 5000 dollars; internal estimate</li> <li>• Defined ongoing cost of marketing the program each year excluding initial and staff costs is assumed to be 10000 dollars per annum; internal estimate</li> <li>• Specified cost to evaluate the savings of the program (split in two payments one year after first year and one year after completion) as dollars per program; internal estimate</li> <li>• The proportion of the targeted customers that participate in the program is assumed to be 0.75; internal estimate</li> <li>• The component of the unit costs incurred per participant that is provided by the utility (excluding the contribution from the participant) is assumed to be 150 dollars per unit; based on similar programs implemented in major cities</li> <li>• Water yield per installed unit is assumed to be 15 kilolitres per participant per annum; based on evaluated savings for a similar program implemented at the gold coast (Snelling et al 2006)</li> <li>• The component of the unit costs incurred per participant that is provided by the customer as dollars per participant; based on the assumption that all sales would have occurred otherwise and therefore no net incremental cost to the customer</li> <li>• Proportion of an administrator's annual working time assigned to the option is assumed to be 0.2 full time equivalent; internal estimate</li> <li>• Proportion of a project manager's annual working time assigned to the option is assumed to be 0.1 full time equivalent; internal estimate</li> <li>• Defined initial cost of marketing the program excluding ongoing and staff costs is assumed to be 5000 dollars; internal estimate</li> <li>• Defined ongoing cost of marketing the program each year excluding initial and staff costs is assumed to be 10000 dollars per annum; internal estimate</li> </ul>

Components in Wagga Wagga	Description	Assumptions
DS Hotels S1	Water audit, install efficient fixtures and sensors and carry out air-conditioning maintenance. 49 (hotels/motels)	<ul style="list-style-type: none"> <li>Specified cost to evaluate the savings of the program (split in two payments one year after first year and one year after completion) as dollars per program; internal estimate</li> <li>The proportion of the targeted customers that participate in the program is assumed to be 0.3; internal estimate</li> <li>The component of the unit costs incurred per participant that is provided by the utility (excluding the contribution from the participant) is assumed to be 800 dollars per unit; internal estimate</li> <li>The component of the unit costs incurred per participant that is provided by the customer as dollars per participant; internal estimate</li> <li>Proportion of an administrator's annual working time assigned to the option is assumed to be 0.2 full time equivalent; internal estimate</li> <li>Proportion of a project manager's annual working time assigned to the option is assumed to be 0.1 full time equivalent; internal estimate</li> <li>Defined initial cost of marketing the program excluding ongoing and staff costs is assumed to be 5000 dollars; internal estimate</li> <li>Defined ongoing cost of marketing the program each year excluding initial and staff costs is assumed to be 20000 dollars per annum; internal estimate</li> <li>Specified cost to evaluate the savings of the program (split in two payments one year after first year and one year after completion) as dollars per program; internal estimate</li> <li>The proportionate reduction in mean customer demand attributable to the program is assumed to be 0.2 %; internal estimate</li> <li>Share of water savings that are also wastewater savings is assumed to be 0.8; ISF estimate</li> <li>Share of water savings that are also hot water savings is assumed to be 0.3; ISF estimate</li> </ul>
DS Hotels S2	Water audit, install efficient fixtures and sensors and carry out air-conditioning maintenance. 49 (hotels/motels)	<ul style="list-style-type: none"> <li>The proportion of the targeted customers that participate in the program is assumed to be 0.8; internal estimate</li> <li>The component of the unit costs incurred per participant that is provided by the utility (excluding the contribution from the participant) is assumed to be 800 dollars per unit; internal estimate</li> <li>The component of the unit costs incurred per participant that is provided by the customer as dollars</li> </ul>

