Water Supply Demand Strategy

28 April 2011

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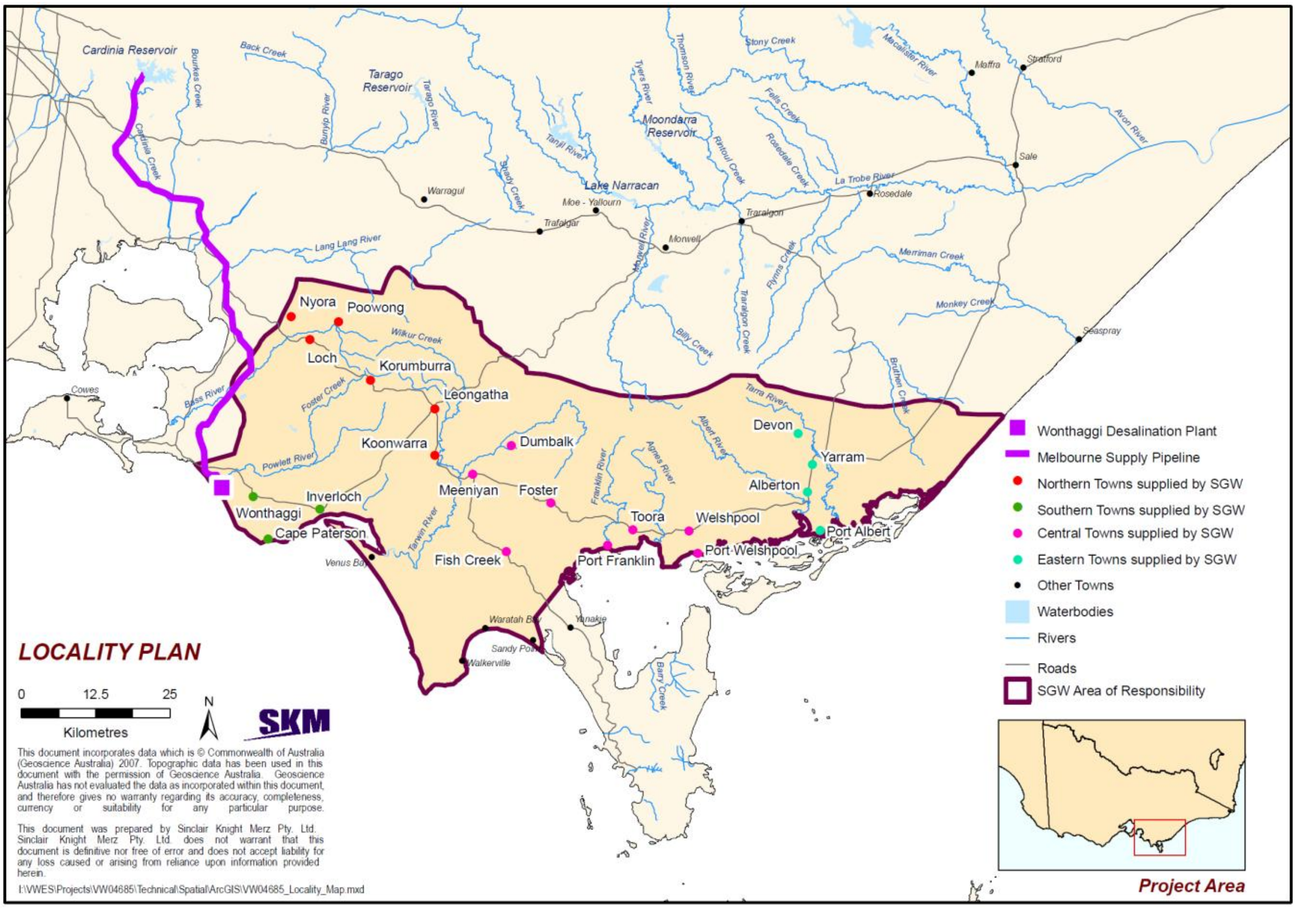
This document was prepared with the assistance of:
Sinclair Knight Merz
ABN 37 001 024 095
Level 11, 452 Flinders Street, Melbourne VIC 3000
PO Box 312, Flinders Lane, Melbourne VIC 8009
Tel: +61 3 8668 3100
Fax: +61 3 8668 3400
Web: www.skmconsulting.com

Executive Summary

South Gippsland Water has responsibility for the current operation and future system planning for 10 separate town water supply systems in its district shown in Figure 1. Future system planning has involved developing, for the district, a Water Supply Demand Strategy (WSDS). Key to this WSDS, which updates South Gippsland Water's previous WSDS prepared in 2007, is the possibility of connecting South Gippsland Water's supply systems to the Melbourne supply system. Connection to the Melbourne supply system provides South Gippsland Water with an opportunity to access a significant volume of water that is not dependent on rainfall. This has the potential to reduce South Gippsland Water's supply risk due to climate change. The approach to this planning study has therefore been to consider future supply options both with and without a connection to the Melbourne supply system.

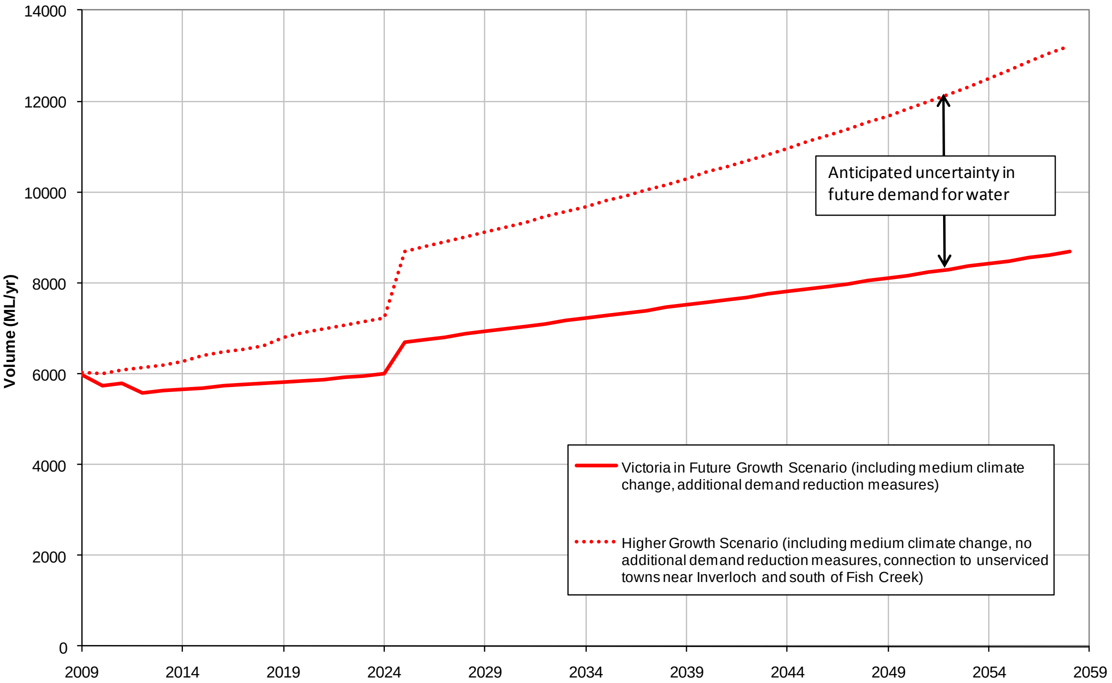
▪ **Figure 1 Locality Map**



South Gippsland continues to grow – with a high rate of growth particularly evident along the coastal strip near Inverloch. Demands for water are expected to increase because towns supplied by South Gippsland Water are close to the ever expanding Melbourne fringe. There is also potential for major industry to relocate to the area. Some industrial water customers who produce saline wastewater are expected to move from Melbourne to take advantage of South Gippsland Water's saline outfall transfer system, which the Victorian Environment Protection Authority (EPA) has noted as being an asset of State-wide significance. Some of South Gippsland Water's existing industrial water customers also have the potential to expand, particularly in the food processing industry. The dairy industry – producing milk, cheese, butter, yoghurt and now more sophisticated protein and pharmaceutical products – is one of the main industries in the region. South Gippsland Water supplies a limited amount of water to dairy farms and a considerable amount of water to dairy processing factories in Leongatha and Korumburra. These factories require a very reliable supply of water.

Water supply and demand strategies for each supply system have been developed for two demand scenarios with sensitivities for additional demand from connection of unserviced coastal towns. The two scenarios are for growth based on Victoria in Future (ViF) forecasts available from the State Government, and a Local Growth forecast based on South Gippsland Water's assumed higher growth scenario, including allowances for higher demand from existing and future major industries. Figure 2 indicates that total water demand from South Gippsland Water's supply systems is expected to increase by at least one third over the next 50 years and could potentially double over this time.

- **Figure 2 Anticipated Growth in Demand for Urban Water in South Gippsland**



South Gippsland Water foresaw the risk of shortfalls in some of its water supply systems many years ago and commissioned strategic assessments of demand and future supply alternatives. This update to the Water Supply Demand Strategy in 2011 follows on from the previous update in 2007. Since that time, South Gippsland Water has implemented its strategy to secure additional water supplies for Leongatha, Korumburra and Yarram with the approval of government environment agencies. The 2011 strategy now also takes into account the effects of the 2006/07 drought year, changes in South Gippsland Water's infrastructure and operation as a result of the drought, the 2006 population census results and projections, and the potential to obtain a supply from the Melbourne Water Supply System. Melbourne's circumstances with supply and demand for water some years ago led the State Government to contract for the design, build and operation of a desalination plant at Wonthaggi with connecting pipeline to the Melbourne water supply system. When operable after 2011, water will be available from this connecting pipeline to the Lance creek water supply system.

