WATER SUPPLY DEMAND STRATEGY

Ballarat and District Water Supply System Strategic Plan 2011-2060
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1. INTRODUCTION

Background information

The Victorian Government has outlined a sustainable vision for Victoria's future water supplies. Part of this vision is to establish Victoria as a world leader in integrated urban water management so that our cities become more sustainable and liveable.

The purpose of Water Supply-Demand Strategies is to identify the best mix of measures to maintain a balance between the demand for water and available supply in urban supply systems now and into the future.

Figure 1.1 Policy Framework for Sustainable Urban Water Management

The development of this Water Supply Demand Strategy (WSDS) details the commitment of Central Highlands Water (CHW) towards supporting efficient urban water use and identifying supply options to maintain an appropriate balance between urban water supply and demand over the next 50 years.

This long-term strategy is a component of CHW’s overall planning processes, which includes planning for drought response, financial expenditure, asset management, water quality and wastewater reuse. Short-term actions presented in this strategy will inform the development of the Corporation’s Water Plan (2013-2018).

This strategy follows on from the initial WSDS for this system, completed in 2006. This WSDS is to be reviewed every five years to take into account changes to the availability of water supplies and changes in consumer demand, as a requirement under the Statements of Obligations (SoO) issued to all water corporations by the Minister for Water under sections 41 and 8(1)(a) of the Water Industry Act 1994.

Considering the effects of conditions faced and actions taken in the period of 2006-2011, this update outlines the integrated urban water use and identifying supply options to maintain an appropriate balance between urban water supply and demand over the next 50 years.

Key objectives

The objective of WSDS is to facilitate efficient and effective urban water management in the medium and long term by adopting a range of measures that focuses on reducing water demand, securing water supplies, recycling and using alternative supplies, and balancing water supply and demand. Refer to Figure 1.2 for the key objectives.
Key Objectives:

1. Ensure safe, secure, reliable and affordable water supplies that meet society’s needs;
2. Enable customers to have access to desired water products and services, and to choose to use water for activities they value highly;
3. Encourage all water resources – including rainwater, stormwater and recycled water – to be utilised in ways that are efficient and fit-for-purpose, whilst ensuring that public and environmental health are protected – wherever possible;
4. Encourage water projects to also enhance the liveability, productivity, prosperity and environment of our cities and towns – wherever possible;
5. Ensure that water needs of environmental assets are transparently considered and delivered; and
6. Ensure that water planning is subject to a transparent and rigorous decision-making process, with clear roles and responsibilities and accountabilities, which can adapt to the changing environment.

The WSDS is a key component of the framework of plans and processes that governs the management of water for urban consumption in the state of Victoria. Figure 1.3 depicts the Victorian water supply planning framework and highlights the importance of the WSDS in developing strategies to achieve sustainable management of water resources to ensure that they meet the current and future water needs of the community.

Previous long-term planning

Long-term water supply planning is an ongoing process that requires regular review. As part of this process, Water Supply-Demand Strategies shall be reviewed every five years.

Some of the previous long-term planning studies undertaken include:
- Sustainable Water Strategy, Central Region: Action to 2055
- Ballarat Long Term Water Resource Management Plan, 2005
- Options Paper: Securing Ballarat and District’s Future Water Supply, 2005
- Ballarat Water System Development Plan, 2010

Regulatory documents governing water management in the Ballarat system

- The Victorian Liberal Nationals Coalition Plan For Water
- Central Highlands Region Water Authority Water Plan 2008-2013
- Central Region Sustainable Water Strategy 2006

Plan development
CHW have developed this plan in accordance with the *Guidelines for the Development of a Water Supply Demand Strategy (Version 2)* prepared and issued in October 2011 by the Department of Sustainability and Environment (DSE), with the assistance of representatives of all metropolitan and urban water corporations and the Department of Treasury and Finance.

**Figure 1.4 Ballarat Region Map**


Source: CHW GIS System
2. CURRENT WATER RESOURCE REVIEW

Local water supply catchments

The Ballarat and district water supply is predominantly sourced from the Upper West Moorabool and Yarrowee River catchments situated to the east of Ballarat. The majority of the catchment is a declared Water Supply Protection Area, which is predominantly managed through planning controls. However, it is an open catchment that contains a wide variety of land uses. The most prevalent land use purposes are grazing and agriculture, with some forest, scattered housing and several small townships within the catchment area.

CHW is actively involved in catchment management activities in relation to water supply to maximise the harvest of water resources and protect source water quality. Some of the most important activities include river health works, biodiversity management, fire prevention, and property management.

River health

The official manager of the broader Moorabool River Catchment is the Corangamite Catchment Management Authority (CCMA). The CCMA develops key strategies to maintain and restore river health and environmental values.

The Moorabool River system contains many important environmental assets including species of native fish, aquatic invertebrate communities, threatened water dependant bird species and wetlands of international importance in the lower reaches. High importance is also placed on the economic value of the river as it provides urban water for Ballarat and Geelong as well as rural water for stock and domestic purposes, irrigated crops and lifestyle properties.

Figure 2.1 West Moorabool River below Hunts Bridge (Downstream of Lal Lal Reservoir)

CHW will continue to work with the CCMA to identify opportunities and implement programs to maintain environmental values and improve river health while securing the water future of the region. CHW will also liaise with the CCMA, Barwon Water, Southern Rural Water, and the State Government to negotiate cost sharing arrangements and evaluate options that further benefit the environment.

Storage systems

The local water supply catchment area is classified into two storage systems that extend laterally from Leigh Creek across to Gordon. The White Swan system is located to the north and the Lal Lal system to the south.

The White Swan system contains ten local reservoirs, various diversion weirs, connecting channels and pipelines. Water within the system is ultimately transferred to White Swan Reservoir which acts as the terminal storage. Water is predominantly harvested from the Upper West Moorabool catchment, with smaller volumes harvested from the Yarrowee River catchment and the Creswick water supply catchment and Birch Creek sub-catchment via the Cosgrave and Newlyn pipelines.
In 2008 CHW, together with Coliban Water, commissioned the Goldfields Superpipe. The Superpipe is capable of delivering water from the Goulburn River system, via the Waranga Channel. CHW also utilises Lake Eppalock for optimizing supply and delivery of water to Ballarat and District water supply system.

The Lal Lal system contains one large storage, Lal Lal Reservoir which captures water from the West Moorabool River, Lal Lal River and neighbouring creeks. The catchment area is known as the Lal Lal Reservoir water supply catchment.

**Reservoirs**

The Ballarat and district water supply system currently consists of ten reservoirs and has a total storage capacity of 61,640 megalitres (ML). The two main storages are White Swan Reservoir and Lal Lal Reservoir.

Lal Lal Reservoir has a total storage capacity of 59,549 ML, but CHW’s share of capacity is limited to 59.9% of this volume. Barwon Water has a 28.2% share of the capacity of Lal Lal to supply the Geelong and district water supply system, while the remaining 11.9% is allocated to private entitlement holders and environmental entitlements.
Groundwater

In July 2007 CHW commissioned the Ballarat West bore site, supplementing the Ballarat and District Water Supply System with up to 1700 ML/year of groundwater, with the potential to supply up to 3000 ML/year in drought subject to ministerial approval. The Bungaree groundwater source was also commissioned to supplement the Ballarat water supply system with a further 120 ML/year.

Water treatment

The multiple supply system provides the Ballarat system with considerable operational flexibility. Water treatment plants are situated at the two main storages (White Swan and Lal Lal) and can be distributed at different ratios. Water is fully treated at the two water filtration plants, prior to entering the distribution network.

Ballarat Water P/L provide and operates the plants through a Public Private Partnership (PPP) contract with CHW.

The two main water treatment plants utilise Dissolved Air Flotation Filtration (DAFF) with chloramination disinfection, and each has a capacity of 65 ML per day. Powdered Activated Carbon and Potassium Permanganate dosing can also be added address water quality issues such as taste and odour.

Following an instruction from The Department of Health to CHW under SECTION 5(1) of the Health (Fluoridation) Act 1973, CHW installed fluoridation dosing units at the Lal Lal and White Swan treatment plants. Water fluoridation was introduced to the Ballarat and District Water Supply System in November 2009.

The Lal Lal plant has a 2.5 ML clear water storage tank, and the White Swan plant has 18 ML of clear water storage.

An additional water source situated at the Ballarat West bore field enables the disinfection of groundwater prior to entering the distribution system. Ballarat West utilises chloramination disinfection to treat the groundwater prior to mixing with surface water, and can be distributed into a large discreet pressure zone to the west of Ballarat

Distribution network

The Ballarat and district water supply system services 60 different localities across six local government municipalities. The system provides potable water to more than 50,000 connections and serves a permanent population of approximately 110,000 people.

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1 Bulk Entitlement allocates a maximum annual volume of 500 ML to CHW from the Creswick Water supply Catchment
### Recent water supply trends

The extensive drought over the past decade has resulted in very low inflows to the White Swan and Lal Lal storage systems. The reduced inflows meant that the development of the Bungaree and Ballarat West bores, along with the Goldfields Superpipe had to be fast-tracked in order to ensure adequate supply to Ballarat and District.

The Goldfields Superpipe was used from 2008, to restore storage levels in the White Swan Reservoir, with the ability to pump up to approximately 52 ML/day into White Swan.

