

# Bathurst Regional Council Demand Management Plan



**OCTOBER 2014**

© HydroScience Consulting 2014

This document shall remain the property of HydroScience Consulting.

Unauthorised use of this document in any form is prohibited.

# Bathurst Regional Council

## Demand Management Plan

### **HydroScience Consulting**

A.B.N. 79 120 716 887

Email: [hsc@hydroscience.com.au](mailto:hsc@hydroscience.com.au)

### **Sydney Office**

Level 1, 189 Kent Street

Sydney, NSW, 2000

Telephone: 02 9249 5100

Facsimile: 02 9251 4011

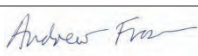
### **Byron Bay Office**

6/64 Centennial Circuit

Byron Bay, NSW, 2481

Telephone: 02 6639 5600

Facsimile: 02 6680 9319

Document Control					
Approved for Issue					
Issue	Author	Reviewer	Name	Signature	Date
3	ARA	AFR	Andrew Fraser		October 2014

# Executive Summary

This Demand Management Plan reviews Bathurst Regional Council's (BRC) existing water conservation measures and recommends additional actions that Council can implement to achieve best-practice demand management.

The water demand analyses include climate corrected historical water production and demand forecast analyses for the Bathurst urban water supply scheme. The main outcomes of the analyses include:

- ❑ Annual demand forecasts
- ❑ Peak day demand forecasts
- ❑ Per capita demand forecast
- ❑ Potential water conservation measures suitable for BRC region

The NSW Office of Water Demand Side Management Decision Support System (known as DSS) model provides the benefit/cost for each water conservation measure. The measures are recommended in priority of the most positive benefit/cost ratio. The outcomes of the model indicate that the recommended water conservation measures for BRC are:

- ❑ Dual reticulation for all new residential developments
- ❑ Permanent low level of restrictions on water use
- ❑ Residential Washing Machine Rebate
- ❑ System water loss management
- ❑ Rainwater use for Hector Park amenities block
- ❑ Stormwater Harvesting for Bathurst Golf Course

The existing and potential water conservation measures have been analysed and their benefits are outlined in section 5 of this report. Section 6.6 of this report contains a proposed implementation plan for the potential water conservation measures identified for BRC.

The main drivers for implementing demand management in the Bathurst Regional Council Area are:

- ❑ Likely climate change impacts
- ❑ Impact of drought on water security
- ❑ High residential water consumption
- ❑ Satisfaction of Best-Practice Management Guidelines requirements

It is anticipated that BRC will continue the implementation of existing water conservation measures and where practical implement the recommended water conservation measures identified. If BRC decides to implement demand management strategies, it is recommended that a process to monitor and evaluate implementation be developed to measure effectiveness.

It is expected that the implementation of recommended water conservation actions will be considered by Council as opportunities arise and specifically as part of its Integrated Planning and Reporting Operations Plan.

# Contents

<b>Executive Summary .....</b>	<b>3</b>
<b>1 Introduction .....</b>	<b>7</b>
1.1 Background.....	7
1.2 Demand Management Plan Context .....	7
<b>2 Bathurst Water Supply Scheme Overview .....</b>	<b>9</b>
<b>3 Demand Monitoring.....</b>	<b>10</b>
<b>4 Water Demand Management Drivers.....</b>	<b>11</b>
4.1 Climate Change .....	11
4.2 Impact of Drought on Water Security .....	13
4.3 High Residential Water Consumption .....	13
<b>5 Demand Management Planning.....</b>	<b>14</b>
5.1 Recommended Additional Demand Management Measures.....	14
5.1.1 Introduction .....	14
5.1.2 Dual Reticulation for all new Residential Development.....	14
5.1.3 Permanent Low Level of Restrictions on Water Use.....	14
5.1.4 Residential Washing Machine Rebate .....	15
5.1.5 System Water Loss Management.....	15
5.1.6 Water Sensitive Urban Design (WSUD) Option 1 - Rainwater Use for Hector Park Amenities Block.....	16
5.1.7 WSUD Option 2 - Stormwater Harvesting for Bathurst Golf Course Irrigation .....	17
5.1.8 Summary of Recommended Demand Management Measures .....	18
5.2 Demand Management Measures in Place .....	19
5.2.1 Standards and Water Efficiency Labelling .....	19
5.2.2 Community Education.....	19
5.2.3 Modern Low Flow Showerheads and Showerheads Low Flow Regulators .....	19
5.2.4 Conservation Pricing for Residential Users .....	20
5.2.5 Low Flow Tapware and Tap Regulators .....	20
5.2.6 Dual Flush Toilets and Water Efficiency Urinals .....	20
5.2.7 Non-Residential Audits .....	20
5.2.8 Rainwater Tank Use .....	21
5.2.9 BASIX - Fixture Efficiency with Dual Reticulation and Rainwater Use.....	21
5.3 Demand Management Scenarios .....	21
<b>6 Demand Forecasting .....</b>	<b>23</b>
6.1 Background.....	23
6.2 Forecast Annual Demand Analyses.....	23
6.3 Forecast Per Capita Demand Analysis .....	24
6.4 Forecast Peak Day Demand Analysis.....	25
6.5 Demand Forecast for Each Customer Category .....	26
6.6 Unaccounted for Water .....	29

<b>7</b>	<b>Implementation Plan .....</b>	<b>30</b>
7.1	Local Water Utility Implementation Costs .....	30
7.2	5 years Demand Management Implementation Outcomes .....	30
7.3	Quadruple Bottom Line Assessment of Demand Management Options .....	32
<b>8</b>	<b>References.....</b>	<b>35</b>
	<b>Appendix A .....</b>	<b>36</b>
	<b>Appendix B .....</b>	<b>43</b>

# List of Tables

Table 1: Water Demand Management Compliance with Best-Practice Requirements.....	10
Table 2: Potential Impacts of Climate Change on Water Management .....	11
Table 3: Major Water Conservation Measures Comparison .....	18
Table 4: Parks Water Consumption.....	20
Table 5: Water Demand Management Scenarios .....	21
Table 6: Bathurst Annual Demand Reduction in 30 years .....	24
Table 7: Bathurst per Capita Demand Reduction in 30 years.....	25
Table 8: Projected Bathurst Peak Day Demand Reduction in 30 years.....	26
Table 9: Bathurst UFW Analysis.....	29
Table 10: Water Conservation Measures Implementation Plan (2011 dollars) .....	30
Table 11: 5 Years Water Savings and Costs Comparison (2011 dollars).....	31
Table 12: Quadruple Bottom Line Analyses of the Demand Management Measures.....	33

# List of Figures

Figure 1: Bathurst Water Supply Network.....	9
Figure 2: Annual Water Demand Forecasts.....	12
Figure 3: Bathurst Annual Demand Forecast.....	24
Figure 4: Bathurst per Capita Demand Projection.....	25
Figure 5: Bathurst WFP Capacity & Peak Day Demand.....	26
Figure 6: Bathurst Consumption Breakdown .....	27
Figure 7: Bathurst Forecast Consumption Breakdown.....	27
Figure 8: Historical and Forecast Consumption by Customer Type.....	28
Figure 9: Existing Stormwater Infrastructure around Hector Park.....	37



# 1 Introduction

## 1.1 Background

Bathurst Regional Council (BRC) is committed to conserving water and working with the community to conserve precious water resources. Council aims to provide services to its customers that comply with regulatory requirements.

BRC developed a Water Conservation and Demand Management Strategy in 2009 and a Climate Change and Water Security Plan in 2011. This 2014 Demand Management Plan will replace the 2009 Demand Management Strategy. Some analyses and major outcomes of the Bathurst Climate Change and Water Security Plan have been incorporated into this document.

By developing this Demand Management Plan, BRC aims to ensure a safe and secure potable water supply. It will also achieve compliance with the Best-Practice Management of Water Supply and Sewerage Guidelines (2007) prepared by NSW Office of Water. A Best-Practice Management check list is provided in Appendix B to demonstrate compliance with the guidelines requirements.

Annual and per capita historical demand and demand forecast analyses for the Bathurst urban water supply scheme were undertaken for the Bathurst Climate Change and Water Security Plan (2011) by Sinclair Knight Merz (SKM). The demand analyses included climate correction of historical demand and demand forecasting. This was done using the Water Demand Trend Tracking and Climate Correction model and the Water's Demand Side Management Decision Support System (DSS) model, developed by NSW Office of Water. In June 2013, SKM updated the Water Demand Trend Tracking and Climate Correction model as part of the Fish River Secure Yield Enhancement Project for State Water (completed in March 2014). The outcomes of this update were used to update the Bathurst DSS model.

## 1.2 Demand Management Plan Context

This Demand Management Plan was developed to ensure that water use in BRC's service areas is efficient and appropriate and to ensure that Council complies with regulatory requirements.

According to the NSW Office of Water Best Practice Management Guidelines (2007) water demand management 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 undertaken by Council. BRC best-practice management compliance status in regards to demand monitoring is provided in Section 3.

**Element 2:** The development of the baseline demand forecast is not part of the scope of works of this project because, as mentioned above, the DSS model has recently been updated for a State Water project and that data is considered current. The outcomes of the baseline demand forecast analysis are provided in this report and checked against the capacity of the existing infrastructure in supplying the current and future demand. These are provided in section 5.3.

**Element 3:** Demand management planning is the core of this report. Section 5 of the report lists the water conservation measures currently in place and includes recommended water conservation measures for the BRC water supply scheme. The recommended water conservation measures' water saving and financial benefits are also analysed.

**Element 4:** five years implementation plan including all water conservation measures suggested to BRC are provided for Council's consideration. These are provided in section 6.6.

## 2 Bathurst Water Supply Scheme Overview

As a Local Water Utility, Bathurst Regional Council is responsible for the water supply functions within the Bathurst Local Government Area. Council operates two water supply schemes:

1. Potable water supply - Bathurst Water Supply Scheme
2. Raw water supply - Winburndale Dam Raw Water Supply Scheme and Hillview Estate Groundwater Supply Scheme

The historical and forecast demand analyses are undertaken only for the Bathurst urban water supply area. Therefore only Bathurst Water Filtration Plant (WFP) daily potable water production records are analysed. The Bathurst WFP serves a population of 32,050 in 2013. This figure is estimated based on Bathurst urban centre 2011 Census data of 31,294 and a growth rate of 1.2% per annum (source: Profile ID website).

The Bathurst WFP current treatment capacity is 60 ML per day. The water supply scheme's reticulated supply network (Figure 1) includes four inlet pumps from the Macquarie River weir to the WFP. Water sourced from the weir pool is treated and pumped to 22 reservoirs located around the City of Bathurst including Perthville. The combined capacity of the filtered water reservoirs is 91 ML. The water supply scheme also includes 10 pump stations and over 382 km of pipeline (source: BRC Drought Management Plan draft report, October 2013).