In 2010 the State Government funded a 10 ML/d pipeline to provide a water supply from the Lance Creek water supply system (adjacent to the Powlett River near Wonthaggi) to the desalination construction site. After construction of the desalination plant, which is to be commissioned in 2011, this pipeline will be available to South Gippsland Water to connect the Lance Creek system to the Melbourne supply system. The Lance Creek system is currently a very reliable source of water for the towns of Wonthaggi, Cape Paterson and Inverloch. The availability of a connection to the Melbourne supply system provides increased drought security to these towns, as well as the potential to connect other less reliable supply systems and currently unserviced towns.

The approach to this planning study has been to consider future supply options for the northern, southern and central towns both with and without a connection to the Melbourne supply system. South Gippsland Water must carefully consider any cost implications associated with being connected to the Melbourne supply system, and is currently preparing business cases to assess this issue. The connection to the Melbourne supply system also has implications for South Gippsland Water's water treatment operations. The preferred strategy for the northern, southern and central towns, and the unserviced coastal towns, will not be known until the business cases are completed. Therefore South Gippsland Water has developed a dual strategy which allows for the possibility of either developing local water sources or utilising water from the Melbourne supply system.

For the WSDS, South Gippsland Water has planned its demand reduction and supply enhancement measures on the assumption of medium climate change conditions over the next 50 years, based on CSIRO's climate change projections, as reported in Jones and Durack (2005). South Gippsland Water has also prepared itself for the possibility that the low inflow conditions observed since the late 1990s could continue indefinitely. The "ongoing low flows" scenario assumes that long-term climate and streamflow conditions will be similar to those experienced from 1997 to 2009. Many of South Gippsland Water's supply systems have only small storage capacities relative to demand

and inflows, so South Gippsland Water has also considered the resilience of each supply system to severe prolonged drought based on a repeat of the 2006/07 drought in consecutive years.

Strategy Outcomes

The key outcomes from the WSDS assessment process were:

- South Gippsland Water's customers have responded well to calls to reduce water consumption. Consumption has reduced significantly over the last few years and these reductions have been sustained. In many cases this has been achieved despite increases in population and the number of dwellings. South Gippsland Water's demand reduction measures targeting specific user groups have also been successful, such as the measures introduced to assist rural customers with alternative water supplies at Fish Creek and the WaterMAP program for industrial customers. Water conservation remains a top priority – water must be used more efficiently.
- Further demand reduction will be pursued in all supply systems with a target set for:
  - 25% reduction in per capita demand by the year 2015 relative to 1990s average demand;
  - 30% reduction in per capita demand by the year 2020 relative to 1990s average demand.
- These demand reductions will be insufficient to maintain supply at South Gippsland Water's level of service objective for reliability of supply in some supply systems over the 50 year planning horizon. Supply augmentation will be required in these systems.
- **For South Gippsland Water's northern and southern towns**, which includes Poowong, Loch, Nyora, Korumburra, Leongatha, Wonthaggi, Cape Paterson and Inverloch:
  - Supply enhancement is required within the next few years for Poowong, Loch, Nyora and Korumburra.
  - Future supply requirements for Leongatha are dependent on whether proposed water savings at Murray Goulburn result in a reduction in demand from South Gippsland Water's reticulated supply. Additional supply would be required by around 2020 if Murray Goulburn demands remain at current levels.
  - A business case is currently underway which is considering the financial costs and benefits and associated risk profile for two alternative supply strategies for the northern and southern towns. These include supply from enhancing existing separate South Gippsland Water headworks or supply from an interlinked system connected to Lance Creek Reservoir and the Melbourne supply.
  - Preliminary outcomes from the business case and this WSDS indicate that the connection to the Melbourne supply option has the advantage of being more robust to changes in streamflow under climate change and potential increases in demand under the Local Growth scenario. It is also more resilient to severe prolonged drought. This option also potentially improves river health if existing on-stream storages in the Tarwin and Bass

River catchments are decommissioned. Both options were of similar cost at the preliminary costing stage. A definitive preferred strategy is dependent on the outcomes of the business case.
  - Both options would allow the potential to connect the nearby unserviced towns of Venus Bay and Tarwin Lower, which would increase South Gippsland Water's customer base by up to 1,000 ML/yr at the end of the 50 year planning horizon.
- **For South Gippsland Water's central towns**, which includes Dumbalk, Meeniyan, Foster, Fish Creek, Toora, Port Welshpool, Welshpool and Port Franklin:
  - Dumbalk, Meeniyan and Foster have sufficient supply to meet demands at South Gippsland Water's level of service objective for reliability of supply over the 50 year planning horizon.
  - Supply enhancement is required within the next few years for Fish Creek and towns currently supplied by the Agnes River (Toora, Port Welshpool, Welshpool and Port Franklin).
  - Two alternative supply strategies were considered for the central towns, namely enhancing existing separate South Gippsland Water headworks or supply from an interlinked system connecting Foster, Fish Creek and Toora.
  - A preliminary assessment indicated that the interlinked system has the advantage of greater flexibility and robustness to potential future changes in demand at Barry Beach and provides South Gippsland Water with the option to provide reticulated supply to the currently unserviced towns south of Fish Creek. These unserviced towns include Sandy Point, Walkerville, Waratah Bay and Yanakie. A definitive preferred strategy is dependent on the outcomes of further financial analysis, which is currently being undertaken by South Gippsland Water.
- **For South Gippsland Water's eastern towns**, which include Yarram, Port Albert, Alberton and Devon North:
  - South Gippsland Water's current program to purchase up to 400 ML/yr of groundwater licences from existing licence holders for use at its newly constructed bore is expected to be sufficient to meet South Gippsland Water's level of service objective for reliability of supply over the 50 year planning horizon.

A plan of system wide actions is shown in Table 1, along with specific actions for each group of towns in Figure 3 to Figure 5.

The WSDS will be reviewed and updated every 5 years to incorporate additional hydrologic data, changes in demand for water, changes in community expectations and improvements in scientific knowledge. There are several areas of uncertainty for South Gippsland Water in developing the WSDS, which will need to be monitored on an ongoing basis.

Table 1 Action plan – system wide actions

A. Demand Management	
1	Reduce uncertainty in current and future estimates of consumer demand through ongoing monitoring and metering, particularly for major industrial water users
2	Continue current successful water conservation initiatives, including the WaterMap program for major industrial and rural customers
3	Actively pursue opportunities for the use of treated wastewater to offset potable supply
B. System Management	
4	Reduce water leaks and wastage in reticulation systems and water treatment processes
5	Secure dams against leakage and future failures
C. Management for Forward Planning	
6	Monitor stream flows and possible climate change
7	Monitor catchments to ensure reliable supply and quality of water
8	Encourage the use of alternative water sources where appropriate
9	Develop long term plan to extend water supply to unserviced towns
10	Monitor demographic trends, and hence potential demand for water, in cooperation with DSE and local planning authorities

Figure 3 Action Plan for Northern and Southern Towns (preferred option dependent on business case outcomes)

Supply from Existing Separate South Gippsland Water Headworks

Approx. Timing	Action under Victoria in Future Growth	Action under Local Growth
2012/13	Raise Little Bass Reservoir and connect Korumburra to Little Bass Reservoir.	
2016/17	None	Upgrade Tarwin R West Branch supply to bulk entitlement limit.
2017/18	Raise Bellview Creek Reservoir whilst dam safety works are undertaken.	
~2025	Connect unserviced towns near Inverloch to Lance Creek system.	
~2025	None	Increase storage at Leongatha by 1000 ML
2025-2039	None	Connect Leongatha to Melbourne supply
2034-2039	None	Connect Korumburra to Melbourne supply
2040-2047	None	Increase supply to Lance Creek from Melbourne
2044-2049	None	Connect PLN to Melbourne supply

Supply from Melbourne

Approx. Timing	Action under Victoria in Future Growth	Action under Local Growth
2012/13	Connect Poowong, Loch, Nyora and Korumburra to Melbourne supply and decommission water treatment plants. Decommission or seek alternative uses for raw water storages.	
2020	None	Connect Leongatha to Melbourne supply, decommission Leongatha water treatment plant. Decommission or seek alternative uses for raw water storages.
~2025	Connect unserviced towns near Inverloch to Lance Creek system.	Increase supply from Melbourne to above 10 ML/d and connect unserviced towns near Inverloch to Lance Creek system.
2052-2058	Increase supply from Melbourne above 10 ML/d.	Further increase supply from Melbourne.

Figure 4 Action Plan for Central Towns (preferred option dependent on financial analysis outcomes)

Supply from Existing Separate South Gippsland Water Headworks

Approx. Timing	Action under Victoria in Future Growth	Action under Local Growth
2012/13	Construct off-stream storage up to 250 ML at Toora	
2012/13	-Obtain bulk entitlement to divert from Hoddle Creek -Raise Battery Creek Reservoir by 2 metres -Construct weir on Hoddle Creek and diversion pipeline	
~2025	Connect some or all unserviced towns south of Fish Creek from Foster or from new water source	

Supply from Interlinked System

Approx. Timing	Action under Victoria in Future Growth	Action under Local Growth
2012/13	Connect Toora, Foster and Fish Creek treated water systems	
~2025	Connect some or all unserviced towns south of Fish Creek	Connect some or all unserviced towns south of Fish Creek with additional 100 ML off-stream storage at Toora
In response to concrete development proposal at Barry Beach	Consider increasing off-stream storage at Toora in stages up to 250 ML	

Figure 5 Action Plan for Eastern Towns

Approximate Timing	Action
2011	Continue purchasing groundwater licences up to 400 ML/yr from existing licence holders

Glossary

This glossary of terms is largely based on the relevant terms from the glossary used by the Department of Sustainability and Environment for the draft Gippsland Region Sustainable Water Strategy (DSE, 2010).