Local storage levels had dropped to below 10% and without the introduction of the Superpipe, the Ballarat water supply system would certainly have been without water. Pumping of water through the Superpipe ceased in August of 2010, in-line with the general recovery of the local water supply system.

### Drought conditions

The extensive drought during the past decade has placed significant stress on water supply systems across the region, including the Ballarat system. Figure 2.5 shows that there has been significantly below average rainfall over the 1996 – 2009 period.
Figure 2.5 Historical Ballarat Catchment Rainfall

Source: Data obtained from the Bureau of Meteorology website, www.bom.gov.au

Figure 2.6 shows the recent storage levels of the local raw water storages that supply the Ballarat system.

Figure 2.6 Ballarat Recent Local Water Storage Levels

Source: CHW operational data

The system failed to fill significantly over the last ten years, prior to the introduction of the Superpipe and the exceptionally wet 2010/11 spring filling season. As a result, water restrictions were implemented in Ballarat over much of this period as shown in Figure 2.7.

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2 Incomplete rainfall data for 2003 available from the BoM for the Ballarat Aerodrome raingauge site
Figure 2.7 Ballarat Recent Water Restriction History

<table>
<thead>
<tr>
<th>Period</th>
<th>Water Restriction Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>August 2000 - November 2000</td>
<td>Stage 1</td>
</tr>
<tr>
<td>December 2000 - October 2002</td>
<td>Nil</td>
</tr>
<tr>
<td>November 2002 - February 2003</td>
<td>Stage 1</td>
</tr>
<tr>
<td>March 2003 - July 2003</td>
<td>Stage 2</td>
</tr>
<tr>
<td>August 2003 - February 2005</td>
<td>Stage 3</td>
</tr>
<tr>
<td>March 2005 - August 2006</td>
<td>Stage 2</td>
</tr>
<tr>
<td>September 2006 - October 2006</td>
<td>Stage 3</td>
</tr>
<tr>
<td>November 2006 to February 2007</td>
<td>Stage 4</td>
</tr>
<tr>
<td>March 2007 to October 2009</td>
<td>Stage 4+</td>
</tr>
<tr>
<td>November 2009 to December 2009</td>
<td>Stage 4e</td>
</tr>
<tr>
<td>January 2010 to July 2010</td>
<td>Stage 3</td>
</tr>
<tr>
<td>August 2010 to December 2010</td>
<td>Stage 1</td>
</tr>
<tr>
<td>January 2011 to present</td>
<td>PWSR</td>
</tr>
</tbody>
</table>

As of August 2011, Permanent Water Saving Rules (PWSR) was in force and the volume of surface water available for the Ballarat water supply system was above 95% of total capacity. In addition, CHW has access to a further 1700 ML/year from the Ballarat West groundwater source, 120 ML/year from the Bungaree groundwater source, and significant volumes of water available located in Lake Eppalock and Sandhurst Reservoir through the Superpipe.

The recovery of the water storages for the Ballarat region and the addition of the Goldfields Superpipe has provided sufficient capacity for a number of decades. However CHW will continue to focus on demand initiatives, NRW minimisation and alternative water sources to minimise the requirement to draw on water sources outside the natural catchment.

Water Resource Modeling

CHW, with assistance from DSE, has developed a resource simulation model (REALM) of the total Ballarat water supply incorporating the connection to the Goulburn system via the Goldfields Superpipe. Two approaches have been employed.

The initial modeling was carried out using stochastic data sets generated from historical data. The stochastic model was selected to provide a statistically valid distribution of the likelihood and magnitude of supply yields and to avoid the inherent bias in limited data sets. The method adopted is summarised in Section 4.

The second approach is consistent with the methods described in the DSE Guidelines. Yield forecasts were generated in accordance with the four methods recommended.

The results of the two methods are compared in Section 4.

Level of Service and Security of Supply

CHW has adopted supply reliability as its level of service (LOS) measure.

The measures include both the frequency of key restriction levels and the frequency of reaching critical storage levels.

The level of service criteria for Ballarat is summarised in Figure 2.8.
The adopted LOS criteria provide a practical measure of the system performance. Based on the above frequencies, the agreed Level of Service is that unrestricted demand is expected to be supplied the majority of the time (i.e. 19 out of 20 years) and high level restrictions (i.e. stage 3 or higher) are unlikely to occur.

This approach provides a statistically sound and consistent basis for identifying the timing for an upgrade of assets. It also allows a number of criteria to be applied in a system and the critical criteria for the system to be determined, providing a planning focus on the weakest point of the system.

**System yield**

The ‘system yield’ is a term used to describe the volume of water that can be supplied at the adopted level of service. System yield is always associated with a level of service and reduces if the level of service increases, that is, with the same system, less water can be supplied long-term at a better level of service and/or vice versa.

In practical terms, this means that the level of service able to be provided by a water supply system may be acceptable to one community, which is willing to accept restrictions that are more frequent. However, the same level of service may be unacceptable for another community who are less tolerant of frequent restrictions. As such, the specific level of service appropriate for any system is dependent upon the needs and wants of that community.

The yield of the system under the adopted LOS criteria is shown in Figure 2.9. It should be noted that this does not include the yield from the Ballarat West groundwater source (1,700 ML/a)

### Figure 2.9 Summary of Ballarat System Yield

<table>
<thead>
<tr>
<th>Performance criteria</th>
<th>Target LOS (1 in x years)</th>
<th>Base stochastic</th>
<th>Climate sensitivity stochastic</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOS system yield (ML/a)</td>
<td>17,500ML/a</td>
<td>15,500 ML/a</td>
<td></td>
</tr>
<tr>
<td>Frequency of White Swan aesthetic storage level 50%</td>
<td>1 in 20</td>
<td>&lt;1 in 1,000</td>
<td>&lt;1 in 1,000</td>
</tr>
<tr>
<td>Frequency of Stage 1 restrictions</td>
<td>1 in 20</td>
<td>&lt;1 in 1,000</td>
<td>&lt;1 in 1,000</td>
</tr>
<tr>
<td>Frequency of Stage 3 restrictions</td>
<td>1 in 1,000</td>
<td>&lt;1 in 1,000</td>
<td>&lt;1 in 1,000</td>
</tr>
<tr>
<td>Frequency of White Swan critical storage level 20%</td>
<td>1 in 1,000</td>
<td>&lt;1 in 1,000</td>
<td>&lt;1 in 1,000</td>
</tr>
<tr>
<td>Frequency of Lal Lal critical storage level 20%</td>
<td>1 in 1,000</td>
<td>1 in 1000</td>
<td>1 in 1000</td>
</tr>
</tbody>
</table>

The assessment shows that the critical criterion for the system is the storage level at Lal Lal for both the Base case and the climate sensitivity case. A preliminary assessment indicates that the system yield may be able to be increased by the modification of operating rules for the system to provide a better balance between storages.

**Bulk Entitlements and ground water licences**
CHW’s entitlement to extract water for the Ballarat and district water supply system is specified in the following legal entitlements made under sections 43 and 47 of the Water Act 1989:

- Bulk Entitlement (Upper West Moorabool System) Conversion Order 1995;
- Bulk Entitlement (Lal Lal – Central Highlands) Conversion Order 1995;
- Bulk Entitlement (Yarrowee – White Swan System) Conversion Order 2002; and
- Bulk Entitlement (Creswick) Conversion Order 2004;

Refer to figures 2.10 and 2.11 for further details.

CHW also has Water Shares for the Goulburn and Campaspie Rivers.

### Figure 2.10 Summary of System Entitlements

<table>
<thead>
<tr>
<th>Source</th>
<th>Entitlement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total System</td>
<td>Up to 80,300 ML in any successive three year period</td>
</tr>
<tr>
<td>Upper West Moorabool &amp; Yarrowee Catchment</td>
<td>Up to 36,800 ML in any successive three year period (from combined catchment), but limited to 10,500 ML/year from the Upper West Moorabool</td>
</tr>
<tr>
<td>Lal Lal System</td>
<td>Up to 42,000 ML in any successive three year period</td>
</tr>
<tr>
<td>Creswick Catchment</td>
<td>Up to 500 ML/year</td>
</tr>
</tbody>
</table>

### Figure 2.11 Minimum Passing Flow Requirements below Water Diversions

<table>
<thead>
<tr>
<th>Source</th>
<th>Minimum Passing Flow Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cosgrave Reservoir</td>
<td>Minimum flow of the lesser of 1.0ML/day and inflows in Creswick Creek</td>
</tr>
</tbody>
</table>
| Lal Lal Reservoir               | When the preceding 24-month cumulative inflow is greater than the 90th percentile 24-month cumulative inflow:  
When calculated daily inflow <20 ML/day - all flow shall pass  
When calculated daily inflow >20 ML/day – 20 ML/day shall pass  
When the preceding 24-month cumulative inflow is less than the 90th percentile 24-month cumulative inflow:  
When calculated daily inflow <5 ML/day - all flow shall pass  
When calculated daily inflow >5 ML/day – 5 ML/day shall pass |
| Moorabool Reservoir             | When inflow is <3 ML/day - all flow shall pass  
When inflow is >3 ML/day – 3 ML/day shall pass |
| Kirks/Gong Gong Reservoirs      | When inflow is <0.6 ML/day - all flow shall pass  
When inflow is >0.6 ML/day – 0.6 ML/day shall pass |
| Clarkes Creek Weir              | When flow is <1.25 ML/day - all flow shall pass  
When flow is >1.25 ML/day – 1.25 ML/day shall pass |

CHW’s licence to extract groundwater for the Ballarat system is specified in the Groundwater Licence No. 9026895 issued by Southern Rural Water made under sections 51, 67 and 145 of the Water Act 1989. Refer to Figure 2.12 for details.