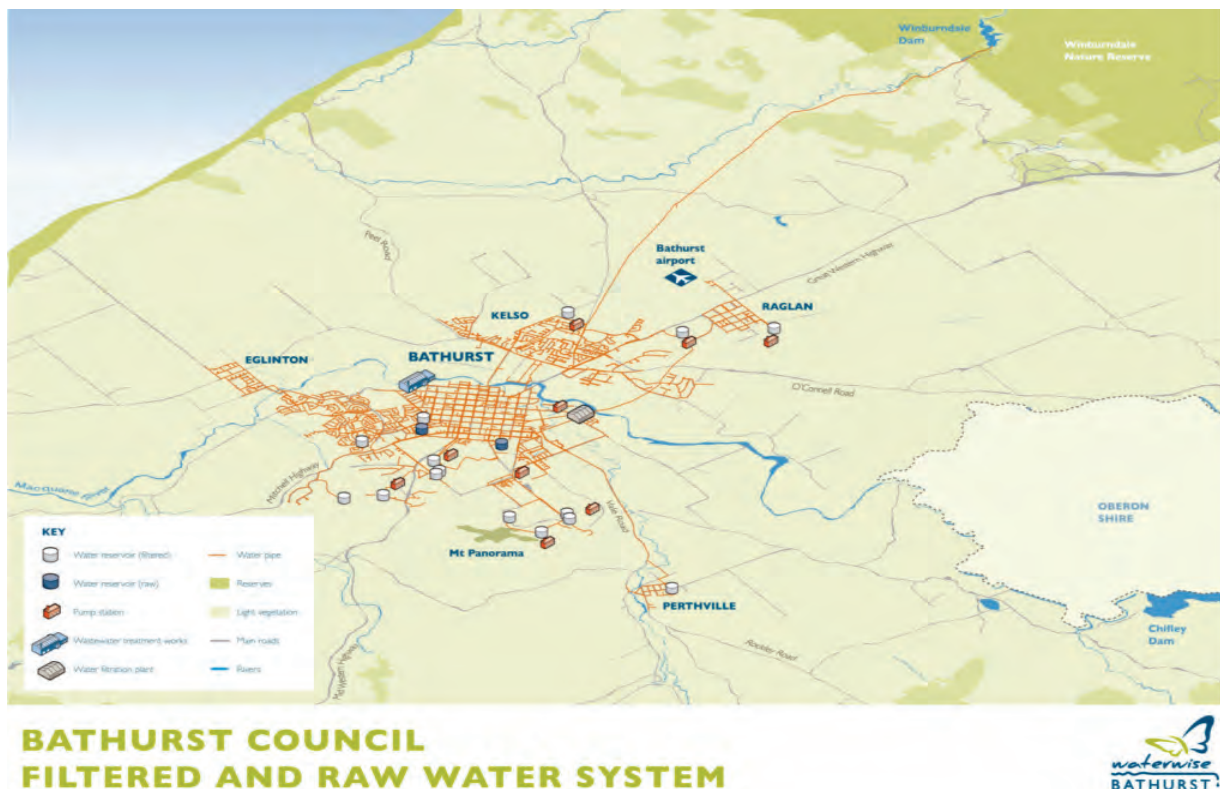


Figure 1: Bathurst Water Supply Network

### 3 Demand Monitoring

Water demand monitoring is essential for efficient management of a Local Water Utility water supply business and for efficient use of water resources. Table 1 presents BRC's demand monitoring status.

**Table 1: Water Demand Management Compliance with Best-Practice Requirements**

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	Council bills water supply customers four times a year.
Customers classified in accordance with the categories* defined in the latest NSW Water Supply and Sewerage Performance Monitoring Report and consumptions reported annually (NSW)	Yes	BRC's filtered water consumption is categorized under residential, commercial, industrial, institutional and rural usage.

\* Customer categories: Residential, commercial, industrial, rural, institutional, public parks and gardens, unbilled authorised consumption (unmetered)

The NSW Office of Water suggests that each LWU should review its water conservation measures every 2 years to ensure that it has an appropriate balance between demand and supply-side investment.

It is Council's responsibility to monitor water demand and review the effectiveness of water conservation measures implemented.

The fact that Council complies with demand monitoring requirements, means that data is available to undertake a best-practice demand management analyses of the system and identify potential water conservation measures that may improve water usage within Council. The following sections provide outcomes of the analyses and recommendations in regards to water conservation measures.

## 4 Water Demand Management Drivers

BRC aims to have a compliant water conservation demand management plan that satisfies the Best-Practice Management of Water Supply and Sewerage requirements. See Appendix B for compliance check list. In addition to this, the main drivers for implementing demand management in Bathurst Regional area considered in this study are:

- ❑ Likely climate change impacts
- ❑ Impact of drought on water security
- ❑ High water consumption compared to neighbouring LWUs

### 4.1 Climate Change

In 2011 BRC prepared a Climate Change and Water Security Plan to examine the impact of climate change on Council's water supply and sewerage services and to ensure the sustainability of these services.

The main conclusion of climate change impacts from the 2011 plan were:

"There is a significant amount of uncertainty in the potential impacts of climate change. Although there is general agreement in climate modelling that temperatures and evapotranspiration can be expected to increase, there is less certainty in the outcomes for precipitation. The wide range of precipitation modelling results clearly demonstrates the level of uncertainty."

"Future climate change has the potential to generate a number of adverse impacts, with implications for Bathurst's water management infrastructure, environment, community and economy. Climate change will have a number of flow-on effects into infrastructure, the environment, the community and the economy beyond the most direct impacts."

The major potential impacts identified in the Climate Change and Water Security Plan that are related to water demand management are:

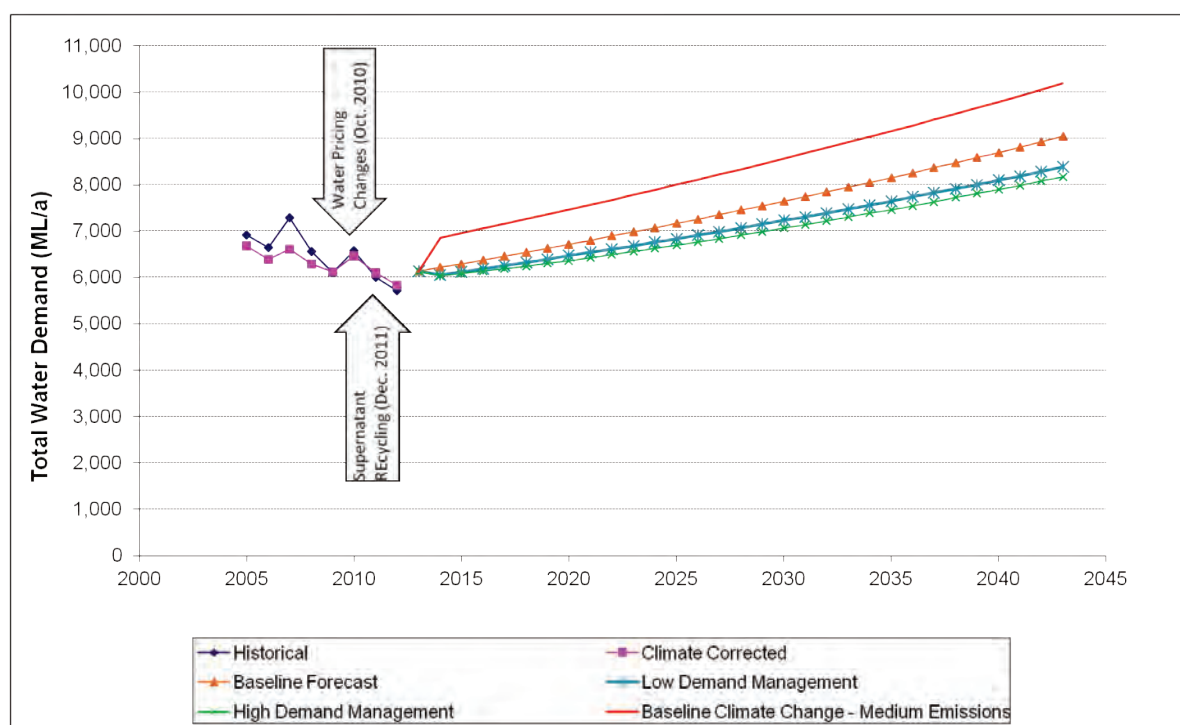
**Table 2: Potential Impacts of Climate Change on Water Management**

Impact	Flow-on Effects	Impact on Current Level of Service
Reductions in runoff from surface water catchments	Increased pressure on water resource and low flow regimes	<ul style="list-style-type: none"><li>▪ Increased urban demand for water will decrease the reliability of supply</li><li>▪ Water supply allocated to firefighting may be exceeded due to likely increase in bush fire frequency</li></ul>
Reduced rainfall for dry land agriculture	Reduction/change in grass and vegetation cover	Increased rural water demand along Campbell River upstream of WFP will decrease the reliability of supply

Impact	Flow-on Effects	Impact on Current Level of Service
Increase in water use for urban irrigation	<ul style="list-style-type: none"> <li>Reduction in the reliability of water supplies</li> <li>Higher peak water supply loads</li> <li>Increase in saline run-off</li> </ul>	<ul style="list-style-type: none"> <li>Availability of supply may not be met which includes not meeting maximum static pressure or minimum supply requirements</li> <li>Increase in the frequency of restrictions</li> <li>Increase in peak demands – lack of WFP capacity</li> </ul>
Increased use of water for evaporative cooling	<ul style="list-style-type: none"> <li>Reduction in the reliability of water supplies</li> <li>Higher peak water supply loads</li> </ul>	Availability of supply may not be met which includes not meeting max static pressure or minimum or peak day supply requirements.

The Climate Change and Water Security Plan analysed 3 climate change scenarios: low, medium and high emissions. Due to the uncertainty of the impacts of climate change and for the purposes of the plan the median outcome of results were used in the analyses. The median emissions scenario was considered in this demand management plan to estimate the potential increase in water consumption due to climate change. The outcome of this analysis is provided in Figure 2.

Figure 2 shows the historical and forecast annual demand in Bathurst. The forecast demand shows the baseline demand, which is the “business as usual” demand that increases with growth. The demand management scenarios are packages of water conservation measures such as dual reticulation for all new residential developments and permanent water conservation measures, which are described in section 5.3.



**Figure 2: Annual Water Demand Forecasts**

## **4.2 Impact of Drought on Water Security**

The Climate Change and Water Security Plan stated that the latest drought resulted in severe water shortages throughout Australia and that in Bathurst, storage levels in the Chifley Dam fell below 50% a number of times. While the supply remained above critical levels, the significant fluctuations in storage levels suggest that the supply may not be as reliable as commonly thought.

## **4.3 High Residential Water Consumption**

The 2012 annual residential water consumption in Bathurst was 215kL per property (i.e. 2473kL residential consumption / 11,508 residential properties). This is about 38% higher than NSW statewide median of 155kL/ residential property.

# 5 Demand Management Planning

## 5.1 Recommended Additional Demand Management Measures

### 5.1.1 Introduction

This section provides a list of recommended water conservation measures that could be implemented by BRC with a positive benefit cost ratio. The benefit/cost assessment was done using the DSS model prepared for the Bathurst Climate Change and Water Security Plan (2011) and updated for the Fish River Secure Yield Enhancement Project (2014). The benefit/cost ratio is calculated based on several factors such as water bills savings, hot water savings and operational costs savings divided by the costs of implementation of the water conservation measure.

The following water conservation measures are provided in order of highest to lowest positive benefit/cost ratio for the Local Water Utility. The estimated average water saving and utility and community savings from implementing these water conservation measures based on Council's 2013/14 water usage charge and operational costs are provided for each option. The data and assumptions used to calculate the benefits of the water conservation measures are also described below.

### 5.1.2 Dual Reticulation for all new Residential Development

This option assumes that all new subdivisions will be fitted with dual reticulation system with recycled water to be used for toilet flushing and irrigation.