Aquifer A layer of underground sediments which holds water and allows water to flow through it.

Augmentation Increase in size and/or number.

Baseflows The component of streamflow supplied by groundwater discharge (or simulated from other environmental water).

Bulk Entitlement (BE) The right to water held by water corporations and other authorities defined in the Water Act 1989. The BE defines the amount of water that an authority is entitled to from a river or storage, and may include the rate at which it may be taken and the reliability of the entitlement.

Cap An upper limit for the diversion of water away from a waterway, catchment or basin.

Catchment An area of land where run-off from rainfall goes into one river system.

Catchment management authorities (CMAs) Government authorities established to manage river health, regional and catchment planning, and waterway, floodplain, salinity and water quality management.

Dead storage Water in a storage that is below the lowest constructed outlet.

Desalination Removing salt from water sources – normally for drinking purposes.

Diversions The removal of water from a waterway.

Domestic and stock Water used in households and for pets and other animals.

Drought response plan Used by urban water corporations to manage water shortages, including implementation of water restrictions.

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

Effluent Treated sewage that flows out of a sewage treatment plant.

Environmental flow regime The timing, frequency, duration and magnitude of flows for the environment.

Environmental water reserve (EWR) The share of water resources set aside to maintain the environmental values of a water system.

EPA Victoria Environmental Protection Authority Victoria.

Estuaries Zones where a river meets the sea, influenced by river flows and tides and characterised by a gradient from fresh to salt water.

Farm dams Individually owned storages that capture catchment run-off. Also referred to as small catchment dams.

Floodplain Lands which are subject to overflow during floods. Often valuable for their ecological assets.

Gigalitre (GL) 1,000,000,000 litres.

Greywater Household water which has not been contaminated by toilet discharge, and can be reused for non-drinking purposes. Typically includes water from bathtubs, dishwashing machines and clothes washing machines.

Groundwater All subsurface water, generally occupying the pores and crevices of rock and soil.

Groundwater management area (GMA) Discrete area where groundwater resources of a suitable quality for irrigation, commercial or domestic and stock use are available or are expected to be available.

Groundwater management plans Created for water supply protection areas that have been or are proposed to be proclaimed under the Water Act 1989 to ensure equitable and sustainable use of groundwater.

Groundwater management unit (GMU) Either a groundwater management area (GMA) or water supply protection area (WSPA).

Headworks Dams, weirs and associated works used for the harvest and supply of water.

Inflows Water flowing into a storage or a river.

Instream The component of a river within the river channel, including pools, riffles, woody debris, the river bank and benches along the bank.

Level of service objectives South Gippsland Water's target maximum frequency of restrictions and the objective to maintain continuous supply to customers without running out of water.

Licensing authority Administers the diversion of water from waterways and the extraction of groundwater on behalf of the Minister for Water.

Mean Annual Flow (MAF) is the average flow for the individual year or multi-year period of interest. Mean annual flow is calculated by dividing the sum of all the individual daily flows by the number of daily flows recorded for the year.

Megalitre (ML) One million (1,000,000) litres.

Non-residential Water use in industry, commercial/institutional buildings, open spaces (parks and gardens) and the water distribution system.

Outfall The site of discharge of a liquid from a pipe. Applied particularly to the point at which a sewer discharges to a treatment works or receiving water (such as river, creek or bay).

Passing flow Flows that a water corporation must pass at its reservoirs before it can take any water for consumptive use.

Perennial stream A stream that flows all year.

Permissible consumptive volume (PCV) The volume of water permitted to be allocated in discrete groundwater management areas. Previously called permissible annual volumes (PAVs).

Potable Suitable for drinking.

Qualification of rights The Minister for Water declares a water shortage and qualifies existing water entitlements to reallocate water to priority uses.

Raw water Water that has not been treated for the intended purpose.

Recharge (to groundwater) The process where water moves downward from surface water to groundwater due to rainfall infiltration or seepage/leakage.

Recycled water Water derived from sewerage systems or industry processes that is treated to a standard appropriate for its intended use.

Regional River Health Strategy The key strategy for the protection of river values in each catchment management region in Victoria.

Reliability of supply Represents the annual frequency with which water can be supplied without the need for water restrictions.

Reservoir Natural or artificial dam or lake used for the storage and regulation of water.

Residential use Water use in private housing.

Reticulation Network of pipelines used to deliver water to end users.

River basin The land into which a river and its tributaries drain.

Run-off Precipitation or rainfall which flows from a catchment into streams, lakes, rivers or reservoirs.

Salinity The total amount of water-soluble salts present in the soil or in a stream.

Sewage Wastewater produced from household and industry.

Sewerage The pipes and plant that collect, remove, treat and dispose of liquid urban waste.

Stormwater Run-off from urban areas. The net increase in run–off and decrease in groundwater recharge resulting from the introduction of impervious surfaces such as roofs and roads within urban development.

Streamflow management plan Prepared for a water supply protection area to manage the surface water resources of the area.

Sustainable Diversion Limit (SDL) The upper limit on winter-fill diversions within an unregulated river sub-catchment, beyond which there is an unacceptable risk to the environment.

Unincorporated areas (UA) Areas with limited groundwater resources which are not defined as groundwater management areas and do not have a defined permissible consumptive volume.

Unregulated systems River systems with no large dams or weirs to regulate flow and all groundwater sources.

Water corporations Government organisations charged with supplying water to urban and rural water users. They administer the diversion of water from waterways and the extraction of groundwater. Formerly known as water authorities.

Water Supply Protection Area (WSPA) An area declared under the Water Act 1989 to protect groundwater and/or surface water resources in the area. Once an area has been declared, a water management plan is prepared.

Water-use licence Authorises the use of water on land for irrigation.

Wetlands Inland, standing, shallow bodies of water, which may be permanent or temporary, fresh or saline.

Winter-fill licence A licence issued which permits taking water from a waterway only during the winter months (July-November).

Yield The quantity of water that a storage or aquifer produces. For supply systems in this WSDS it is defined as the average annual demand at which the level of service objectives for supply are just met.

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1. Introduction

1.1. About the Water Supply Demand Strategy (WSDS)

The Water Supply Demand Strategy (WSDS) outlines South Gippsland Water's strategy for managing the water supply and demand balance to its customers over the next 50 years. This long-term view is a component of South Gippsland Water's overall planning processes, which includes planning for drought response, financial expenditure, asset management, water quality and wastewater. Short-term actions presented in this strategy will feed directly into the Corporation's expenditure program. The strategy also formed the basis of South Gippsland Water's input into the Gippsland Region Sustainable Water Strategy, which considered the needs of other water users such as irrigators and the environment in a regional context. The WSDS takes into account regional river health strategies and works within sustainable diversion limits for water resource development set by the State Government.

This strategy is to be reviewed every five years to take into account changes in consumer demand and water availability. Actions which are due to take place more than five years into the future can therefore be reviewed in light of better knowledge when that update takes place. Revision of the WSDS will be particularly important for current areas of uncertainty, such as the impact of climate change on available water supplies.

This update to the Water Supply Demand Strategy in 2011 follows on from the previous update in 2007 and now takes into account the effects of the 2006/07 drought year, changes in South Gippsland Water's operation as a result of the drought, the 2006 population census results and projections, and the potential to obtain a supply from the Melbourne Water Supply System via a pipeline that connects the desalination plant at Wonthaggi, to be commissioned in 2011, to the Melbourne supply system. This review is occurring ahead of schedule in order to ensure that South Gippsland Water's planning is in line with these recent developments.

This strategy was prepared in accordance with the Department of Sustainability and Environment's *Guidelines for the Development of a Water Supply Demand Strategy* (DSE, 2005). These guidelines are in the process of being updated by DSE, but were not finalised prior to the drafting of this WSDS.

1.2. South Gippsland Water's supply systems

South Gippsland Water currently manages ten water supply systems to 21 individual towns, listed in Table 1-1. A locality map of the towns supplied by South Gippsland Water is shown in Figure 1-1.