Components in Wagga Wagga	Description	Assumptions
DS Industrial S1S2	Water audits and modifications for 5 high water users	<ul style="list-style-type: none"> <li>per participant; internal estimate</li> <li>• Proportion of an administrator's annual working time assigned to the option is assumed to be 0.2 full time equivalent; internal estimate</li> <li>• Proportion of a project manager's annual working time assigned to the option is assumed to be 0.1 full time equivalent; internal estimate</li> <li>• Defined initial cost of marketing the program excluding ongoing and staff costs is assumed to be 5000 dollars; internal estimate</li> <li>• Defined ongoing cost of marketing the program each year excluding initial and staff costs is assumed to be 30000 dollars per annum; internal estimate</li> <li>• Specified cost to evaluate the savings of the program (split in two payments one year after first year and one year after completion) as dollars per program; internal estimate</li> <li>• The proportionate reduction in mean customer demand attributable to the program is assumed to be 0.2 %; internal estimate</li> <li>• Share of water savings that are also wastewater savings is assumed to be 0.8; ISF estimate</li> <li>• Share of water savings that are also hot water savings is assumed to be 0.3; ISF estimate</li> <li>• The proportion of the targeted customers that participate in the program is assumed to be 1; internal estimate</li> <li>• The component of the unit costs incurred per participant that is provided by the utility (excluding the contribution from the participant) is assumed to be 75000 dollars per unit; internal estimate</li> <li>• The component of the unit costs incurred per participant that is provided by the customer is assumed to be 75000 dollars per participant; internal estimate</li> <li>• Proportion of an administrator's annual working time assigned to the option is assumed to be 0.2 full time equivalent; internal estimate</li> <li>• Proportion of a project manager's annual working time assigned to the option is assumed to be 0.1 full time equivalent; internal estimate</li> <li>• Defined initial cost of marketing the program excluding ongoing and staff costs is assumed to be 5000 dollars; internal estimate</li> </ul>



Components in Wagga Wagga	Description	Assumptions
DS Schools S1S2	Monitoring, alarm systems for leaks plus education. 36 schools	<ul style="list-style-type: none"> <li>• Defined ongoing cost of marketing the program each year excluding initial and staff costs is assumed to be 10000 dollars per annum; internal estimate</li> <li>• Specified cost to evaluate the savings of the program (split in two payments one year after first year and one year after completion) as dollars per program; internal estimate</li> <li>• The proportionate reduction in mean customer demand attributable to the program is assumed to be 0.2 %; internal estimate</li> <li>• The proportion of the targeted customers that participate in the program is assumed to be 0.8; internal estimate</li> <li>• Proportion of an administrator's annual working time assigned to the option is assumed to be 0.2 full time equivalent; internal estimate</li> <li>• Proportion of a project manager's annual working time assigned to the option is assumed to be 0.1 full time equivalent; internal estimate</li> <li>• Defined initial cost of marketing the program excluding ongoing and staff costs is assumed to be 5000 dollars; internal estimate</li> <li>• Defined ongoing cost of marketing the program each year excluding initial and staff costs is assumed to be 20000 dollars per annum; internal estimate</li> <li>• Specified cost to evaluate the savings of the program (split in two payments one year after first year and one year after completion) is assumed to be 35000 dollars per program; internal estimate</li> <li>• The proportionate reduction in mean customer demand attributable to the program is assumed to be 0.2 %; internal estimate</li> <li>• Share of water savings that are also wastewater savings is assumed to be 0.6; ISF estimate</li> <li>• Share of water savings that are also hot water savings is assumed to be 0.05; ISF estimate</li> </ul>
DS Commercial Nature strips S1S2	Rebate for re-landscaping of commercial properties	<ul style="list-style-type: none"> <li>• The proportion of the targeted customers that participate in the program is assumed to be 0.2; internal estimate</li> <li>• The component of the unit costs incurred per participant that is provided by the utility (excluding the contribution from the participant) is assumed to be 1000 dollars per unit; assumes partial subsidy</li> </ul>

