Westernport Water

Report for Westernport Water
Water Supply Demand Strategy

Strategy Report

March 2007

Contents

CONTENTS

Table Index

Figure Index

Appendices

Executive Summary

Westernport

Westernport Water sources water from Candowie Reservoir. It also has an agreement for supplies from South Gippsland Water's Lance Creek Reservoir.

The system can currently supply 2 400 ML a year assuming long-term average inflows and 100 ML a year assuming continued low inflows. Current (unrestricted) demand is estimated to be 2 000 ML a year.

The population of Westernport is forecast to increase from its current level of 12 000 to 19 000 by 2030 and to 32 000 by 2055.

The Challenges and Solutions

The table below shows the expected shortfalls in Westernport's urban water supply and the water that will be provided by the actions in this Strategy. Shortfalls based on long-term averages of rainfall and inflows that might be expected if rainfall of the past 10 years continue, have been provided. The Strategy provides an action plan to secure water under both of these scenarios.

Table 1 Predicted shortfalls for Candowie Reservoir System[1]

Scenario		2006	2015	2030	2055
Long term average inflows (medium climate change)	Supply (ML)	2 400	1 900	1 750	1 550
	Demand (ML)	2 000	2 300	3 300	4 650
	Urban water shortfall (ML)	**400**	**-400**	**-1 550**	**-3 100**
Continued low inflows	Supply (ML)	1 500	1 500	1 500	1 500
	Demand (ML)	2 000	2 300	3 300	4 650
	Urban water shortfall (ML)	**-500**	**-800**	**-1 800**	**-3 150**

Note 1 Minor differences from CRSWS result from minor refinements to supply and demand estimates

Immediate actions in response to low inflows and drought

- Conservation and efficiency programs for homes and businesses to start immediately (310 ML);
- Interconnection with one or more of the following by 2008 (2 000 ML by 2015): the Bass River; Corinella aquifer; or the Melbourne supply system;
- Local reuse and recycling initiatives to commence by 2009 (80 ML).

Planning using long-term averages

Estimates of Westernport's future water supply and use are based on averages of the past 50-100 years of inflows to reservoirs, with population growth as outlined on the previous page. A gradual reduction in supply (over 50 years) is expected as a result of medium climate change. Under this scenario, the expected decline in inflows to Westernport's reservoirs is 12 per cent by 2030 and approximately 24 per cent by 2055.

Planning for continued low inflows

Over the past 10 years, inflows to Westernport's reservoirs have been 21 per cent less than the long-term average. The reduced inflows mean that reliability of water supplies is reduced.

In order to maintain reliability at an acceptable level with either average inflows or continued low inflows, it will be necessary to secure additional water. Table 1 shows the estimated volumes of water that could be needed (ie. the expected "shortfalls") for both long-term average conditions and continuing low inflow conditions. Immediate actions to address these shortfalls are described below.

Action

The Government requires Westernport Water to work with its customers to achieve a 25 per cent reduction in total per capita water use for Westernport by 2015, increasing to 30 per cent by 2020. The basis of comparison is the 1990's average water use.

What if inflows return to average conditions?

Conservation and local reuse and recycling initiatives would continue as planned. The volume of water accessed through a Melbourne connection or the Corinella aquifer could be varied as required.

Actions to secure Water Supplies in the Region

Under medium climate change conditions, the year in which demand exceeds supply is estimated to be 2010. Under low inflow conditions, the demand already exceeds supply by 100 ML, and immediate action is currently under way to connect to the Corinella Aquifer and also to obtain an additional supply via diversions from the Bass River.

A range of actions are in Table 3 to provide 2 400 ML of water in 2015 – enough to meet the shortfalls forecast under either scenario, as well as a buffer supply of water.

Conservation and efficiency

Conservation and efficiency remains an important focus for Westernport. A range of programs will be implemented by Westernport Water to achieve its new conservation target.

This conservation targets mean water use in Westernport will need to be reduced from 323 litres per person per day (current use) to 280 litres per person per day by 2015 and 261 litres by 2020. By 2015, this reduction will result in water savings of about 300 ML each year.

As outlined in Chapter 3 (Action 3.13) of the CRSWS, metropolitan Pathways to Sustainability program will be expanded to target all commercial and industrial customers in the Central Region that use more than 10 ML a year. This program encourages these users to develop plans and voluntarily reduce their water use.

Reuse and recycling

In addition to using less water, it is also necessary to decrease our reliance on rivers and reservoirs by using alternative sources of water. Recycling water from the Cowes Wastewater Treatment Plant and Westernport Water's purification plant will help to achieve this.

Interconnections

Further water supplies will be needed immediately as the 500 ML of water Westernport obtains from South Gippsland Water's Lance Creek is not a guaranteed supply. The agreement between Westernport Water and South Gippsland Water is such that if South Gippsland requires this water, it has priority over Westernport's needs.

In order to provide secure supplies to meet Westernport's immediate needs, Westernport Water will need to implement an augmentation action by 2008 for an initial volume of 1000 ML. Westernport Water currently has a range of options for this, including augmenting supplies in Candowie Reservoir through an interconnection with the Bass River and groundwater extraction from the Corinella aquifer. In addition Westernport Water could interconnect to the Melbourne supply system.

The interconnection with Melbourne has been evaluated in some detail; however the groundwater and Bass River interconnection options also represent potentially viable alternatives for meeting Westernport's immediate water needs. There is the potential to extract 1000 ML of water from the Bass River within its sustainable diversion limit.

A comparative assessment will be undertaken to determine the most appropriate action to secure water by 2008. The volume of water accessed through this option could be increased over time, in order to meet Westernport's longer term needs.

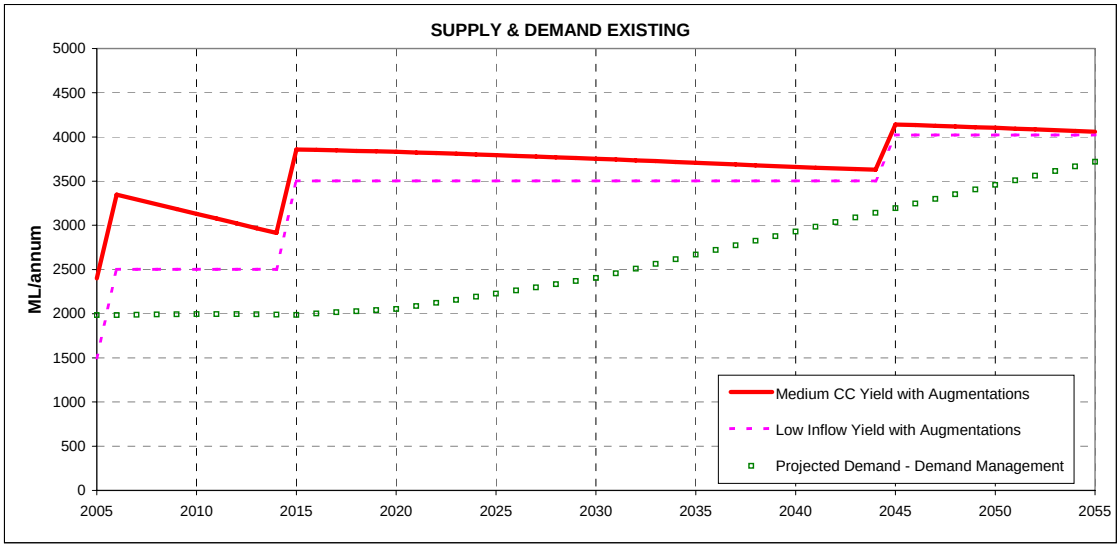
Table 2 Overall Strategy for Providing Water Supply

CURRENT OVERVIEW	YEAR THAT FORCAST DEMAND EXCEEDS SUPPLY		ACTIONS TO BE TAKEN	PAGE Ref.
AS OF 1 MARCH 2007	MEDIUM CLIMATE CHANGE	CONTINUED LOW INFLOWS	OVER 7 YEARS	
Storage levels: 15% Restrictions: Stage 4 Drought due to the lowest ever rainfall in 2006 resulting in lowest recorded inflows.	2010	Now	● Conservation and efficiency programs for homes and businesses to start immediately. ● Drought response interconnect to Bass River and Corinella aquifer immediately. ● Continue and expand local reuse and recycling schemes for potable substitution.	28 35 & 37 32

The Strategy

The preferred supply-demand strategy is illustrated in the figure below showing which actions to be adopted to meet the supply and demand balance to 2055.

Figure 1 Supply-Demand Forecast with Targets Achieved



Projected Demand – the demand forecast shown in the figure above incorporates the water conservation targets described in Table 9 of this report6. It is worth noting, that these targets are aggressive and the rate of reduction in demand will exceed the expected rate of increase in demand due to population growth. Therefore, it is expected that over the next 10-15 years, demand on the system will remain at or around 2000 ML/a, on average. The Authority will closely monitor annual demand over this period and take appropriate action by if an increasing pattern becomes evident.

Supply Forecasts – Figure 1 illustrates that proposed supply augmentations provide the required balance between supply and demand over the 50 year planning period, for both climate change impacted conditions and continued low inflow conditions. The strategy provides for an additional supply source of about 1000 ML/a to be brought on-line immediately. This will also assist with the short term water shortage. The Corinella Aquifer and Diversions from Bass River are both currently being developed and implemented to provide this additional supply. The strategy allows for an additional 1000 ML/a to be implemented by about 2015. This additional supply is required to provide sufficient buffer between the available supply and demand to mitigate unforseen issues and future drought conditions. Beyond 2015, it is expected that supply augmentation should not be required until 2045, provided the identified supply sources provide the anticipated yields.

The key actions for the strategy are detailed in Table 11 of this report. These actions are aimed at providing sufficient buffer within the system to mitigate the impacts of climate change, continuation of the existing drought, increased population growth.

Westernport Water will be seeking to convert any extraction licences issued during the current drought period from temporary to permanent Bulk Entitlements as part of its strategy to obtain long term water supply security for the region.

Table 3 Actions Established for Securing Water Systems

	Timing of implementation and volume of water provided (ML/year)				
Conservation and Efficiency	2006	2010	2015	2030	2055
Priority actions include permanent water savings measures, leakage detection, and water improved efficiency at home and in industry. Maintaining water savings after the removal of existing water restrictions will also be a short term priority.	50	140	310	900	1000
Re-Use and Recycling	2006	2010	2015	2030	2055
Westernport Water will maintain a strong focus on supporting water recycling opportunities across the region. Options which allow for the substitution of potable water will be favoured in the short to medium terms.	50	100	100	100	100
New Water Sources	2006	2010	2015	2030	2055
Preferred short term options include: Bass River Diversions Corinella Groundwater	500	1200	1600	1600	1600
Preferred medium to long term options include: Interconnection to Melbourne System (Subject to confirmation of sustainability of the Bass River and Corinella groundwater options. May need to be bought forward)	0	0	0	0	2000
Total	2006	2010	2015	2030	2055
Current Shortfall/Surplus throughout Systems (Shortfall from Low Inflows shown in Brackets)	400 (-500)	0 (-700)	-400 (-800)	-1550 (-1800)	-3100 (-3150)
Total volume provided by options (ML/yr)	600	1440	2010	2600	4800

1. Introduction

1.1 Overview of Westernport Water

Westernport Region Water Authority (Westernport Water) provides water and wastewater services to properties located within its water supply region. The region extends from Grantville in the north to Dalyston in the south, and supplying all areas to the west including Phillip Island. The towns serviced by Westernport Water lie within the Bass Coast Shire. Water is sourced from Candowie Reservoir in the Bass Hills near Glen Forbes, treated and distributed to each of the communities through a network of supply mains.

Westernport Water has remained focused on undertaking long-term asset improvements and upgrades in accordance with its corporate strategy of life-cycle management.

1.2 Purpose of Water Supply-Demand Strategy

The purpose of this Water Supply-Demand Strategy (WS-DS) for Westernport Water is to be proactive in securing the future water supplies for the Westernport Region.

This Strategy looks at the factors that will affect water supply and demand for the Westernport Region over the next 50 years (i.e. until 2055), including the likely impacts of climate change.

Key actions from Westernport Water's WS-DS are summarised in the Central Region's Sustainable Water Strategy (CRSWS). The CRSWS provides a coordinated approach to planning for a sustainable water future in Victoria and was completed in 2006.

The aim of this Water Supply-Demand Strategy is to achieve the following objectives:

- Ensure reliable and safe water supplies for all users into the future;
- Understand the implications of the record low rainfall and inflows to our reservoirs experienced over the past ten years;
- Make the best use of water resources locally and throughout the region; and
- Be consistent with, and deliver on, river health obligations in Part 6 of the Westernport Statement of Obligations;
- Be consistent with the relevant Regional River Health Strategies;
- Protect and where necessary, improve the health of rivers, aquifers and estuaries;
- Protect the indigenous and other heritage values associated with the region's rivers and catchment areas;
- Maximise overall community benefits and ensure that no generation or group incurs unwarranted extra costs or receives additional benefits;
- Support high value water use by industry and agriculture with the least impact;

- Further develop an appreciation of the value of water and of conservation cultures in the community; and
- Aim to be greenhouse gas emission neutral.

It is expected that Westernport Water will review the WS-DS every five years. In the future, this process will be aligned with submissions of Water Plans to the Essential Services Commission to facilitate a more integrated short and long term planning approach.

1.3 Key Features of the Westernport WSDS

Westernport Water has historically relied solely on Candowie Reservoir for its potable water supply. With the recent drought and subsequent decreasing streamflows, Candowie Reservoir may not be adequate to meet the demands of the customers in the near future.

This strategy therefore aims to provide actions that Westernport Water can implement in the short, medium and long term. These actions will focus on:

- Promoting water conservation and efficiency to reduce potable water use;
- Identification and implementation of local water recycling projects to substitute potable water use; and
- Augmentation with other water sources to diversify Westernport Water's security of supply.

1.4 Context

The Central Region Sustainable Water Strategy (CRSWS) provides the government's policy directions and actions for water utilities. The CRSWS is focused on balancing the water needs of urban and rural customers and the environment across the whole region for the next 50 years. It also addresses any conflicts arising from sharing water between urban areas, irrigators and rivers in the Central Region. Information on the Central Region Sustainable Water Strategy is available from the Department of Sustainability and Environment (www.dse.vic.gov.au).

Westernport Water is located within the Central Region and the WS-DS details how the Authority will implement the government's policy directions and actions over the next 50 years.

1.5 Acknowledgements

Westernport Water wishes to acknowledge the authors of information published in Westernport Water Annual Reports 2000/01 to 2005/06, the Draft Central Region Sustainable Water Strategy, and the Final Central Region Sustainable Water Strategy. Many excerpts from these documents have been utilised within this strategy and the individual contributions are recognised herewith. Contributions from non-government organisations have been referenced separately where possible.

2. Development of the Strategy

2.1 The Past

Westernport Water has typically undertaken a review of its water supply and demand balance every two to three years on average.

In 2000, a "Review of Augmentation Needs For the Water Supply System" (Byrne, 2000) was undertaken. This review aimed to identify "what actions need to be taken by the authority to secure the water supply for the future". The key outcomes from this review included the conclusion that the system yield from the combined Candowie and Lance Creek catchment systems is likely to be adequate for the next 10 to 15 years. However, the link between the Lance Creek Reservoir and Candowie Reservoir was considered an important element in the system yield and therefore liaison with South Gippsland Water was important to manage the arrangement over the longer term. In addition, water quality concerns regarding blue green algae in Candowie Reservoir were recognised, but were seen as being manageable.