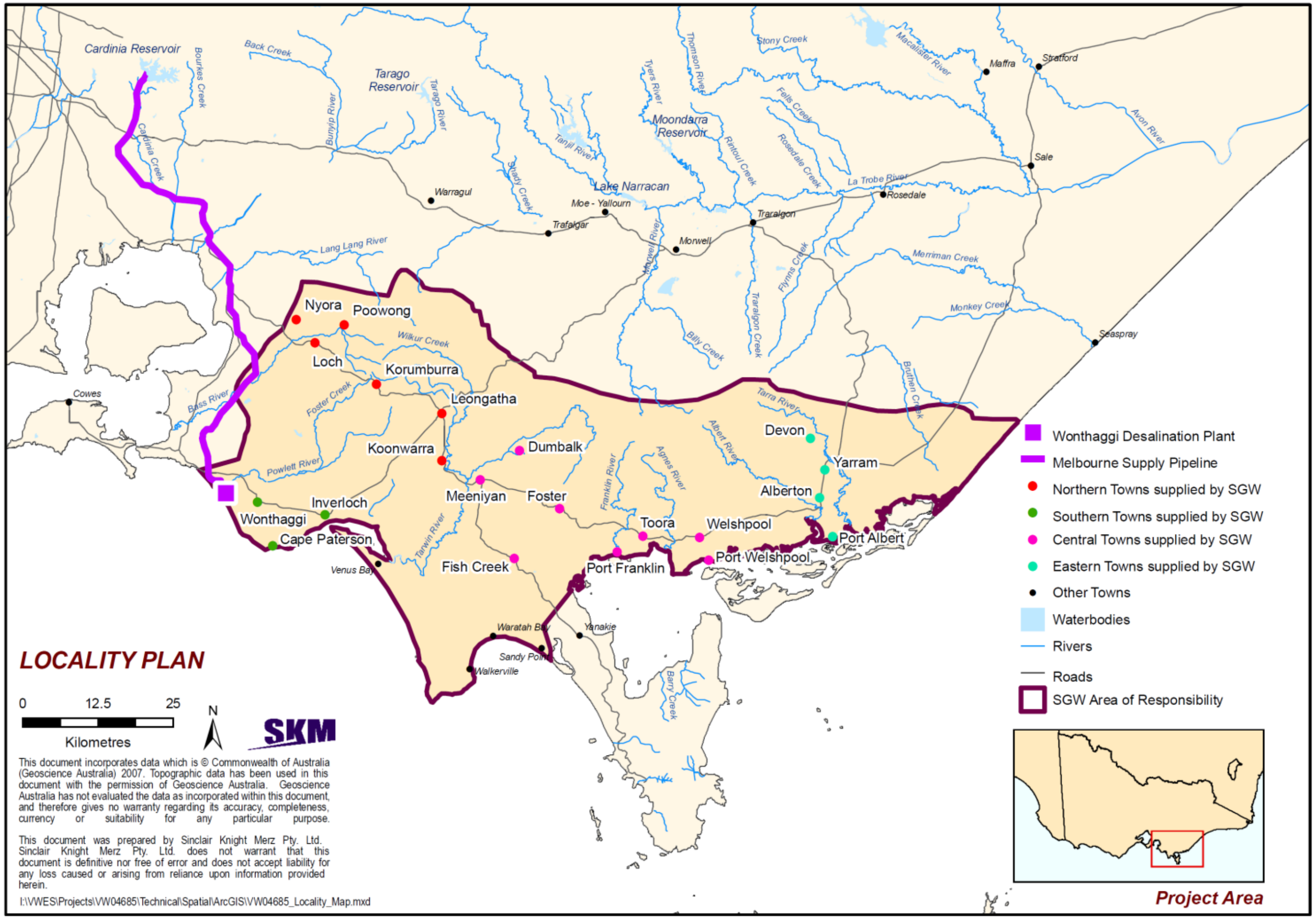
Current raw water demand is presented to indicate the relative size of each supply system. The towns of Poowong, Loch, Nyora, Korumburra, Leongatha and Koonwarra are referred to collectively as South Gippsland Water's "northern towns" and Wonthaggi, Cape Paterson and Inverloch are referred to as South Gippsland Water's "southern towns". Dumbalk, Meeniyan, Foster, Fish Creek, Toora, Welshpool, Port Welshpool, Port Franklin and Barry Beach are referred to as South Gippsland Water's "central towns", whilst "Yarram, Alberton, Port Albert and Devon North are referred to as South Gippsland Water's "eastern towns".

- **Table 1-1 Water Supply Systems Managed by South Gippsland Water**

Supply System	Towns Supplied	Current average raw water demand (ML/yr)(1)
Northern Towns		
Little Bass River	Poowong, Loch, Nyora	264
Coalition Creek	Korumburra	621
Ruby Creek	Leongatha, Koonwarra	1,893
Southern Towns		
Lance Creek	Wonthaggi, Cape Paterson, Inverloch	1,706
Central Towns		
Tarwin River East Branch	Dumbalk	17
Tarwin River	Meeniyan	65
Deep Creek/Foster Dam	Foster	140
Battery Creek	Fish Creek	136
Agnes River	Toora, Welshpool, Port Welshpool, Port Franklin, Barry Beach Port	564
Eastern Towns		
Tarra River	Yarram, Alberton, Port Albert, Devon North	560
	TOTAL	5,966

(1) Estimated at current level of population and industrial development over a long-term climate sequence (typically 40+ years) to account for differences in water demand in wet, average and dry years

Figure 1-1 Locality Map



1.3. Previous long-term water supply planning undertaken by South Gippsland Water

South Gippsland Water's area of operation has one of the fastest growing populations in Victoria. South Gippsland Water has been actively investigating the future water demand and supply balance in its region over a number of years in order to anticipate and adequately plan for any potential future water supply shortfalls.

South Gippsland Water examined specific supply augmentation options for those supply systems that did not meet level of service objectives in 2003 (SKM, 2003b). It then prepared a long-term water supply planning strategy for all of its supply systems in 2004, including options to supply unserviced towns (SKM, 2004b). This strategy pre-empted the State Government's call for a WSDS from Victoria's water authorities, which was prepared and released by South Gippsland Water (2007).

South Gippsland Water is also undertaking various investigations in parallel with the WSDS, which in particular include supply enhancement investigations for connecting to the Melbourne supply, financial business case modelling of options, and bulk entitlement amendments for some surface water systems.

1.4. The Melbourne supply connection and South Gippsland Water's water planning

In 2010 the State Government funded a 10 ML/d pipeline to provide a water supply from the Lance Creek water supply system (adjacent to the Powlett River near Wonthaggi) to the desalination construction site. After construction of the desalination plant, which is to be commissioned in 2011, this pipeline will be available to South Gippsland Water to connect the Lance Creek system to the Melbourne supply system. The Lance Creek system is currently a very reliable source of water for the towns of Wonthaggi, Cape Paterson and Inverloch. The availability of a connection to the Melbourne supply system provides increased drought security to these towns, as well as the potential to connect other less reliable supply systems and currently unserviced towns.

Key to this update of the long-term Water Supply Demand Strategy (WSDS) for South Gippsland is to consider the opportunity for additional water that connection of South Gippsland Water to the Melbourne supply system provides. A connection to the Melbourne supply system provides South Gippsland Water with the option to access a significant volume of water that is not dependent on rainfall. Given the significant reduction in available supply during the 2006/07 drought and the subsequent severe restrictions imposed on customers, this alternative source of water would significantly reduce South Gippsland Water's risk to climate variability and climate change.

The approach to this planning study has been to consider future supply options for the northern, southern and central towns both with and without a connection to the Melbourne supply system. South Gippsland Water must carefully consider any cost implications associated with being connected to the Melbourne supply system, and is currently preparing business cases to assess this issue. The connection to the Melbourne supply system also has implications for South Gippsland Water's water treatment operations. The preferred strategy for the northern, southern and central towns, and the unserviced coastal towns, will not be known until the business cases are completed. Therefore South Gippsland Water has developed a dual strategy which allows for the possibility of either developing local water sources or utilising water from the Melbourne supply system.

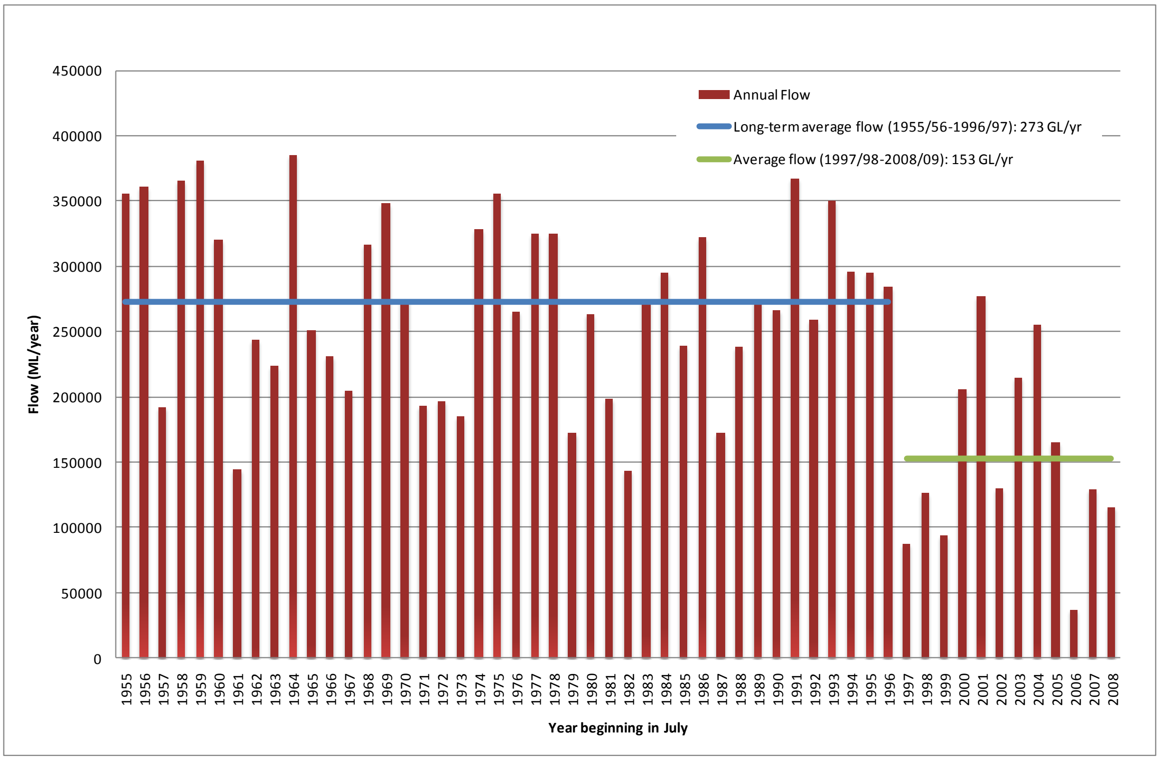
1.5. Climate conditions assumed for the WSDS