The assumed market penetration is 90% of all new residential developments (assume 10% are infill and therefore not suitable for supply with dual reticulation). The assumed potable water saving is 100% reduction in targeted end uses.

The assumed implementation costs are based on the following estimates:

- ❑ Setup: \$10,000 plus 20 cents for each person in the supply area
- ❑ Annual administration (from year 1): \$3,000 plus 5 cents for each person in the supply area
- ❑ Annual operation and maintenance cost borne by customer is \$173 per account

The DSS model benefit/cost ratio and water savings for this conservation measure are:

- ❑ Utility B/C ratio: 27
- ❑ Community B/C ratio: 0.8
- ❑ 30 year Average Water Savings: 201.4 ML/year

Water savings from implementing this water conservation measure represents about 3.28% of the Bathurst baseline forecast annual water production of 6,141 ML in 2013.

### 5.1.3 Permanent Low Level of Restrictions on Water Use

This option assumes that Council would introduce a water waste regulation that would:

- ❑ Prohibit irrigation during the times of the day with the highest evaporation
- ❑ Mandate the use of a trigger nozzle when washing cars
- ❑ Prohibit irrigation that fell on hard surfaces or hosing down of footpaths or driveways



The assumed market penetration is 50% of all customers connected to the potable water supply system. The assumed potable water saving varies dependent on the customer category and end use, however for the purposes of modelling a 10% savings is expected from non-residential customers.

The assumed implementation costs are based on the following estimates:

- ❑ Setup (year 1): \$5,000 plus 20 cents for each person in the supply area
- ❑ Annual administration and enforcement (from year 1): \$1000 plus 5 cents for each person in the supply area

The DSS model benefit/cost ratio and water savings for this conservation measure are:

- ❑ Utility B/C ratio: 26.8
- ❑ Community B/C ratio: 26.8
- ❑ 30 year Average Water Savings: 199 ML/year

Water savings from implementing this water conservation measure represents about 3.24% of the Bathurst baseline forecast annual water production of 6,141 ML in 2013.

#### **5.1.4 Residential Washing Machine Rebate**

This option is based on a residential rebate provided by Council to convert to efficient 4 star washing machines.

The assumed market penetration is 15% of residential customers would take up the washing machine rebate scheme over a three year period. The assumed potable water saving is based on average use volumes for each type of washing machine. The model also assumes that 5% of participants are free riders (i.e. no extra cost for these 5% participants)

The assumed implementation costs are based on the following estimates:

Cost per unit - \$700 (60% is utility cost and 40% is community cost)

Installation cost (Extra cost to community):

- ❑ Efficient front loader: \$1000/unit
- ❑ Front loader: \$900/unit
- ❑ Efficient top loader: \$700/unit

The DSS model benefit/cost ratio and water savings for this conservation measure are:

- ❑ Utility B/C ratio: 1.7
- ❑ Community B/C ratio: 0.6
- ❑ 30 year Average Water Savings: 112.5 ML/year

Water savings from implementing this water conservation measure represents about 1.83% of the Bathurst baseline forecast annual water production of 6,141 ML in 2013.

#### **5.1.5 System Water Loss Management**

Council has been involved with a water loss management plan group in conjunction with the NSW Water Directorate for an extended period. However Council never actually received a formal set of recommendations coming out of this project and process.

This option from the DSS model assumes that instead of the more passive approaches where leaks are fixed when reported, Council would take a more active role by actually searching for and repairing leaks in the supply system.

The assumed market penetration is one third of the system targeted each year for leak detection and repair. Leak detection and repair are assumed to be carried out over 10% of the system targeted (i.e. 364km of water mains). The assumed potable water saving is to reduce 75% of leakages in targeted areas upon completion of works and that the impact of leakage reduction effort will last 3 years.

The assumed implementation costs are based on the following estimates:

- ❑ \$300/km detection cost
- ❑ \$500/km repair cost
- ❑ Program establishment costs (year 1): \$5,000 plus 5 cents for each person in the supply area
- ❑ Annual administration/ enforcement (from year 1): \$2,000 plus 1 cent for each person in the supply area

The DSS model benefit/cost ratio and water savings for this conservation measure are:

- ❑ Utility B/C ratio: 0.1
- ❑ Community B/C ratio: 0.1
- ❑ 30 year Average Water Savings: 29.5 ML/year

Water savings from implementing this water conservation measure represents about 0.48% of the Bathurst baseline forecast annual water production of 6,141 ML in 2013.

#### **5.1.6 Water Sensitive Urban Design (WSUD) Option 1 - Rainwater Use for Hector Park Amenities Block**

The proposed project is to harvest rainwater from the Bathurst Indoor Sports Stadium roof (3350m<sup>2</sup> area) in a rainwater tank for reuse at the Hector Park amenities block for toilet flushing only. During dry periods when water from the rainwater tank is not available the storage tank above the amenities will be topped up with town potable water supply.

This project involves the following components:

- ❑ A 10 kL rainwater tank including a first flush device, a ball valve and an inlet strainer installed on the east facade of the Stadium
- ❑ This project assumes that the gutters are appropriate for rainwater collection. Gutters should not be rusty or corroded and should freely drain to the downpipe/s used to collect the roofwater
- ❑ A pump with capacity to pump up to 1 kL per day
- ❑ 300 m of pipes to transfer water from the rainwater tank to a storage tank in the amenities block
- ❑ 1 kL storage tank installed above the amenities block (note: rainwater reuse for toilet flushing does not require treatment)
- ❑ Toilets flush will be fed by gravity

The estimated water saving from implementing this project is about 268 kL per year. This estimation is based on the following assumptions:

- ❑ 20 years of Bathurst daily rainfall and temperature data records
- ❑ Stormwater catchment area (roof area) of 3,350m<sup>2</sup>
- ❑ First flush per storm of 50 L per day
- ❑ Average daily toilet usage of 1 kL per day

Total estimated implementation cost is \$15,540. This includes:

- ❑ 10 kL rainwater tank installed (quotation from local supplier)
- ❑ Pump (capacity up to 1 kL per day) (quotation from local supplier)
- ❑ 300 m of 50 mm pipes installed
- ❑ 1 kL storage tank installed (quotation from local supplier)
- ❑ Energy cost is negligible therefore it is not included in the costs

Detailed description and assumptions about this option are provided in Appendix A.

### **5.1.7 WSUD Option 2 - Stormwater Harvesting for Bathurst Golf Course Irrigation**

The proposed project is to transfer water from the end of the 'chain of ponds' (i.e. Hector Park Wetlands) terminating at Peel Street to a storage tank at the Bathurst Golf Club for replacement of filtered water used for irrigation. Currently water used for irrigation is approximately 19.5 ML per year.

It is proposed to connect the storage tank to the existing reticulation system (assuming they are on the same system) that supplies the bubblers and the irrigation taps. As the water is non-potable the bubblers will be disconnected from this system. Stormwater will then be pumped from the storage tank to the irrigation taps only. Based on Council's advice, the flow in the wetlands has always been sufficient to supply the required demand. In the event of dry periods when the water is not available from Hector Park Wetlands, the storage tank will be topped up with town potable water from the club house.

This project involves the following components:

- ❑ Pump with capacity to transfer summer peak demand of 30 kL per day (i.e. 0.75 L/s), installed at the end of the wetlands
- ❑ 1 km of pipes to transfer water to the golf club
- ❑ 30 kL storage tank installed near the clubhouse
- ❑ Pump with pressure system (capacity 5 L/s) to transfer stormwater from the storage tank to the irrigation taps
- ❑ 2 km of pipes to transfer potable water from the club house to the bubblers

Assuming that the stormwater volumes match demand and are always available from Hector Park Wetlands, the estimated water saving from implementing this project is approximately 5350 kL per year or 14.7 kL per day, on average. Potential peak day savings are 30 kL/day.

Total estimated implementation cost is \$153,000. This includes:

- ❑ Pump with 0.5 L/s capacity
- ❑ 1000 m of 50 mm pipes
- ❑ 30 kL storage tank
- ❑ Pump and pressure system with 5 L/s capacity
- ❑ 2000 m of potable water reticulation (i.e. bubblers) – estimated cost of \$60,000
- ❑ Energy cost is negligible therefore it is not included in the costs – solar power would be considered

Detailed description and assumptions about this option are provided in Appendix A.

### 5.1.8 Summary of Recommended Demand Management Measures

Table 3 summarizes the benefits of the water conservation measures recommended for BRC implementation.

Water Sensitive Urban Design (WSUD) options are water conservation measures suggested for specific sites. These WSUD water savings volumes are very small when compared to the total town water consumption. Therefore when compared to the other options their benefits are not as significant, thus there is little meaning in including them in the comparison analysis below.

**Table 3: Major Water Conservation Measures Comparison**

Water Conservation Measures	Utility	Community	Average Water Savings	% Savings from current annual demand
	B/C Ratio		(ML/year)	(%/year)
<b>Dual Reticulation for all new Residential Development</b>	27	0.8	201.4	3.28%
<b>Permanent Low Level of Restrictions on Water Use</b>	26.8	26.8	199	3.24%
<b>Residential Washing Machine Rebate</b>	1.7	0.6	112.5	1.83%
<b>System Water Loss Management</b>	0.1	0.1	29.5	0.48%
<b>Total</b>	<b>3.2</b>	<b>0.6</b>	<b>525.4</b>	<b>8.55%</b>

\*Baseline refers to the water bills and operational costs of forecast water consumption without the implementation of any further water conservation measures. The reduction from baseline percentage represents an average savings per year.

If BRC decided to implement all the water conservation measures recommended above, the 30 years average water savings would be approximately 525 ML per year, which represents about an 8.5% reduction in water production.

The baseline demand forecast and the impact of the water conservation measures on the baseline demand forecast are provided in section 5.3. The estimated costs for implementation of each of the water conservation measures during the first 5 years are summarised in section 6.6.

## **5.2 Demand Management Measures in Place**

This section provides a list of the water conservation measures that are currently implemented in Bathurst and some that have been implemented but that are no longer in place. The water conservation measures in place currently affect the water consumption in Bathurst. Therefore the baseline forecast shown in graphs in section 6 represent the consumption including these water conservation measures. These are:

- ❑ Community Education
- ❑ Standards and water efficiency labelling –water efficiency labelled products
- ❑ Dual flush toilets – Council facilities and rental properties
- ❑ Modern low flow showerheads - Council facilities and rental properties
- ❑ Low flow regulators to reduce existing showerhead water flows - Council facilities and rental properties
- ❑ Adoption of new lower flow tap ware and tap regulators - Council facilities and rental properties
- ❑ Rainwater tank use
- ❑ Pressure reduction - thereby reducing leakage

### **5.2.1 Standards and Water Efficiency Labelling**

WELS is Australia's Water Efficiency Labelling Scheme introduced in 2005 that requires certain products to be registered and labelled with their water efficiency in accordance with the standard set under the National Water Efficiency Labelling and Standards Act 2005. Council's role in regards to demand management is to encourage customers to purchase products labelled accordingly with the WELS program.

The DSS model analysis undertaken for the Bathurst water supply scheme shows an expected 30 year average water savings of 60 ML/year. The DSS model assumes that the uptake of water efficient products (i.e. washing machines, showers, dishwashers and taps) by residential customers is continuing.