A range of actions were recommended covering monitoring water usage, reducing leakage, improving operational rules regarding the use of Lance Creek water, assessing supply augmentation options, assessing the potential for rainwater tanks and trialling proposed circulation techniques to manage blue green algae blooms. Westernport Water acted on the above recommendations by initiating a process to undertake a review of the long term water supply options, particularly with respect to the North Arm storage option, a Melbourne Water supply replacement option and enlargement of Candowie Reservoir.

In 2002, a comprehensive study was undertaken to "Review Long Term Water Supply Augmentation Options" (GHD, 2002). This review aimed to provide information on the water supply augmentation options identified in the 2000 study, the costs, impacts and benefits of the options and to present conclusions and recommendations. The key outcomes of the study centred on increasing the capacity of Candowie Reservoir and connecting to the Melbourne Water system. Westernport Water has in recent years proceeded to investigate both options further.

2.2 The Present

The unprecedented decline in run-off during the past 10 years, and the likely future reduction to system yields to take into account climate change has resulted in a substantial change in direction for future management of Westernport Water's Water Supply System.

The recent dry conditions have highlighted the vulnerability of the system to extended drought conditions, including the reliance on the State Government initiated agreement with South Gippsland Water for transfers from Lance Creek. In December 2006, Stage 4 restrictions were implemented due to rapid depletion of supplies in Candowie Reservoir. Westernport Water has been actively investigating and implementing emergency supply measures to mitigate future impacts if the dry conditions continue. These additional supplies include a groundwater supply from the Corinella Aquifer and an entitlement to divert water from the Bass River.

Westernport Water has continued to source water from South Gippsland Water's Lance Creek Reservoir. This has been an important supply source over recent years however there is future uncertainty regarding the security of this supply.

2.3 The Future

The development of the WS-DS commenced in mid 2005 via Westernport Water's involvement in the Central Region Sustainable Water Strategy (CRSWS). The Draft CRSWS was released in May 2006. For Westernport Water's region, the Draft CRSWS did not support the Candowie option and indicated that connection to the Melbourne supply system was the preferred option in the short term, with potential groundwater and water conservation initiatives. The final CRSWS assisted to identify demand reduction targets, water recycling targets and several possible options for augmenting the Westernport Water supply, including:

- Augmenting supplies in Candowie from Bass River;
- Extracting groundwater from the nearby Corinella aquifer; and
- Connecting to the Melbourne supply system.

Westernport Water Authority supports the directions identified in the CRSWS and has therefore proceeded to develop the WS-DS to provide further detail behind the input prepared for the CRSWS. In addition, Westernport Water has been assessing other opportunities (such as local re-use of recycled water and a supply source from the abandoned Wonthaggi Coal Mine) in response to more recent drought conditions

The following major activities have therefore been undertaken to guide the development of this strategy:

Table 1 Summary of Strategy Development Activities

Activity	Related Information
Review of Current Status	
◗ Define existing system; ◗ Define water sources; ◗ Operating requirements (i.e. BE)	◗ Westernport Water Annual Reports (2002-2006) ◗ Westernport Water - Draft Water Resources Plan 2002 ◗ Water Plan 2005-2008

Activity	Related Information
	◗ BE Conversion Order
Population and Demand ◗ Current population estimates ◗ Future population growth rates ◗ Current water use per capita ◗ Forecasted water use	◗ Based on Victoria in Future statistics ◗ Water Plan 2005-2008 (provides projects till 2008) ◗ Westernport Water Annual Reports ◗ Water consumption data (1995 to 2005)
System Yield and Climate Change ◗ Estimates of system reliability and yield ◗ Impacts of climate change on System Yield ◗ Continued dry conditions	◗ Yield study (2006) ◗ CSIRO climate change estimates
Option Assessment ◗ Demand reduction measures ◗ Supply augmentation options ◗ Greenhouse gas neutral driver	◗ Draft Water Resources Plan (2002) ◗ Demand reduction targets adopted in CRSWS ◗ Review of Long Term Water Supply Augmentation Options (2002) ◗ CRSWS
Sustainability Assessment ◗ Greenhouse gas neutral approach ◗ Enhancing river health	◗ DSE Sustainability Assessment Methodology
Consultation	◗ Consultation program by Westernport Water following preparation of Draft WSDS.

2.4 Consultation

A joint public consultation program will commence shortly to gain public input to the Water Supply Demand Strategy in association with the new Water Plan to be submitted to the Essential Services Commission. It is proposed to have public information sessions/publicity and present this strategy to the Customer Consultative Panel (CCP) at one of their regular meetings.

All of the proposals in the Water Supply Demand Strategy for the future water supply sources for Westernport Water are similar to the proposals in the Central Region Sustainable Water Strategy (CRSWS), The CRSWS has undergone considerable public consultation with a discussion paper (October 2005) and a Draft for Community Comment (April 2006) issued widely throughout the area serviced by Westernport Water. The CRSWS also conducted several public meetings throughout the central region including a meeting at Narre Warren which was attended by officers from Westernport Water.

The final CRSWS action plan was finalised and distributed in October 2006 to all interested customers of Westernport Water.

3. Existing Urban Water Supply System

3.1 The Westernport Water Supply System

3.1.1 Rivers and Reservoirs

The primary source of supply for the Westernport Water Supply System Candowie Reservoir which is situated on Tennent Creek about 8 km east of Grantville. This reservoir has a capacity of 2 207 ML.

Westernport Water also has an arrangement with South Gippsland Water to access supplies in Lance Creek Reservoir. Lance Creek Reservoir has a capacity of 4 600 ML. This reservoir is managed by South Gippsland Water and is used to supply the South Gippsland region including Wonthaggi, Inverloch and Cape Patterson areas.

In particular years, water is transferred from Lance Creek Reservoir to Candowie Reservoir via a pump station and connecting 13 km long pipeline which was constructed in 1990. Over the last 10 years, this supply has been utilised during six seasons with between 45 ML and 773 ML transferred on an annual basis.

The arrangement between Westernport Water and South Gippsland Water is subject to availability each year and in the longer term access to this supply is likely to reduce as South Gippsland Water responds to increases in demand and the impacts of climate change. South Gippsland Water is under pressure to provide water supply to coastal areas not currently supplied with water and Lance Creek could be used to supply these additional areas.

Other potential water supplies in the region include:

Groundwater	The Corinella Groundwater Management Area has a Permissible Consumptive Volume of 2 550 ML with approximately 2 000 ML presently unallocated. Investigations are currently underway to assess feasibility of sourcing water from this resource for short term drought response and long term supply enhancement.
Seawater	Seawater desalinisation could provide new supplies of water for people and the environment. Westernport Water will work with other Authorities to continue to monitor the advances in desalinisation technology and the potential for renewable energy.
Recycled Water	New technologies are emerging to enable recycled water and stormwater to be used to meet future needs. Westernport Water will continue to participate in the development of new technologies to increase the use of recycled water across the region.
Bass River	Augmenting supplies from in Candowie Reservoir through an interconnection with the Bass River could provide up to 1 000 ML per annum on average depending on passing flow and other environmental obligations.

Wonthaggi Coal Mine

The feasibility of sourcing water from the abandoned "water filled" mines in the Wonthaggi area is currently being assessed in response to the immediate water shortages. Investigations are exploratory in nature at present to collect more information.

Assessing these additional supply sources involves liaison with appropriate regulatory Authorities in particular Southern Rural Water and Melbourne Water.

These options are considered in more detail in Section 5.

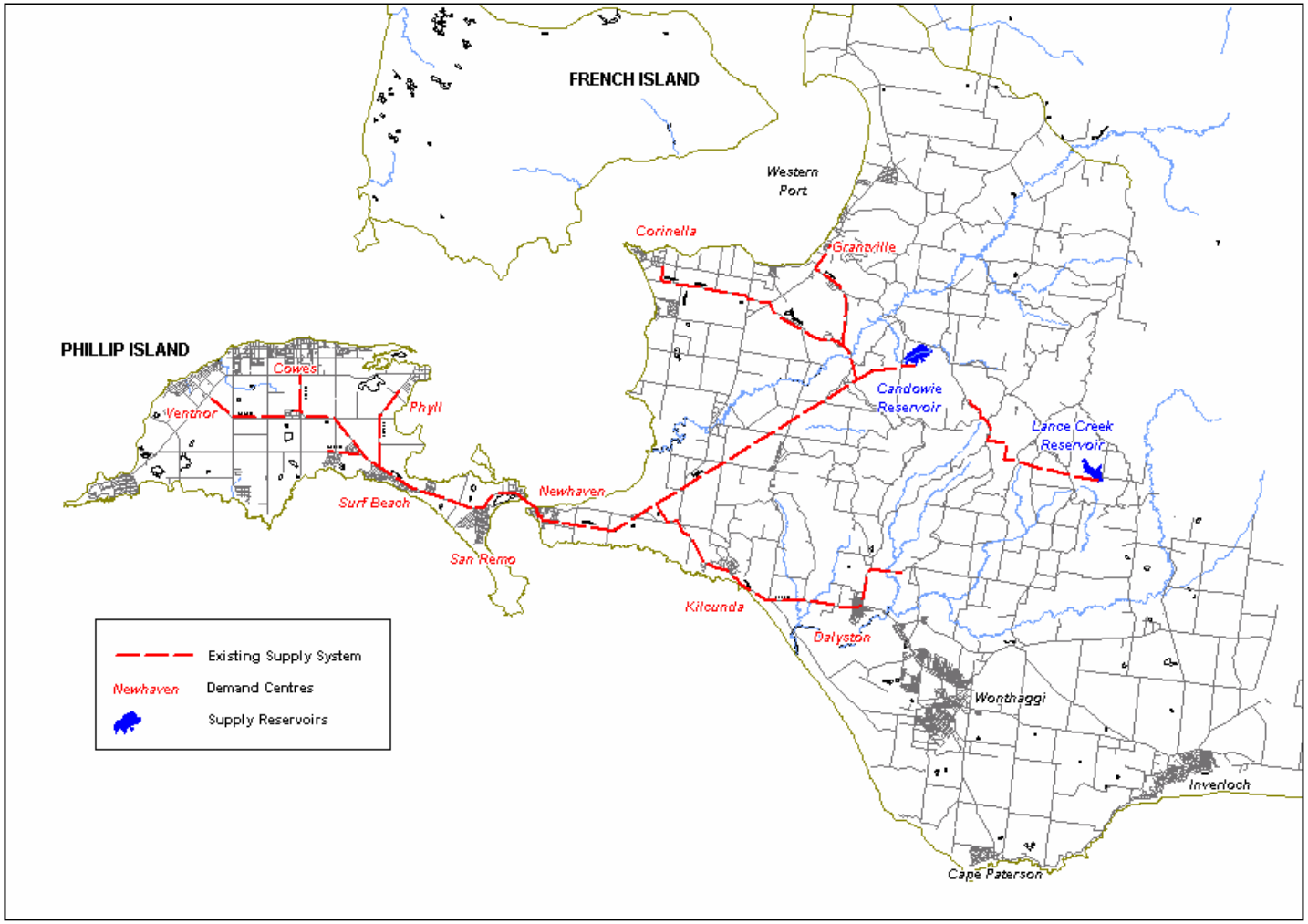
3.1.2 The Supply Network

The Ian Bartlett Water Purification Plant, located at Candowie Reservoir, was built in 1989 and treats all water supplied within Westernport Water's supply system. The water treatment plant (WTP) has a capacity of 30 ML/d.

Treated water from the WTP is piped a total of 37 km via a 650 mm diameter supply main to the main urban demand centres in the region. The capacity of the main is 45 ML/d. Offtake pipelines located along the main pipeline deliver water to other smaller urban areas on the mainland and to the rural areas west and south of Candowie Reservoir.

Figure 1 provides a plan of the Westernport Water Supply System.

Figure 1 Existing Westernport Supply Network



3.1.3 Towns Supplied

The major demand centres supplied through the Westernport System include:

- Grantville;
- Corinella;
- San Remo;
- Phillip Island (Cowes, Newhaven, Ventnor, Rhyll, Surf Beach, Rocks);
- Kilcunda; and
- Dalyston.

Westernport Water currently services about 12 000 permanent residents and up to 50 000 residents in total including visitors during peak tourist season (summer holidays). Cowes is the largest demand centre serviced by Westernport Water, with a current permanent population of around 4 000.

A breakdown of population and connections across Westernport Water's Region is provided in the table below. The regions water use is influenced by the significant increase in population during the summer and holiday periods, particularly to Phillip Island. This has been a characteristic of the region for many years and is expected to continue.

Table 2 Summary of Current Population and Connections

Towns Supplied	Permanent Population[1]	Peak Summer Population[2]	Connections[3]		
			Domestic	Non-Domestic	Total
Grantville	500	2100	534	110	644
Corinella/ Coronet Bay	1200	3500	1270	78	1348
San Remo	900	2700	693	40	733
Phillip Island (Cowes, Newhaven)	8900	40000	9360	505	9865
Kilcunda	300	1200	217	57	274
Dalyston/ Archies Creek	200	500	168	66	234
Total System	**12 000**	**50 000**	**12 242**	**856**	**13 098**

1. Based on Towns in Time publication from ABS Census 2001and rounded down to 12,000 from 12,600 census figure.
2. Estimate only
3. Source: Westernport Water's Financial and Billing System

3.2 Water Entitlements, System Yield & Reliability

3.2.1 Bulk Water Entitlements

Westernport Water sources the majority of its water from Candowie Reservoir. All water is extracted from this source under the Bulk Entitlement (Westernport) Conversion Order 1997, allowing a maximum diversion of 2 911 ML in any one year, at a rate not exceeding 50 ML/d with 13.3 ML being the maximum amount taken during any one day.

Westernport Water is not required to provide a passing flow downstream of Candowie Reservoir however the Authority is required (and has done so) to implement a program to manage the environmental effects of the authority's works to take water under the bulk entitlement which includes:

- Impacts on the bed and banks of the waterway in the vicinity of works;
- Operation practices to remove silt from works;
- Operational practices to manage the water quality in works on the waterway; and
- Operational rules for managing flood flows through works in the waterway.

Westernport Water is seeking additional entitlements from the Bass River (1 000 ML subject to environmental impact assessment and passing flow requirements) and a permanent extraction licence from the Corinella Aquifer (1 600 ML). Licencing and operating conditions are currently being discussed with the relevant approval Authorities.

Westernport Water will be seeking to convert any extraction licences issued during the current drought period from temporary to permanent Bulk Entitlements as part of its strategy to obtain long term water supply security for the region.

Westernport Water has continued funding to the Lance Creek/Candowie Community Catchment Group for a Landcare facilitator to provide guidance to the group as well as funding to onsite catchment improvements. These catchment improvements include fencing, willow removal and planting trees to improve water quality and extend the wildlife corridors according to the Bass Region Landcare Group biodiversity strategy. Westernport Water partnered this group in developing this strategy.

Westernport Water has installed an inflow stream monitoring station on Tennent Creek a tributary to Bass River to monitor the quality and flow into Candowie Reservoir, this will also monitor the quality of the catchment upstream enabling future catchment projects to be monitored on their effectiveness.

3.2.2 Existing System Yield & Reliability

The yield of a water supply system is defined as the **average** annual volume that can be supplied by a water supply system to an adopted set of operating rules and typical demand pattern without violating a given level of service standard.