South Gippsland, similar to many other parts of south-east Australia, has since the late 1990s experienced the worst prolonged drought on record. The "ongoing low flows" scenario assumes that long-term climate and streamflow conditions will be similar to those experienced from 1997 to 2009. Figure 1-2 presents historical streamflows for the Tarwin River at Meeniyan, which is the site of one of the longest recorded streamflow gauging stations in South Gippsland and includes contributions from streams supplying Korumburra, Leongatha, Dumbalk and Meeniyan. This figure shows that streamflows from July 1997 to June 2008 were around 44% lower than the long-term average prior to July 1997. The figure also shows that dry periods have occurred in the past during the early 1970s and in individual years such as 1982/83. It is arguable that these conditions are due to natural climate variability and it is noted that the reduction in streamflows over the last twelve years is greater than the 15% reduction anticipated under medium climate change conditions by the year 2060.

For the WSDS, South Gippsland Water has planned its demand reduction and supply enhancement measures on the assumption of medium climate change conditions over the next 50 years, based on CSIRO's climate change projections, as reported in Jones and Durack (2005). These are the basis of the climate change projections currently used in the Draft Gippsland Region Sustainable Water Strategy (DSE, 2010). More recent atmospheric modelling has been undertaken by CSIRO as part of the South East Australia Climate Initiative (SEACI), however those modelling results only currently extend to the year 2030, which is well short of the planning horizon for the WSDS. South Gippsland Water will adopt the SEACI modelling results when sufficient guidance is provided by DSE on the appropriate use of this information over the 50 year planning horizon. Such guidance is expected in 2011 for all water utilities across Victoria.

South Gippsland Water has also prepared itself for the possibility that the low inflow conditions observed since the late 1990s could continue indefinitely. The "ongoing low flows" scenario assumes that long-term climate and streamflow conditions will be similar to those experienced from 1997 to 2009.

Figure 1-2 Tarwin River at Meeniyan Streamflows



Many of South Gippsland Water's supply systems have only small storage capacities relative to demand and inflows, so South Gippsland Water has also considered the resilience of each supply system to severe prolonged drought based on a repeat of the 2006/07 drought in consecutive years. Verdon-Kidd and Kiem (2009) previously illustrated that in south-east Australia the Federation drought at the start of the 19th century, the World War II drought in the 1930-40s, and the post-1997 drought were all unique in terms of their underlying climate drivers, and that an alternative combination of climate conditions could potentially result in a drought which is worse than all three of these historical events. This scenario of a consecutive repeat of the 2006/07 climate year, whilst highly unlikely based on historical experience, is therefore nevertheless possible and plausible. Melbourne Water has used a similar scenario in its augmentation planning, which involved a repeat of the three dry years from 2004/05 to 2006/07 (DSE, 2008), however the inclusion of the additional two years prior to 2006/07 is more suited to that supply system which has much longer storage drawdown periods than exist in South Gippsland.

1.6. Consultation process for preparing the 2010 WSDS

1.6.1. Background 2006 - 09

South Gippsland Water's consultation process began in 2006 at the outset of the Water Supply Demand Strategy project. Using a social research consultant with experience in the water industry and the South Gippsland Region the initial consultation was broadly based including major industrial customers, local domestic customer groups and landholders.

The consultation process included workshops in Yarram, Wonthaggi and Leongatha, for customers and information/feedback sessions with relevant local authorities. Over 200 personal invitations were mailed to known interested customers. Customer participation was encouraged by offering incentives and covering costs to attend the workshops.

Following the Governments announcement of the Desalination Plant Project at Wonthaggi a range of new options were available for consideration in the Water Supply Demand Strategy. The advent of the Desalination Plant Project also called for an updated consultation process with key stakeholders and customers.

1.6.2. Consultation & Information Process 2009 -10

South Gippsland Water required the development of a comprehensive information and consultation plan in order to ensure engagement of the widest range of key stakeholder’s on the 2010 revised Water Demand Supply Strategy. Communication consultants were engaged to assist in the preparation and implementation of a Communications Strategy and Action Plan.

In line with the plan presentations, briefings and feedback sessions were undertaken during 2010 with Chief Executive Officers, Councillors of the relevant Shires, other local government authorities, such as the West Gippsland Catchment Authority, relevant State Government Departments, peak bodies of the Victorian Water Industry, Economic and Financial Advisors, and regional community and service groups, across the Region.

The presentations outlined the key elements of the revised Water Supply Demand Strategy including the significant opportunities provided by the possibility of connection to the Melbourne water supply leading to the development of the two options that have been closely assessed – develop existing surface supply systems versus connection to the Melbourne system to supplement and augment supplies. Feedback from participants at the presentations was sought and has been included in the Strategy.

As an ongoing part of the communication process further information and consultation sessions are planned, to present the South Gippsland Water Board endorsed Strategy, to the regions key stakeholders and community throughout 2011.

2. Long-term Planning Objectives

2.1. Introduction

This section of the WSDS outlines South Gippsland Water's objectives in undertaking the WSDS and the water supply objectives that have been set for customers.

2.2. Planning process objectives

The WSDS is a strategy to ensure a reliable supply of water to South Gippsland Water's customers over the next 50 years. The strategy was prepared within the current guidelines for the WSDS and within the policy framework for sustainable urban water management outlined in the State Government's White Paper *Our Water Our Future*. Specifically, this WSDS:

- Determines the expected long-term water demand under different demand scenarios for towns supplied by South Gippsland Water;
- Determines the current available supply to meet those demands;
- Identifies a range of potential demand reduction and supply enhancement options and selects and prioritises actions associated with preferred options.

Key aspects of this current WSDS are that it considers:

- The total water cycle, including demand reduction and alternative supply options;
- Environmental impacts on and risk to the aquatic ecosystems of waterways, wetlands and aquifers, both now and into the future;
- Population growth including "Sea Change Growth" for coastal towns and city fringe development as shown in a "Local Growth" scenario;
- Economic growth for the region's primary industries including milk processing at Leongatha and Korumburra, and attraction of other food processing industries to the region;
- Land use changes, both gradual and event based; and
- Climate change risk.

The WSDS will lead into subsequent feasibility studies, business case analyses and detailed design for proposed demand reduction and supply enhancement options. These will be undertaken prior to seeking Government approvals for the required works. The WSDS provides indicative sustainability assessments for proposed demand and supply enhancement options. It also forms the basis of South Gippsland Water's position for discussions with other water users in the Gippsland Region Sustainable Water Strategy.

2.3. Level of service objectives

South Gippsland Water's current target level of service objectives for maintaining a reliable supply to customers are specified as follows:

- any level of water restriction should not occur more frequently than 1 year in 10 (i.e. 10 years in 100)
- more severe restrictions (levels 3 and 4 of four stages) should not occur more frequently than 1 year in 15 (i.e. ~7 years in 100).

Stages 1 and 2 restrictions tend to restrict the times at which users can use water for certain activities, whereas Stages 3 and 4 restrictions tend to affect the activities that can be undertaken at any time. These level of service objectives for the frequency of restrictions are comparable with other non-metropolitan urban water authorities in Victoria. South Gippsland Water has already implemented permanent water saving measures in line with the rest of Victoria.

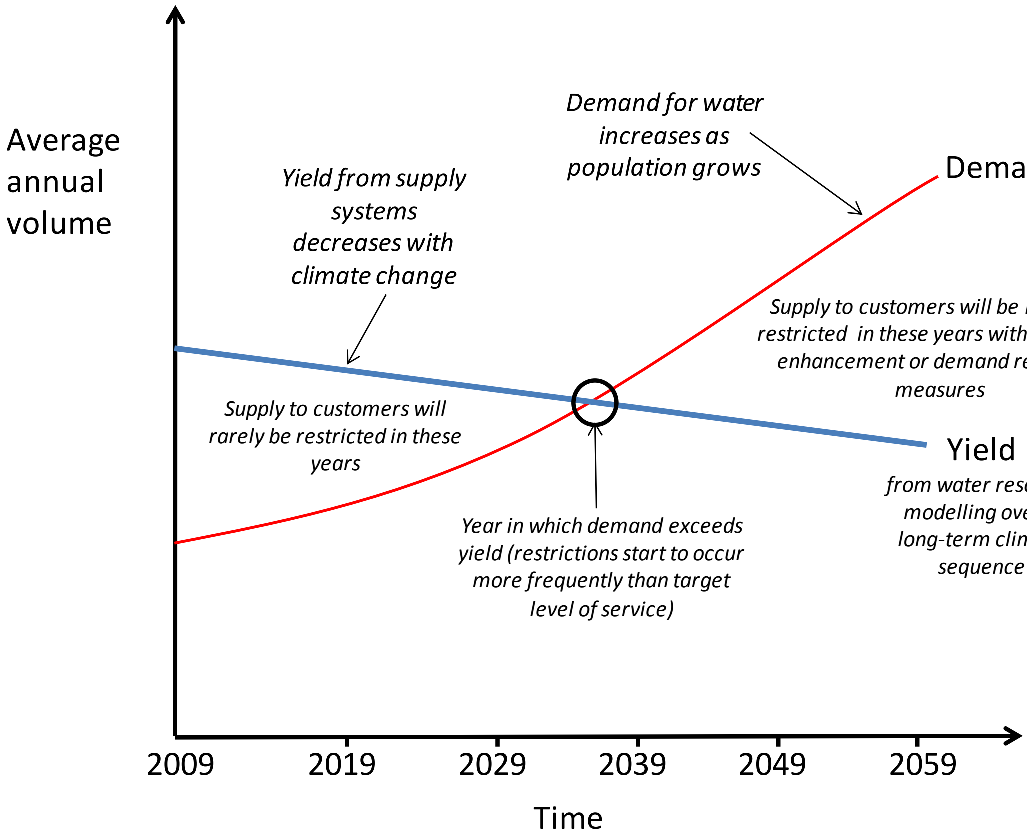
South Gippsland Water will review target levels of service in the future if the reliability of supply to its customers can be improved through accessing more reliable sources of water, such as the Melbourne supply.