### **5.2.2 Community Education**

Council encourages community water saving through educational programs for the use of high water efficiency washing machines and dishwashing machines.

### **5.2.3 Modern Low Flow Showerheads and Showerheads Low Flow Regulators**

Council has implemented a low flow showerhead exchange program for residential customers from 2008 until 2013. The program allowed 1 exchange per household and Council exchanged 525 showerheads. Unfortunately actual water savings from installing low flow showerheads and low flow regulators cannot be quantified because they are not separately metered.

Council did a retrofit program in 2011 of low flow regulators to reduce existing showerhead water flows. This program was undertaken at Council's leased residential properties. The water consumption of these properties are recorded separately in Council's data base. Savings cannot be identified at this stage due to the short period that the program has been implemented.

### 5.2.4 Conservation Pricing for Residential Users

Conservation pricing for residential users is an efficient water conservation measure. This involves a 2 tier tariff for residential use where an access fee is applied to every connection and usage is charged on a per kL rate which increases by 50% at 250 kL per annum.

Council changed its pricing structure in October 2010 and that complies with the conservation pricing structure rule. Council's inclining block tariff for single family residential customers is:

- ❑ up to 250kL/yr - \$1.71 (2013/14)
- ❑ above 250kL/yr - \$2.57 (2013/14)

The DSS model estimated 30 year average water savings at 278 ML/year. Based on the current first tier water usage charge of \$1.71/kL, the average annual bill savings are \$476,169. The current Council potable water production operational cost is 1.04 \$/kL therefore the average annual savings for the utility is \$289,600 (it does not include savings from reduced sewerage operations or future upgrades resulting in changes to production costs).

### 5.2.5 Low Flow Tapware and Tap Regulators

In June 2011 Council retrofitted some parks taps in order to reduce water use. Table 4 shows an increase in water consumption up to 2009/10, then a big drop in consumption one year before the park taps retrofit and then a small increase in after the retrofit.

**Table 4: Parks Water Consumption**

	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13
Total (ML)	139	181	226	288	169	199	198

Council also installed telemetry based irrigation at numerous parks and sportsgrounds in 2011. Ad-hoc reporting tells of water savings however issues with the flow meters have not allowed Council to accurately record this information. Council aims to rectify this problem as soon as possible.

### 5.2.6 Dual Flush Toilets and Water Efficiency Urinals

Council has provided subsidy (\$100 per unit) for 180 residential units. Unfortunately water savings from this measure cannot be quantified because they are not separately metered.

Council has also installed high water efficiency urinal systems. The waterless urinals were originally installed at Mount Panorama and trialled during the V8 race weekend. They were unsuccessful due to the amount of race patrons using them over a short period of time, vandalism and poor maintenance requirements. Furthermore they were offensive to maintain and therefore Council would not consider using this again.

### 5.2.7 Non-Residential Audits

In 2010/11 Council commissioned a consultant to undertake commercial audits. Council staff have advised that the project was unsuccessful because the consultant didn't select appropriate customers to audit and also didn't follow up with businesses after the audit.

It should be noted that the DSS model does not rate this measure as having a high benefit cost ratio. For this reason it is not recommended that this measure be given a high priority.

### 5.2.8 Rainwater Tank Use

Council has advised that 283 residential dwellings applied for the State Government rebate available up to September 2011. The government rebate is no longer available and Council does not intend to provide any rebates.

Water savings from the existing rainwater tanks cannot be quantified because they are not metered individually.

### 5.2.9 BASIX - Fixture Efficiency with Dual Reticulation and Rainwater Use

The Building Sustainability Index (BASIX) is a NSW government requirement that affects everyone building a new house, villa, townhouse or apartments. The purpose of BASIX is to ensure that all new homes are built to be more energy and water efficient. BASIX sets specific targets for energy and water reduction in new homes. To meet these targets, simple design features and fixtures are needed, such as the use of rainwater for toilet flushing and taps.

BASIX is an ongoing measure being implemented by all new buildings and therefore the impacts on water consumption are already built in the baseline forecast production. No further reduction in consumption is expected.

## 5.3 Demand Management Scenarios

The updated DSS model was used to assess the impact of further water conservation measures in Bathurst. Below is a list of all the water conservation measures included in the DSS model.

Two demand management scenarios were developed for Council's consideration:

- ❑ High demand management (DM): includes all the potential water conservation measures that Council may want to implement
- ❑ Low demand management: includes the two water conservation measures that have the highest benefit/cost to the LWU

The water conservation measures that form the scenarios are listed in Table 5. The DSS model evaluates the benefit-cost and water savings of implementing these scenarios. Detailed description and outcomes from the DSS model for each individual water conservation measure are provided in section 5.1.

**Table 5: Water Demand Management Scenarios**

Water Conservation Measures	Currently in place or previously implemented	High DM	Low DM
National Mandatory Water Efficiency Labelling Scheme (WELS)	In place		
Community Education	In place		
Residential Shower Retrofit	Done		
Residential Washing Machine Rebate		X	
Permanent Low Level Restrictions on Water Use		X	X
Conservation Pricing for Residential Users	In place		

Water Conservation Measures	Currently in place or previously implemented	High DM	Low DM
Fixture Code - Taps and Showers - New Development	In place		
Non-Residential Water Audits	Done		
System Water Loss Management		X	
Rainwater Tanks for all New Residential Development	Covered by BASIX		
Dual Reticulation for all New Residential Development		X	X
BASIX - Fixture Efficiency with Rainwater Use	Covered by BASIX		
BASIX - Fixture Efficiency with Dual Reticulation	Covered by BASIX		
Evaporative Cooling Unit and Cooling Tower Audit	Not appropriate due to small number of towers.		
Utility Benefit/Cost		3.2	24.1
Community Benefit/Cost		0.6	1.1
30 years Average Water Savings (ML/year)		525.4	383.3



# 6 Demand Forecasting

## 6.1 Background

The Bathurst demand forecast analysis (i.e. DSS model) was prepared in 2011 for the Bathurst Climate Change and Water Security Plan. The DSS model was updated in 2013 by the SKM project team with the outcomes of the Water Demand Trend Tracking and Climate Correction model updated for the Fish River Secure Yield Enhancement project. Both, the DSS and climate correction models were prepared according to the best-practice guidelines requirements. The HydroScience team was involved in the update of the DSS model only.

Below are the outcomes of the demand forecasts from the DSS model. For further information about the models methodology and technical data, refer to the Climate Change and Water Security Plan (2011).

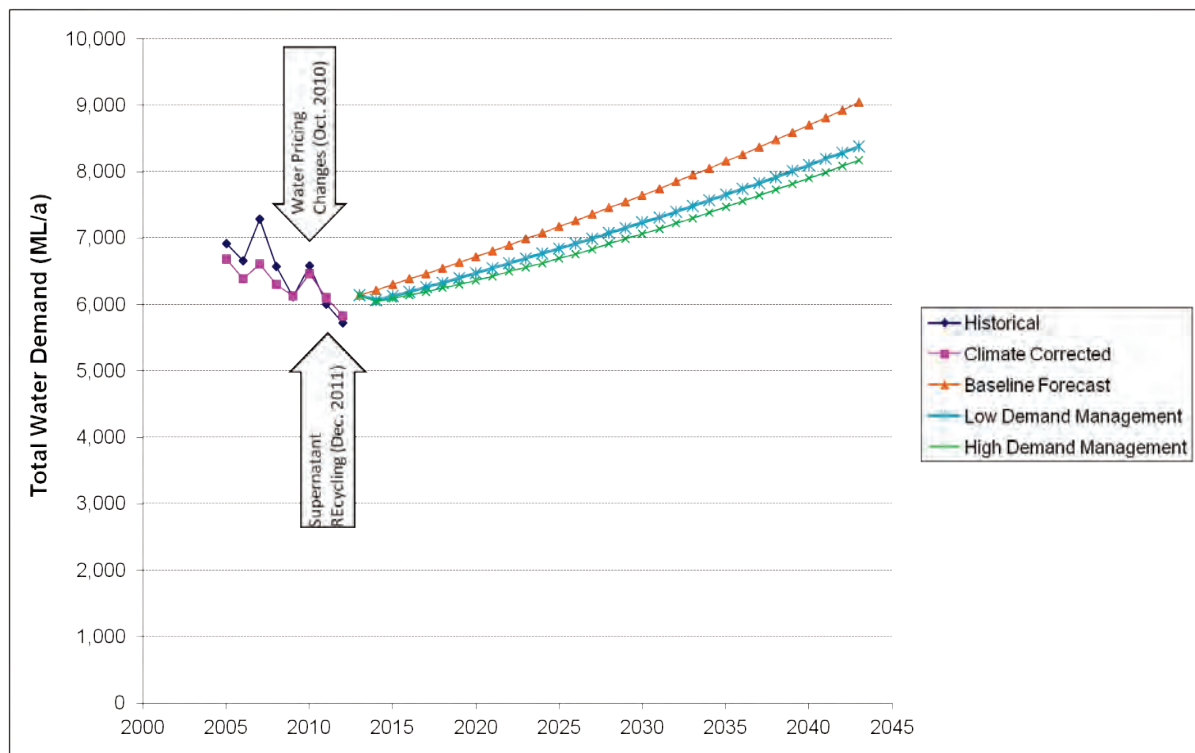
## 6.2 Forecast Annual Demand Analyses

The historical annual production data in Figure 3 shows a rapid drop in water production in 2010. Council advised that this is due to a pricing structure changed in October 2010 and the commissioning of the supernatant recycling plant in December 2011. The later replaced potable water use for irrigation.

The starting point of Bathurst total annual demand forecast analysis is the current climate corrected annual water production per capita (i.e. 525 L/d/p) multiplied by the estimated current number of people (i.e. 32,050) in the serviced area.

BRC water extraction licence is based on extraction on a daily basis. BRC is licenced to extract surface water from the Chifley Dam subject to a condition that a flow of not less than 4.53 ML per day is allowed to pass out of the Chifley Dam into Campbell's River downstream. When the inflow into the dam is less than 4.53 ML per day, the flow allow to be passed out of the dam shall match the inflow for the duration.

The annual forecast shows that the estimated average daily demand in 2043 will be about 25 ML/d (i.e. 9,047 ML/year divided by 365 days). BRC should monitor the increase in demand against the current licence and take actions when the flow available to be extracted is less than the volume required to supply town water consumption.



**Figure 3: Bathurst Annual Demand Forecast**

Figure 3 shows the demand management scenarios suggested for BRC. The low demand management scenario is expected to have a 7% reduction in annual demand in 30 years. The high demand management scenario is expected to have a slightly higher reduction of 10%.

The annual demand reductions in 30 years for the low and high water demand management scenarios are summarized in Table 6.