### Figure 2.12 Ballarat and Districts Groundwater Licence

<table>
<thead>
<tr>
<th>Source</th>
<th>Annual Volume</th>
<th>Extraction Rate</th>
<th>Daily Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ballarat West Bore</td>
<td>1700 ML/year 3</td>
<td>At a rate not exceeding 9.3 ML per day</td>
<td>Max volume extracted per day must not exceed 9.3 ML</td>
</tr>
<tr>
<td>Bungaree Bore</td>
<td>120 ML/year</td>
<td>At a rate not exceeding 1ML per day</td>
<td>Max volume extracted per day must not exceed 1 ML</td>
</tr>
</tbody>
</table>

### Water demand trends

The 2010/11 bulk demand for the Ballarat and district water supply system was recorded as 9,717 ML. Figure 2.13 depicts the comparative usage of different consumer groups for the 2010/11 financial year.

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3 Licence allows for extraction of up to 3000ML/year subject to approval from Minister
There has been a significant decline in per capita demands, as a result of restrictions, demand initiatives and other factors, from those experienced in the pre-restriction period as shown in Figure 2.14. The current level of demand is approximately the estimated level of unrestricted demand, indicating that further demand management initiatives are unlikely to provide significant further reductions in unit demands.

The lifting of restrictions and the adoption of Permanent Water Saving Rules (PWSR) has not led to any significant rebound to date. There has been a modest increase in demand in the 2010/11 demands over those of the previous year.

The lack of any significant rebound might be partly attributable to the relatively high rainfall occurring in the summer months. However, the significant uptake of rainwater tanks, greywater diversions, drip systems and other measures seems to have had a significant impact even on relatively warm and dry periods within those years.

Indoor demand, which is far less sensitive to rainfall levels, has not significantly increased either. This is probably attributable to reductions in underlying demand caused by the adoption of water efficient devices within the home which was accelerated during the long restriction periods and is now mandatory for new houses and renovations**.

There has also been no significant rebound in non-residential and concessional demands. The results of a number of measures, including the WaterMap program has seen reductions in potable water demand for major process water users, which constitute a large proportion of this demand.

There is also a reduction in demands in smaller non-residential that parallels, with a slight lag, that of residential indoor demands.

It should be noted that NRW shown in Figure 2.13 includes losses associated with raw water transfer and treatment processes, as well as distribution system losses. This is known as Total Losses.

Figure 2.14 Water Demand Trends
Review of previous WSDS Actions

The previous WSDS for the Ballarat system was completed in 2006. Short-term actions recommended in that strategy are included in Figure 2.15.

**Figure 2.15 Summary of proposed actions for the short term as set out in the Ballarat and Districts WSDS 2006**

<table>
<thead>
<tr>
<th>Timeframe</th>
<th>Action required</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short term</td>
<td>Implement a wide range water saving initiatives targeting homes, industry, and unaccounted water and achieve water saving up to 1100 ML/year by 2010</td>
<td>Target achieved, work ongoing to obtain additional savings</td>
</tr>
<tr>
<td></td>
<td>Ongoing development of water recycling projects</td>
<td>Ballarat South WWTP process improvements and Lake Wendouree Project completed</td>
</tr>
<tr>
<td></td>
<td>New Water Supply Options</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Connect Newlyn Reservoir to Ballarat system</td>
<td>Commissioned 2008</td>
</tr>
<tr>
<td></td>
<td>Commission Bungaree Groundwater supply</td>
<td>Commissioned 2007</td>
</tr>
<tr>
<td></td>
<td>Commission Cardigan Aquifer</td>
<td>Commissioned 2007</td>
</tr>
<tr>
<td></td>
<td>Augment super pipe capacity to enhance the bulk supply from Goulburn system up to 10,000 ML</td>
<td></td>
</tr>
</tbody>
</table>

*Newlyn Reservoir Connection*

The connection of the Newlyn Reservoir to the Ballarat system via the Newlyn – Cosgrave pipeline was completed in 2008.

*Bungaree Groundwater*

The Bungaree bore was commissioned in 2007; this allows CHW to extract 120 ML/year to supplement the Ballarat system.

*Cardigan Aquifer (Ballarat West bores)*

The Ballarat West bores were commissioned in 2007, able to supply 1700 ML/year (3000 ML subject to Ministerial approval) of ground water to a discreet pressure zone set up in the western portion of Ballarat. This groundwater was generally blended with surface water to improve water quality.

*Recycled Water Projects*
The Ballarat North WWTP was upgraded and has the capacity to deliver “Class A” recycled water. CHW has constructed infrastructure to deliver 651 ML of recycled water each year to Lake Wendouree, and other council assets and commercial operators.

The Ballarat North Reuse Project will help to reduce demands on the water supply system in the short term and will achieve water savings that are sustainable in the long term. CHW also believe that the reuse scheme will create new opportunities for local industry to access recycled water and achieve additional water savings in the future.

At Ballarat South, opportunities to develop large-scale reuse schemes are currently limited due to geographical, economic and logistical constraints. However, work has been done to implement smaller scale recycling schemes at the Ballarat South WWTP. On site recycling facilities have enabled 140 ML of recycled water to be incorporated into the treatment process each year to directly replace the use of potable water supplies. The recycling facility has also enabled recycled water to be accessed for local purposes such as road works, watering bowling greens and other small recreational areas, such as the Marty Busch Reserve.

A key feature of CHW’s management of water and wastewater supplies is to encourage and assist local industry to implement on site treatment and direct use of recycled water during industrial processes. Significant water savings have already been achieved with many commercial operators, and CHW will continue to work with industry to reduce wastewater volumes and promote water conservation through the attainment of water efficiencies and on site recycling, where appropriate.

Goldfields Superpipe

The Goldfields Superpipe was commissioned in 2008, to restore storage levels in the White Swan Reservoir, with the ability to pump up to approximately 52 ML/day into White Swan Reservoir.

Non-Revenue Water

CHW has had a strong focus on reducing non-revenue water throughout the region, setting a target of 10% non-revenue water by 2013, as an average across all systems. The performance of the Ballarat and Districts system are shown in Figure 2.16.

It should be noted that NRW shown in Figure 2.16 does not include losses associated with raw water transfer and the treatment processes.

Associated NRW targets relate to Distribution Losses only.
Since the release of the initial Ballarat and Districts WSDS in 2006, non-revenue water in the Ballarat and Districts water supply system has decreased by approximately 1261 ML/year. Leakage rates have decreased from a rate of 68.84 L/s in 2006, to a current leakage rate of 29.1 L/s.

Work completed and ongoing in the Ballarat and Districts water supply system to minimise non-revenue water losses include the following:
- Creation of new Pressure Management Areas (PMAs)
- Installation of additional flow meters
- Monitoring bulk flows on a weekly basis.
- Establish the current Infrastructure Leakage Index (ILI) level.
- Measuring unaccounted water at the end of each property meter tricycle (three times per year).
- Quantify scouring losses undertaken for water quality purposes.
- Prompt service response times to burst water mains (within travel limitations).
- Determine minimum nightly flow level,
- Viewing remote pipeline alignments in Ballarat for visible signs of leakage, including leak detection on a yearly basis.
- Implementing leak detection programs
- Relocation of all private service meters closer to the water main
- Maintaining bulk meter accuracy through regular verification and meter replacements
- Purchase and recorded metered hydrant use by CHW staff
- 248 known unmetered services - metered

**Demand Management**

Demand for CHW supplied potable water has changed greatly over the last five years. The protracted dry climatic conditions and resulting shortages of surface water resources created a major change in attitudes and behaviours of CHW customers and CHW strategy and actions. CHW was prompted to accelerate demand management plans and develop new strategies for rapidly improving customer water efficiency and maintaining the improvements. Through CHW initiatives and the general severity of the supply situation customers developed an appreciation of how precious water resources are and now firmly believe that water is a precious resource that should be used sustainably. Customer research indicates that the current attitudes and behaviours towards water conservation are strongly held and are unlikely to weaken significantly in the short term.

Almost all of the Demand Management Initiatives, current and future considered, in the 2006 WSDS, have been successfully implemented, with some still continuing. New initiatives not even
considered at the time have also been implemented. The main initiative that was proposed but did not proceed was the Washing Machine Rebate Scheme. A washing machine rebate is however now available through the Victorian Government's new Living Victoria Rebate Program and is being promoted by CHW to its customers.

With the combination of restrictions and a large variety of demand management activities it is challenging to separate out the impacts of individual initiatives. Estimated impacts of some major programs are given below and on-going end use analysis will allow the impact of device adoption and behaviour change (both temporary and in-grained) to become clearer.

Figures 2.17 and 2.18 show the initiatives listed in the 2006 WSDS.