The system yield has been estimated using REALM system modeling, which was updated in 2006 (SKM, 2006) covering a 114 year historical modeling period. A summary of the REALM model is provided in the highlight below. For the purposes of this WS-DS, the security of supply has been based on the criterion that the frequency of water restrictions should not occur more often than 15 years on average.

The yield of the existing Westernport Water Supply System, comprising supplies from Candowie Reservoir only, is estimated to be about 1 900 ML/a. It is estimated that the Lance Creek pumping scheme could increase the yield by an additional 500 ML/a, given the existing level of demand on the Lance Creek system. The combined yield of the systems (including supplies from Lance Creek) is therefore estimated to be about 2 400 ML/a, which has been adopted as the baseline current yield for this strategy. The target reliability of the existing Candowie only system, in meeting current demands, is 93 % but in recent years this has been reduced to 86%.

It is acknowledged that the supply from Lance Creek Reservoir will not be available indefinitely. It is assumed that this supply will not be available beyond 2015 and will reduce from 2008 due to South Gippsland Water's increasing utilisation of the resource.

The climate of the Westernport region includes the lush foothills of the Bass Coast Ranges where the average annual rainfall is double that of the wide coastlines of Phillip Island. For example, the catchment of Candowie Reservoir, located in the foothills, receives on average 1 100 mm of rain per year whilst the township of Cowes, on Phillip Island, receives about 765 mm per year.

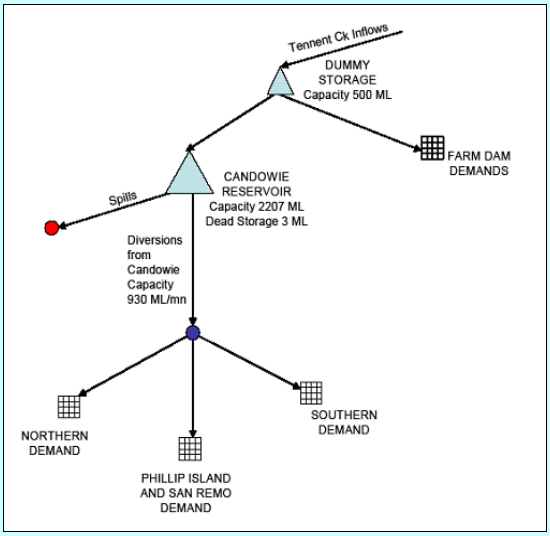
HOW WAS THE WESTERNPORT SYSTEM YIELD ESTIMATED?

The Westernport Water REALM model was updated in 2006 for the purpose of determining the yield of the existing supply system for the Central Region Sustainable Water Strategy.

The REALM model includes Candowie reservoir and the three main demand centers:

- Phillip Island and San Remo;
- Northern Mainland (Corinella, Coronet Bay, Tenby Point, Grantville, Pioneer Bay);
- Southern Mainland (Bass, Wollamai, Kilcunda, Daylston, Archies Creek).

A schematic of the REALM model is shown in the Figure below.



Realm Model Details:

- Period Modeled: 1890 – 2005
- Model Time Step: Monthly

Model Inputs:

- Gauged streamflow on Tenant Creek,
- Rainfall extended using Glen Forbes Station
- Monthly Potential Evaporation
- Historical urban demands represented using gauged data at the Candowie Reservoir outlet

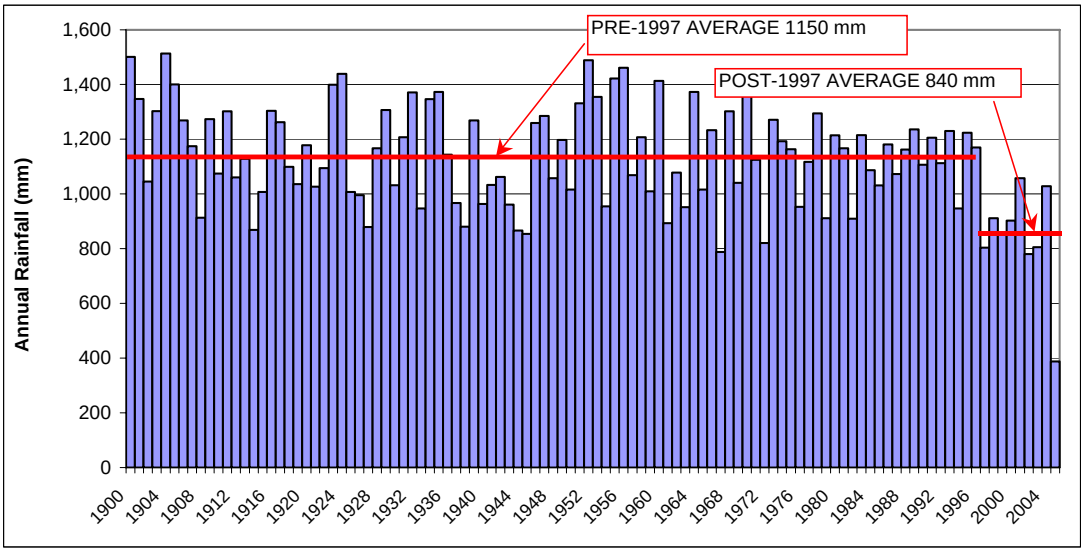
System Yield

The system yield was defined as the annual urban demand which could be supplied such that water restrictions occur once every 15 years, on average or 93% annual reliability. The yield was calculated using the REALM model to determine the number of years in which restrictions are triggered.

The yield of the system (excluding Lance Creek) was estimated to be 1 900 ML/a.

Over the last 10 years, rainfall across the region has been significantly lower than the long term average. This is illustrated in the figure below.

Figure 2 Annual Rainfall for Candowie Reservoir



The continuation of these drier than average conditions would significantly impact on the reliability of the existing water supply system. In addition, the yield of the Westernport Water Supply System under a continuation of low inflows is estimated to reduce by about 20%, to about 1 500 ML/a (excluding any supply from Lance Creek). In line with the CRSWS, this scenario has been taken into consideration when developing the long term strategy for the system.

3.2.3 Water Quality & River Health

Westernport Water is reliant on the health of the Bass River Catchment and in particular Tennant Creek. Protecting the ecosystems of these streams is complex, but crucial to ensuring there is sufficient clean water to drink and a healthy environment that supports a range of ecosystems and recreational and cultural activities.

The Victorian Government's Our Water Our Future program recognised the impacts water extractions have had on river health and put in place actions to increase flows and restore river health. River health will also be impacted by climate change and it is important that the right balance is achieved between protecting our rivers and consumptive water use.

The Port Phillip and Westernport Regional River Health Strategy (RRHS) provides a framework for the overall co-ordination of natural resource management in the region. It also provides a five year blueprint for Catchment Management Authorities, councils, community groups and environmental and industry associations to work together to improve our rivers and creeks.

The Bass River rises near Poowong and flows through Glen Forbes and Bass before joining Westernport, north of San Remo. Tennant Creek is a small tributary which joins the Bass River near Grantville. From a regional perspective, the Bass River has relatively low environmental significance, the current condition is moderate (RRHS)

Westernport Water supports the proposed actions and programs described in the RRHS, these being revegetation, weed control and streamside fencing and also the development of a waterway plan for managing the Bass River and information will be collected on water quality, fish and aquatic macroinvertebrates.

Westernport Waters Actions

The Candowie Reservoir catchment supports agricultural activities including dairy farming. These activities contribute to the nutrients in Candowie Reservoir and increase the risk of blue-green algae outbreaks.

Westernport Water in partnership with the local landcare groups is involved in ongoing projects to improve river health in the Candowie Reservoir catchment. These projects are focussed on restoring riparian zones using indigenous plants in the main feeder creeks entering the reservoir, removing willows creating bank and bed erosion and replacement with indigenous species. Large scale tunnel erosion sites have also been targeted, leading to a reduction in sedimentation and nutrients entering the reservoir.

As part of its investigation into accessing water from the Bass River Westernport Water has commissioned a detailed fish and macro-invertebrate study. This study will take place during 2007.

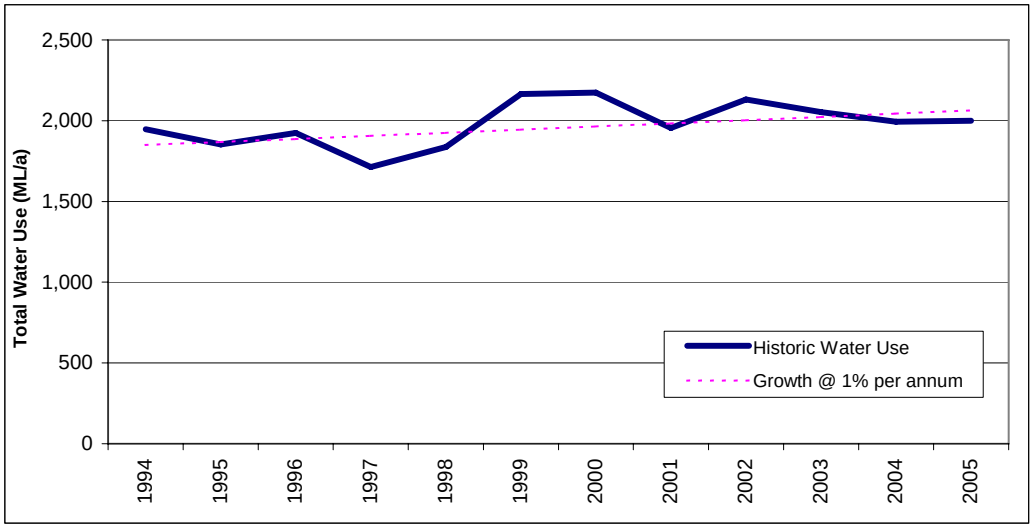
Further investigations into the zoning and land uses in the Candowie catchment are also planned for the 2008 – 2013 Water Plan as part of Westernports intent to improve water quality.

3.3 Historic Water Use

3.3.1 Total Raw Water Use

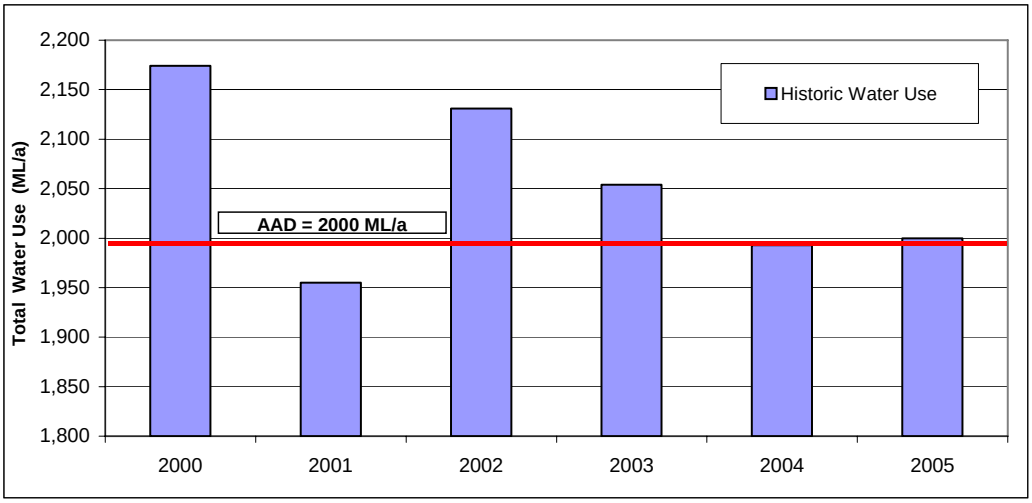
The Westernport region has experienced modest growth in water consumption over the last 10 years. Figure 3 shows that whilst demand has been variable, a gradual increase is evident. This relative low level of growth in demand has occurred despite higher growth rates in population and tourism numbers over recent years. Interestingly, total water consumption has been gradually declining since 2002 possibly related to more sensitive water consumption by customers during the extended dry period. Over this period, water restrictions were implemented in 1997 and 2003.

Figure 3 Historic Total Raw Water Use



Since 1989/91, between 1713 ML and 2170 ML of raw water has been supplied each year. The latest year of 2005/06 1952 ML were used the lowest in the last 6 years. The variability in water use is illustrated in Figure 4 below. For the purposes of this strategy, the adopted unrestricted average annual demand (AAD) is **2 000 ML/a,** based on annual demand totals since 2000.

Figure 4 Total Annual Water Use over the last 6 years



Westernport Water's Permanent Water Savings Plan was introduced in 2005. It is expected that permanent water savings measures (PWSMs) will reduce consumption rates by about 2% or 7 L/person/d annually. Whilst anecdotally it appears that the water savings measures are being implemented by the community, it is still too early to quantify the effectiveness of these measures.

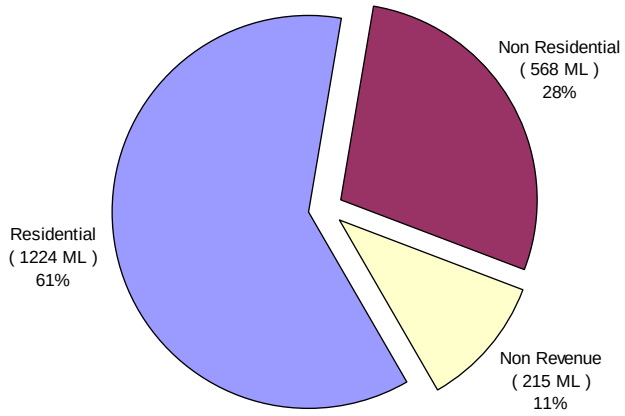
The current average rate of total water consumption (inclusive of PWSMs) on a per capita basis is currently about **323 L/person/d**[1]**,** compared to the 1990's average of about 373 L/person/d.

3.3.2 Distribution of Water Users by Sector

Residential customers used about (61%) of the total water supplied, with about 28% used in industry and businesses. Some 11% is taken up by 'non-revenue water' which includes leakage from water mains (7%) with the remainder used for firefighting, unauthorized use of water or unaccounted for due to meter inaccuracies. This is illustrated in Figure 5.

[1] Based on Equivalent population, refer Section 4.2.2.

Figure 5 Distribution of Water Use



Residential Water Use

It is difficult to determine how water is used within homes. Data from across Australia has been collected by the Water Services Association of Australia, but a recent study undertaken by Yarra Valley Water indicated that 80% is used internally in the kitchen, bathroom and laundry and 20% is used externally on gardens and car washing. Showers (30%) and washing machines (14%) are the highest uses of water inside homes. These are considered to be applicable for the permanent residents of Westernport Water's system which make up about 66% of total residential usage.