Components in Wagga Wagga	Description	Assumptions
DS PermWatConMeasures S1	No fixed sprinklers allowed between 10am-5pm. All requested to reduce water consumption by 20%	<ul style="list-style-type: none"> <li>• Water yield per installed unit is assumed to be 243 kilolitres per participant per annum; based on mean nature strip area of 300m<sup>2</sup> lawn converted to hardy native garden</li> <li>• Proportion of an administrator's annual working time assigned to the option is assumed to be 0.2 full time equivalent; internal estimate</li> <li>• Proportion of a project manager's annual working time assigned to the option is assumed to be 0.1 full time equivalent; internal estimate</li> <li>• Defined initial cost of marketing the program excluding ongoing and staff costs is assumed to be 5000 dollars; internal estimate</li> <li>• Specified cost to evaluate the savings of the program (split in two payments one year after first year and one year after completion) is assumed to be 35000 dollars per program; internal estimate</li> <li>• Unit cost attributed to each participating customer is assumed to be 1500 dollars per participant; assumes \$5 per square metre converted</li> <li>• The proportion of the targeted customers that participate in the program is assumed to be 1; internal estimate</li> <li>• The component of the unit costs incurred per participant that is provided by the utility (excluding the contribution from the participant) as dollars per unit; internal estimate</li> <li>• The component of the unit costs incurred per participant that is provided by the customer as dollars per participant; internal estimate</li> <li>• Proportion of an administrator's annual working time assigned to the option is assumed to be 0.1 full time equivalent; internal estimate</li> <li>• Proportion of a project manager's annual working time assigned to the option as full time equivalent; internal estimate</li> <li>• Defined initial cost of marketing the program excluding ongoing and staff costs is assumed to be 10000 dollars; internal estimate</li> <li>• Defined ongoing cost of marketing the program each year excluding initial and staff costs is assumed to be 5000 dollars per annum; internal estimate</li> <li>• Specified cost to evaluate the savings of the program (split in two payments one year after first year</li> </ul>

Components in Wagga Wagga	Description	Assumptions
DS Residential Nature Strips S1	Rebate for re-landscaping of nature strip, ban watering of nature strips	<p>and one year after completion) as dollars per program; internal estimate</p> <ul style="list-style-type: none"> <li>• The proportionate reduction in mean customer demand attributable to the program is assumed to be 0.04 %; internal estimate</li> <li>• The proportion of the targeted customers that participate in the program is assumed to be 0.05; internal estimate</li> <li>• The component of the unit costs incurred per participant that is provided by the utility (excluding the contribution from the participant) is assumed to be 700 dollars per unit; internal estimate</li> <li>• Water yield per installed unit is assumed to be 52 kilolitres per participant per annum; based on modelled within irrigation water balance model substituting a 60m<sup>2</sup> grass nature strip with hardy natives</li> <li>• The component of the unit costs incurred per participant that is provided by the customer is assumed to be 700 dollars per participant; internal estimate</li> <li>• Proportion of an administrator's annual working time assigned to the option is assumed to be 0.2 full time equivalent; internal estimate</li> <li>• Proportion of a project manager's annual working time assigned to the option is assumed to be 0.1 full time equivalent; internal estimate</li> <li>• Defined initial cost of marketing the program excluding ongoing and staff costs is assumed to be 50000 dollars; internal estimate</li> <li>• Defined ongoing cost of marketing the program each year excluding initial and staff costs is assumed to be 50000 dollars per annum; internal estimate</li> <li>• Specified cost to evaluate the savings of the program (split in two payments one year after first year and one year after completion) is assumed to be 35000 dollars per program; internal estimate</li> </ul>
DS Residential Nature Strips S2	Rebate for re-landscaping of nature strip, ban watering of nature strips	<ul style="list-style-type: none"> <li>• The proportion of the targeted customers that participate in the program is assumed to be 0.1; internal estimate</li> <li>• Water yield per installed unit is assumed to be 52 kilolitres per participant per annum; based on modelled within irrigation water balance model substituting a 60m<sup>2</sup> grass nature strip with hardy natives</li> </ul>