2.4. Defining yield

Water supply system yield is the amount of water that can be reliably harvested from a supply system. Yield can be affected by several factors, such as the amount of rainfall in South Gippsland Water's supply catchments, the mix of water sources in each supply system, the available storage, operational rules that South Gippsland Water must follow for extracting water and passing environmental flows, and South Gippsland Water's target reliability for providing supply to customers without restrictions. Yield is defined by the Water Services Association of Australia as "the average annual volume that can be supplied by a water supply system subject to an adopted set of operational rules and a typical demand pattern without violating a given level of service standard" (Erlanger and Neal, 2005). For this Water Supply Demand Strategy, water resource models for each supply system have been used to estimate how much water could be supplied over a long-term climate sequence (typically 40+ years) without experiencing restrictions more frequently than desired (as expressed in Section 2.3) and without running out of water in the most severe drought over that climate sequence. Yield at any point over the planning horizon is defined for this strategy as the average annual demand at which the level of service objectives are just met. Using the average annual demand to define yield allows direct comparison with the future demand projections to determine when demand exceeds available yield.

An illustration of an example supply and demand curve over the planning horizon is shown in Figure 2-1. When projected demands exceed the available yield, it does not imply that South Gippsland Water will no longer be able to supply its customers. For most supply systems it means that the frequency of restrictions would be expected on average over the long-term to be more frequent than desired by South Gippsland Water's customers. Small deviations below the desired level of service are likely to be imperceptible to customers. For example, it is unlikely that customers would be able to perceive a difference if mild restrictions occurred on average in the long-term 1 year in 9 rather than 1 year in 10. Customers would however be likely to perceive a difference if restrictions were to occur 1 year in 5, which would be roughly double the desired frequency of restrictions.

- **Figure 2-1 Yield and demand over the planning horizon – example only**



Where yield is limited by the criterion to not run out of water in the most severe drought, any further increase in demand above this yield is likely to empty bulk water storages in a severe drought and contingency supplies could be required. The possibility of this event occurring in any given year will depend on prevailing climate conditions, but in the long-term will have a low probability of occurrence. For most supply systems a minimum of 40 years of climate data was used in the analysis, which would mean that the likelihood of requiring emergency supply measures is less than 2.5% in any one year. For some supply systems, longer climate sequences were used where available.

Where water is obtained from more than one supply source, the reported yield is for the combined water supply system. Where those two supply sources have a different reliability of supply, the resulting yield will often be greater than the sum of the two individual supply sources, particularly where the timing of supply shortfalls is complementary. Sources of water that are less responsive or unresponsive to climate, such as groundwater and desalination, will therefore often increase supply system yield to an extent greater than the sum of the yield from the individual supply sources.

3. Regulatory Framework Governing Current and Future Water Supply

3.1. Introduction

There are various legislative and regulatory controls when seeking additional sources of water. This section of the WSDS discusses each of those controls and how they influence the decisions that South Gippsland Water can make about its future demand reduction and supply enhancement opportunities. This includes discussion of surface water supply, groundwater supply and desalination.

3.2. Bulk entitlements from rivers

Bulk entitlements define a water corporation's entitlement to take water from water sources such as rivers, reservoirs or other sources of supply. These entitlements are issued to corporations under the *Water Act* 1989. South Gippsland Water currently holds bulk entitlements totalling 14,643 ML, as shown in Table 3-1. This represents the maximum volume that South Gippsland Water could harvest from its water sources in any given year, subject to availability. The summer supply from the Tarwin River West Branch is only available as an interim source of water until 30 June 2015.

Table 3-1 Bulk entitlements held by South Gippsland Water

<table>
<tr><th>Source</th><th>Maximum annual volume (ML/yr)</th><th>Maximum diversion rate (ML/d)</th><th>Minimum passing flows</th></tr>
<tr><td>Little Bass River</td><td>420</td><td>2.7</td><td>Minimum of 0.5 ML/d or natural flow</td></tr>
<tr><td>Coalition Creek storage</td><td rowspan="3">1,000</td><td>4.8</td><td>Minimum of 0.6 ML/d or natural flow</td></tr>
<tr><td>Ness Creek</td><td>1.6</td><td>Minimum of 0.6 ML/d or natural flow</td></tr>
<tr><td>Bellview Creek</td><td>3.0</td><td>Minimum of 1.0 ML/d or natural flow</td></tr>
<tr><td>Ruby Creek</td><td>2,476</td><td>17.3</td><td>Minimum of 0.5 ML/d or natural flow</td></tr>
<tr><td>Coalition Creek at Spencers Road</td><td rowspan="2">1,800</td><td>6.0 (May-Nov)</td><td>Minimum passing flow 10 ML/d</td></tr>
<tr><td>Tarwin River West Branch at Koonwarra</td><td>10.0 (May-Nov)
5.0 (Dec-Apr)*</td><td>Minimum passing flow 90-100 ML/d
Minimum passing flow 15-20 ML/d</td></tr>
<tr><td>Lance Creek</td><td>3,800</td><td>35</td><td>100 ML/yr when Lance Creek storage greater than 3000 ML at 1st December. No daily minimum passing flow.</td></tr>
<tr><td>Powlett River</td><td>1,800</td><td>10</td><td>As per Table 3-2. Winterfill diversions only.</td></tr>
<tr><td>Tarwin River at Dumbalk</td><td>100</td><td>0.72</td><td>No minimum passing flows</td></tr>
<tr><td>Tarwin River at Meeniyan</td><td>200</td><td>1.3</td><td>No minimum passing flows</td></tr>
<tr><td>Deep Creek</td><td>326</td><td>3.5</td><td>Minimum of 0.2 ML/d or natural flow</td></tr>
<tr><td>Battery Creek</td><td>251</td><td>1.0</td><td>No minimum passing flows</td></tr>
<tr><td>Agnes River</td><td>1,617</td><td>4.8</td><td>Minimum of 1.0 ML/d or natural flow</td></tr>
<tr><td>Tarra River</td><td>853</td><td>As per Table 3-3.</td><td>As per Table 3-3.</td></tr>
<tr><td>TOTAL</td><td>14,643</td><td colspan="2"></td></tr>
</table>

*Summer diversion only available until 30 June 2015 as an interim measure

Table 3-2 Powlett River bulk entitlement

Flow in the Powlett River upstream of offtake, F (ML/d)	Flow available for diversion (ML/d)	Minimum passing flow (ML/d)
> 17	10	F – 10
12 – 17	5	F – 5
≤ 12	0	F

Note: F = flow in the Powlett River upstream of the offtake in ML/d.

▪ **Table 3-3 Tarra River bulk entitlement**

Flow in the Tarra River upstream of offtake weir, F (ML/d)	Flow available for diversion (ML/d)	Minimum passing flow (ML/d)
> 12	6	F – 6
6 – 12	0.5 * F	0.5 * F
3 – 6	F – 3	3.0
< 3	0	F

Note: F = flow in the Tarra River upstream of the offtake weir in ML/d.

3.3. Groundwater licences

South Gippsland Water has groundwater licences for groundwater bores at Leongatha and Yarram. Details of these groundwater licences are listed in Table 3-4. One of the groundwater bores at Leongatha is shared with a local landowner. The period of groundwater pumping at Leongatha is restricted to the periods October to December when storage is less than 75% of capacity, and March to May when storage is less than 50% of capacity. In the March to May pumping period the pumping must cease when the storages reach 75% of capacity. South Gippsland Water has obtained in-principle approval from the licensing authority Southern Rural Water to purchase up to 400 ML/yr of groundwater licences at Yarram for extraction at the South Gippsland Water bore at a rate of up to 4 ML/d.

▪ **Table 3-4 Current groundwater licences**

Location	Annual licensed volume (ML/yr)	Maximum extraction rate (ML/d)
Leongatha Bore S9025900/2	310.25	0.85
Leongatha Bore 138891 (shared)	40.0	0.25
Leongatha Bore S9026806/1	91.25	0.25
Leongatha Bore S9029805/2	273.75	0.75
TOTAL Leongatha Bores	386.4*	2.1
Yarram – Golf course	60	1
Yarram – South Gippsland Water bore	Transfer process underway	4

*due to restrictions on the timing of pumping, the maximum annual extraction rate is less than the licensed volume of 715.25 ML/yr

There is also an emergency supply bore at Dumbalk. Its currently unconfirmed yield of 1.5 L/s or 0.13 ML/d is considered insufficient to improve reliability of supply and it was recommended that a new deeper bore should be drilled if groundwater was to remain an emergency supply (SKM, 2003a). South Gippsland Water investigated the costs of providing a new deeper bore and concluded that the high estimated cost was not warranted for its minimal possible future use, and the preferred option is to include restriction of supply and short term carting of water as an emergency supply.