Non-Residential Use

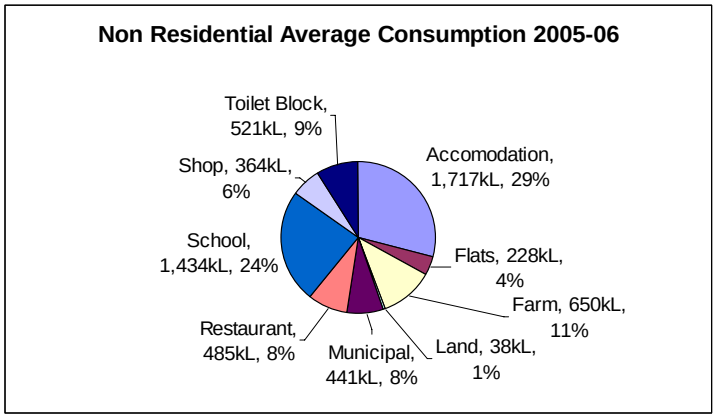
Westernport Water has no major industries within the water supply area with these groups of customers comprising commercial, farms and tourist accommodation and attractions. The major water users in this group are farms that use the water principally for livestock, mainly beef cattle but with a diverse range of livestock, and there are some cropping farms that either produce lucerne or hay or peas. The other large users of water are accommodation places that include apartments, hotels, motels, resorts and caravan parks. Another interesting factor when looking at the largest 100 water users is that there is a number of tourist facilities that cater for the day visitor including 3 public toilet blocks and the Penguin Parade visitor centre. This centre is where the viewing platform for the penguins is located and is a major tourist attraction for Victoria with busloads of tourists arriving daily.

Non Residential Water Use

Major Users 388 ML

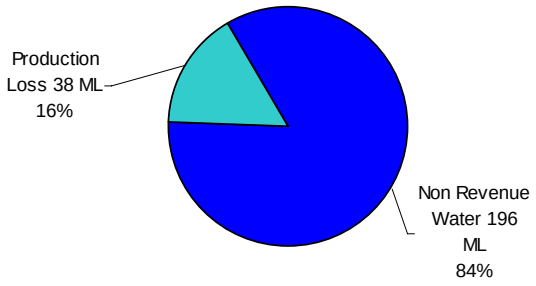
Minor Users 181 ML

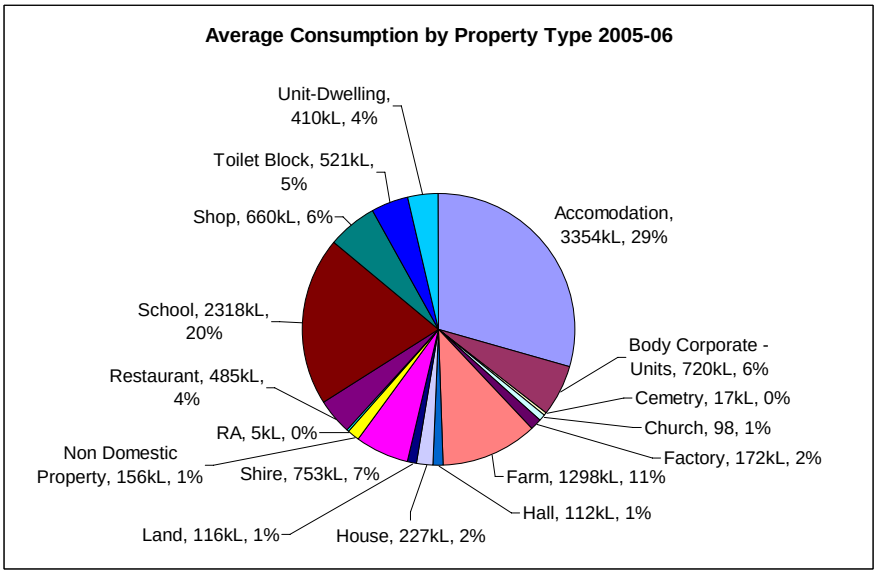
Major users are composed of mainly tourist related commercial enterprises that have grown as tourist numbers have increased in the past. It is expected that this demand will continue to grow. The other major users are farms whose demand will likely stay constant.



Non Revenue Water

Non revenue water refers to water that is either lost through breaks or bursts, mains flushing, meter inaccuracies or unauthorized use of water. This volume of water is the difference between the water entering the supply system and the metered consumption.





4. Future Demand and Supply Needs

4.1 The Challenges Ahead

This Section describes the ability of the system to meet the projected demands in the future and the critical period for which augmentation of water supplies, or demand management measures should be implemented.

In addition, the potential effects of climate change on the security of water supplies have also been considered to assist to identify appropriate actions to mitigate these impacts. Providing adequate flows for rivers is a key requirement for maintaining river health. Others include protecting or restoring habitat and water quality. Westernport Water will therefore continue to assess a range of complementary works to protect these and other aspects of river health to maximise the benefits of the environmental flow regime. These complimentary works may include sediment control in reservoirs, re-vegetation of supply catchments, river bank protection works at proposed diversion sites.

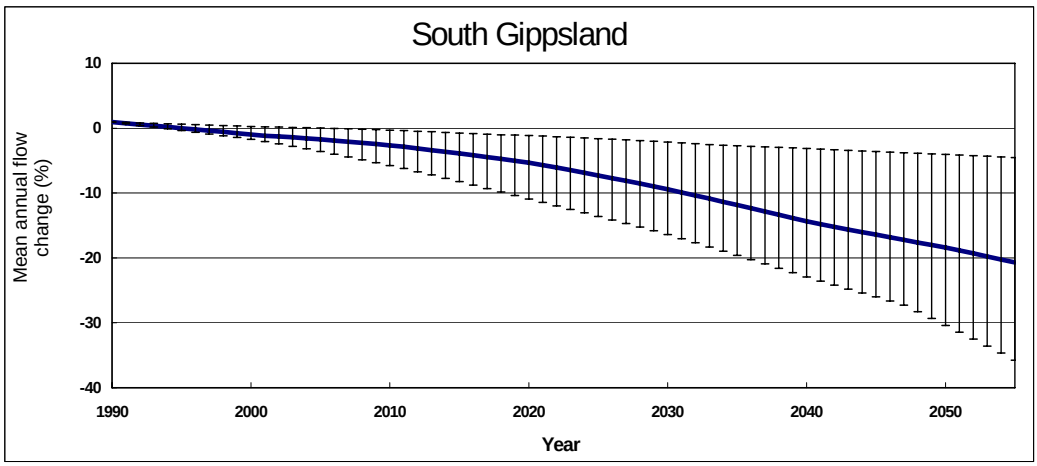
With the threat of the continuation of low inflows, Westernport Water will work with Catchment Management Authorities in developing drought response plans to protect environmental values of our rivers. These actions will also be incorporated into future updates of the Authorities own Drought Response Planning process.

4.2 Supply Forecasts

There is now strong scientific evidence that climate change is happening. The CSIRO and DSE have recently completed a comprehensive investigation of the potential impacts of climate change on surface water supplies across Victoria.

Initial estimates show that climate change could potentially result in a reduction in streamflow of between 3% and 17% (medium about 9%) by 2030 and between 5% and 37% (medium about 21%) by 2055. These reductions are illustrated below.

Figure 6 Estimated Climate Change Impacts on Streamflow

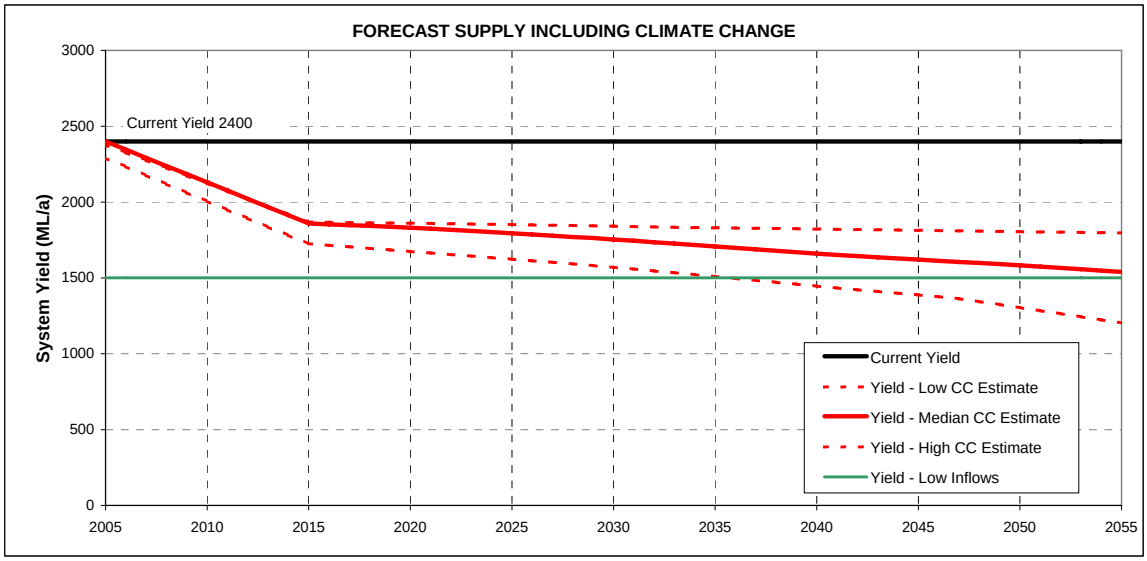


There is a wide range of uncertainty associated with the rate of change and the extent of the impacts of climate change on water resources. To manage this uncertainty, the Strategy takes an adaptive management approach which includes monitoring and reviewing climate change impacts as further information becomes available.

The baseline supply forecast for the Westernport Water's supply system is based on the continued access of water from Candowie Reservoir under the existing Bulk Entitlement for medium climate change impacts on streamflow. Under this scenario the supplementary supply from Lance Creek reservoir is assumed to reduce from 500 ML/a to zero by 2015, to reflect the expected uptake of this resource by South Gippsland Water due to increased demand and climate change. It is assumed that under the medium climate change any reduction in streamflow will see a similar reduction in the yield as all the streamflow flows to the reservoirs. Further modelling of the system is currently being undertaken to confirm the relationship between the reduction in streamflow and the reduction in system yield. This work will also extend to assess surface water / groundwater interactions as this may also have a significant impact on system yield.

An additional baseline supply forecast has also been examined to assess the potential impact of continued low inflows. Under this scenario, it is assumed that the dry conditions experienced over the last 10 years will continue to occur indefinitely and as a result supplementary supplies from Lance Creek Reservoir are immediately discontinued. The yield of the system under low inflow conditions have been estimated to be about 1500 ML/a. The current yield, baseline yield under medium climate change conditions and low flow yields to 2055 are illustrated in the following figure.

Figure 7 Adopted Supply Forecasts



The current yield under existing streamflows is shown to be 2 400 ML/a (1900 ML/a from Candowie and 500 ML/a from Lance Creek). The baseline yield with medium climate change impacts is shown to initially fall from 2 400 ML/a in 2005 to 1 900 ML/a in 2015, representing the declining supply from Lance Creek, and a more gradual decline in the yield from 2015 to 2055. The baseline yield at 2055 is estimated to be 1500 ML/a. The low inflow yield is estimated to be 1500 ML/a. Under low streamflow conditions, the existing 1900 ML/a supply from Candowie Reservoir immediately reduces to 1500 ML/a and no supply would be available from Lance Creek.

4.3 Urban Demand Forecasts

4.3.1 General

Water demand is difficult to forecast because it varies depending on weather conditions, changing population and water use behaviour.

The baseline demand forecast is based on the current consumption level as the starting point and estimates for future population growth and future consumption rates based on the expected behaviour of water users in response to the range of water conservation measures being promoted in this strategy. The forecast is based on several assumptions:

- Victorian Government forecasts for population increases;
- Victorian Government policies for housing stock growth;
- Projections for industrial and commercial growth;
- Water savings from existing water conservation programs (eg. Program working with high non-residential users and Permanent Water Saving Rules);
- Water savings from the current and anticipated adoption of water efficient appliances (eg. water efficient washing machines and showerheads) and rainwater tanks; and
- Water savings from the recent pricing reform.

Previous planning studies undertaken over recent years (Byrne, 2000 & GHD, 2002) have highlighted the difficulties in estimating future demands due to the large uncertainty with estimating the trends with permanent and non-permanent residents for the Bass Coat Shire. These studies have also highlighted that Victoria in Future Estimates provided by the Department of Infrastructure (DSE's preferred method for urban demand forecasting) may not necessarily reflect the population growth rates for towns within the Westernport Water System. An alternative method for estimating future growth in demand has therefore been adopted as described below.

4.3.2 Equivalent Population

For the purposes of this strategy, Westernport Water has used "Equivalent Population" as the basis for estimating future demands. This approach converts visitor/tourist numbers for overnight and day visitors obtained from Tourist Victoria, for this area, into an equivalent permanent resident population. This provides a measure of visitor numbers that will have some impact on water consumption. The number of visitors is divided by the number of days in a year to provide an "Equivalent Population", these visitor numbers include day visitors that will have minimal impact and overnight visitors that are assumed to stay only 1 night. As data on visitor numbers is very limited it is expected that overnight visitors will balance overnight visitors who stay for 2-14 nights and these figures do not include any allowance for holiday home occupation. A uniform consumption rate can then be applied to estimate future demand.

Westernport Water has adopted long term population growth rates as summarised in the following table.

Table 3 Adopted Population Growth Rates

Period	Population Growth Rate[1] (% per annum)	ViF Growth Estimates[2]
2006 – 2015	1.8 to 1.6	2.05 to1.76
2016 – 2020	2.1 to 2.0	1.75 to 1.73
2021 – 2030	1.7 to 1.5	1.73 to 1.55
2030 – 2050	2.1 to 1.4	1.52 to 1.28

1 Equivalent Population

2 Victoria in Future growth estimates based on whole of Bass Coast Shire not true representation of the water supply area of Westernport Water. VIF growth figures on Phillip Island only, 0.4-1.5% higher.

It is expected that over the 50 year planning period, the proportion of permanent to non permanent residents will change as retirees move permanently to the region. As permanent and non-permanent residents have quite different water use characteristics, it is expected that the consumption rate per capita will also change over this period. The long term consumption rates are summarised in the following table.

Table 4 Adopted Long Term Consumption Rates

Period	Total Consumption Rates[1] (L/person/d)
2006 – 2015	331 to 325
2016 – 2020	325 to 324
2021 – 2030	324 to 361
2030 – 2050	361 to 330

1 Equivalent Population

The adopted long term consumption rates are the rates used in the CRSWS before any conservation targets are used to reduce this rate. In the CRSWS the very first figure of 331 in the above table has been transposed into 323. The figure of 361 L/P/d in the year 2030 is an abnormal figure due to a forecast small population growth and a larger demand growth in this year due to changing rates of increase in the forecast figures.

4.3.3 Baseline Demand Forecast

The baseline demand forecasts have been based on forecasted population growth rates and consumption rates as stated above. This forecast allows for the expected high growth over the next 20 to 30 years due to retirees moving to the area. The projections show that demand could increase to 2 270 ML/a by 2015, 3 270 ML/a by 2030 and 4 620 ML/a by 2055, refer Figure 8. The baseline demand forecast excludes any potential increases associated with climate change.