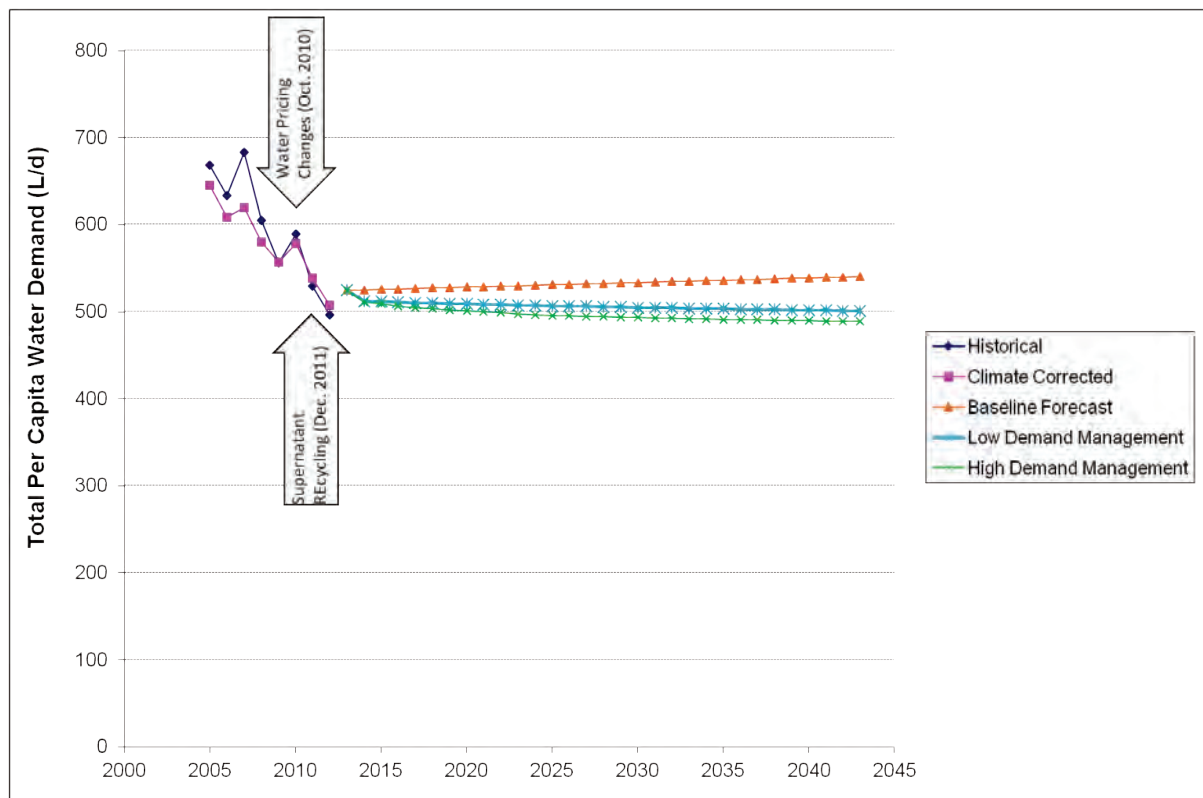
**Table 6: Bathurst Annual Demand Reduction in 30 years**

Scenario	Annual Demand in 2043 (ML/year)	% of Reduction from Baseline Demand
Baseline	9,047	-
Low DM	8,385	7%
High DM	8,177	10%

### 6.3 Forecast Per Capita Demand Analysis

Bathurst's per capita demand forecast is shown in Figure 4. The per capita demand is expected to increase by 3% over the next 50 years based on historical trends. The starting point of the forecast is the current climate corrected annual water production per capita (i.e. 525 L/d/p) in Bathurst. This analysis is based on the total production divided by the number of people served with potable water therefore it cannot be compared to the residential per capita demand.

The reduction in per capita demand from demand management implementation is expected to be at the same ratio as the annual demand reductions. The per capita demand reductions in 30 years for each of the scenarios are summarized in Table 7.



**Figure 4: Bathurst per Capita Demand Projection**

**Table 7: Bathurst per Capita Demand Reduction in 30 years**

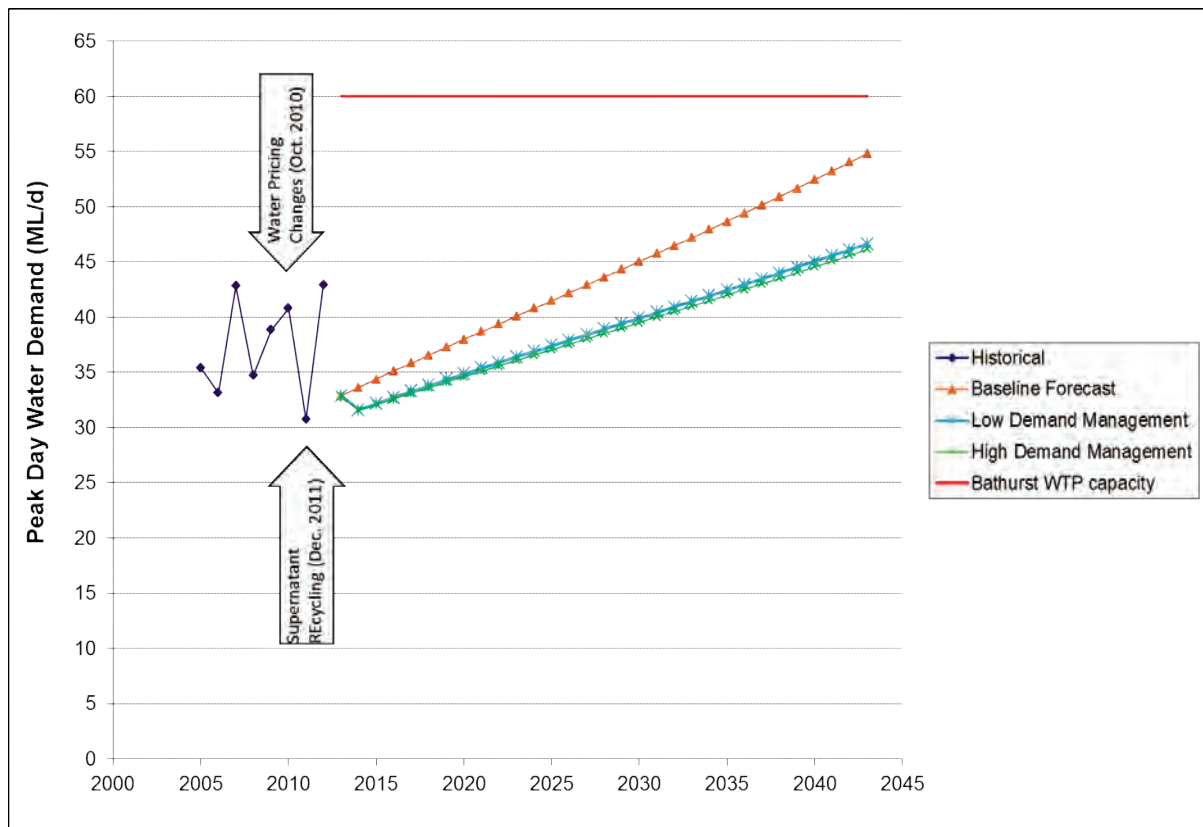
Scenario	Per Capita Demand in 2043 (L/person/day)	% of Reduction from Baseline Demand
Baseline	540.4	-
Low DM	501.2	7%
High DM	488.7	10%

## 6.4 Forecast Peak Day Demand Analysis

Figure 5 shows the historical and predicted peak day demand (PDD) for Bathurst. The starting point of the forecast is based on the first year forecast average daily demand (i.e. 16.8ML/day) and current peak to average ratio (i.e. 1.96). The historical PDD is the average of the 5 highest PDD of each year.

The Bathurst Water Treatment Plant current design capacity is 60 ML/d. The graph shows that the Bathurst WTP has sufficient capacity to supply the expected PDD for the next 30 years.

The reduction in peak day demand in 30 years from demand management implementation is expected to be 16% and 6% from high and low demand management scenarios, respectively. The peak day demand reductions in 30 years for each of the scenarios are summarized in Table 8.



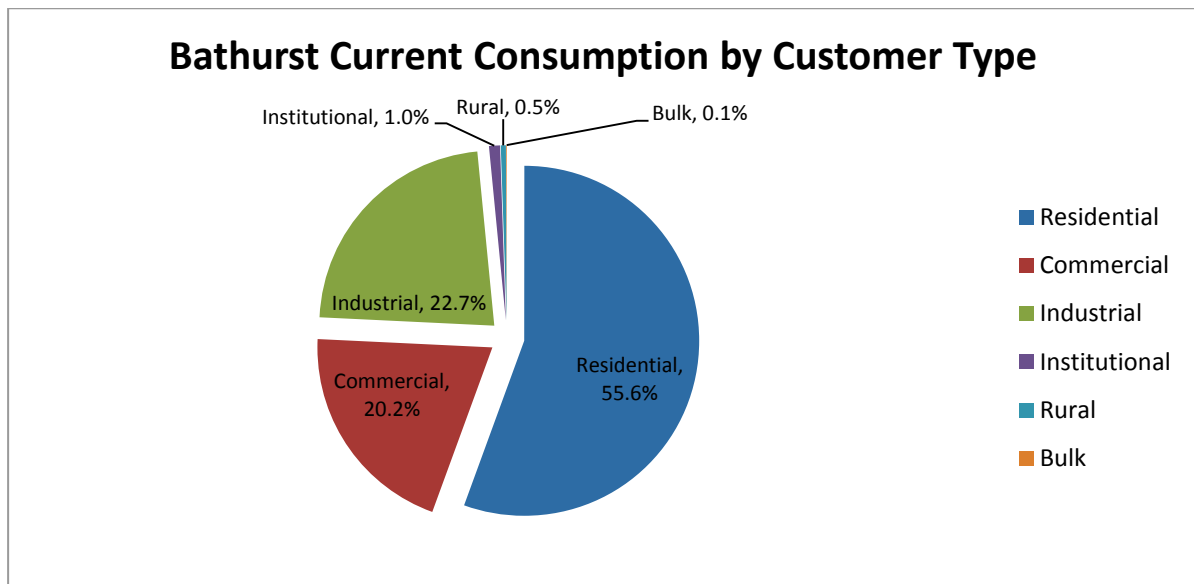
**Figure 5: Bathurst WFP Capacity & Peak Day Demand**

**Table 8: Projected Bathurst Peak Day Demand Reduction in 30 years**

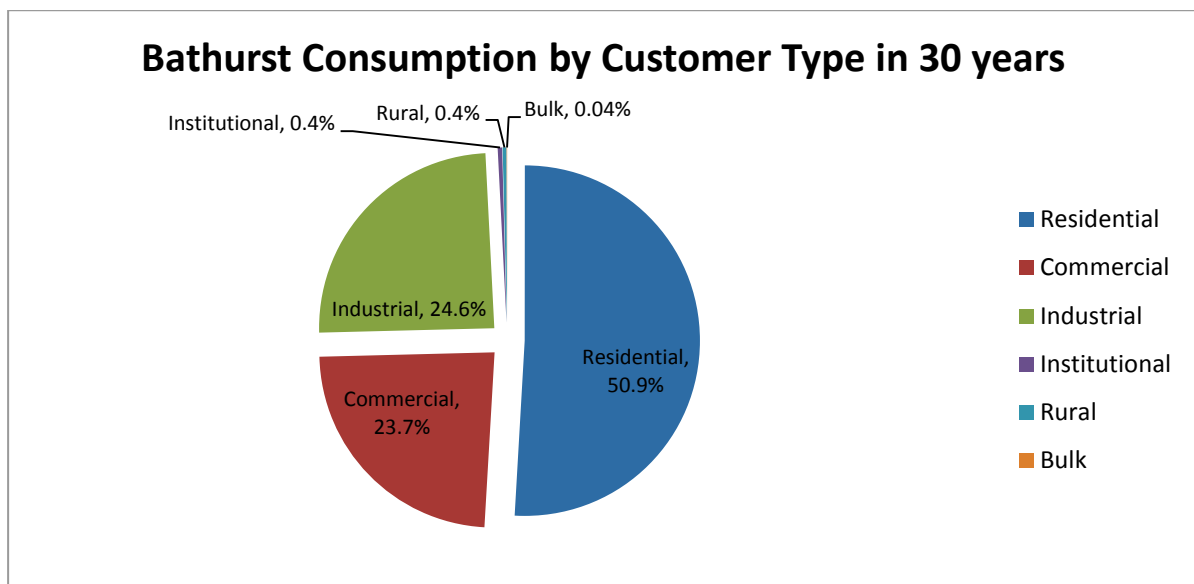
Scenario	Peak Day Demand in 2043 (ML/day)	% of Reduction from Baseline Demand
Baseline	54.8	-
Low DM	46.6	15%
High DM	46.1	16%

## 6.5 Demand Forecast for Each Customer Category

Bathurst's current and 30 year forecast consumption by customer type is shown in Figure 6 and Figure 7.