**Figure 2.17 2006 Current Demand Management Initiatives**

<table>
<thead>
<tr>
<th>Current Initiative</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permanent Water Saving Rules</td>
<td>Statewide regulations that conserve water usage</td>
</tr>
<tr>
<td>Community Education program</td>
<td>Ongoing primary school education program</td>
</tr>
<tr>
<td>Supporting community events</td>
<td>CHW provide sponsorship and displays to promote water saving awareness</td>
</tr>
<tr>
<td>Media releases and advertising</td>
<td>Ongoing campaign to keep raise community awareness of water issues</td>
</tr>
<tr>
<td>Customer newsletters</td>
<td>Household water saving information for customers</td>
</tr>
<tr>
<td>Water saving information listed on the CHW website</td>
<td>Water saving information for household and commercial customers</td>
</tr>
<tr>
<td>Retrofitting and rebates scheme</td>
<td>State Government’s Water Smart Gardens and Homes Rebates Scheme to encourage installation of water efficient appliances</td>
</tr>
<tr>
<td>National Water Week events and promotions</td>
<td>Local events that raise awareness during National Water Week</td>
</tr>
<tr>
<td>Consumption reduction strategies for major consumers</td>
<td>CHW liaise with the local shire, community groups, the industrial sector and key stakeholders to explore demand reduction options and alternative water sources (such as wastewater reuse).</td>
</tr>
<tr>
<td>Large (non-residential) consumer efficiency program</td>
<td>Provision of assistance to large consumers to improve efficiency</td>
</tr>
<tr>
<td>Five Star House</td>
<td>Energy and water efficiency legislation for new homes</td>
</tr>
</tbody>
</table>

**Figure 2.18 (Future) Demand Management Initiatives under Consideration in 2006**

<table>
<thead>
<tr>
<th>Future Initiative</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Aquarius</td>
<td>Indoor retrofit program where water saving fittings will be installed in participating homes. The program is set to commence in February 2007 and participating customers will receive a retrofit valued at $180 for the cost of $50.</td>
</tr>
<tr>
<td>Delacombe Retrofit Project</td>
<td>A joint venture with Sustainability Victoria that will deliver energy and water efficiency gains to homes in the Delacombe neighbourhood renewal area. CHW will be providing an indoor retrofit to each household in the neighbourhood.</td>
</tr>
<tr>
<td>Showerhead Exchange Program</td>
<td>Program where CHW customers may exchange old showerheads for new water efficient showerheads (free of charge).</td>
</tr>
<tr>
<td>DIY Giveaway program</td>
<td>Program where customers may receive a free do-it-yourself water efficiency kit for home installation.</td>
</tr>
<tr>
<td>Washing machine rebate scheme</td>
<td>A rebate scheme for CHW customers who purchase water efficient washing machines</td>
</tr>
<tr>
<td>Major consumers strategy</td>
<td>Continuing to liaise with major water users to develop and implement water saving plans</td>
</tr>
<tr>
<td>Proposed Unaccounted Water Strategy</td>
<td>A revised unaccounted water strategy that will outline stringent targets that is achievable through leakage prevention and more efficient metering.</td>
</tr>
</tbody>
</table>

Figure 2.19 details further demand management initiatives that were not specified in the 2006 WSDS, but were investigated and implemented due to the ongoing water shortages.
<table>
<thead>
<tr>
<th>Initiative</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Residential Program</td>
<td>Assistance with water audits, identifying water efficiency options and help</td>
</tr>
<tr>
<td></td>
<td>with access to funding opportunities. Specific targets included:</td>
</tr>
<tr>
<td></td>
<td>Large water consumers</td>
</tr>
<tr>
<td></td>
<td>waterMAPs for customer using more than 10ML/yr</td>
</tr>
<tr>
<td></td>
<td>Accommodation Industry</td>
</tr>
<tr>
<td></td>
<td>DSE Stormwater Fund</td>
</tr>
<tr>
<td></td>
<td>RDV Water for Industry Fund</td>
</tr>
<tr>
<td>Target 150</td>
<td>Encouraging households to achieve water use target of 150L/person/day.</td>
</tr>
<tr>
<td></td>
<td>Assistance included monthly statements of household water use and water saving</td>
</tr>
<tr>
<td>Bonus Rebates</td>
<td>Doubling of Smart Gardens and Homes Rebates</td>
</tr>
<tr>
<td>Toilet Retrofit</td>
<td>Service to remove old inefficient toilet and replace with new 4 Star</td>
</tr>
<tr>
<td></td>
<td>efficient dual-flush. Government rebate applied up-front</td>
</tr>
<tr>
<td>Ballarat Gardens Come Alive</td>
<td>Raising awareness that it is OK to water gardens again and to encourage</td>
</tr>
<tr>
<td></td>
<td>water efficient gardening.</td>
</tr>
</tbody>
</table>

**Project Aquarius**

Project Aquarius was the first home indoor water retrofit program in Victoria. Over 4,500 households participated, creating ongoing water savings of 170ML/yr. During the course of the program the installation of Compact Fluorescent Lights (to replace inefficient incandescent globes) was added and the name changed to Program Aquarius Plus+. These added to the energy (and money) savings from hot water for participants, as well as free CFL’s, which proved very popular.

**Non-Residential Program**

CHW’s higher water using business customers also responded to the critical water supply conditions, engaging with CHW in co-funded water audits which identified opportunities to increase water efficiency. CHW also helped connect a number of customers to Government funding and CHW co-contributed. Combined ongoing water savings of over 700ML/yr were achieved. It was an important feature in the community-wide behaviour change messages that residents could see that businesses were also ‘Doing The Right Thing’, not just households.

**Toilet Retrofit Program**

CHW began the PROJECTaquarius2 Toilet Retrofit Program in December 2009 and it continues to operate. Initially focused on replacing single-flush toilets with efficient dual-flush suites it now offers replacement of less efficient dual-flush as well as single-flush. Over 600 inefficient toilets have been replaced creating ongoing water savings of around 20ML/yr

**Ballarat and Maryborough Gardens Come Alive**

Launched in the spring of 2010 the Gardens Come Alive program raised the awareness of the communities of Ballarat and Maryborough that with the easing of Drought Restrictions it was OK to water their gardens again. The program provided credible information and tools to promote efficient watering to help customers maintain good water efficient behaviour whilst rejuvenating their gardens after 3 years of Stage 4 Restrictions. The program will continue to reinforce this message.

**Target 150**

Early in 2007 it was realised that household water used would need further reduction below Stage 4 Restriction level to ensure that Ballarat would not run out of water prior to completion of The Goldfields Superpipe. Whilst Ballarat remained on Stage 4, CHW ran Target 150, a residential behaviour change program encouraging customers to lower their water use to 150L/person/day. To help customers CHW provided information on how to save water but more importantly for 12 months delivered monthly household water use statements so customers could monitor their progress.
The program, along with CHW’s other initiatives and the general dry conditions succeeded in reducing average consumption to below 150L/person/day and holding it there.

Customer Attitude Change

CHW has been closely monitoring Ballarat residential customer attitudes regarding water use. What began with a DSE funded customer survey in April 2009 has developed into an ongoing longitudinal study. The findings have revealed that through the variety of influences people have developed strongly held attitudes about water as a valuable and finite resource and about the responsible use of that resource. These attitudes have shown to be so strongly held that they are likely to be maintained for a long period of time. CHW will continue to monitor this through continuing the longitudinal study.

Review of Drought Response Plan Actions

The Ballarat and Districts Drought Response Plan (DRP) was first developed in 2006, and is currently undergoing a review. See Figure 2.20 for a list of potential actions specified in the Ballarat and Districts DRP.

<table>
<thead>
<tr>
<th>Potential supply augmentation options during extreme drought conditions</th>
<th>Current Status</th>
<th>Key considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groundwater options</td>
<td>The Ballarat West bore and the Bungaree bore are both being developed as part of Ballarat’s short-term and long-term requirements. Making maximise use of these resources during times when surface water is scarce will provide valuable drought relief.</td>
<td>• The interim licence for the Ballarat West bore contains conditions that enables additional water to be accessed during times of drought • The Bungaree bore is relatively low yielding and only provides less than 1 ML/day</td>
</tr>
<tr>
<td>Connecting discontinued CHW reservoirs to the Ballarat system</td>
<td>Cosgrave Reservoir has been connected and the Newlyn Reservoir connection is under construction. Colbrook Reservoir, St Enochs Reservoir, Russells Reservoir and Dean Reservoir have also been assessed for possible reconnection, however there are some logistical difficulties and they are relatively high cost options.</td>
<td>• CHW have rights to water from these locations • High costs can be associated in constructing new infrastructure • Consideration needs to be given to water quality considerations and other logistical constraints</td>
</tr>
<tr>
<td>Purchasing water rights</td>
<td>The purchase of temporary and/or permanent water rights can be undertaken with landholders within the Ballarat catchment provided that the location is accessible to CHW’s reservoirs, channel network or in the case of groundwater can be transferred to a CHW bore.</td>
<td>• Practical option, utilises local resources • Depends on landholders willingness to sell water rights • Could require the installation of some temporary equipment</td>
</tr>
<tr>
<td>Ministerial qualification of water rights</td>
<td>An emergency drought relief option where CHW may apply for the cessation of passing flows below specified points in the system.</td>
<td>• Impacts on the stock and domestic users, downstream urban diversions, and the environment • Formal application to the Minister for Water is required to gain approval</td>
</tr>
<tr>
<td>Requesting access to additional reserves from Lal Lal Reservoir</td>
<td>An emergency drought relief option where CHW may make a request to Barwon Water for the transfer of a portion Lal Lal Reservoir water to CHW.</td>
<td>• Depends on Barwon Water having sufficient reserves in storage • Quantities transferred must be returned when the drought situation eases</td>
</tr>
</tbody>
</table>
Many projects listed in the Ballarat DRP have also been listed as supply enhancement options in the Ballarat WSDS, and have likely been discussed in the above section.