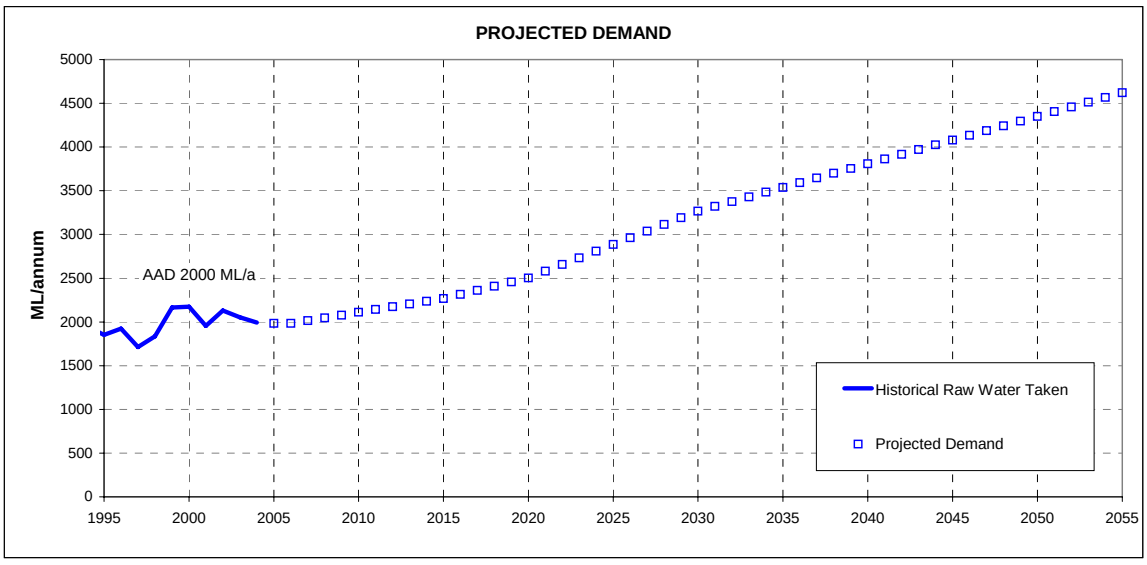


Figure 8 Projected Water Usage to 2055

4.4 The Supply – Demand Balance

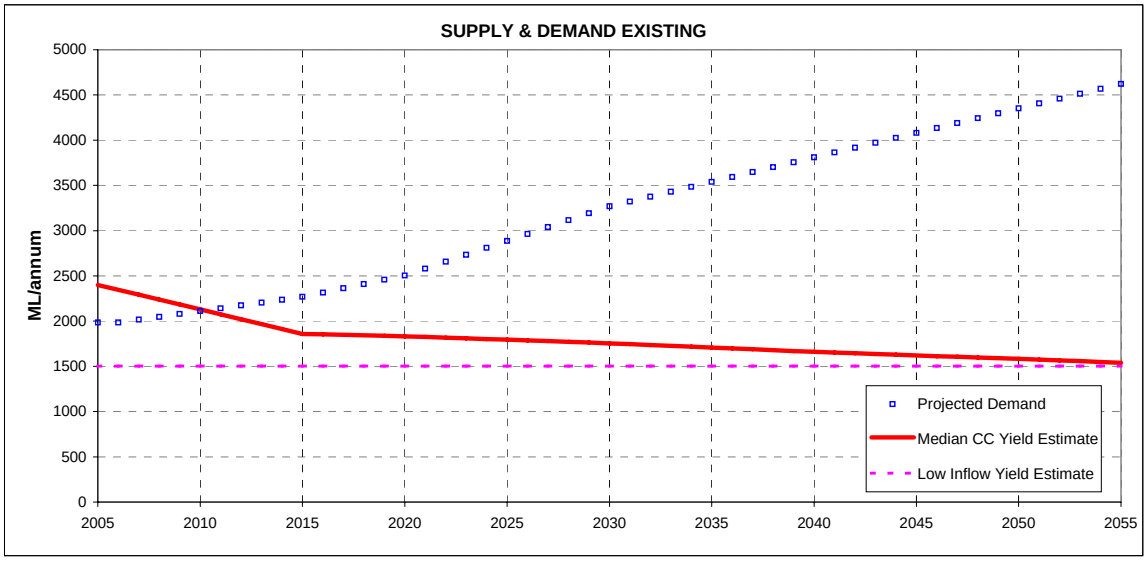
The baseline assessment of the supply-demand balance over the entire 50 year planning period has been undertaken for two scenarios as follows:

Long term average inflows – the estimated yield is based on long term average inflows including a medium climate change impact scenario. The supply from Lance Creek Reservoir is assumed to cease by 2015.

Continued low inflows - the estimated yield is based on a continuation of current low inflows into the future. There is no available supply from Lance Creek Reservoir at any time under this scenario.

Figure 9 provides a comparison of the projected supply-demand balance of the total supply system for the two supply scenarios.

Figure 9 Summary of Current Supply-Demand Balance



Under medium climate impacted streamflow conditions, the current supply exceeds demand by about 400 ML/a. However, this surplus includes the additional supply from South Gippsland Water's Lance Creek Reservoir. The year in which the forecast demand meets the forecast supply is about 2010. If no action is taken, the expected shortfall by 2055 is about 3100 ML/a.

Under the continued low inflow conditions, the current demand **exceeds** the available supply by about 500 ML/a. It is evident that immediate action in response to low inflows is therefore required. In the short term, water restrictions will be used to conserve available supplies until alternative sources are connected to the system.

Summary figures on the supply demand balance are provided in the table below.

Table 5 Predicted shortfalls for Candowie Reservoir System[1]

Scenario		2006	2015	2030	2055
Long term average inflows (medium climate change)	Supply (ML)	2 400	1 900	1 750	1 550
	Demand (ML)	2 000	2 300	3 300	4 650
	Urban water shortfall (ML)	**400**	**-400**	**-1 550**	**-3 100**
Continued low inflows	Supply (ML)	1 500	1 500	1 500	1 500
	Demand (ML)	2 000	2 300	3 300	4 650
	Urban water shortfall (ML)	**-500**	**-800**	**-1 800**	**-3 150**

Note 1 Minor differences from CRSWS result from minor refinements to supply and demand estimates

These figures differ slightly from the data used in the CRSWS due to rounding of the predicted demand. In the CRSWS the demands were rounded to the nearest 100 ML while the figures reported above have been rounded to the closest 50ML including a reduction in demand due to demand management.

If low inflows continue, an additional 500 ML/a would be required over the next two to three years, and up to 800 ML/a is required by 2015, to maintain the required reliability. A range of actions are presented in the following sections to meet the expected shortfall in supply under each of the flow scenarios described above. In 2006, this estimated shortfall was mitigated by implementing water restrictions (ie reducing demand) and also by obtaining water from the Lance Creek supply, which is unlikely to be unavailable in future low inflow years.

5. Options to Secure the Regions Water Future

5.1 Introduction

Conservation and efficiency remain an important focus for Westernport Water and become more effective over time as these measures are implemented and adopted by the community. In the short-term, Westernport Water needs to consider augmentation of additional water supplies until the demand management measures are effective. This will also assist to manage the immediate water shortages occurring due to drought. Over the medium to long term, it is expected that supplies from existing sources will decrease with climate change, highlighting the importance of implementing water saving measures.

Three groupings of options were identified to develop a strategy to manage the supply demand balance over the 50 year planning period. **Conservation and Efficiency** options are aimed at reducing the long term demand for potable water, **Re-use and Recycling** options are aimed at using existing supplies more efficiently and using alternative sources that are "fit for its purpose", and **New Water Sources** assist to identify additional cost effective and sustainable water supplies. The key options in each of these groupings are summarised below.

1. Conservation and Efficiency

A. Permanent Water Savings Measures

B. Improved system efficiency and leakage detection

C. Education and Public Awareness

D. Water Efficiency at Home

- Water efficient appliances
- Water efficient gardens
- Water conservation incentives

E. Pricing Charges

F. Improved Commercial/Industrial Water Usage

- Water Sensitive Urban Design
- Improved industry Usage

2. Re-Use and Recycling

A. Reuse of water from Water Purification plant

B. Reuse of wastewater for potable water substitution

3. New water sources

A. System interconnection with Melbourne System

B. Groundwater supply from Corinella Aquifer

C. Wonthaggi Coal Mine

D. Diversion from Bass River

Numerous options have been assessed in the previous studies (Byrnes 2000 and GHD 2002) with each of these options have distinct advantages and disadvantages. Several of these options have been incorporated into this Strategy, however there are also several options which are not currently supported by Westernport Water, and therefore have not been assessed in this strategy. These include:

- Full raising of Candowie Dam;
- Desalinisation of sea water; and
- Recycling wastewater for direct use in potable water.

Although a full raising of Candowie Dam is not being considered a partial raising of the storage level via mechanical means at the spillway is being assessed as part of the 2008 – 2013 Water Plan.

Further details on each of the shortlisted options are provided in Appendix A and summarised below.

5.2 Conservation and Efficiency

5.2.1 General

Conservation and efficiency options aim to reduce water usage through behaviour changes and improved water management. These options can affect the general community or single organisations and be implemented over short and medium time frames. Conservation and efficiency options assessed under the Westernport Water WSDS are described below. See Appendix A for all the details on conservation and efficiency.

A. Permanent Water Savings Measures This option implements permanent water saving measures that will require customers to reduce their use of water. The following five key water saving measures were applied from 1 December 2005.

Westernport Water is aiming to achieve a 2% reduction in total water consumption which equates to about 40 ML/a.

B. Improved system efficiency and leakage detection This is focussed on the provision of zone metering to the water supply system to isolate the areas where leakages occur. This will allow the Authority to track major leakages in water supply mains and provide the means to rectify the main before the main becomes an obvious burst. This will reduce the water wasted as a result of main leakages throughout the system.

C. Education and public awareness of water conservation is implemented through the water conservation policy. Westernport Water, under the direction of this policy, undertake activities which educate and promote water conservation in the community, encourage and promote substitution of water with reuse and stormwater, plant local trees and shrubs and grasses to reduce watering. In educating and communicating with the community, they do so in closer partnership with councils and government.

D. Water Efficiency at Home A range of initiatives that offer the highest potential to save water at home have been identified. Westernport Water's preferred options include; focus on using water efficient appliances particularly targeting new developments and owners who are renovating properties; water efficient gardens will also be a focus for Westernport Water particularly where house block are larger than those in most urban areas around Melbourne As part of the State Government initiative Westernport Water runs a shower head exchange program where customers exchange their old inefficient showerhead for a new water efficient showerhead. So far over 550 (March 2007) customers have exchanged their old showerheads for new ones.

E. Pricing charges Westernport Water moved from a seasonal pricing structure to a flat pricing structure in 2005/06. The impacts of this new revised pricing structure on water consumption is currently being evaluated by Westernport Water, however additional information is still required to confirm reliable longer term trends.

F. Improved Commercial/Industrial Water Usage This initiative is aimed at Local Councils, local businesses and local industrial usage. Westernport Water will work with these organisations to assess and implement water savings opportunities.

5.2.2 Water Savings & Actions

Preferred options for reducing the demand for potable water including key actions and estimates of the volume of water saved are provided below. Westernport Water will also work with other Victorian Water Authorities, Victorian Water Industry Association and the Department of Sustainability and Environment in developing a Victorian Water Industry End Use Model that will improve demand modelling and forecasting capabilities by better understanding demand and the influencing factors and disaggregating water users (ie residential, open space, industry users etc.)

Table 6 Preferred Options for Reducing the Demand for Potable Water

Water Conservation Option	Actions	Estimated Water Savings by 2055
Permanent Water Savings Measures	◗ Implemented in 2005 ◗ Monitor effectiveness over next 1-2 years	40 ML
Improved system efficiency and leakage detection	◗ Implement zoned metering program ◗ Improve leakage detection and repair programs	30 ML
Education and public awareness	◗ Actively promote water conservation and awareness throughout the community, schools, businesses and industry	100 ML
Water Efficiency at Home	◗ Water conservation incentives/rebates ◗ Water efficient appliances ◗ Water efficient gardens	550 ML
Pricing Charges	◗ Review effectiveness of pricing structure over next 1-2 years	40 ML
Improved industry/commercial water usage	◗ Assist Council and Industry to undertake Sustainable Water Strategies	200 ML
Total		**960 ML**

5.3 Re-Use and Recycling

Westernport Water currently reuses approximately 19% of its treated wastewater, equating to a total volume of 210 ML (based on 2005/2006 usage). The majority of this reuse occurs at the King Road WWTP where treated wastewater effluent is beneficially reused via a land based disposal system. See Appendix A for all the details on re-use and recycling. Westernport Water has already implemented initiatives for wastewater reuse at Cowes WWTP and at the Woolamai WWTP. These currently include:

Cowes WWTP:

- Reuse of approximately 40 ML/a for irrigation of the Cowes Golf Course greens and fairways; and
- Reintroduction of reuse irrigation (10 ML/a) of the Cowes Recreation Reserve (football oval).

These reuse schemes are supplied with Class B^+ recycled water from an Effluent Filtration Facility at the Cowes WWTP site.

In addition, effluent from the plant is also reused on-site on a tree irrigation area and in the treatment process itself, substituting potable water wherever possible for uses such as washing down of trucks and equipment, washing the step screen, scum sprays on secondary sedimentation tanks and backwashing of the filtration facility. It is estimated that approximately 7.5% of effluent treated by the plant was reused in the year 2005/06.

Woolamai WWTP

- The plant is proposed to supply recycled water, by sewer mining, to customers in the area including: local schools; recreation reserve; Westernport Water's new office and depot complex; and possibly a golf course in San Remo.

Other Initiatives

Westernport Water has been actively pursuing new reuse opportunities including:

- Recent issue of a Request for Expressions of Interest for the Use of Recycled Water involving use of Westernport Water owned land at the King Rd and Cowes WWTP sites to undertake value added activities such as trial crops;
- Drought relief through tankered recycled water; and
- Negotiations with three new golf course developments, local Council and schools to use recycled water to irrigate sporting facilities.

The Drought Relief through Tankered Recycled Water program has lead to many innovative applications of recycled water. An example is a local quarry using recycled water to wash down their agitator trucks and to process wetted gravel. This represents up to 5ML/a of potable water substitution. In addition many community groups are benefiting from the Tankered program which assists in raising the awareness of recycled water. To March 2007 approximately 50kL/week of potable water is being saved through the Tankered program.

Westernport Water will begin to target its top 100 water supply customers, providing incentives and opportunities to substitute potable water reuse with recycled water from the treatment plants where feasible.

The top 100 users within Westernport Region currently equate to 20% of the total water consumption, or just under 400 ML/a based on the 2005/2006 total annual water use of 1952 ML. The majority of these users are commercial with the remainder being farms and caravan parks.

The table below provides a summary of the potential recycling schemes, benefits and costs, which could be implemented by Westernport Water when the opportunities arise.

Table 7 Summary Of Recycling Option Costs And Benefits

Opportunities	Level of potable water substitution	Treatment to EPA Class Water Quality	Costs	General Project Risks and Uncertainty
Indirect Potable Reuse - effluent treated to potable water standards is mixed with potable water supplies at storages.	Very High	Drinking Water Standards	High capital and O&M cost	High risk with no existing schemes of this nature and lack of guidelines in Australia and no clear indication of community acceptance.
Domestic Third Pipe System – recycled water is supplied for domestic non-potable water uses including garden watering and toilet flushing.	High.	Requirement for EPA Class A recycled water	High capital and O&M costs	Significant costs and risks (cross connection) associated with modification of internal household plumbing.
Irrigation – supply to private landowners, commercial, industrial and/or recreational users for irrigation purposes.	Low	EPA Class A if irrigation of properties with unrestricted public access EPA Class C recycled water for properties with restricted public access	High capital and O&M costs if EPA Class A recycled water required	Possible significant cost associated with construction of a winter storage if no such storage exists and if there is a need to store recycled water during the non-irrigation period.
Commercial/Industrial – supply to commercial/industrial customers for various purposes such as wash down, cooling water, etc.	Medium	Requirement for EPA Class A recycled water as a minimum	High capital and O&M costs	Costs depending on degree of treatment and the need for a winter storage.