**Figure 6: Bathurst Consumption Breakdown**



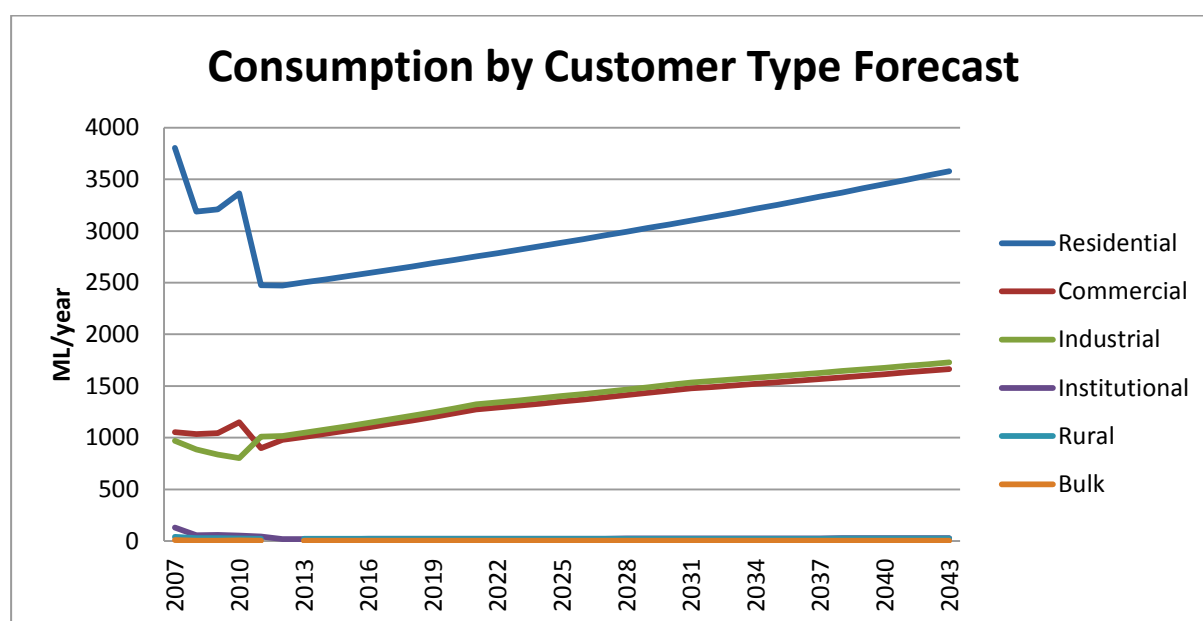
**Figure 7: Bathurst Forecast Consumption Breakdown**

The demand forecast for each customer category may be of relevance when major development(s) such as a new high water consumption industry is developed/expanded. Council has advised that currently there are no development applications in place that may require high water consumption. In 2007 Council prepared a Region Urban Strategy study with regards to urban development strategies and Council is currently preparing business development strategy which outlines expected future business development in the region. These reports provide some estimated growth projections for commercial and industrial developments. The estimated growth rate for each category varies between customer categories as follows:

- ❑ Residential: growth rate of 1.2% (as used in the DSS model)
- ❑ Commercial: growth rate is based on the assessment of future floor space requirements provided in the Bathurst Business Development Strategy draft report (2011)

- ❑ Industrial: As stated in the Bathurst Business Development Strategy, long term population and economic growth have been reflected in residential, industrial and commercial land use development in Bathurst. This is a long term process which is likely to continue for the foreseeable future. Both the Bathurst Region Urban Strategy (2007) and the Business Development Strategy have identified the need for significant additional development to meet future requirements, however none of these reports have clearly identified an estimated growth. For the purposes of this analysis it has been assumed that the industrial water consumption growth will be at the same ratio as the commercial growth
- ❑ Institutional: consumption by institutional customers has been declining over the past 6 years. For the purposes of this analysis it is assumed that the consumption will increase at the same ratio as the population growth to reflect the need for infrastructure growth for the growing population
- ❑ Rural: The Bathurst Business Development Strategy draft report states the projections for the Bathurst rural area (rural areas surrounding the urban area) prepared by the NSW Department of Planning in 2008. The forecasts growth rates are approximately 0.6% per year for the period of 2006 – 2021 and 0.51% per year for the period 2021 – 2031
- ❑ Bulk: It is assumed that bulk consumption will remain steady

The expected demand by each customer type is as shown in Figure 1Figure 8.



**Figure 8: Historical and Forecast Consumption by Customer Type**

Based on this analysis industrial and commercial demand will have a higher share of the total consumption in 30 years. Council may monitor the water consumption growth in the industrial and commercial sectors to ensure a continuous secure urban water supply in Bathurst and if required, consider the implementation of water conservation measures incentives targeting the industrial and commercial customers.

## 6.6 Unaccounted for Water

An Unaccounted for Water (UFW) analyses was undertaken for the purposes of this demand management plan to indicate the level of leakage and non-revenue water in the Bathurst water supply scheme. UFW represents leakage, water losses and unbilled water. Leakage studies for over 70 NSW LWUs indicate an average leakage from potable water supply distribution systems of 10% of annual consumption (range from 2% to 27%). Similarly, statewide analysis of non-revenue water (Real Loss, Apparent Loss and Unbilled Water) for NSW water utilities other than bulk water suppliers indicates a minimum of 10% of annual water supplied. (Source: 2011-12 NSW Benchmarking Report by NSW Office of Water)

Bathurst UFW is estimated based on Bathurst's annual (i.e. financial year data) water production figures and consumption data from Council's water bill data base.

The percentage of UFW shown in Table 9 in 2012 is a bit higher than the average leakage and non-revenue water (i.e. 10%) of 70 NSW LWUs in the same period of time. Historical data shows that BRC's UFW has been higher than the average for the past 6 years. Council has advised that the high UFW figure is due to the amount of water used for flushing manganese out of the system. Council has a very high number of water quality complaints and the problem of discoloured water is wide-spread across the city from November to February each year. Flushing is the only option until the new caustic and hypo dosing plant comes online in 2015.

It is expected that the percentage of UFW will reduce after the commissioning of the dosing plant. Council is recommended to closely monitor the levels of leakage and non-revenue water in the following years to ensure the levels of water losses and unbilled water are acceptable.

**Table 9: Bathurst UFW Analysis**

	2007	2008	2009	2010	2011	2012
Residential	3805	3188	3208	3364	2476	2473
Commercial	1055	1036	Not available	1150	899	980
Industrial	969	887	837	802	1011	1017
Institutional	131	57	61	55	45	20
Rural	41	30	30	26	21	
Bulk	10	4	4	6	3	
Total Consumption	6,011	5,202	5,186	5,403	4,455	4,490
Total Production	7,287	6,572	6,117	6,586	6,006	5,719
UFW	1,276	1,370	-	1,183	1,551	1,229
% of UFW	18%	21%	-	18%	26%	21%

# 7 Implementation Plan

## 7.1 Local Water Utility Implementation Costs

As described in section 5, BRC already has some water conservation measures in place. If Council decides to implement further water conservation measures, Council may use the cost analysis below as a guide to select the potential option(s).

Table 10 shows a 5 year implementation costs plan of all water conservation measures analysed for the Bathurst water supply area. They are estimates from the DSS model prepared for the Bathurst Climate Change and Water Security Plan (2011). Further investigation and on-going review of the program will be needed to identify the actual costs. The final implementation plan would be determined by Council in its annual Management Planning process.

**Table 10: Water Conservation Measures Implementation Plan (2011 dollars)**

Water Conservation Measure	Year 1	Year 2	Year 3	Year 4	Year 5
<b>Dual Reticulation for all new Residential Development</b>	\$21,012	\$4,602	\$4,602	\$4,602	\$4,602
<b>Permanent Low Level of Restrictions on Water Use</b>	\$14,012	\$2,602	\$2,602	\$2,602	\$2,602
<b>Residential Washing Machine Rebate</b>	\$152,619	\$186,927	\$151,477	0	0
<b>System Water Loss Management</b>	\$36,426	\$32,501	\$32,864	\$33,230	\$33,601
<b>WSUD Option 1 - Rainwater Use for Hector Park Amenities Block</b>	\$15,075	\$96	\$96	\$96	\$96
<b>WSUD Option 2 - Stormwater Harvesting for Bathurst Golf Course Irrigation</b>	\$147,956	\$482	\$482	\$482	\$482
<b>Total Cost for LWU – High DM scenario</b>	<b>387,100</b>	<b>227,210</b>	<b>192,123</b>	<b>41,012</b>	<b>41,383</b>
<b>Total Cost for LWU – Low DM scenario</b>	<b>35,024</b>	<b>7,204</b>	<b>7,204</b>	<b>7,204</b>	<b>7,204</b>

## 7.2 5 years Demand Management Implementation Outcomes

The total implementation costs and total costs savings in the first 5 years of implementation of the water conservation measures suggested to BRC as well as the 5 years average annual water savings are listed in Table 11.



**Table 11: 5 Years Water Savings and Costs Comparison (2011 dollars)**

<b>Water Conservation Measures</b>	<b>Total LWU Costs (\$)</b>	<b>5 years Average Water Saving (ML/year)</b>	<b>Total Water Bill Savings (\$)</b>	<b>Total Operating Costs Savings (\$)¹</b>
<b>Dual Reticulation for all new Residential Development</b>	\$39,422	34.4	\$294,140	\$21,425
<b>Permanent Low Level of Restrictions on Water Use</b>	\$24,422	155.5	\$1,329,438	\$60,389
<b>Residential Washing Machine Rebate</b>	\$491,023	47.3	\$404,758	\$26,819
<b>System Water Loss Management</b>	\$168,622	6.6	N/A	\$8,559
<b>WSUD Option 1 - Rainwater Use for Hector Park Amenities Block</b>	\$15,461	0.268	N/A	\$493
<b>WSUD Option 2 - Stormwater Harvesting for Bathurst Golf Course Irrigation</b>	\$149,884	5.3	N/A	\$9,752
<b>Total – High DM Scenario</b>	<b>\$888,834</b>	<b>249.4</b>	<b>\$2,028,337</b>	<b>\$127,427</b>
<b>Total – Low DM Scenario</b>	<b>\$63,844</b>	<b>190</b>	<b>\$1,623,578</b>	<b>\$81,814</b>

1. Total operational costs savings is calculated based on operating (i.e. transfer and treatment) costs savings per mega litre of water and wastewater saved per year; \$155 and \$213 per mega litre, respectively.