3.4. Future water supply

South Gippsland Water has a range of potential future water supply sources available to meet increases in demand over the planning horizon. The regulatory framework governing these potential future water supply sources are discussed in turn in the following sections, and include:

- Future water supply from rivers and streams (Section 3.5), which includes a discussion of:
  - river basin caps on diversion;
  - winter sustainable diversion limits from streams;
  - streamflow management plans and local management rules for private diversions from streams;
  - heritage rivers which can prevent some water source developments; and
  - regional river health strategies, which highlight environmental condition of rivers and priorities for regional environmental management.
- Future groundwater supply (Section 3.6);
- Future supply from the Melbourne supply system (Section 3.7);
- Future supply from stormwater (Section 3.8); and
- Future supply from treated effluent (Section 3.9).

3.5. Future water supply from rivers and streams

3.5.1. River basin caps and Sustainable Diversion Limits

Basin caps limiting total water use in a river basin have been set for all river basins in Victoria. The South Gippsland Basin is one of the few in Victoria that has remaining entitlements available prior to the cap being reached. The current cap is set at the Sustainable Diversion Limit, which is described below and which is not available uniformly throughout the basin. When this cap is reached in particular rivers, this limits South Gippsland Water's access to new resources, but it also creates a market for water trade which South Gippsland Water could access to obtain entitlements at the market price. If growth were predicted beyond South Gippsland's current bulk entitlement, it would be prudent to seek to obtain an appropriate bulk entitlement volume before the Sustainable Diversion Limit is reached.

The State Government has defined sustainable diversion limits for harvesting additional water from streams. Sustainable diversion limits only apply where a Streamflow Management Plan has not previously been prepared. Under sustainable diversion limits, new diversion from a catchment can only occur over winter months (July to October inclusive) and is subject to:

- **A maximum annual diversion** from the catchment – this ensures that the reliability of winterfill supply is at least 80%.
- **A maximum diversion rate** at any given time from the catchment – this is defined as the difference between the median winterfill flow exceeded in 50% and 80% of years, computed over the months July to October.
- **A minimum flow** at which diversions cease **-** this is defined as the maximum of (i) 30% of the mean daily flow from July to June and (ii) the median daily flow from July to October that is exceeded in 95% of years.

The annual volume available for diversion in the SDL catchment containing each of South Gippsland Water's existing offtakes is shown in Table 3-5, along with the maximum diversion rate in the catchment and the minimum flow threshold. This table does not include any additional entitlements or licences granted since the SDL database was compiled in 2005, this being the latest information available. It can be seen from this table that additional flow could be diverted in all catchments except Lance Creek (Wonthaggi, Cape Paterson and Inverloch supply) and Coalition Creek (part of Korumburra and Leongatha supply). Ruby Creek and Ness Creek are in the same SDL catchment at Coalition Creek. These catchments are already developed beyond their sustainable diversion limit.

The sustainable diversion limit is a precautionary value. The sustainable diversion limit does not necessarily represent an absolute upper limit on development, but rather it can be used as a trigger for undertaking more detailed studies under a streamflow management plan (SKM/CRCFE, 2002) or other environmental flow assessment process. This means that South Gippsland Water could apply to harvest additional water from these catchments, however the granting of any diversion licences would need to be supported by environmental flow studies that indicate that the ecology of that particular waterway would not be adversely affected by the diversion.

For the overdeveloped catchments, diversion could occur from the adjacent catchments of Wilkur Creek and Tarwin River (for Coalition and Ruby Creeks) or Foster Creek (for Lance Creek). A map of the annual volume available for winter diversion across the region is shown in Figure 3-1, which highlights some of the potential alternative surface water sources for these over-allocated catchments. Greater detail in each supply area is shown in subsequent figures.

In some cases, the SDL catchment is larger than the catchment above South Gippsland Water's offtake. This means that even if an SDL volume is available, it does not imply that there is sufficient streamflow to harvest this volume at every location within the SDL catchment. Further assessments would be required to confirm that streamflow is physically available for harvesting in catchments where the SDL area is much larger than the area upstream of the town offtake.

It should be noted that the SDL volumes presented in Table 3-5 are based on information from 2005. These SDL volumes are what is currently available at a local scale, and do not take into account any uptake of unallocated water that may have occurred since that time, such as South Gippsland Water's Powlett River entitlement and South Gippsland Water's amendment to the Tarwin River bulk entitlement.

For the overdeveloped catchments, opportunity could also exist to purchase entitlements from other water users within the catchment such as upstream private diverters or catchment farm dams. This would most likely not trigger an environmental flow assessment if entitlements are traded downstream (B.Hansen DSE pers.comm. 8/4/2004) and would allow South Gippsland Water access to water within its existing supply catchments.

Table 3-5 Sustainable diversion limits in SDL catchments containing South Gippsland Water water supply catchments^

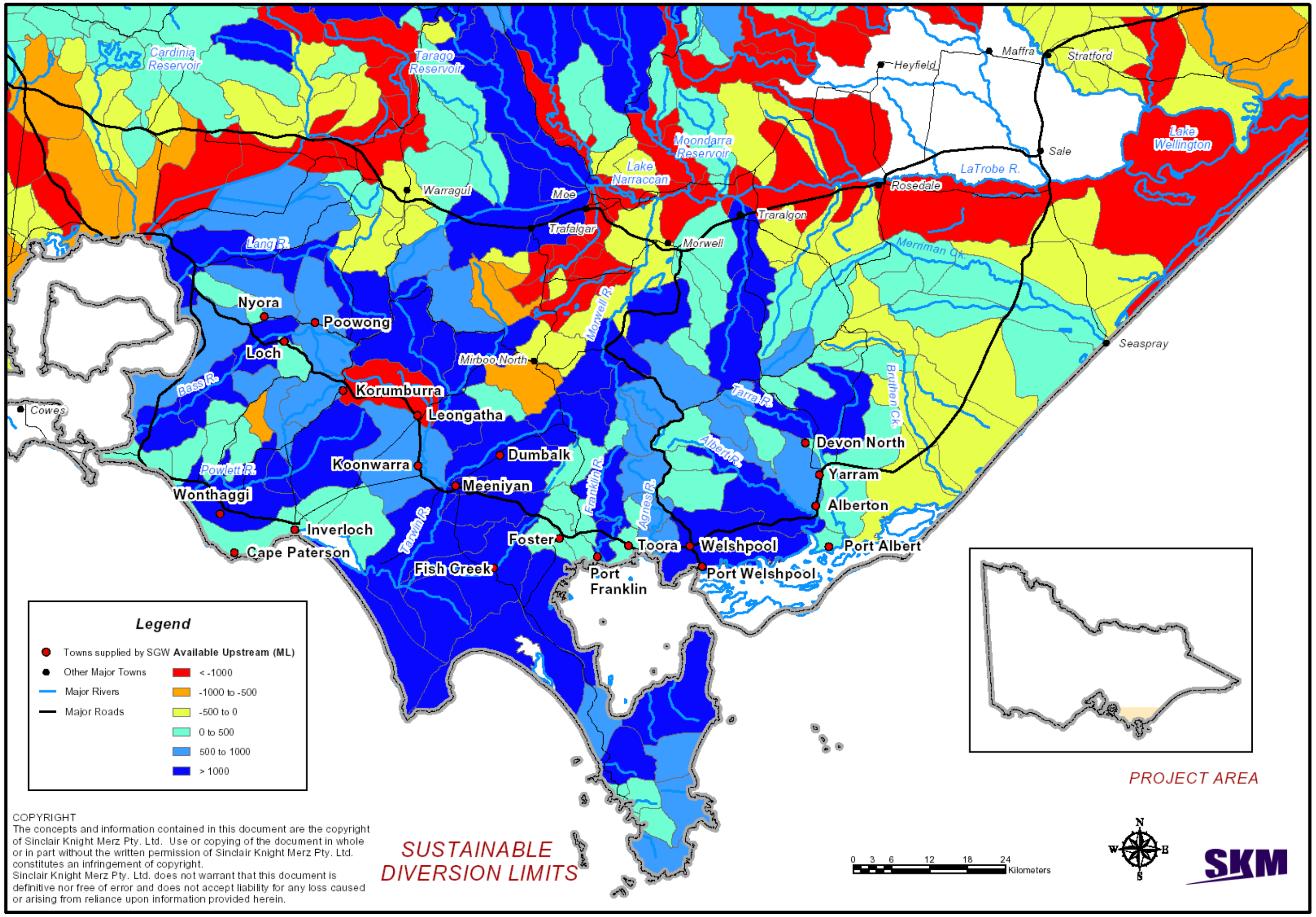
Stream	SDL catchment number	SDL catchment area (km^2)	Water available for winter diversion at SDL catchment outlet (ML/yr)	Catchment area at South Gippsland Water offtake (km^2)	Water available for winter diversion at South Gippsland Water offtake (ML/yr)	Maximum diversion rate (ML/d)#	Minimum flow threshold (ML/d)#
Little Bass River	2270001	54	809	7.9	118	19.2	13.2
Bellview Creek				4.14	62		
Ruby Ck	2270208	99	-1456	9.0	-132	22.9	19.8
Coalition Creek				0.55	-8		
Ness Ck				1.46	-21		
Lance Creek	2270105	19	-624	18	-591	5.8	4.5
Tarwin R at Dumbalk	2270211	126	1016	126	1016	29.6	29.6
Tarwin R at Meeniyan	2270213	1071	3577	1067	3564	252.6	178.4
Deep Creek	2270303	36	307	36	307	9.6	8.2
Battery Creek (Fish Creek)	2270216-2270215	62	840	2.2	30	40.2	25.8
Agnes River*	2270402	67	567	67	567	20.1	24.6
Tarra River*	2270604	216	69	31	69	37.1	32.4

*Available water at downstream locations is lower than at the diversion location. The lower value at the downstream location is shown in this table.