5.4 New Water Sources

Until recently, it was expected that the existing water supply could meet projected demand until about 2010. The current situation has shown that the supply system is vulnerable to extended dry periods and in response, Westernport Water has commenced investigations on a range of water supply options that will meet the short term requirements and longer term objectives. As part of the justification for each of these projects, impacts and proposed mitigation activities on the broader environment and in particular river health will be evaluated. These assessments are under way.

In addition, Westernport Water recognises that some of the options require high energy use and some of the proposed works may increase greenhouse gas emissions (e.g. groundwater pumping). In the selection of preferred options, Westernport Water will develop a carbon neutral approach. An assessment of the costs of a carbon offset to make the works carbon neutral will therefore be included in all project business plans.

The supply options currently being investigated by Westernport Water are summarised in the sections below. Further details are provided in Appendix A.

5.4.1 System interconnection with Melbourne Supply System

This option looks to connect Melbourne Water's existing Tarago – Westernport pipeline to Westernport Water's main supply pipeline from Candowie Reservoir. The connection would involve the construction of a 47 km long, 300 mm diameter pipeline to deliver up to 6.5 ML/day from the Melbourne Water Supply System.

The pipeline would be located on a combination of private property, oil and gas easements, rail reserves and road reserves.

This option provides a high level of reliability as it will use Melbourne Water's network of dams and reservoirs and will only impose a 0.25% extra demand on the Melbourne Water Supply System.

The following are considered as major risks to the project:

- **Authority Approvals**. In-principle approval has been obtained from major stakeholders to locate the pipeline within their easements or road reserves. There remains a risk that full approval from these authorities will not be granted as their position may have changed since they were last consulted. Planning permits may be required from the Bass Coast Shire and the Cardinia Shire including net gain assessments and offsets. Delays in approval from any of the above authorities may delay the program.
- **Costs may escalate from the time of estimation**. A contingency of 10% on the costs estimates has been adopted at this stage. This was based on the functional design and may not be adequate to cover any unforeseen events, which may arise during the detailed design phase.
- **Landowner consultation** has yet to be commenced and therefore the social and political issues associated with the proposed pipeline easement and overall project

approval remains unknown. It community and landowner consultation is not implemented successfully the project could be delayed substantially or even cancelled. Social and political issues associated with the proposed pipeline easement will need to be identified through consultation. The approvals process will involve identification of affected land, negotiation with landholder, land valuation, proposed easement contract, clarification of easement, approval of easement and registration of easement on title.

- **Environmental & Heritage** assessment remains to be completed and therefore the risks associated with the preferred alignment are yet to be determined. Preliminary surveys of the route have been completed that reduces or eliminates any environmental risk to this project. Generally the alignment is within the road reserve but where any significant vegetation is present the route has been moved to the other side of the road reserve or into private land. Almost all private land adjacent to the road reserve is grazing land that has been cleared for decades and has no remnant vegetation or native fauna. The risk of this causing a major delay is small. Initial desk top surveys of heritage sites reveals that there is no recorded sites close to the preliminary route but a full ground survey will reveal most sites. There is a possibility of a minor risk but this would be mitigated by consultation with local groups. The vast majority of the route location has already been disturbed with road works, clearing and grazing, other services and waterway channel works.
- **Access Fee** – Under the 2004 White Paper initiative management of the Bulk Entitlement for the metropolitan system has been delegated to a pool of retailers. Negotiations have been proceeding with the retailers over the payment of an access fee. The fee represents the long run marginal cost of the least cost options to restore the security of supply associated with Westernport Water accessing approximately 2000ML/a from the metropolitan system.

The current estimated capital cost for the preferred pipeline option to deliver 6.5 ML/day is $14.4M, which includes a 10% contingency. This does not include the Access Fee.

The Net Present Cost for this option is $140/ML based on a 5.2% per annum discount rate and 50 year planning period.

5.4.2 Groundwater supply from Corinella Aquifer

The Corinella Groundwater Management Area (GMA) has been identified as a potential new water source that could be harvested to meet the increasing demands of Westernport Customers.

The Corinella GMA is managed by Southern Rural Water and has a permissible consumptive volume (PCV) of 2 550 ML/year. The PCV was set by the Department of Sustainability and Environment (DSE) and represents the maximum sustainable extraction volume for the GMA.

Existing licensed allocations for the Corinella GMA were in the order of 482 ML, which is 19% of the PAV. Therefore, unlike many other groundwater systems, this aquifer system is not over allocated.

To harvest water from the Corinella GMA, Westernport Water would have to obtain a groundwater extraction license from Southern Rural Water. Given that little hydrogeological information exists in this region, further exploratory investigations would be required to identify specific bore locations.

Costs for construction of the bores and connecting to existing supply mains ranges between $800 000 and $3 500 000. The net present cost ranges between $80/ML and $540/ML.

This preliminary appraisal has shown that there are cost effective options to utilise groundwater within the system. Whilst the Corinella GMA has the potential to provide an additional source of water to Westernport Water, the exact details of the augmentation procedure and costs per ML have not been clarified.

This option is currently being implemented. Bore construction licences have been obtained from Southern Rural Water. Several bores have been constructed and one at Grantville is being connected to the recently constructed Bass River pipeline via a 300mm dia x 5.5km pipeline. An application for a diversion licence for 1600Ml/a out of the Corinella aquifer has been submitted to Southern Rural Water. Westernport Water will apply for a bulk entitlement for this 1600ML/a after the current drought contingency emergency works have been completed.

Little is currently known about surface and groundwater interactions and the potential impacts of climate change on the future groundwater resource in the region. As a pre-requisite to the licence approval, a hydrogeological assessment will be undertaken.

5.4.3 Wonthaggi Coal Mine

In collaboration with South Gippsland Water a preliminary project is currently being evaluated to obtain water from the disused Wonthaggi coal mine (WCM). This project is at a preliminary stage and is subject to determination of the quality of the water and testing the volume of water that can be sustainably used both in the short and long term. The WCM option is a new option that has only been developed since the CRSWS had been finalised so it is not an option in the CRSWS. This option was not considered in the CRSWS as the project is a completely new source of groundwater.

A concept investigation was completed to assess options for incorporating coal mine water into the regional water supply system. Little is currently known about the likely supply from this source due to the lack of data. This preliminary evaluation draws on regional groundwater information and the report "Preliminary Investigation Into The Feasibility Of Using Coal Mine Water For Potable Supply And Recharge With Urban Stormwater" (SKM, 2006).

SKM (2006) reports that the yield from the mine areas is in excess of 3 ML/day (or about 1000 ML/a) could be expected. The salinity of the bore water is a major issue.

Concentrations of 5 313 mg/L noted in SKM report for Eastern Area Mine, well in excess of current drinking water standards. Other key issues and risks include:

- Risk of subsidence has not been quantified;
- A location for the pump station and treatment facility needs to be determined; and
- Environmental and social issues cannot be scoped at this stage.

Current key gaps in information include:

- Understanding of surface and groundwater interactions;
- Lack of water quality testing;
- Requirements for water treatment are not known;
- There is a lack of documented pumping trials. Pumping trials are needed to determined draw down rates;
- There has been no stakeholder consultation; and
- Treatment requirements and costs require more investigation.

Likely options to connect this supply to the existing pipe network include:

- Construct a 23 km long pipeline from Wonthaggi to San Remo or alternatively a 19 km pipeline from Wonthaggi to Anderson including additional treatment; and
- Construct pipeline to Lance Creek Reservoir and utilise existing connections and treatment via this system.

The estimate of capital cost to construct a 23 km long pipeline from Wonthaggi to San Remo, pump station and storage tank at the extraction point is approximately $9M. This includes conventional treatment plant for turbidity issues however an additional $3M would be required if treatment was to include salt removal. Annual costs would also need to account for chemical dosing to reduce elements such as manganese levels.

The estimate of capital cost to construct a 20 km long pipeline from Wonthaggi to Lance Creek Reservoir, pump station and storage tank at the extraction point is approximately $5M.

Sourcing water from the Wonthaggi Coal Mine will continue to be explored as part of the Authority's response to the current drought.

5.4.4 Diversion from Bass River

This option is currently being implemented by Westernport Water. An application has been submitted to Southern Rural Water to access 1000 ML/a from the Bass River. Further negotiations have progressed with Melbourne Water over environmental studies and flows required. Work has commenced on a fish and macro-invertebrate study and this will be completed during 2007. A 300mm dia x 2.5km pipeline has already been completed which will allow Bass River flows to be pumped into Candowie reservoir for storage and treatment. Westernport Water will apply for a bulk entitlement

for this 1000ML/a after the current drought contingency emergency works have been completed.

5.4.5 Connecting to Other Water Supply Systems

As all of the New Water Sources will have the capability to provide additional water to this water supply system in excess of our demands in the short term it has become apparent that this extra capacity could be used in adjacent water supply systems.

A preliminary feasibility study, in conjunction with South Gippsland Water, is currently being assessed on the merits of providing an interconnection between Dalyston and Wonthaggi. This study will examine the benefits of using the combined storages at Lance Creek and Candowie to provide water supply from the most advantaged storage depending on the time of year or source of water available. This interconnection is still being assessed and is subject to approval.

5.5 Preliminary Assessment of Options

5.5.1 Introduction

The methodology, for this assessment of the options, was based on the Sustainability Assessment Methodology implemented in the Central Region Sustainability Water Strategy (CRSWS) by the Department of Sustainability, Victoria.

The options were scored against a set criteria, which was determined through consultation and then endorsement from key stakeholders of the CRSWS. The criteria is as follows:

- Net Present Cost ($/ML);
- Effect on Regional GDP and development;
- Greenhouse gas emissions;
- Environmental flow objectives;
- Water Quality;
- Terrestrial ecosystem;
- Acceptability; and
- Cultural heritage and recreational values.

The intention of this sustainability assessment is not to provide a detailed implementation assessment, rather, to act as a tool to provide an assessment of the relative merit of each option for further investigation and/or action. Therefore the criteria has not been weighted, as this would inappropriately emphasis one criteria over another, or tallied. Each criteria is assessed separately across the options. The "most appropriate" option will be a tradeoff between the economics and the environmental and social impacts. Acceptable tradeoffs will depend on the views of the stakeholders.

This assessment merely presents the relative magnitude of the economic, environmental and social impacts, providing a sound basis for proceeding or ruling out options for further investigation. The decision of whether to proceed remains the responsibility of the stakeholders.

Comparative Assessment

A comparative assessment was undertaken for all options against the abovementioned criterion. A summary of the key outcomes is provided below.

Table 8 Sustainability Assessment

Conservation and Efficiency	Key Issues/Opportunities/Constraints
Permanent Water Savings Measures	◗ High level of community support ◗ High likelihood of success
Improve system efficiency and leakage detection	◗ Immediate opportunities identified ◗ Can be implemented as on-going program
Education and public awareness	◗ Effectiveness difficult to quantify
Water Efficiency at Home Water conservation incentives Water efficient appliances Water efficient gardens	◗ High potential with relatively low cost
Pricing Charges	◗ Currently regulated by ESC
Improved Commercial/Industrial Usage Water sensitive urban development Efficient water use in industry/commercial	◗ Improved stormwater quality ◗ Reduce use of potable water in longer term
Reuse and Recycling	
Recycling opportunities from WWTP	◗ Options involving substitution could attract financial support from Westernport Water
New Water Sources	
Corinella Groundwater	◗ Low-Medium uncertainty at this stage ◗ $80/ML to $540/ML depending on location and treatment ◗ Short term priority

Conservation and Efficiency	Key Issues/Opportunities/Constraints
Interconnection with Melbourne System	◗ $140/ML plus connection fee ◗ High reliability and good quality
Bass River Diversions	◗ Lower reliability over the longer term ◗ Short term priority

5.5.2 Preferred Options and Targets

Following a review of demand side and supply side options and estimation of potential savings that could be achieved, a series of targets have been established to assist achieve the strategy objectives. These targets are summarised below.

Table 9 Water Conservation Targets for Securing Water Systems

Conservation and Efficiency	
◗ Permanent Water Savings Measures ◗ Improve system efficiency and leakage detection ◗ Education and public awareness ◗ Water conservation incentives ◗ Water efficient appliances ◗ Water efficient gardens ◗ Pricing Charges ◗ Water sensitive urban development ◗ Efficient water use in industry/commercial	Reduce Total per capita consumption: 25% by 2015 (280 L/p/d) 30% by 2020 (261 L/p/d) Equates to reductions as follows: 313 ML by 2015 484 ML by 2020 531 ML by 2030 729 ML by 2055

Table 10 Targets for Additional Supply Sources

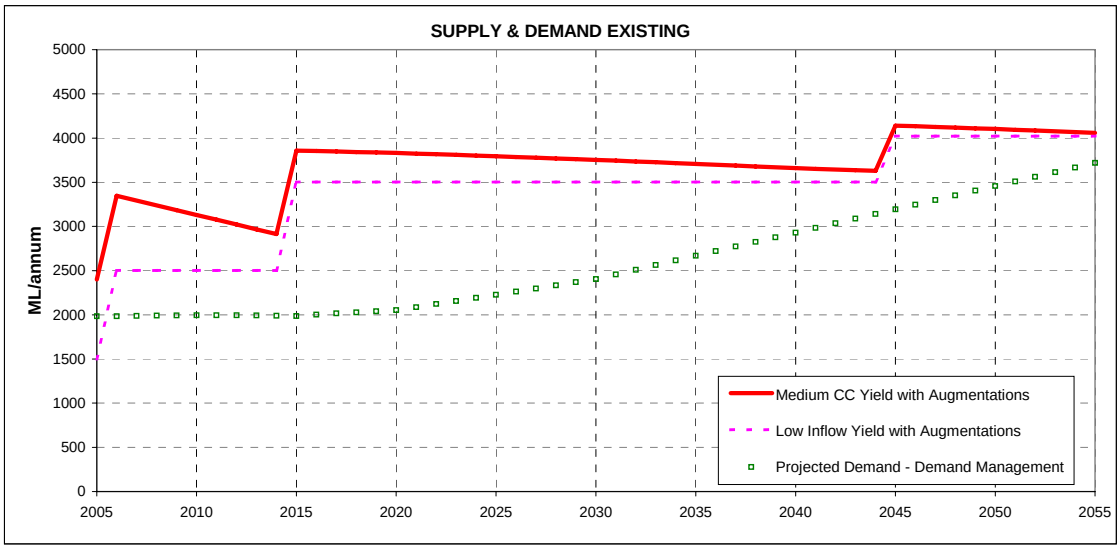
Reuse and Recycling ◗ Recycling opportunities from WWTP	Volumes required as follows: 100 ML by 2006 800 ML by 2015 1800 ML by 2030 3100 ML by 2055
New Water Sources ◗ Corinella Groundwater ◗ Bass River Diversions ◗ Interconnection with Melbourne System	

6. Development Plan & Actions for Securing Our Water Future

6.1 Development Plan

The preferred supply-demand strategy is illustrated in the figure below showing which actions to be adopted to meet the supply and demand balance to 2055.

Figure 10 Supply-Demand Forecast with Targets Achieved



Projected Demand – the demand forecast shown in the figure above incorporates the water conservation targets described in Table 9. It is worth noting, that these targets are aggressive and the rate of reduction in demand will exceed the expected rate of increase in demand due to population growth. Therefore, it is expected that over the next 10-15 years, demand on the system will remain at or around 2000 ML/a, on average. The Authority will closely monitor annual demand over this period and take appropriate action by if an increasing pattern becomes evident.