Some of the water conservation measures recommended will have a shorter lead time than others, but generally they all have financial benefits. This is a preliminary cost analysis using water savings and costs assumptions from NSW Office of Water guidelines and DSS model. If BRC determines the recommended water conservation measures should be implemented, Council should further investigate the options and local costs of implementing the options.

If the recommended water conservation measures are implemented Council should develop a monitoring program for reviewing the effectiveness of the implemented water conservation measures.

### 7.3 Quadruple Bottom Line Assessment of Demand Management Options

“Social, environmental and economic” criteria have been applied for an extended period as components of a Triple Bottom Line (TBL) approach to decision making. Recently “leadership” or more specifically in the case of Local Government “governance” has been added to promote a more rounded consideration of any options through the decision making process as it relates to any Council service or activity. This is known as a Quadruple Bottom Line (QBL) approach, a tool used to assess the likelihood of implementing successful and relevant options on a civic leadership, social, environmental and economic basis.

Council has adopted a QBL approach to its Integrated Planning and Reporting Process and the 2036 Community Strategic Plan takes a whole of Council approach to the delivery of services to the community. The plan identifies actions to address community priorities and objectives under each of the four key themes -Environmental, Economic, Social and Governance.

A QBL approach advocates that any options cannot be considered on economic benefits alone but social and environmental benefits must be weighed up – in doing this Council is taking a sound governance approach to the decision, covering the fourth element of the QBL approach.

For the purpose of this Demand Management Plan the four QBL elements have been described below solely with reference to the water related objectives contained within 2036 Community Strategic Plan. It is with these descriptions in mind that the recommended options have been identified.

- ❑ Environmental Sustainability - The ability of the option (proposed action or undertaking) to minimise the environmental footprint, promote a sustainable water supply and increase or restore water in natural streams
- ❑ Liveable Communities – The impact the option (proposed action or undertaking) has on increasing awareness and urban water security and the impact on the customer’s perception on sustainable water use (e.g. recycled water use and compliance with water restrictions)
- ❑ Economic Prosperity – The cost effectiveness to the Local Water Utility of implementing the option and the level of operating cost savings
- ❑ Sound Leadership – The ability to demonstrate Council’s Leadership in planning for growth and protection of the environmental and social assets; and maintaining and upgrading existing assets and levels of service

The water conservation measures suggested in this plan are assessed based on these four criteria. The outcome is a qualitative analyses of the options based on Council and community’s needs and business objectives.

Based on the assumptions used in this plan it is clear that providing dual reticulation for new residential development and implementing permanent water conservation restrictions are the most financially viable options that could be implemented in Bathurst. However Council will consider the complex social, environmental and governance benefits of each option within their decision making process.

As mentioned in section 7, the implementation costs are estimates from the DSS model prepared for the Bathurst Climate Change and Water Security Plan (2011) and further investigation and on-going review of the program is recommended to determine actual local costs and to ensure the financial feasibility of implementing the measure. Table 12 indicates that from QBL perspective implementing permanent low level water restrictions would have a higher QBL rating than the other measures.

**Table 12: Quadruple Bottom Line Analyses of the Demand Management Measures**

Options	Environmental Sustainability	Liveable Communities	Economic Prosperity	Sound Leadership
<b>Dual Reticulation for all new Residential Development</b>	<ul style="list-style-type: none"> <li>✓ Increases water in streams</li> <li>✓ Minimise environmental footprint</li> <li>✓ Promotes a sustainable water supply</li> </ul>	<ul style="list-style-type: none"> <li>✗ Adverse impact on community perception on recycled water use</li> <li>✗ Low benefit/cost ratio to customers</li> </ul>	<ul style="list-style-type: none"> <li>✓ Cost effective</li> </ul>	<ul style="list-style-type: none"> <li>✓ Shows Council's leadership in planning for growth and protection of environmental and social assets</li> </ul>
<b>Permanent Low Level of Restrictions on Water Use</b>	<ul style="list-style-type: none"> <li>✓ Increases water in streams</li> <li>✓ Minimise environmental footprint</li> </ul>	<ul style="list-style-type: none"> <li>✓ Increases awareness on water issues and urban water security</li> <li>✓ High benefit/cost ratio to customers</li> <li>✓ Encourages a supportive and inclusive community</li> </ul>	<ul style="list-style-type: none"> <li>✓ Cost effective</li> </ul>	<ul style="list-style-type: none"> <li>✓ Shows Council's leadership in planning for growth and protection of environmental and social assets</li> </ul>
<b>Residential Washing Machine Rebate</b>	<ul style="list-style-type: none"> <li>✓ Increases water in streams</li> <li>✓ Reduces GHG emissions</li> <li>✓ Promotes energy efficient growth</li> </ul>	<ul style="list-style-type: none"> <li>✓ Increases awareness</li> <li>✗ Low benefit/cost ratio to customers</li> </ul>	<ul style="list-style-type: none"> <li>✗ Expensive to implement</li> </ul>	<ul style="list-style-type: none"> <li>✓ Demonstrates Council's leadership with the provision of rebates to the customers to incentive water conservation practices</li> </ul>
<b>System Water Loss Management</b>	<ul style="list-style-type: none"> <li>✓ Reduces waste</li> <li>✓ Promotes a sustainable water supply</li> </ul>	<ul style="list-style-type: none"> <li>✓ Increases urban water security</li> </ul>	<ul style="list-style-type: none"> <li>✗ Expensive to implement</li> <li>✗ Low operating costs savings</li> </ul>	<ul style="list-style-type: none"> <li>✓ Shows Council's leadership in planning for protection of environmental and social assets</li> <li>✓ Guides the management and upgrading of existing assets and service levels</li> </ul>

Options	Environmental Sustainability	Liveable Communities	Economic Prosperity	Sound Leadership
<b>WSUD Option 1 - Rainwater Use for Hector Park Amenities Block</b>	<ul style="list-style-type: none"> <li>✓ Restores more natural flow regimes</li> <li>✓ Promotes a sustainable water supply</li> </ul>	<ul style="list-style-type: none"> <li>✓ Increases awareness</li> </ul>	<ul style="list-style-type: none"> <li>✗ Benefit/cost ratio is negligible due to small scale of the project</li> <li>✗ Very low operating costs savings</li> </ul>	<ul style="list-style-type: none"> <li>✓ Shows Council's leadership in planning for protection of environmental and social assets</li> </ul>
<b>WSUD Option 2 - Stormwater Harvesting for Bathurst Golf Course Irrigation</b>	<ul style="list-style-type: none"> <li>✓ Restores more natural flow regimes</li> <li>✓ Promotes a sustainable water supply</li> </ul>	<ul style="list-style-type: none"> <li>✓ Increases awareness and urban water security</li> </ul>	<ul style="list-style-type: none"> <li>✗ Expensive to install and maintain</li> <li>✗ Low operating costs savings</li> </ul>	<ul style="list-style-type: none"> <li>✓ Shows Council's leadership in planning for protection of environmental and social assets</li> </ul>

## 8 References

1. Bathurst 2036 Community Strategic Plan, Bathurst Regional Council, February 2013
2. Bathurst CBD & Bulky Goods - DRAFT 3, 8th July 2011
3. Bathurst Climate Change and Water Security Plan, Sinclair Knight Merz, May 2011
4. Bathurst Drought Management Plan draft report, October 2013
5. Bathurst Region Urban Strategy, Bathurst Regional Council, March 2007
6. Fish River Secure Yield Enhancement Project, Sinclair Knight Merz, March 2014
7. Water Conservation and Demand Management Strategy, 2009
8. NSW Office of Water, Best-Practice Management of Water -Supply and Sewerage Guidelines, August 2007
9. NSW Water Supply and Sewerage Benchmarking Report, 2010/11

# Appendix A

## Water Sensitive Urban Design Options Technical Report

Bathurst Regional Council has requested the development of two water sensitive urban design (WSUD) options to be considered as demand management options. The options below were developed to promote the harvesting and reuse of stormwater in public areas.

Hector Park in Bathurst was selected for the implementation of two WSUD projects for the following reasons:

- ❑ Highly visible area popular with visitors. It is a rest stop area with a small playground, toilet block and BBQ hut
- ❑ The existing Hector Park Wetlands on the Jordan Creek just behind the amenities. The wetlands act as stormwater storage and provide a natural treatment due to the dense macrophytes present
- ❑ Potential for stormwater reuse on-site at the amenities block and on the golf course across the road



**Figure 9: Existing Stormwater Infrastructure around Hector Park**





## WSUD Case Study 1

### Small scale stormwater reuse project – Hector Park Amenities Block

#### Background Information

##### Rainwater Source:

The Bathurst Indoor Sports Stadium has a roof area of 3350m<sup>2</sup>. The stadium is approximately 300 m from the amenities block.

##### Rainwater Reuse site:

The existing amenities block at Hector Park. The amenities block is open every day and the estimated water usage for toilets is 1kL per day.

#### Project Description

The proposed project is to harvest rainwater from the Bathurst Indoor Sports Stadium roof in a rainwater tank for reuse at the Hector Park amenities block for toilet flushing only. During dry periods when water from the rainwater tank is not available the storage tank above the amenities will be topped up with town potable water supply.

This project involves the following components:

- A 10 kL rainwater tank including a first flush device, a ball valve and an inlet strainer installed on the east facade of the Stadium
- This project assumes that the gutters are appropriate for rainwater collection. Gutters should not be rusty or corroded and should freely drain to the downpipe/s used to collect the roofwater
- A pump with capacity to pump up to 1 kL per day
- 300 m of pipes to transfer water from the rainwater tank to a storage tank in the amenities block
- 1 kL storage tank installed above the amenities block (note: rainwater reuse for toilet flushing does not require treatment)
- Toilets flush will be fed by gravity

Maintenance: low maintenance required. Maintenance depends on the amount of debris/leaves in the roof area. Council staff should check the inlet strainer a couple of times in the first year of installation and then determine how often it should be undertaken from there onwards.



## Small scale stormwater reuse project – Hector Park Amenities Block

### Considerations/Constraints

Before starting the project, it is recommended that the stadium roof be inspected. Ideally, the roof should not have:

- Public access (roofs with maintenance access are acceptable)
- Structures above the roof that may rust or corrode (e.g. unpainted metal or concrete), or
- provide a resting place for birds
- Discharge, overflow or bleed-off pipes from roof-mounted appliances, such as air-conditioning units, hot water services and solar heaters
- A flue from a slow combustion heater that is not installed in accordance with the relevant Australian standard
- A chimney or flue from an industrial process within or adjacent to the building
- Exposure to chemical sprays from processes within the building (eg: spray painting) that may be deposited on the roof
- Significant atmospheric deposition of pollutants (eg: from industrial sources or from aerial spraying)
- Vegetation growing on the roof (eg: a 'green roof')

Source: *Australian Guidelines for Water Recycling: Stormwater Harvesting and Reuse*, 2009.