Components in Wagga Wagga	Description	Assumptions
DS Residential Lawns DCP S2	DCP banning irrigated lawns	<ul style="list-style-type: none"> <li>• Proportion of an administrator's annual working time assigned to the option is assumed to be 0.2 full time equivalent; internal estimate</li> <li>• Proportion of a project manager's annual working time assigned to the option is assumed to be 0.1 full time equivalent; internal estimate</li> <li>• Defined initial cost of marketing the program excluding ongoing and staff costs is assumed to be 50000 dollars; internal estimate</li> <li>• Defined ongoing cost of marketing the program each year excluding initial and staff costs is assumed to be 50000 dollars per annum; internal estimate</li> <li>• Specified cost to evaluate the savings of the program (split in two payments one year after first year and one year after completion) is assumed to be 35000 dollars per program; internal estimate</li> <li>• The proportion of the targeted customers that participate in the program is assumed to be 1; internal estimate</li> <li>• Water yield per installed unit is assumed to be 122 kilolitres per participant per annum; based on irrigation savings calculator assuming 150m<sup>2</sup> turf replaced by hardy native garden</li> <li>• Proportion of an administrator's annual working time assigned to the option is assumed to be 0.05 full time equivalent; internal estimate</li> <li>• Proportion of a project manager's annual working time assigned to the option as full time equivalent; internal estimate</li> <li>• Defined initial cost of marketing the program excluding ongoing and staff costs is assumed to be 5000 dollars; internal estimate</li> <li>• Specified cost to evaluate the savings of the program (split in two payments one year after first year and one year after completion) as dollars per program; internal estimate</li> </ul>
DS Residential Evaporative Coolers S1	Maintenance visit and education campaign (turn them down, turn them off when not at home)	<ul style="list-style-type: none"> <li>• The proportion of the targeted customers that participate in the program is assumed to be 0.1; internal estimate</li> <li>• The component of the unit costs incurred per participant that is provided by the utility (excluding the contribution from the participant) is assumed to be 90 dollars per unit; based on phone conversations with AC installers in Wagga</li> </ul>

Components in Wagga Wagga	Description	Assumptions
DS Residential Evaporative Coolers S2	Maintenance visit and education campaign (turn them down, turn them off when not at home)	<ul style="list-style-type: none"> <li>• Water yield per installed unit is assumed to be 28 kilolitres per participant per annum; based on end use assumptions, assumes reduced mean usage per day from 6 hrs to 4 hrs</li> <li>• Proportion of an administrator's annual working time assigned to the option is assumed to be 0.2 full time equivalent; internal estimate</li> <li>• Proportion of a project manager's annual working time assigned to the option is assumed to be 0.1 full time equivalent; internal estimate</li> <li>• Defined initial cost of marketing the program excluding ongoing and staff costs is assumed to be 5000 dollars; internal estimate</li> <li>• Defined ongoing cost of marketing the program each year excluding initial and staff costs is assumed to be 10000 dollars per annum; internal estimate</li> <li>• Specified cost to evaluate the savings of the program (split in two payments one year after first year and one year after completion) is assumed to be 35000 dollars per program; internal estimate</li> <li>• The proportion of the targeted customers that participate in the program is assumed to be 0.4; internal estimate</li> <li>• Proportion of an administrator's annual working time assigned to the option is assumed to be 0.2 full time equivalent; internal estimate</li> <li>• Proportion of a project manager's annual working time assigned to the option is assumed to be 0.1 full time equivalent; internal estimate</li> <li>• Defined initial cost of marketing the program excluding ongoing and staff costs is assumed to be 5000 dollars; internal estimate</li> <li>• Defined ongoing cost of marketing the program each year excluding initial and staff costs is assumed to be 10000 dollars per annum; internal estimate</li> <li>• Specified cost to evaluate the savings of the program (split in two payments one year after first year and one year after completion) is assumed to be 35000 dollars per program; internal estimate</li> </ul>
DS Residential Toilet Replacement S1	Complete toilet replacement	<ul style="list-style-type: none"> <li>• The proportion of the targeted customers that participate in the program is assumed to be 0.1; internal estimate</li> <li>• Water yield per installed unit is assumed to be 22 kilolitres per participant per annum; based on a</li> </ul>