Those items not discussed as part of the WSDS actions include:

**Imery’s Kaolin Quarry**

Water held in Imery’s Quarry was successfully pumped into Lal Lal Reservoir.

**Purchasing Water Rights**

CHW purchased approximately 12 GL low reliability share at Lake Eppalock, and also purchased approximately 10 GL permanent high reliability water rights from the Goulburn / Murray systems.

**Ministerial Qualification of Water Rights**

Exemption of passing flow requirements was granted to CHW for the Lal Lal, Upper West Moorabool, Yarrowee and Creswick Bulk Entitlements.

**Access to Barwon Water Share of Lal Lal**

CHW negotiated access to Barwon Water’s share of water in the Lal Lal Reservoir.

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### Potential supply augmentation options during extreme drought conditions

<table>
<thead>
<tr>
<th>Option</th>
<th>Current Status</th>
<th>Key considerations</th>
</tr>
</thead>
</table>
| Imery’s Kaolin Quarry   | The quarry holds up to 400 ML when full and lies within the Lal Lal catchment. Water can be pumped out of the quarry into a nearby drain that flows into Lal Lal Creek upstream of the reservoir. | - Losses may be incurred during the transfer of water  
- Approval required from SRW and the EPA  
- Negotiations required with Imery’s to access the water  
- Some pumping cost involved |
| Water cartage           | Water cartage could be used for short term relief in extreme circumstances     | - Highly impractical  
- Low yield, high cost                                                             |
3. WATER DEMAND FORECASTING

General

Water demand forecasts are a key component of developing effective water supply-demand strategies as they drive the need to implement measures that moderate demand, or investigate the provision of alternative and additional water supplies. CHW recognise the difficulty in establishing statistically accurate projections beyond a five-year period due to the wide range of factors that influence water demand and have used rigorous analysis of historical trends and developed forecasts using local and regional information.

![Figure 3.1 Factors Influencing Water Demand](image)

Source: Guidelines for the Development of a Water Supply-Demand Strategy (Version 2)

Methodology

CHW have based the water demand forecast on a demand model incorporating end use analysis of key demand sectors. This has allowed the impacts of water device adoption rates and changes in customer water use behaviours to be tracked.

The model incorporates a weather correction module to allow differentiation between the impacts of annual variation in demand due to changes in temperature and rainfall, and changes in underlying demand caused by device adoption and customer behaviour in reaction to restrictions, supply issues and other external factors.

The model also incorporates impacts of pricing and economic conditions.

The model forecasts have been based on forecast trends in the adoption rates and assessments of the possible range of customer behaviours in reaction to the climate scenarios.
It should be noted that, due to the permanent impacts of device adoption rates (through Council consumption targets on new houses and natural replacement rates in existing houses), the model has demonstrated that unit demand rates are likely to remain low even assuming a return to customer behaviours (e.g. shower times, garden watering times) from pre-restriction drought conditions.

In particular, the advent of rainwater and greywater systems, the adoption of water efficient devices (such as drip systems), the conversion to drought tolerant gardens and the increasing stock of smaller house blocks with reduced garden space, has reduced the potential rebound in outdoor potable water reuse even if garden watering behaviours are relaxed.

Due to the large uncertainties regarding demand factor trends beyond the next water plan period, unit demands have been held constant beyond 2017/18. The future climate trends and changes in water device technologies will have an unpredictable impact on demand. CHW will continue to monitor these trends and update forecasts.

It is planned that, if any signs of a demand re-bound appear, CHW will design focused demand management initiatives to encourage customer behaviours that promote efficient water usage.

The model has been used to generate a range of scenarios providing reasonable upper and lower bounds to future demand.

**Adopted growth rates**

Through the release of *Victoria In Future 2008* (VIF) statistics, the Department of Sustainability and Environment (DSE) developed population projections for Statistical Local Areas (SLA's) across Victoria. The vast majority of customers serviced by the Ballarat and district water supply system reside within the SLA's of Ballarat Central, Ballarat Inner North and Ballarat South.

In developing forecasts for the Ballarat system, VIF growth statistics have been used as the baseline for CHW forecasts, along with sensitivity tests against population and household forecasts provided by Ballarat City Council and other local information.

The pattern of growth is expected to continue into the future, with numerous regional projects and strategies generating ongoing opportunities for growth, including:
- the regional growth corridor strategy;
- Deer Park freeway bypass project;
- fast train project;
- upgrades to the local transport network;
- residential development strategies;
- business and industry initiatives; and
- Education and research opportunities.

The projections shown in Figure 3.2 form the base demand figures for future water demand in the Ballarat system and provide the basis of CHW’s short, medium and long term planning to achieve an appropriate balance between supply and demand.

The base demand figures used for Ballarat’s water demand projections also include water savings due to strategies that CHW already have in place. These savings include reductions due to existing demand management initiatives and the current non-revenue water strategy (details of
which are listed in Figure 3.3). The introduction of Permanent Water Saving Rules (PWSR) in 2006 was a significant factor in reducing demand, and in changing community behaviour in relation to responsible water usage. However, CHW believe that PWSR’s have a negligible ongoing affect on actual water savings, and any savings will now be part of the existing baseline demand.

**Figure 3.3 Ballarat and Districts – Current Water Demand Assumptions**

<table>
<thead>
<tr>
<th>Water Demand Savings</th>
<th>Residential</th>
<th>Non-Residential</th>
<th>Concessional</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permanent Water Saving Rules</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>Now form part of baseline demand</td>
</tr>
<tr>
<td>Proposed Demand Management Strategy</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>Committed to maintaining current estimated per capita consumption over the next 50 years.</td>
</tr>
<tr>
<td>Non-revenue Water Strategy</td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
<td>50 year target as per CHW’s draft Non-revenue Water Strategy for Ballarat – October 2011</td>
</tr>
</tbody>
</table>

CHW is conscious that other organisations have a significant impact on encouraging water efficiency. CHW has continued to work, with City of Ballarat, to promote the adoption of water efficient devices and rainwater/greywater systems in new housing and renovations.

**Bulk water demand projections**

Figure 3.4 gives the forecast bulk water demands for the planning period.

**Figure 3.4 Ballarat - Projected Bulk Water Demand**

The demand forecast adopted is based on a conservative selection of a scenario near the upper limit, making some provision for the uncertainties involved in whether there will be a return to pre-restriction customer behaviours. This provides a bias towards an early date for reaching the system yield.
4. FUTURE WATER CHALLENGE

Climate change

Yield estimates for the Ballarat system have been made based on both the DSE Guidelines and the stochastic data sets.

Two stochastic data sets were developed. The first (assuming no climate change) was based on the 119 years of climate records generating a set of 10,000 years of data. The second, (assuming a change to underlying climate patterns) generated a data set of 10,000 years from historical records over the last 35 years. This allowed the development of a statistically valid risk based estimate rather than an event based data set.

From these sets, annual exceedence yield tables were prepared for each of the catchments. Yield tables were also generated for the four cases specified in the Guidelines. Figures 4.1 and 4.2 show the forecast demand against the yield estimates. These figures include the 1,700 ML/a capacity of the Ballarat West Groundwater source and the environmental obligation flows.

These figures show that Ballarat has sufficient yield to service demand for at least thirty years, including under the Return to Dry (Millennium Drought) scenario, without any further supply augmentation.

A comparison of the yields generated by the two different methods shows that the stochastic model has a slightly higher estimate (+5%) of the catchment yield both for the Base and Return to Dry scenarios.
The use of the stochastic model has provided a fuller data set and hence a more statistically valid distribution of probabilities for some of the extreme events being considered in the system yields.

For the Base Case, where the Millennium Drought event is assumed to be an extreme event in the normal climate cycle, CHW feels that the stochastic method provides a better reflection of the likely distribution of yield events.

For the Return to Dry scenario, the need to use at least 35 years of data to generate the data set required has meant that data from as far back as 1975 has had to be used. Whether this set provides a better estimate of return to dry depends on a judgment of the extent and timing of climate change and whether the Millennium Drought was an extreme event in the changed climate.

The method recommended in the DSE Guidelines has had to make similar assumptions about the extremeness of the Millennium drought within the modified climate spectrum. The provision of both methods provides alternative views on the timing of future actions to maintain security of supply.

Due to the extended period of time available in Ballarat before a future supply augmentation is required, there will be time to improve the data sets and yield forecasts before the forecasts start to become critical.

Planning approach

Through the development of this water supply demand strategy, CHW has adopted the most appropriate course of action, timing of options, and contingency plans to deal with the uncertainty and risk associated with drought and climate change. Annual reviews of the water resource situation will be undertaken, as well as a five yearly comprehensive review of the strategy, and future options will be implemented earlier than anticipated, if necessary.
5. DEMAND REDUCTION STRATEGIES

CHW’s current and future demand management strategies have and will continue to help to reduce the amount of additional water supplies that need to be used in the future. Demand reduction initiatives look towards improving water conservation through the achievement of greater efficiency, technological improvements and behavioural change.