Supply Forecasts – The figure illustrates that proposed supply augmentations provide the required balance between supply and demand over the 50 year planning period, for both climate change impacted conditions and continued low inflow conditions. The strategy provides for an additional supply source of about 1000 ML/a to be brought on-line immediately. This will also assist with the short term water shortage. The Corinella Aquifer and Diversions from Bass River are both currently being developed and implemented to provide this additional supply. The strategy allows for an additional 600 ML/a to be implemented by about 2015. This additional supply is required to provide sufficient buffer between the available supply and demand to mitigate unforseen issues and future drought conditions. Beyond 2015, it is expected that supply augmentation

should not be required until 2045, provided the identified supply sources provide the anticipated yields.

The key actions for the strategy are detailed in Table 11. These actions are aimed at providing sufficient buffer within the system to mitigate the impacts of climate change, continuation of the existing drought, increased population growth.

Table 11 Actions Established for Securing Water Systems

	Timing of implementation and volume of water provided (ML/year)				
Conservation and Efficiency	2006	2010	2015	2030	2055
Priority actions include permanent water savings measures, leakage detection, and water improved efficiency at home and in industry. Maintaining water savings after the removal of existing water restrictions will also be a short term priority.	50	140	310	900	1000
Re-Use and Recycling	2006	2010	2015	2030	2055
Westernport Water will maintain a strong focus on supporting water recycling opportunities across the region. Options which allow for the substitution of potable water will be favoured in the short to medium terms.	50	100	100	100	100
New Water Sources	2006	2010	2015	2030	2055
Preferred short term options include: Bass River Diversions Corinella Groundwater	500	1200	1600	1600	1600
Preferred medium to long term options include: Interconnection to Melbourne System (Subject to confirmation of sustainability of the Bass River and Corinella groundwater options. May need to be bought forward)	0	0	0	0	2000
Total	2006	2010	2015	2030	2055
Current Shortfall/Surplus throughout Systems (Shortfall from Low Inflows shown in Brackets)	400 (-500)	0 (-700)	-400 (-800)	-1550 (-1800)	-3100 (-3150)
Total volume provided by options (ML/yr)	600	1440	2010	2600	4800

7. Risks, Uncertainties & Gaps

7.1 Risks and Uncertainties

There are several areas of this strategy that rely on limited background information or areas where future trends cannot be readily anticipated. This means that the strategy will need to be dynamic and flexible to evolve as better information becomes available and trends in population and consumption are better understood.

The following assessment provides an appraisal of the major uncertainties and associated risks for consideration.

Table 12 Major Uncertainties with the Strategy

Aspect	Level of Uncertainty	Risks
Population Growth	High	◗ Higher growth may reduce water security forcing options to be brought forward.
Yield and Climate Change	Medium to High	◗ More frequent and severe dry periods can be expected.
Water Conservation Estimates	Medium	◗ Reductions in consumption are not being realised by target dates.
Acceptance for Recycling	High	◗ Community acceptance vital for recycling programs.
Financial Analyses	Medium	◗ Costs for options significantly higher than estimated.
Impacts on regional economy	Medium	◗ Impacts on regional tourism.
Impacts of bushfire on yield	High	◗ Short and long term impacts on water quality and quantity
Long term impacts on river heath	High	◗ Short and long term impacts on water quality and quantity

7.2 Contingencies to Mitigate Future Impacts

The current drought requires immediate attention and has had an impact on the selection of short and long term supply and demand management options. In the short term, augmentation options which achieve an immediate benefit will be favoured with less emphasis on cost. The investment in infrastructure will change possibly resulting in some of the larger yielding longer term options to be deferred.

This strategy has therefore made the assumption that with the availability of water from the Bass River and Corinella aquifer there is a sufficient supply to address the regions water supply needs. As such the Melbourne Water connection has been theoretically deferred to balance the water supply – demand equation.

It is anticipated however that negotiations on a Melbourne Water connection will continue concurrent with the activity to address the immediate water supply issues.

The project to connect to the Melbourne Water system may need to be bought forward to the short to medium term horizon again depending on the sustainability of flows from the Corinella Aquifer and the Bass River. Further details on the aquifer are being obtained and it is expected that over the 2007 and 2008 years the Authority will be in a better position to determine whether the aquifer remains part of the regions long term water supply solution. Historically the Bass River experiences significant flows but further analysis is required, under the assumption of a medium climate change scenario, to forecast the long term sustainability of this water source.

7.3 Current Gaps

There are several areas of this Draft Strategy that will require further evaluation in the future. These include:

- Improved understanding of demographic of current population and the related water use;
- Improved understanding of water consumption rates for various water using sectors including differences between permanent and non-permanent residents;
- Improved understanding of river health, environmental assets and impacts to these assets as a result of the proposed options; and
- Further analyses of risks and uncertainties and the potential impacts on the security of the water supply system.

8. References

SKM (2006), Update of Inputs to the Westernport REALM – Central Region Sustainable Water Strategy, February.

DSE (2006), Sustainable Water Strategy Central Region – Action to 2055, October.

Byrne, A (2000), Review of Augmentation Needs for the Water Supply System – Report to Board, Westernport Water, June.

SKM (2006), Wonthaggi Coal Mine Water Use – Stage 2 Report Preliminary Investigation into the Feasibility of Using Coal Mine Water for Potable Water Supply and Recharge with Stormwater, South Gippsland Water, August.

9. Glossary

Average Annual Demand
The water supplied into the system on a yearly basis averaged over a period

Bulk Water Entitlement
A legal right under the Water Act (1989) to harvest and use water

Catchment
An area of land draining rainfall into a river or reservoir

Cental Region's Sustainable Water Strategy
Overarching strategy of Westernport Water's region for water supply for Victoria's central region.

Demand
The expected average annual future water to be supplied

Desalination
The process of removing salt from seawater or brackish water so that it becomes suitable for drinking or other uses

Ecosystem
A dynamic complex of plant, animal, fungal and micro-organism communities and the associated non-living environment interacting as an ecological unit

Environmental flow
The streamflow required to maintain appropriate environmental conditions in a waterway

Greenfield development
New urban development areas

Greywater
Wastewater from the laundry and bathroom

Groundwater
All subsurface water

Groundwater Management Area
An area where groundwater is or has potential to be developed closely monitored by DSE.

Permissible Consumptive Volume
Amount of water allowed to be pumped from a groundwater source

Sewage
The waterborne waste from a community

Sewage system
The pipes and plant for the collection, removal and treatment of sewage

Streamflow
The flow in a stream or river

Stormwater
Rainfall runoff from urban areas

Triple bottom line
Integrated approach to the achievement of environmental, social and economic outcomes

Water Supply Demand Strategy
Westernport Water's strategy so supply of water is greater than water the water used by customers over the next 50 years

Water utility
An organisation charged with supplying water to towns and cities for urban, industrial or commercial use

WWTP

Wastewater Treatment Plant, turns wastewater or sewerage into water of a better quality for discharge to ocean or streams or reuse

Yield

The quantity of water that a storage or aquifer produces

Appendix A

Option Case Studies

REDUCING DEMAND FOR POTABLE WATER

Conservation & Efficiency

General

Conservation and efficiency options aim to reduce water usage through behaviour changes and improved water management. These options can affect the general community or single organisations and be implemented over short and medium time frames. Conservation and efficiency options assessed under the Westernport Water WSDS are as follows:

A. Permanent Water Savings Measures

B. Improved system efficiency and leakage detection

C. Education and Public Awareness

D. Water Efficiency at Home

- Water efficient appliances
- Water efficient gardens
- Water conservation incentives

E. Pricing Charges

F. Improved Commercial/Industrial Water Usage

- Water Sensitive Urban Design
- Improved industry Usage

Alignment with Current Government Policy

Implementation of water conservation and efficiency measures are the highest priority under The Victorian Government White Paper *"Our Water Our Future"* and the Central Region Sustainable Water Strategy. In accordance with the strategy, Westernport Water has already begun to implement water conservation policy.

Description of Measures

1A. Permanent Water Savings Measures This option implements permanent water saving measures that will require customers to reduce their use of water. The following five key measures were applied from the 1st December 2005.

1. Manual watering systems are to be used only between 7.00pm and 10.00am.
2. Automatic watering systems are to be used only between 10.00pm and 10.00am.
3. Hand held hoses must be fitted with a trigger nozzle (can then be used to wash cars and water gardens and lawns).
4. No hosing of paved areas except in specified circumstances.
5. Before filling new pools/spas (with a capacity of 2000 litres or more), a water conservation

plan application must be lodged with Westernport Water.

Westernport Water is aiming to achieve a 2% reduction in total water consumption which equates to about 40 ML/a.

1B. Improved system efficiency and leakage detection Is focussed on the provision of zone metering to the water supply system to isolate the areas where leakages occur. This will allow the Authority to track major leakages in water supply mains and provide the means to rectify the main before the main becomes an obvious burst. This will reduce the water wasted as a result of main leakages throughout the system.

The Authority maintains a system of meters on the supply mains usually in association with disinfection units. These meters need to be interrogated and analysed to provide proactive maintenance. One option to detect leaks would be to monitor night flows and a rise in this flow may result in a water main leak requiring further investigation. A further part of this option is to identify where additional meters are required to improve this system. This option is currently being implemented with additional meters identified and installed over the next 8 years. Analysis of the data available from all the meters is currently being undertaken.

1C. Education and public awareness of water conservation is implemented through the water conservation policy. Westernport Water, under the direction of this policy, undertake activities which educate and promote water conservation in the community, encourage and promote substitution of water with reuse and stormwater, plant local trees and shrubs and grasses to reduce watering. In educating and communicating with the community, they do so in closer partnership with councils and government.

1D. Water Efficiency at Home A range of initiatives that offer the highest potential to save water at home have been identified. Westernpport Water's preferred options include; focus on using water efficient appliances particularly targeting new developments and owners who are renovating properties; water efficient gardens will also be a focus for Wetsernport Water. In general, house block are typically larger than those in urban areas around Melbourne and also a larger proportion of rural residential blocks also exist. Garden therefore tend to be larger and promotion of drought tolerant grasses and plants will be a major focus; to complement these initiatives Westernport Water will actively lobby the State Government to continue providing incentives to improve the uptake of these initiatives, as well as consideration of extending these incentives or rebates.

1E. Pricing charges Westernport Water moved from a seasonal pricing structure to a flat pricing structure in 2005/06. The impacts of this new revised pricing structure on water consumption is currently being evaluated by Westernport Water, however additional information is still required to confirm reliable longer term trends.

F. Improved Commercial/Industrial Water Usage This initiative is aimed at Local Councils, local businesses and local industrial usage. Westernport Water will work with these organisations to assess and implement water savings opportunities. In the first instance, the Authority will assist these organisations to undertake water audits or sustainable water strategies. Funding for these conservation activities also available from a number of government organisations at present. Westernport Water will also assist these organisations

with applications for securing funding for water conservation works.

Water Savings

Water Conservation Option	Estimated Water Savings by 2055
Permanent Water Savings Measures	40 ML
Improved system efficiency and leakage detection	30 ML
Education and public awareness	100 ML
Water conservation incentives	100 ML
Water efficient appliances	300 ML
Water efficient gardens	150 ML
Pricing Charges	50 ML
Water sensitive urban development	100 ML
Efficient water use in industry/commercial	100 ML
Total	**970 ML**

10.1.1 Sustainability Assessment

These options have little impact on the environment (terrestrial vegetation, river health and greenhouse gas emissions). This is because they focus on changing behaviour or substituting existing infrastructure with water efficient infrastructure.

The confidence of success of these options depends on the level of engagement of the community achieved and the level of commitment required. For options that rely solely on Westernport Waters's actions, are rated as high confidence of success opposed to options that rely on the community changing behaviour, which is more difficult to manage and measure.

These options are economically favourable as the associated actions are low cost to Westernport Water.

Costing of Options

Options at this stage have not been costed by Westernport Water. Further work will be undertaken in this area to identified specific higher priority cost effective initiatives.

WATER RECYCLING

Recycling & Reuse Opportunities

Existing Water Recycling Projects

Westernport Water currently reuses approximately 19% of its treated wastewater, equating to a total volume of 210 ML (based on 2005/2006 usage). The majority of this reuse occurs at the King Road WWTP where treated wastewater effluent is beneficially reused via a land based disposal system.

Current Water Recycling Initiatives

Westernport Water has implemented initiatives for wastewater reuse at Cowes WWTP and at the Woolamai WWTP. This includes:

Cowes WTTP:

- Reuse of approximately 40 ML/a for irrigation of the Cowes Golf Course greens and fairways;
- Provision for the reintroduction of irrigation of the Cowes Recreation Reserve (football oval); and

These reuse schemes are supplied with Class B+ recycled water from an Effluent Filtration Facility at the Cowes WWTP site.

In addition, effluent from the plant is also reused on-site on a tree irrigation area and in the treatment process itself, substituting potable water wherever possible for uses such as washing down of trucks and equipment, washing the step screen, scum sprays on secondary sedimentation tanks and backwashing of the filtration facility. It is estimated that approximately 7.5% of effluent produced by the plant was reused in the year 2005/06.

Woolamai WWTP

- The plant is proposed to supply recycled water, by sewer mining, to customers in the area including: local schools; recreation reserve; Westernport Water's new office and depot complex; and possibly a golf course in San Remo.

Other Initiatives

Westernport Water has been actively pursuing new reuse opportunities including:

- Recent issue of a Request for Expressions of Interest for the Use of Recycled Water involving use of Westernport Water owned land at the King Rd and Cowes WWTP sites to undertake value added activities such as trial crops;
- Drought relief through tankered recycled water; and
- Negotiations with three new golf course developments, local Council and schools to use recycled water to irrigate sporting facilities.

Future Opportunities for Recycling and Reuse

Westernport Water will begin to target its top 100 water supply customers, providing incentives and opportunities to substitute potable water reuse with recycled water from the treatment plants where feasible.

The top 100 users within Westernport Region currently equate to 20% of the total water consumption, or just under 400 ML/a based on the 2005/2006 total annual water use of 1980 ML. The majority of these users are commercial with the remainder being farms and caravan parks.

Immediate recycling opportunities include substitution of potable water for irrigation within farms and caravan parks, where potable water quality is not required.

Further detailed investigation of the uses of potable water by Westernport Water's top 100 high water use customers may identify further opportunities for implementation of recycled water schemes, particularly where large volume users are located in close proximity to each other and/or the recycled water source.

The table attached provides a summary of the potential recycling schemes, benefits and costs, which could be implemented by Westernport Water when the opportunities arise.

Water Savings & Financials

It is difficult to estimate the maximum or likely potential water reuse / recycling at this stage however it is expected that 100 ML per annum is a realistic target initially.

Alignment with the White Paper

The seeking and augmentation of alternative water sources, such as reusing and recycling water is considered the next priority after water conservation. These priorities are spelt out in the Victorian Government White Paper "Our Water Our Future" and the Central Region Sustainable Water Strategy.

Water recycling and reuse is an important long term option as it will reduce our reliance in water from rivers and reservoirs, which will become increasingly scarce due to climate change impacts. Westernport Water is actively perusing water reuse and recycling projects and initiatives in line with the government strategies.

Sustainability

Environmental: Any option which increases the volume of water reused from the WWTP will reduce the outfalls to the ocean.