Components in Wagga Wagga	Description	Assumptions
DS Residential Rain Tanks S2	5kL tank retrofit for existing residential for toilets, washing machines and outdoor	<p>review of evaluated programs implemented at the gold coast (Snelling et al 2006), and the ACT (Fyfe, May &amp; Turner 2009; Lee, Plant &amp; White 2008)</p> <ul style="list-style-type: none"> <li>• Proportion of an administrator's annual working time assigned to the option is assumed to be 0.2 full time equivalent; internal estimate</li> <li>• Proportion of a project manager's annual working time assigned to the option is assumed to be 0.1 full time equivalent; internal estimate</li> <li>• Defined initial cost of marketing the program excluding ongoing and staff costs is assumed to be 5000 dollars; internal estimate</li> <li>• Defined ongoing cost of marketing the program each year excluding initial and staff costs is assumed to be 10000 dollars per annum; internal estimate</li> <li>• Specified cost to evaluate the savings of the program (split in two payments one year after first year and one year after completion) as dollars per program; internal estimate</li> <li>• The proportion of the targetted customers that participate in the program is assumed to be 0.1; internal estimate</li> <li>• Water yield per installed unit is assumed to be 38 kilolitres per participant per annum; based on rain tank model using 2.6 occupancy, 6/3 toilet, 210m<sup>2</sup> landscape area, 5 kL tank, 150m<sup>2</sup> roof catchment area, plumbed to irrigation and toilet demand</li> <li>• Proportion of an administrator's annual working time assigned to the option is assumed to be 0.2 full time equivalent; internal estimate</li> <li>• Proportion of a project manager's annual working time assigned to the option is assumed to be 0.1 full time equivalent; internal estimate</li> <li>• Defined initial cost of marketing the program excluding ongoing and staff costs is assumed to be 5000 dollars; internal estimate</li> <li>• Defined ongoing cost of marketing the program each year excluding initial and staff costs is assumed to be 10000 dollars per annum; internal estimate</li> <li>• Specified cost to evaluate the savings of the program (split in two payments one year after first year and one year after completion) is assumed to be 35000 dollars per program; internal estimate</li> </ul>

Components in Wagga Wagga	Description	Assumptions
DS Residential Retrofit S2	Plumber visit - replace showerheads, install tap flow regulators (kitchen & bathroom), toilet displacement device or cistern weight in single flush toilets, checking for leaks and providing advice	<ul style="list-style-type: none"> <li>• The proportion of the targetted customers that participate in the program is assumed to be 0.5; internal estimate</li> <li>• Water yield per installed unit is assumed to be 22 kilolitres per participant per annum; based on evaluation of similar program (Fyfe, May &amp; Turner 2009; Lee, Plant &amp; White 2008; Sarac &amp; White 2002; ISF 2006; Turner et al 2005)</li> <li>• Proportion of an administrator's annual working time assigned to the option is assumed to be 0.2 full time equivalent; internal estimate</li> <li>• Proportion of a project manager's annual working time assigned to the option is assumed to be 0.1 full time equivalent; internal estimate</li> <li>• Defined initial cost of marketing the program excluding ongoing and staff costs is assumed to be 5000 dollars; internal estimate</li> <li>• Defined ongoing cost of marketing the program each year excluding initial and staff costs is assumed to be 10000 dollars per annum; internal estimate</li> <li>• Specified cost to evaluate the savings of the program (split in two payments one year after first year and one year after completion) as dollars per program; internal estimate</li> </ul>
DS Non-revenue Water	Leak detection and repair, pressure management program (from SWC program)	<ul style="list-style-type: none"> <li>• Proportion of an administrator's annual working time assigned to the option as full time equivalent; internal estimate</li> <li>• Proportion of a project manager's annual working time assigned to the option as full time equivalent; internal estimate</li> <li>• Costs borne by the customer as dollars per annum; internal estimate</li> <li>• Defined initial cost of marketing the program excluding ongoing and staff costs as dollars; internal estimate</li> </ul>
DS PermWatConMeasures S2		<ul style="list-style-type: none"> <li>• Prohibits hosing down of hard surfaces (paths and driveways)</li> <li>• Requires all hand held hoses to have a trigger nozzle</li> <li>• Prohibits irrigation by fixed sprinklers between the hours of 10 am and 5 pm</li> </ul>

**Based in Sydney and Byron Bay, HydroScience Consulting (HSc) is an Australian consultancy dedicated to serving the water industry in Australia.**

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