Current and future demand management initiatives

The demand management initiatives outlined in Section 2 have achieved significant reductions in water demand for both residential and non-residential customers.

Residential indoor demand has declined and is forecast to continue to decline as customers adopt, both consciously and through growth and natural replacement, water efficient devices.

Residential outdoor demand has largely been supplied through alternative water sources (primarily rainwater tanks) and changes to community behaviours. Whilst there is expected to be some bounce-back in outdoor usage, it is expected that an increasing percentage of this will be serviced by alternative water, particularly in light of the Council requirements on new properties. The non-residential and concessional demand is expected to remain low due to the impact of demand initiatives such as Water MAP which have reduced both process water demand, predominately through alternative water sources, and employee related demand.

CHW will continue with a number of the current demand initiatives during the near future; however, given the very low demands currently being experienced, it is too early to identify new initiatives that may be able to have a significant impact.

It is likely that there will be some increase in water usage if there is a return to dry hot summers and CHW will continue to monitor water demand patterns to identify any particular usages that are increasing and develop focused demand initiatives (or modify existing initiatives) to suit.

The future savings that can be achieved will heavily depend on the balance between demand reductions with continued adoption rates and demand increases due to customer behavior bounce-back.

Figure 5.1 provides the current recorded per capita demands and demand targets

<table>
<thead>
<tr>
<th>Water consumption</th>
<th>Total water usage (per capita)</th>
<th>Residential water usage (per capita)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ballarat &amp; District System</td>
<td>Litres/person/day</td>
<td>Litres/person/day</td>
</tr>
<tr>
<td>2010/11 Recorded Demand (Stage 1 Restrictions)</td>
<td>250</td>
<td>148</td>
</tr>
<tr>
<td>Current Unrestricted Demand – and 2060 Target Demand</td>
<td>258</td>
<td>154</td>
</tr>
</tbody>
</table>

Major consumers strategy

CHW will continue its consumption reduction strategies for major consumers, particularly within the industrial sector to assist these customers to develop and implement water saving plans.

Non-revenue water

CHW is currently reviewing the non-revenue water strategy for all water supply systems and a key component of this review is likely to be the announcement of a 10% overall target for non-revenue water by 2018. To achieve this, a target of 10% non-revenue water is likely to be set for the Ballarat system.

See Figure 5.2 for details on non-revenue water targets and performance for Ballarat, note that all figures relate to Distribution Losses, which corresponds to information shown in Figure 2.16

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4 All NRW figures discussed under this section refer to Distribution Losses
Future non-revenue water initiatives for Ballarat will not only include a renewed commitment to current initiatives, but will also include:

- The replacement of existing pressure sensors and the installation of new inter zone flow meters linked to CHW’s SCADA system, to ensure an increased capability to promptly detect and locate bursts and leaks within the system.
6. SUPPLY ENHANCEMENT OPTIONS

The Ballarat water supply system has sufficient capacity to service demand until at least 2035, as discussed in Section 4, based on conservative demand scenarios and adopting the worst case scenario Return to Dry. Less conservative demand and supply assumptions would see the demand not reaching system yields (under the existing LOS) until beyond 2050.

However the current government policy identifies the preference to source water from within natural catchments to minimise the impact on external catchments.

The Goldfields Superpipe is an integral part of ongoing water security for the Ballarat system. This source was critical to providing supply during the Millennium Drought, as yields from the existing catchments fell dramatically, and it now provides ongoing security of supply to the Ballarat system.

As yields from local catchments increased during the last two wetter years, reliance on the Superpipe has dropped and CHW has maximised the supply from natural catchments.

The committed investment in the Superpipe makes it very hard for alternative options to compete on a financial basis. Any decision to invest in alternative options, prior to the yield capacity being met, would need to be based on either a triple bottom line assessment focusing on the environmental and social benefits of demand initiatives and alternative water sources. CHW remains committed to reducing the need for supply by working to maintain efficient per capita demand levels as discussed in Section 5.

Potable Water Initiatives

The existing Ballarat West groundwater source is currently under-utilised due to water quality issues experienced while the source was being used prior to the completion of the Superpipe.

Investigations are currently underway to enable the groundwater entitlement to be more readily utilised. Options under consideration include further treatment at the source and mixing at the storage. This will further reduce reliance on water sourced from outside the catchment.

The review of the system yields and the identification of the critical constraint being the critical storage level at Lal Lal, has led to the development of a number of potential operational and capital works options to optimise the volume of local storage levels to raise the yield of the overall system. A brief has been issued for the next stage of the investigation.

Alternative Water Initiatives

CHW is, currently undertaking a review of its re-use strategy for wastewater to identify any further opportunities for re-use within the catchment.

There are some significant limitations to the potential for additional alternative water supply due the effectiveness of the efforts CHW, Council and other agencies during the restrictions period. The significant uptake of rainwater tanks amongst residential customers and rainwater systems or wastewater reuse by non-residential and concessional customers, particularly large process users, has reduced the opportunities for potable replacement.

Demand Initiatives

At present, with demand approximately at the estimated non-restrictable levels, any alternative water schemes would tend to be used to replace existing alternative water systems. For example, the targets for water efficient systems in new housing, combined with their decreased garden areas, will limit the benefit of third pipe residential schemes.

Continual monitoring of demand levels will be undertaken to identify any sign of customer bounce-back. Current demand initiatives will be modified or new initiatives developed to provide a focused response to the identified nature of the bounce-back.
During the restriction period, there was considerable savings generated in reducing non-revenue water from its previous levels of around 15% to around 11%. This program will continue with a target of 10%.

**Regional Initiatives**

CHW will work with other stakeholders to investigate and evaluate options for the appropriate use of water sourced from outside the natural catchment.
7. ALTERNATIVE WATER ATLAS

The Guidelines for the Development of a Water Supply Demand Strategy (Version 2) advise that a Water Supply Demand Strategy should provide information on specific opportunities for increasing the supply of alternative water services within the geographical bounds of their service areas. This Alternative Water Atlas aims to:

- Identify the volumes of stormwater, recycled water and other alternative water sources available within the works of the water corporation and local council.
- Inform future opportunities for the use of these identified sources of alternative water for the benefit of the community.

End use analysis of Ballarat’s demands has estimated current water usage by residential customers. These are given in Figure 7.1 along with current industry estimates of water usage in new developments (5 star). Potential water savings from potable substitution initiatives are provided in Figure 7.2.

Accordingly, a range of reuse scenarios can be considered and the details of these scenarios are given in Figure 7.2:

Future Investigations and Works

As part of its commitment to considering the option for sourcing water resources within the local catchments, CHW will assist the process by:

- Identifying and evaluating the feasibility of utilising local alternative water resources, together with major user needs or demand for these resources and assist in identifying specific opportunities for the use of stormwater and recycled water in Ballarat.
- Incorporating regulatory and policy requirements, expected yields and water quality requirements, and assessment of the various treatment technologies and collection/storage infrastructure requirements associated with each of these opportunities, to formulate a “short-list” of alternative water opportunities for Ballarat.
- Developing high level concept plans for each of the short-listed alternative water opportunities identified for Ballarat.
- Evaluating the economic, social and environmental benefits of the short-listed alternative water opportunities to ensure the overall least community cost outcomes are identified, which can deliver sustainable water supply and demand outcomes for Ballarat.
Developing a prioritised list of actions for further investigation and implementation of the short-listed alternative water opportunities.

The forecasted potential water savings from potable substitution is displayed in Figure 7.3.

**Figure 7.3 Forecasted Potential Water Savings from Potable Substitution**

<table>
<thead>
<tr>
<th>Reuse Scenario</th>
<th>Existing Development</th>
<th>New development</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2011</td>
<td>2016</td>
</tr>
<tr>
<td>Toilet Flushing</td>
<td>316</td>
<td>343</td>
</tr>
<tr>
<td>Toilet flushing and irrigation</td>
<td>507</td>
<td>549</td>
</tr>
<tr>
<td>Toilet Flushing and laundry</td>
<td>693</td>
<td>751</td>
</tr>
<tr>
<td>Toilet Flushing, laundry and hot water</td>
<td>1,275</td>
<td>1,382</td>
</tr>
<tr>
<td>Toilet Flushing, laundry, irrigation and hot water</td>
<td>1,466</td>
<td>1,588</td>
</tr>
</tbody>
</table>

The following assumptions were used for the calculation of forecasted potential water savings from potable substitution:

- 30% of the existing properties have already been connected to potable substitution.
- The potable substitution for existing properties will increase by an annual growth rate of 0.5%.
- 75% of new properties will be fitted with potable substitution.

**Recycled water**

CHW seeks to maximise the use of recycled water where it is fit-for-purpose and can be justified on economic, social and environmental grounds.

The Ballarat and District water supply system currently contains five wastewater treatment plants, which service different sewerage systems within the Ballarat and District water distribution network. The WWTP’s are located at Ballarat North, Ballarat South, Ballan, Skipton, and Cardigan Village.

The smaller wastewater treatment plants are situated at Ballan, Skipton and Cardigan Village. At Ballan and Skipton, 100% reuse is currently being achieved through land based agricultural irrigation schemes. The Cardigan Village WWTP only receives a small volume of wastewater, which is taken up by evaporation.