### Water savings

The estimated water savings from implementing this project is about 268 kL per year. This estimation is based on the following assumptions:

- 20 years of Bathurst daily rainfall and temperature data records
- Stormwater catchment area (roof area) of 3,350m<sup>2</sup>
- First flush per storm of 50 L per day
- Average daily toilet usage of 1 kL per day

### Estimated Costs

Total estimated implementation cost is \$15,540. This includes:

- 10 kL rainwater tank installed (quotation from local supplier)
- Pump (capacity up to 1 kL per day) (quotation from local supplier)
- 300 m of 50 mm pipes installed
- 1 kL storage tank installed (quotation from local supplier)
- Energy cost is negligible therefore it is not included in the costs (solar power to be investigated)

## Large scale stormwater reuse project – Bathurst Golf Course Irrigation

### Background Information

#### Stormwater Source:

Hector Park Wetlands consists of a detention basin and a chain of 5 ponds.

Water entering the system prior to the detention basin consists mainly of a combination of upstream flows from Jordan Creek, the outlet of the Winburndale Pipeline (raw water), residential stormwater from the houses to the north of Hector Park and water from the surrounding streets.

The area upstream of the detention basin has areas of dense macrophytes as well as some open water. These provide some level of natural treatment/filtration. Water exiting the detention basin flows through a grated pit (acting as a gross pollutant trap) before entering the 'chain of ponds' system.

Maximum capacity of the detention basin is 19,732 kL and at this level the maximum depth is 4.2m. The level of water in the basin is dictated by the outlet - a raised, grated pit - with water only exceeding this level when flows exceed the out flow capacity of this device. Unfortunately flows into this system are not metered, thus historical records of volume available from this system are not available. However Council staff advised that based on anecdotal evidence it seems that water in this system flows on an almost permanent basis (i.e. water is overflowing into the grated pit and exiting downstream). Since the construction of the Hector Park Wetlands - approximately 10 years - even when the creek is not flowing, the wetlands have never run completely dry.

The most appropriate point of stormwater extraction for reuse would be at the end of the 'chain of ponds' (i.e. wetlands) terminating at Peel Street. Extracting water from this point instead of from the sediment basin offer the following benefits:

- All water flowing downstream of the wetlands could be extracted. Downstream from Peel Street the creek is piped so there are no considerations of environmental flows. (Note: water licence may be required, this is not considered in the scope of this project)
- Water at this point has been filtered through a gross pollutant trap and the 'chain of ponds' which are densely populated with macrophytes
- Water quality at this point is expected to be appropriate for irrigation purposes, thus further treatment is not considered in this study. Council should monitor water quality at the extraction point for a period of 6-12 months. This will assist Council to identify whether further treatment is required for irrigation purposes or not

The distance from the extraction point to the proposed stormwater reuse site (i.e. Bathurst golf club house) is 1 km.

#### Stormwater Reuse site:

Bathurst Golf Club is located across the road from Hector Park, 1 km from the proposed stormwater extraction point.

Council has 3 water meters ( average demand shown in brackets) installed at the golf course, these are:

- Manual irrigation and water bubblers 80mm - Filtered Water: (5409 kL/year)
- Clubhouse 50mm - Filtered Water: (292 kL/year)
- Irrigation 100mm - Raw Water: ( 19565 kL/year)

Manual irrigation is assumed to be hand held hoses along the fairways. The golf club uses a significant amount of filtered water for irrigation purposes and bubblers, as listed above. This project assumes that 1% (approximately 52 kL/year) of the annual consumption is used in the bubblers and the rest is used for manual irrigation.

## Large scale stormwater reuse project – Bathurst Golf Course Irrigation

Based on historical records the peak demand at the golf course is during summer months (i.e. Dec to Feb) when temperature and evaporation are higher than in the rest of the year, requiring more irrigation during this period.

### Project Description

The proposed project is to transfer water from the end of the 'chain of ponds' (i.e. wetlands) terminating at Peel Street to a storage tank at the Bathurst Golf Club for replacement of filtered water used for irrigation.

Water from Hector Park is assumed to be of appropriate quality for irrigation at the golf course due to the removal of pollutants in the detention basin and in the wetlands. This project does not include any further treatment. Council is required to investigate the water quality from the extraction point to determine if treatment is required for irrigation purposes at the golf course.

It is proposed to connect the storage tank to the existing reticulation system (assuming they are on the same system) that supplies the bubblers and the irrigation taps. As the water is non-potable the bubblers will be disconnected from this system. Stormwater will then be pumped from the storage tank to the irrigation taps only. Based on Council's advice, the flow in the wetlands has always been sufficient to supply the required demand. In the event of dry periods when the water is not available from Hector Park Wetlands, the storage tank will be topped up with town potable water from the club house.

We propose to connect the existing bubblers to a new smaller scale reticulation system connected to Bathurst's potable supply. However this component of the project may be quite costly. Bathurst Golf Club management may consider providing one bubbler at the club house for topping up water. This will depend on an agreement between Council and the club about who will pay for this part of the project.

This project involves the following components:

- Pump with capacity to transfer summer peak demand of 30 kL per day (i.e. 0.5 L/s), installed at the end of the wetlands
- 1 km of pipes to transfer water to the golf club
- 30 kL storage tank installed near the clubhouse
- Pump with pressure system (capacity 5 L/s) to transfer stormwater from the storage tank to the irrigation taps
- 2 km of pipes to transfer potable water from the club house to the bubblers

## Large scale stormwater reuse project – Bathurst Golf Course Irrigation

### Recommendations

In order to implement this project, Council should firstly collect some data to ensure this option is feasible. This include:

- Regular volume of stormwater flowing into the sediment basin
- Water quality and flows at the proposed extraction point (i.e. end of the chain of ponds)
- Check with NSW Office of Water in regards to water licence requirements to extract water from the Jordan Creek
- Negotiate agreement with the Golf Club in regards to potable water supply to the bubblers or use of alternative options such as provide one bubbler at the club house and give away water bottles to the members

### Water savings

Assuming stormwater volumes to match demand are always available from Hector Park Wetlands, the estimated water savings from implementing this project is approximately 5350 kL per year or 14.7 kL per day, on average. Potential peak day savings of 30 kL/day.

### Estimated Costs

Total estimated implementation cost is \$153,000. This includes:

- Pump with 0.5 L/s capacity
- 1000 m of 50 mm pipes
- 30 kL storage tank
- Pump and pressure system with 5 L/s capacity
- 2000 m of potable water reticulation (i.e. bubblers) – estimated cost of \$60,000
- Energy cost is negligible therefore it is not included in the costs

This cost estimate does not include any additional filtration processes that may be required by a detailed water quality assessment.

# Appendix B

## NSW Office of Water Demand Management Plan-Check List

## **Water Conservation**

### **Check List – August 2007**

Best-practice water conservation and demand management are essential for efficient management of a Local Water Utility's (LWU's) water supply business and for efficient use of water resources. Cost-effective demand management measures deliver significant environmental and social benefits and help minimize customer water supply bills through lower capital and operating costs.

A permanent reduction in demand achieved through demand management serves the same purpose as an increase in supply capacity – such as building new treatment or storage facilities. LWUs have often found many demand management actions to be more cost-effective than increasing supply capacity. When demand is reduced, benefits accrue through deferral and downsizing of the capacity of new capital works and lower treatment and transfer costs.

A key part of managing demand is understanding how and when water is used. A demand management program therefore requires metering of all customers supplied, together with demand analysis.

Demand management measures that should be examined as part of a demand management program include:

- ☐ Implementation of permanent water saving measures to minimize wastage, in accordance with Item 91 (iii) of the National Water Initiative<sup>5</sup>
- ☐ Active intervention – appropriate retrofit, rebate and building code programs
- ☐ Water pricing reform
- ☐ Community education
- ☐ Effluent and stormwater re-use.

LWUs should also pursue active programs to identify and reduce system water loss through leakage reduction.

This check list is essentially a road map to assist LWUs to quickly implement sound demand management measures. Each LWU should also review its demand management measures every 2 years to ensure that it has an appropriate balance between demand and supply-side investment.

<sup>5</sup>Review the effectiveness of temporary water restrictions and associated public education strategies, and assess the scope for extending low level restrictions as standard practice.

## Water Conservation and Demand Management – Check List

No.	Topic	Outcome Achieved		Section of the Report
1.	Demand Monitoring	Bulk water production metered and recorded on a daily basis.	✓	3
		All new free standing and multi-unit residential developments (both strata and non-strata) approved after 1 July 2004 must be separately metered.	✓	3
		All free standing residential premises must be separately metered by 1 July 2007	✓	3
		LWUs should encourage separate metering of existing multi-unit residential developments, where cost-effective	✓	3
		Customer water consumption billed at least three times a year (and preferably quarterly)	✓	3
		Customers classified in accordance with the categories defined in the latest NSW Water Supply and Sewerage Performance Monitoring Report and consumptions reported annually	✓	3
		If facing augmentation of the peak day capacity of your system, monitor and record service reservoir levels on a daily basis in high demand periods.	-	Not Applicable as Council does not plan to do augmentation
2.	Demand Forecasting	Historical records corrected for influence of climate.	✓	6
		Data records screened for errors	✓	6
		Demand forecasts prepared for each customer category as well as for leakage and unaccounted for water (UFW).		6.5 and 6.6
3.	Demand Management Planning	Examined a range of long-term demand management measures including: - retrofit programs - rebates for water efficient appliances - rebates for rainwater tanks - rebates for garden mulch - effluent - stormwater re-use programs	✓	5
		Completed benefit/cost analysis of demand management measures that includes benefits from reduced capital works and lower operating costs	✓	5 and 7
		Completed investment schedule/plan for implementing cost-effective demand management measures.	✓	7

No.	Topic	Outcome Achieved		Section of the Report
4.	Implementation	Subsidized and promoted at least two of the identified demand management initiatives, referred to in 3. above	✓	5.2 - This report makes recommendations to Council. It is expected Council will assess the viability of implementing the demand management measures
		Examined the implementation of permanent water saving measures to minimize wastage, in accordance with Item 91 (iii) of the National Water Initiative	✓	7 - Council will assess the viability of implementing permanent water saving measures
		Implemented a cost-effective leakage reduction program to reduce system water losses	✓	5.1.5
		Ongoing customer education campaign focusing on the importance of conserving our valuable water resources	✓	5.2.2
		If average residential water use per property exceeds that for the median NSW utility (i.e. 155 kL/a in 2011/12) by over 20%, the LWU must show progress towards achieving a reduction in average residential use by 1 July 2014	-	Not applicable. 11/12 residential water use does not exceed median usage by 20% - TBL Performance Report
		Monitoring program for reviewing the effectiveness of the implemented demand management measures	-	It is expected that based on this report Council will develop a monitoring program

## REFERENCES

3. *2005/06 NSW Water Supply and Sewerage Performance Monitoring Report*, Department of Water and Energy/Local Government Association and Shires Association, NSW
4. *Water Demand Trend Tracking & Climate Correction – User manual*, Department of Land and Water Conservation, NSW, 2002
5. *Demand Management Decision Support System – User Manual*, Department of Land and Water Conservation, NSW, 2002



## Sydney

Level 1

189 Kent Street

Sydney, NSW, 2000

Tel: 02 9249 5100

Fax: 02 9251 4011

Email: [hsc@hydroscience.net.au](mailto:hsc@hydroscience.net.au)

## Byron Bay

Unit 6

64 Centennial Circuit

Byron Bay, NSW, 2481

Tel: 02 6639 5600

Fax: 02 6680 9319

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

**HydroScience provides planning and design services to public and private sector clients throughout Australia. We are committed to developing strong client relationships that become the foundation for understanding our clients' needs and exceeding their expectations.**