Greenhouse: Recycling schemes may require additional pumping and therefore increased energy consumption.

Social: Community consultation strategy for this option has not been implemented and therefore any potential social risks have not been identified.

Economic: There are no direct impacts.

Stage of Development

Westernport Water is currently investigating opportunities for implementation of recycling schemes for its top 100 users of water.

SUMMARY OF RECYCLING OPTION COSTS AND BENEFITS

Opportunities	Level of potable water substitution	Treatment to EPA Class Water Quality	Costs	General Project Risks and Uncertainty
Indirect Potable Reuse - effluent treated to potable water standards is mixed with potable water supplies at storages.	Very High	Drinking Water Standards	High capital and O&M cost.	High risk with no existing schemes of this nature and lack of guidelines in Australia and no clear indication of community acceptance.
Domestic Third Pipe System – recycled water is supplied for domestic non-potable water uses including garden watering and toilet flushing.	High.	Requirement for EPA Class A recycled water.	High capital and O&M costs.	Significant costs and risks (cross connection) associated with modification of internal household plumbing.
Irrigation – supply to private landowners, commercial, industrial and/or recreational users for irrigation purposes.	Low	EPA Class A if irrigation of properties with unrestricted public access. EPA Class C recycled water for properties with restricted public access.	High capital and O&M costs if EPA Class A recycled water required.	Possible significant cost associated with construction of a winter storage if no such storage exists and if there is a need to store recycled water during the non-irrigation period.
Commercial/Industrial – supply to commercial/industrial customers for various purposes such as wash down, cooling water, etc.	Medium	Requirement for EPA Class A recycled water as a minimum.	High capital and O&M costs.	Costs depending on degree of treatment and the need for a winter storage.

NEW WATER SOURCES

3A. Interconnection with Melbourne's Water Supply Network

Description

This option looks to connect Melbourne Water's existing Tarago – Westernport pipeline to Westernport Water's main pipeline from Candowie Reservoir. The connection would involve the construction of a 47 km long, 300 mm diameter pipeline to deliver up to 6.5 ML/day from the Melbourne Water Supply System.

The pipeline would be located on a combination of private property, oil and gas easements, rail reserves and road reserves.

This option provides a high level of reliability as it will use Melbourne Water's network of dams and reservoirs and will only impose a 0.25% extra demand on the Melbourne Water Supply System.

The pipeline would augment supply at a maximum of 6.5 ML/day in Stage 1 and further augmentation in Stage 2 to 15 ML/day by year 2025 (if required) with the addition of a further pipeline.

Implementation requires a lead time of about 3 years for Stage 1. Stage 1 could be considered a short term project by Westernport Water as it will be implemented within 5 years.

Project Risks & Uncertainties

The following are considered as major risks to the project:

- **Authority Approvals** from Esso, Origin Energy and Vic Roads. These companies have provided in-principle approval to locate the pipeline within their easements or road reserves. There remains a risk that full approval from these authorities will not be granted as their position may have changed since they were last consulted. Planning permits may be required from the Bass Coast Chire and the Cardinia Shire including net gain assessments and offsets. Delays in approval from any of the above authorities may delay the program.

- **Costs may escalate from the time of estimation**. A contingency of 10% on the costs estimates has been adopted at this stage. This was based on the functional design and may not be adequate to cover any unforeseen events, which may arise during the detailed design phase.

- **Landowner consultation** has yet to be commenced and therefore the social and political issues associated with the proposed pipeline easement and overall project approval remains unknown. It community and landowner consultation is not implemented successfully the project could be delayed substantially or even cancelled. Social and political issues associated with the proposed pipeline easement will need to be identified through consultation. The approvals process will involve identification of affected land, negotiation with landholder, land valuation, proposed easement contract, clarification of easement, approval of easement and registration of easement on title.
- **Environmental & Heritage** assessment remains to be completed and therefore the risks associated with the preferred alignment are yet to be determined. Preliminary surveys of the route have been completed that reduces or eliminates any environmental risk to this project. Generally the alignment is within the road reserve but where any significant vegetation is present the route has been moved to the other side of the road reserve or into private land. Almost all private land adjacent to the road reserve is grazing land that has been cleared for decades and has no remnant vegetation or native fauna. The risk of this causing a major delay is small. Initial desk top surveys of heritage sites reveals that there is no recorded sites close to the preliminary route but a full ground survey will reveal most sites. There is a possibility of a minor risk but this would be mitigated by consultation with local groups. The vast majority of the route location has already been disturbed with road works, clearing and grazing, other services and waterway channel works.
- **Melbourne Water Access Fee** – Under the 2004 White Paper initiative management of the Bulk Entitlement for the metropolitan system has been delegated to a pool of retailers. Negotiations have been proceeding with the retailers over the payment of an access fee. The fee represents the long run marginal cost of the least cost options to restore the security of supply associated with Westernport Water accessing approximately 2000ML/a from the metropolitan system.

The current estimated capital cost for the preferred pipeline option to deliver 6.5 ML/day is $14.4M, which includes a 10% contingency. This does not include the Melbourne Water Access Fee.

The Net Present Cost for this option is $140/ML based on a 5.2% per annum discount rate and 50 year planning period.

Alignment with the White Paper

Augmentation of fresh water supplies is given the lowest priority in government policy as it is recognised that harvesting more water means less for the environment. However, the recent droughts have left some water supplies dwindling, reaching critical supply levels. Despite water restrictions, some areas remain at immediate risk of severe water shortages.

The implementation of priority options such as water efficiency and water conservation measures will take some time until their full effects are realised and thus are considered as a medium to long term solution.

To mitigate the immediate risk of water shortages, options such as connecting to the

Melbourne Water Supply become favoured. This option ahs the ability to provide a large volume fo water in the short term. However, over the longer term, the reliance on fresh water sources becomes more uncertain as climate change takes it effect.

Westernport Water is pursuing this option in light of the current drought conditions and water shortages.

Sustainability

- Environmental: The main environmental risks which would result from this option is the removal of native vegetation due to the construction of the pipeline. A net gain assessment and associated net gain offset would be required to managed the environmental impact.
- Greenhouse: there will be greenhouse gas emissions as a result of the construction of the pipeline and the operation of the pump station. This is option has one of the largest greenhouse impact of the options considered.
- Social: Community consultation strategy for this option has not been implemented and therefore any potential social risks have not been identified.

Stage of Development

This option as been investigated in some detail in which its feasibility has been confirmed, a preferred alignment agreed upon and preliminary cost estimates provided. Still remaining on the development of this option is environmental assessment, geotechnical investigations, survey, detailed design, easement acquisitions and negotiations, planning permit approval, tender estimates and specification and tender documentation.

Project Costs

The current estimated capital cost for the preferred pipeline option to deliver 6.5 ML/day is $14.4M, which includes a 10% contingency. This does not include the Melbourne Water Access Fee.

The Net Present Cost for this option is $140/ML. based on 5.2% per annum discount rate and 50 year planning period.

B. Augmentation of groundwater from Corinella Aquifer

Description

The Corinella Groundwater Management Area (GMA) has been identified as a potential new water source that could be harvested to meet the increasing demands of Westernport Customers.

The Corinella GMA is managed by Southern Rural Water and has a permissible annual volume (PAV) of 2,550 ML/year. The PAV was set by the Department of Sustainability and Environment (DSE) and represents the maximum sustainable extraction volume for the GMA/

Existing licensed allocations for the Corinella GMA were in the order of 482 ML, which is 19% of the PAV. Therefore, unlike many other groundwater systems, this aquifer system is not over allocated.

To harvest water from the Corinella GMA, Westernport Water would have to obtain a groundwater extraction license from Southern Rural Water. Given that little hydrogeological information exists in this region, further exploratory investigations would be required to identify specific bore locations.

10.1.2 Details

There are two geological formations within the Corinella GMA that are of particular interest to Westernport Water. These are:

- **The Baxter Formation Aquifer**, which is assumed to have a minimum bore yield of 5 L/s and a maximum bore yield of 12 L/s with water quality of less than 500 mg/L TDS; and
- **The Childers Formation Aquifer System**, which is assumed to have a minimum bore yield of 12 L/s and a maximum bore yield of 24 L/s with water quality of around 600 mg/L TDS.

The configuration of the augmentation option is largely dependant on the actual location of the bores, the yield of the bore and the likely water quality. For the purposes of this preliminary appraisal, four bore sites that intersect either the Baxter or the Childers Formation have been evaluated. The quality of the groundwater is unknown at this stage, therefore two of the options include treatment, and two of the options allow for no treatment. The yield for these four bore sites ranges from 5 to 24L/s with the depth of the bore ranging from 50 to 120m. Locations for bore sites at this stage have been selected as they represent the higher yielding sites based on existing information options are detailed below and illustrated on Figure 1.

Bore	Depth	Acquifer	Treatment	Size
BS1	50	Baxter	No	150 – 200
BS2	120	Childers	No	200 – 250
BS3	50	Baxter	Yes	150 -200
BS4	120	Childers	Yes	200 -250

Bore site locations have been selected using the available hydrogeologic information and represents the most likely higher yielding locations. It should be noted that bore sites located closer to the treatment plant or the main pipeline may be viable, but would require further investigative work.

Pipelines are also required to transfer water from the borefield to the existing water supply infrastructure. Design details for each of the bore options are summarised below:

Bore	Details
BS1	◗ 150mm diameter bore approx. 50m deep. ◗ Pump station located adjacent to bore. Peak pump rate 0.4 ML/d. ◗ 1.3 km long pipeline to Candowie Main Pipeline..
BS2	◗ 150mm diameter bore approx. 120m deep. ◗ Pump station located adjacent to bore. Peak pump rate 1 ML/d. ◗ 1.9 km long pipeline to Candowie Main .
BS3	◗ 150mm diameter bore approx. 50m deep. ◗ Pump station located adjacent to bore. Peak pump rate 0.4 ML/d. ◗ 8.5 km long pipeline to Candowie Reservoir.
BS4	◗ 200mm diameter bore approx. 50m deep. ◗ Pump station located adjacent to bore. Peak pump rate 1 ML/d. ◗ 10.0 km long pipeline to Candowie Reservoir.

Costs

Preliminary costs estimates have been prepared to assess likely costs relative to other water supply options. These costs are summarised below for the four possible bore sites described above.

Bore	BS1	BS2	BS3	BS4
Capital	$ 800,000	$ 1,100,000	$ 3,000,000	$ 3,500,000
PV Operational	$ 350,000	$ 350,000	$ 850,000	$ 1,450,000
NPC	$ 120	$ 80	$ 420	$ 540

The proximity of the bore field relative to either Candowie Reservoir (for options requireing treatment) or the Candowie Main Pipeline (for options not requiring treatment) influences the cost of these options significantly.

Alignment with the White Paper

Augmentation of fresh water supplies is given the lowest priority in government policy as it is recognised that harvesting more water means less for the environment. However, the recent droughts have left some water supplies dwindling, reaching critical supply levels. Despite water restrictions, some areas remain at immediate risk of severe water shortages.

The implementation of priority options such as water efficiency and water conservation measures will take some time until their full effects are realised and thus are considered as a medium to long term solution.

To mitigate the immediate risk of water shortages, options such as harvesting groundwater become favoured. This option has the ability to provide a larger volumes of water in the short term.

Westernport Water is pursuing this option in light of the current drought conditions and water shortages.

Sustainability

Environmental: The installation and extraction of groundwater from the GMA is likely to affect the groundwater tables immediately surrounding the bore. The bore site has been carefully selected to minimise the impact on base flow in the Bass River and also on the surrounding bore users.

Greenhouse: The requirement for continual pumping of groundwater into the supply pipeline results in this option having one of the largest greenhouse impacts of the options considered.

Social: There are no direct impacts

Stage of Development

Whilst the Corinella GMA has the potential to provide an additional source of water to Westernport Water, the exact details of the augmentation procedure and costs per ML have not been clarified. More detail and information on the yields of the aquifer system, water quality and possible bore locations are required before this option is pursued further.

3C. Wonthaggi Coal Mine

General

In collaboration with South Gippsland Water a preliminary project is currently being evaluated to obtain water from the disused Wonthaggi coal mine (WCM). This project is at a preliminary stage and is subject to determination of the quality of the water and testing the volume of water that can be sustainably used both in the short and long term. The WCM option is a new option that has only been developed since the CRSWS had been finalised so it is not an option in the CRSWS. This option was not considered in the CRSWS as the project is a completely new source of groundwater.

A concept investigation was completed to assess options for incorporating coal mine water into the regional water supply system. Little is currently known about the likely supply from this source due to the lack of data. This preliminary evaluation draws on regional groundwater information and the report "Preliminary Investigation Into The Feasibility Of Using Coal Mine Water For Potable Supply And Recharge With Urban Stormwater" (SKM, 2006).

SKM (2006) reports that the yield from the mine areas is in excess of 3 ML/day (or about 1000 ML/a) could be expected. The salinity of the bore water is a major issue. Concentrations of 5 313 mg/L noted in SKM report for Eastern Area Mine, well in excess of current drinking water standards.

Any water pumped from the Wonthaggi coal Mines would require construction of a pipeline of DN225 PVC PN16(ID=246mm) pipeline from "Area Mine Workings" to San Remo Basin or the supply main from Candowie to San Remo basin. The existing reticulation pipes in Dalyston and Kilcunda have limited capacity and pressure ratings which would be exceeded if a pump of sufficient capacity was used to transfer the coal mine water from Wonthaggi to the San Remo basin or the supply main.

The "Eastern Area" was highlighted as the area of greatest extraction potential in the SKM report dated 31 August 2006. Another potential site is just west of Wonthaggi near South Dudley the "Dudley Area" at the entrance to the town south of the Bass Highway.

A new pipeline to San Remo basin is approximately 23km long if the existing alignment of the distribution main from San Remo to Corinella is followed, and the Bass Highway Road reserve to Wonthaggi is adopted. Alternatively the pipeline could be constructed 17 km long from Wonthaggi to the supply main just west of Anderson.

Other key issues and risks include:

- Risk of subsidence has not been quantified;
- A location for the pump station and treatment facility needs to be determined; and
- Environmental and social issues cannot be scoped at this stage.

Current key gaps in information include:

- Understanding of surface and groundwater interactions;
- Lack of water quality testing;
- Requirements for water treatment are not known;
- There is a lack of documented pumping trials. Pumping trials are needed to determined draw down rates;
- There has been no stakeholder consultation; and
- Treatment requirements and costs require more investigation.

Likely options to connect this supply to the existing pipe network include:

- Construct a 23 km long pipeline from Wonthaggi to San Remo or alternatively a 19 km pipeline from Wonthaggi to Anderson including additional treatment; and
- Construct pipeline to Lance Creek Reservoir and utilise existing connections and treatment via this system.

The estimate of capital cost to construct a 23 km long pipeline from Wonthaggi to San Remo, pump station and storage tank at the extraction point is approximately $9M. This includes conventional treatment plant for turbidity issues however an additional $3M would be required if treatment was to include salt removal. Annual costs would also need to account for chemical dosing to reduce elements such as manganese levels.

The estimate of capital cost to construct a 20 km long pipeline from Wonthaggi to Lance Creek Reservoir, pump station and storage tank at the extraction point is approximately $5M.

Sourcing water from the Wonthaggi Coal Mine will continue to be explored as part of the Authority's response to the current drought.

Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date