The two largest wastewater treatment plants are Ballarat North and Ballarat South. At present, treated wastewater from these facilities is discharged into local creeks in accordance with discharge licence arrangements issued by the Environmental Protection Authority (EPA).

CHW currently supplies water under agreement with City of Ballarat; 651 ML per annum of Class A recycled water for Lake Wendouree, from the Ballarat North Waste Water Treatment Plant (BNWWTP). It is proposed over time to recycle all water from BNWWTP.

See Figure 7.4 for a Ballarat regional map, showing key sources of alternative water for consideration.

**Stormwater Harvesting**

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5 Based on the survey undertaken by CHW 30% -40% of existing residential properties are connected with rainwater tanks
6 Benefit of Rainwater Tanks in Ballarat study by COB
City of Ballarat has informed CHW that the following water resources are currently managed by the Council:

- Specimen Vale Creek
- Canadian Creek
- Yarrowee Creek
- Lake Wendouree
- The Gong Reservoir (Buninyong)
- Retarding basin at Cardigan Village
- Lake Esmond
- Lake Learmonth
- Lake Burrumbeet
- Coghills Creek

City of Ballarat has implemented several storm water harvesting schemes to support water needs for Lake Wendouree and several major open space and recreational areas.

Extensive studies in relation to annual yield, in terms of stormwater harvesting have not been carried out at this stage. CHW is planning to collaborate with COB in relation to further stormwater harvesting opportunities within the Council area and how these could supplement other water supply options.

The infrastructure cost associated with stormwater harvesting is believed to be substantial; however, a detailed cost benefit analysis has not been completed.

**Rainwater Tanks**

Substitution of potable supplies with fit-for-purpose water such as rainwater for toilet flushing, laundry, hot water and garden use is a potential alternative supply arrangement.

CHW acknowledges the important role that using rainwater tanks have in conserving urban water supplies. CHW continues to support the use of rainwater tanks through the State Government Water Smart Gardens and Homes Rebates & 5 Star Building Standard requirements.

A study carried out for the City of Ballarat, *Benefits of rainwater tanks in Ballarat*, has revealed that studies have shown that the installation of rainwater tanks can potentially reduce household water demand by 20-40%.

COB is planning to implement a pilot scheme in Ballarat West Urban Growth Zone to test the viability of rainwater tanks as a part of a formal integrated water management strategy.

Together with COB, CHW will be investigating Integrated Water Management options for the remainder of the new development. The rainwater tank option is likely to be extended to the whole of Ballarat West, but other alternatives such as Managed Aquifer Recharge (MAR) with stormwater for open space irrigation will be assessed.

CHW will continue to work with Council and other parties to assess potential in areas already developed.

*Figure 7.4 Ballarat Key Alternative Water Source Map*
8. WATER SECURITY OUTLOOK

The Guidelines for the Development of a Water Supply Demand Strategy (Version 2) advise that a Water Supply Demand Strategy should include a Water Security Outlook, to determine what actions need to be taken in the immediate to short-term to keep supply and demand in balance given current system configuration and current conditions.

As at March 2012, the Ballarat water supply system is at approximately 90% of full capacity. Two projections have been made from this starting position:

- based on the full stochastic data set
- based on the climate change modified data set

See Figure 8.1 and 8.2 for forward storage projections based on the above scenarios.

Figure 8.1 Ballarat System Short Term Projection – Full Data set

Estimated system storage level likelihoods (including Lal Lal)
Base stoch. scenario

Note: Security Outlooks – 2015
CHW updates the security outlooks annually based on actual storage levels and updated information on inflows and demands. Please contact CHW for information on the latest security outlooks.
These projections indicate that, under the climate change modified data set and less than 1% inflows, storage levels in the system will remain above 50% throughout the outlook period.
9. DEVELOPMENT OF PLANS

Short term planning (next 5 years)

In the short to medium-term, CHW will continue to assess Ballarat’s water demand growth and the effects of climate change. This will include an investigation of potential treatment options for the Ballarat West groundwater source and managed aquifer recharge to increase ground water yields. CHW will modify or add new demand initiatives as any customer behavior change becomes identifiable.

CHW will investigate the feasibility of fit for purpose alternative water sources (recycled water/storm water) from local catchments. The findings of the current reuse Strategy review will be implemented.

CHW will maintain focus on reducing the NRW within the Ballarat system by undertaking activities as specified in Chapter 5.

Medium term planning (next 5-25 years)

In the medium term, CHW will implement actions based on investigations carried out over the short-term.

CHW will continue to monitor the balance between supply and demand and maintain flexible plans to deal with future uncertainty. In particular, the extent of climate change and population growth will undoubtedly have implications for future planning. As a result, a complete water supply demand strategy review will be performed every 5 years.

CHW will also advance existing ideas, identify new water supply options, assess the feasibility of maximize the potential use of recycled water/storm water harvesting for urban use, and consider implementing specific demand management options in order to meet the guidelines expected to be presented in the final MAC report.

Ongoing maintenance plans will be established to maintain non-revenue water at 10%, and existing demand management options and targets will continue to be pursued.

Long term planning (next 25-50 years)

In the long term, additional water supply or water conservation options may be required to counteract the impact of climate change and water demand growth. CHW will remain committed towards maintaining current per capita usage through to 2060, and to a long-term non-revenue water target of 10% for the Ballarat system.

The ongoing WSDS review process will enable the latest research to be utilised in understanding the future impact of climate change. CHW will also look towards expanding existing ideas and identifying new opportunities to achieve efficiency gains.

A key component of long term planning will be conducting a complete WSDS review every five years and identifying lead times for options to ensure that they can be introduced as required.

Based on the investigation CHW will endeavour to achieve the development of plans to ensure that the Ballarat and district water supply is secure into the next century and identify opportunities expand water recycling schemes and achieve with fit-for-purpose recycled water use.
### Summary of actions

#### Figure 9.1 Summary of Actions for Short, Medium and Long Term Planning

<table>
<thead>
<tr>
<th>Timeframe</th>
<th>Action required</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Short term</strong></td>
<td>Continue to implement current demand management initiatives</td>
</tr>
<tr>
<td>(next 5 years)</td>
<td>Investigate options to treat and increase yields of groundwater sources</td>
</tr>
<tr>
<td></td>
<td>Continue to assess Ballarat’s water demand growth and the effects of climate change</td>
</tr>
<tr>
<td></td>
<td>Investigate the feasibility of fit for purpose alternative water sources</td>
</tr>
<tr>
<td></td>
<td>Establish comprehensive operating rules for the Superpipe, and establish a broader water resource optimisation plan</td>
</tr>
<tr>
<td></td>
<td>Achieve 10% target for NRW by 2018</td>
</tr>
<tr>
<td><strong>Medium term</strong></td>
<td>Complete WSDS review in 5 years time</td>
</tr>
<tr>
<td>(next 5-20 years)</td>
<td>Maintain flexible plans to deal with risk and uncertainty</td>
</tr>
<tr>
<td></td>
<td>Consider introducing future and alternative options, if necessary</td>
</tr>
<tr>
<td></td>
<td>Establishment of ongoing maintenance plans to keep non-revenue water down</td>
</tr>
<tr>
<td></td>
<td>Continue to implement demand management initiatives</td>
</tr>
<tr>
<td><strong>Long term</strong></td>
<td>Re-assess long-term plans based on WSDS reviews</td>
</tr>
<tr>
<td>(next 20-50 years)</td>
<td>Continue to develop and progress ideas for alternative options</td>
</tr>
<tr>
<td></td>
<td>Achieve demand management targets and consider new opportunities</td>
</tr>
</tbody>
</table>
10. MANAGEMENT OF RISK AND UNCERTAINTY

The inherent difficulty associated in planning for a 50-year period necessitates that plans and strategies need to be flexible to account for different scenarios and developments that may be realised in the future. This section outlines some of the major uncertainties associated with long term water resource planning and the measures that have been put in place to manage these uncertainties.

Water demand growth
Water demand forecasts are developed using the most up-to-date local and regional information and are reviewed on a yearly basis.

Impacts of climate change
The greatest uncertainty within the planning horizon is climate change/variability.

The Guidelines have specified a range of climate scenarios as the basis for supply/demand forecasts. CHW has combined these with its prior stochastic analysis to reflect a wide range of potential climate futures.

The potential range for demand exceeding yield has been assessed to be between 2039 and 2053 for the upper limit demand and the yield scenarios presented. It would be significantly delayed for more moderate demand scenarios.

Given the lead times, it is prudent to adopt a continual monitoring approach to increase the confidence in the direction of climate trends and maximise the value of demand initiatives and alternative water supplies. The impact of climate variability/change will be monitored annually and the supply/demand balance formally review as part of the 5 year WSDS review process.

Infrastructure and operational constraints
CHW’s long-term water resource plans include comprehensive assessment of infrastructure and operational issues to ensure that potential constraints or limitations do not jeopardise water supply.

Bulk Entitlement limitations
CHW’s entitlement to extract water for the Ballarat and district water supply system is specified in a number of Bulk Entitlement Orders and Water Shares as discussed in Section 2.

Allowing for environmental obligations and climate variability, the Ballarat supply system has sufficient capacity to provide for the forecast demands over the next few decades. However, any modification to this entitlement will require a reassessment of the capacity of the available yields to meet demands.

Compliance with government policy
The committed options outlined in this strategy comply with current government policy and CHW acknowledge that the assessment of all future options should consider government policy.

Drought management
The short-term management of drought conditions is addressed through CHW’s Ballarat Drought Response Plan (DRP). The Ballarat DRP is a sequential plan of effective responses that facilitates the timely implementation of control measures as conditions become drier and water shortages threaten.

Impacts of bushfire
The catchment areas of the water supply system predominantly comprise of farmland that is used for grazing and cropping, with some forested areas. As such, parts of the catchment area may be susceptible to bushfire and the water supply system could be affected by the short-term and longer-term impacts of bushfire.

The most serious short-term impact associated with bushfire would be the isolation of certain storage reservoirs from the water supply system to avoid adverse water quality effects. This could lead to short-term water supply concerns depending on the length of isolation. However, potential water shortages could be managed by implementing response actions similar to those outlined in the Ballarat Drought Response Plan.

The long-term implications of bushfire could result in a decrease in catchment yield as time progresses and vegetation slowly regenerates. Following bushfire, assessments would be undertaken to determine the estimated impact on yield over time. Long term water resource planning would then be reviewed to ensure that an appropriate balance between supply and demand is available.
11. STAKEHOLDER CONSULTATION

CHW is actively engaged with its customers in relation to both the 2011/12 review of WSDS’s and the upcoming Water Plan. A variety of consultation models have been used by CHW for the WSDS process. These include:

- Workshops
- Focus Groups
- Stakeholder Workshops
- Formal and informal surveying
- One on one interviews
- Media articles
- Development of an e-communication list

Below is a summary of completed and proposed actions in relation to engagement:

- Attitudinal / Behavioural studies – ongoing – CHW undertakes regular studies and surveys in relation to our customer’s water use behaviours and preferences. These enable CHW to better understand our customer’s attitudes to water use which in turn informs our demand projections for WSDS development.
- Customer Surveying - Oct / Dec 2011 – To inform the WSDS and upcoming Water Plan, CHW has undertaken an extensive customer survey that covers the whole service area. The survey covered 400 of CHW’s customers and the feedback / data from the survey will be used in relation to service levels and security of supply.
- Draft WSDS’s – Mar 2012 – executive summaries of the draft WSDS’s were made available on the CHW website during March 2012. CHW communicated the process for review and responses to WSDS drafts with its customers, via advertising in a range of local newspapers.
- No submissions were received from the consultation process.
- Final WSDS’s will be made available in full on the CHW website from April 2012.

Customer Surveys

The results of the customer behaviour durability surveys show a high awareness of the need for water conservation, a strong intent to keep their consumption at or below existing levels and a strong adoption of water efficient technology and rainwater tanks as alternative water sources.

In particular there was a strong awareness of the need to limit the use of potable water for outdoor purposes.

This supports the bulk demand data indicating that demand has not substantially increased since the restrictions have been lifted.

Levels of Service

Surveys have supported the appropriate use of restrictions as a suitable measure with a general feeling that restrictions were about the right frequency and length.

The uptake of rainwater tanks shows a strong support for the use of alternative water sources for outdoor use combined with surveys indicating that outdoor use was the least appropriate use of potable water.

Possible Initiatives, Preferences, Willingness to Pay

Surveys have shown a reasonable level of support for the current levels of volume charges but a strong feeling that access are too high.

Implications for the WSDS
CHW customers have continued to show support for the use of supply augmentation, demand initiatives, alternative water sources (whether provided by CHW or not) and, where necessary, restrictions.

It is too early to consult customers in detail in regard to their preferences and willingness to pay in relation to supply-demand initiatives. The lead time until there is a requirement for the next major initiatives to maintain the supply demand balance are too long.

However, with the likely outcomes of the Ministerial Advisory Council, there is a need to consult customers on their preferences and willingness to pay for initiatives to minimise the reliance on water sourced from external catchments.

CHW has commenced a re-evaluation of a number of aspects of the supply demand balance, as discussed in previous sections, to prepare for wider discussions with CHW customers and broader stakeholders about their preferences and willingness to pay for the initiatives required to meet the MAC aspirations.
### 12. GLOSSARY OF TERMS

**Figure 12.1 Glossary**

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Augmentation</td>
<td>Works required to increase water supply</td>
</tr>
<tr>
<td>Aquifer</td>
<td>A layer of underground sediments which water flows through</td>
</tr>
<tr>
<td>Bulk entitlement (BE)</td>
<td>The right to water held by authorities as defined in the Water Act. The BE defines the amount of water that an authority is entitled to from a river or storage, and may include the rate at which it may be taken.</td>
</tr>
<tr>
<td>Catchment</td>
<td>An area of land where run-off enters a particular river system</td>
</tr>
<tr>
<td>Demand management</td>
<td>Initiatives that endeavour to reduce water consumption and encourage more efficient water use</td>
</tr>
<tr>
<td>Diversion</td>
<td>Water harvested from a weir without the use of an on-stream storage</td>
</tr>
<tr>
<td>Diversion weir</td>
<td>A structure across a stream that facilitates the diversion of water into a pipeline</td>
</tr>
<tr>
<td>Drought Response Plans</td>
<td>Short term action plans that provide effective responses to deal with the occurrence of droughts</td>
</tr>
<tr>
<td>Greywater</td>
<td>Uncontaminated household water from sources such as bathtubs, washing machines, and kitchen sinks</td>
</tr>
<tr>
<td>Groundwater</td>
<td>All subsurface water, generally occupying pore spaces and fractures in rock and soil</td>
</tr>
<tr>
<td>Megalitre (ML)</td>
<td>1,000,000 litres</td>
</tr>
<tr>
<td>Minimum passing flow requirement</td>
<td>A requirement to provide a minimum flow below a water diversion point</td>
</tr>
<tr>
<td>Potable</td>
<td>Suitable for drinking</td>
</tr>
<tr>
<td>Recycled water</td>
<td>Water from sewage or industrial processes that is treated to appropriated standards for its intended use</td>
</tr>
<tr>
<td>Regional Sustainable Water Strategies</td>
<td>Long term plans that endeavour to secure water supplies and produce environmental benefits across the region throughout the next 50 years</td>
</tr>
<tr>
<td>Salinity</td>
<td>The total amount of water soluble salts present within water or soil</td>
</tr>
<tr>
<td>Level of service (LOS)</td>
<td>An adopted water supply standard that endeavours to achieve supply outcomes such that water restrictions are only enforced during a specified number of years on average (i.e. 1 in 5 years or 95% standard of service).</td>
</tr>
<tr>
<td>Stormwater</td>
<td>Rainfall runoff from urban areas that flows into drains, channels and urban waterways</td>
</tr>
<tr>
<td>System security</td>
<td>Refers to the actual likelihood of water restrictions being implemented. It is a calculation achieved using simulation modelling based on current demand and climatic variations over a historical period.</td>
</tr>
<tr>
<td>System yield</td>
<td>A notional figure that refers to the volume of water that can be harvested from a water supply system in order to achieve the adopted standard of service</td>
</tr>
<tr>
<td>Unrestricted water demand</td>
<td>The total volume of water used by consumers during periods without water restrictions</td>
</tr>
<tr>
<td>Water Demand</td>
<td>The average annual water demand based on water consumption and population projections</td>
</tr>
<tr>
<td>Water Plans</td>
<td>Short term plans conducted by water authorities to specify revenue and tariff proposals that support expenditure proposals</td>
</tr>
<tr>
<td>Water Supply-Demand Strategy (WSDS)</td>
<td>A long term plan that looks at maintaining an appropriate balance between urban water supplies and demand over the next 50 years</td>
</tr>
</tbody>
</table>
13. REFERENCES & RELEVANT INFORMATION

- Department of Sustainability & Environment, (2006). Central Region Sustainable Water Strategy: Action to 2055, October 2006 (**why multiple references to this document?)
- City of Ballarat , Benefits of Rainwater Tanks in Ballarat ( AECOM), July 2011
- Gilbert and Sutherland, Ballarat Water Supply System – Background Information to the Development of a Water Supply Risk Assessment Modelling Approach , Draft, August 2011
APPENDIX 1: ALTERNATIVE MODELLING ASSESSMENT

Alternative Modelling Assessment – Historical Data

The following provides the catchment yields for Ballarat under the four climate scenarios provided in the Guidance.

This provides a comparison to the yields derived from the prior stochastic analysis carried out as described in Section 2.

The total yield includes the 1700 ML/year yield from the Ballarat West groundwater source.

Summary of Yield Estimates

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Catchment Yield (ML/year)</th>
<th>Total Yield (ML/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base</td>
<td>16,500</td>
<td>18,200</td>
</tr>
<tr>
<td>Return to Dry</td>
<td>14,500</td>
<td>16,200</td>
</tr>
<tr>
<td>Wet 2030</td>
<td>16,000</td>
<td>17,700</td>
</tr>
<tr>
<td>Medium 2030</td>
<td>15,500</td>
<td>17,200</td>
</tr>
<tr>
<td>Dry 2030</td>
<td>15,000</td>
<td>16,700</td>
</tr>
<tr>
<td>Wet 2060</td>
<td>15,500</td>
<td>17,200</td>
</tr>
<tr>
<td>Medium 2060</td>
<td>15,000</td>
<td>16,700</td>
</tr>
<tr>
<td>Dry 2060</td>
<td>13,000</td>
<td>14,700</td>
</tr>
</tbody>
</table>