This is the volume available at the SDL catchment outlet.

^Does not include any reduction in available water due to uptake of licences and bulk entitlements since DSE issued the SDL viewer in 2005

- **Figure 3-1 Water available for winter diversion across South Gippsland**



File Source: I:\wcms\Projects\WC02779\Technical\Spatial\ArcMap\wc02779_sdl_0304.mxd

3.5.2. Streamflow Management Plans and Local Management Rules

Streamflow management plans (SFMPs) govern water sharing rules at a local catchment scale in rivers with unregulated flows where water use is close to or exceeds water availability. No SFMPs exist across the South Gippsland Region. Some technical background studies on local ecology and water supply reliability were undertaken in anticipation of an SFMP for the Tarra River, but the undertaking of that SFMP has been deferred indefinitely. DSE's preferred instrument for managing unregulated flows is now the use of local management rules, so SFMPs are unlikely to be prepared in the future.

Local management rules for private diverters are specified in the Agnes River, Albert River, Bruthen Creek, Franklin River, Tarra River and Tarwin River. These rules developed by Southern Rural Water list the streamflow triggers at which private diverters are placed on rostering, restrictions and bans.

3.5.3. Heritage Rivers

The purpose of the *Heritage Rivers Act* 1992 is to provide protection of public land in particular parts of rivers and river catchment areas in Victoria, which have significant nature conservation, recreation, scenic or cultural heritage attributes. The Act specifies whether impoundments or artificial barriers can be constructed and the degree to which new water diversions are permitted.

There are no heritage rivers in South Gippsland and hence the Act will not restrict water resource development in the region.

3.5.4. Regional River Health Strategies

South Gippsland Water's supply area is covered by two regional river health strategies. The Bass River catchment is covered by the Port Phillip and Westernport Regional River Health Strategy (Melbourne Water and PPWCMA, 2005), whilst the remainder of South Gippsland is covered by the West Gippsland Regional River Health Strategy (WGCMA, 2005). The condition of streams across the region, as identified from index of stream condition assessments in those river health strategies, ranged considerably as summarised in Table 3-6. Further information on the condition of individual river reaches can be found in the river health strategies. The reasons for poor river health can include factors not directly influenced by water availability, such as the presence of weeds along river banks. Water availability in Coalition Creek, downstream of Ruby Creek, is considered a significant issue. Further detail on environmental condition of local waterways is presented in the description of each supply system in subsequent chapters of the WSDS.

- **Table 3-6 Stream condition in South Gippsland from river health strategies**

River	Condition
Bass River	Poor to moderate
Lance Creek and Powlett River	Very poor to moderate
Tarwin River West Branch	Poor to moderate
Tarwin River East Branch	Moderate
Coalition Creek (including Ruby Creek)	Very poor in lower reach (but better condition in mid to upper reaches)
Wilkur Creek	Moderate
Deep Creek	Moderate
Agnes River	Moderate to good
Tarra River	Moderate to good
Fish Creek (including Battery Creek)	Poor

3.6. Future groundwater supply

Groundwater Management Areas (GMAs) are discrete areas where the groundwater resources have been (or can be) sufficiently developed to warrant careful management, or there is a risk to quality. Groundwater Management Areas have been defined in many areas throughout Victoria due to the high level of groundwater development, or potential for development. GMAs cover both a surface area and an aquifer system, where the aquifer system is defined by a depth interval. For most GMAs, a Permissible Consumptive Volume (PCV) has been defined. The purpose of a PCV is to provide the licensing authority (Southern Rural Water) with a limit on groundwater extraction licences to be issued within a GMA, based on the long term sustainable yield of the aquifer system.

Water Supply Protection Areas (WSPA) are proclaimed under the Water Act 1989 for the purpose of establishing management plans to ensure both groundwater and surface water resources are managed in an equitable and sustainable manner. This generally occurs when there is a greater degree of concern and/or uncertainty about the sustainability of extractions from the aquifer. Under the Water Act, the Minister would declare a GMA to be a WSPA when necessary, and a Consultative Committee would be formed to manage the WSPA.

A number of the aquifers in South Gippsland are regulated in Groundwater Management Areas (GMAs) shown in Figure 3-2. These include:

- the Leongatha GMA, managed at all depths
- the Yarram WSPA, which includes the management of deep aquifers (>200m)

- the Giffard GMA which includes the management of the confined Boisdale Formation aquifer between 50 and 200m
- the Tarwin GMA that includes the management of unconfined aquifers (0-25m).

- **Figure 3-2 Groundwater management areas in South Gippsland**

Southern Rural Water, which issues groundwater licences on behalf of the State Government, is not currently allocating new licences where current allocations are more than 70% of the permissible consumptive volume. New licences are not being allocated in the Giffard GMA, which is overallocated, and the Yarram WSPA. Total groundwater extraction is capped , with licences being able to be secured by purchase or transfer. Usage is less than the permissible consumptive volume in the Tarwin and Leongatha GMAs and licences can be obtained for extracting water from these management areas. South Gippsland Water's groundwater licence granted from the Leongatha GMA in 2010 contained a number of constraints which highlighted the difficulty of obtaining reliable access to additional groundwater from this GMA. In the Tarwin GMA there is a risk of saline intrusion and/or contamination by septic tanks due to the concentration of groundwater bores at Venus Bay.

Outside of GMAs and WSPAs, groundwater usage is low relative to the available aquifer yield and licences will generally be granted for new extractions.

Technical investigations into groundwater availability, ranging from desktop analyses to drilling investigations, have been undertaken by South Gippsland Water at Leongatha, Korumburra, Wonthaggi, Poowong/Loch/Nyora, Toora, and Yarram (SKM, 2006 c,d; SKM 2007 d,e). The outcomes resulted in a series of groundwater bores being constructed in Leongatha and at Yarram with suitable water not available at the other locations.

3.7. Bulk entitlement from the Melbourne supply system

As of October 2010, South Gippsland Water holds a bulk entitlement to access supply from the Melbourne supply system. However the entitlement only comes into effect in July 2012 or the date at which the interface point with the South Gippsland Water supply system commences operation.

The entitlement allows South Gippsland Water to take up to:

- 1,000 ML/year to supply Wonthaggi, Inverloch and Cape Paterson;
- 1,000 ML/year to supply Korumburra; and
- 3,000 ML/year to supply Leongatha and Koonwarra.

Poowong, Loch and Nyora would be supplied from Korumburra.

The volume that can be taken can be restricted if the Melbourne retail authorities are subject to water restrictions. Under the bulk entitlement, South Gippsland Water must endeavour to agree on operational arrangements to enable South Gippsland Water to take water from the Melbourne supply system, which will help to define the precise reliability of this source of water for South Gippsland Water and the cost of supply.

3.8. Stormwater

Stormwater harvesting involves capturing rainwater from urban areas for storage, treatment and use within those urban areas. Stormwater can provide a valuable water resource in areas where water availability is limited and suitable storage and treatment facilities are available. Stormwater can only be collected from rainfall events, so stormwater must generally be stored after those events for use at times when conditions are dry. Harvested stormwater makes up a small proportion of currently used water resources in Victoria, however it is seen as having the potential to grow as a water resource in future to alleviate pressure on other traditional sources (DSE, 2010).

Stormwater harvesting schemes for towns have been most successfully implemented when combined with groundwater storage and/or water treatment through wetlands. The City of Salisbury in South Australia provides an example of such a scheme (City of Salisbury, 2010). It established one of the first stormwater harvesting Aquifer Storage and Recovery schemes in Australia, which involved increasing the amount of recharge to underground aquifers by gravity feeding or pumping stormwater into local aquifers for later extraction (Department of Water, Land and Biodiversity Conservation, 2010).

In a similar scheme, South Gippsland Water investigated the feasibility of using water stored in the disused coal mines at Wonthaggi to augment long-term water supply to Wonthaggi, Inverloch, Cape Paterson and unserviced coastal towns (SKM, 2006). The mines would be recharged with stormwater. Water quality testing subsequent to the feasibility study found that the salinity of the water from the mines would be too poor to make the project feasible.

The use and required quality of stormwater is not specifically regulated in Victoria however the right to harvest stormwater and to construct stormwater harvesting schemes is subject to some regulation (EPA Victoria, 2010). Although stormwater is an excellent alternative to drinking water in many situations, there are human health and environmental risks that must be managed before it can be used. Depending on the urban area where runoff has been collected, the stormwater may contain contaminants including pathogens, chemicals and litter. Individuals and organisations implementing a stormwater harvesting scheme have a duty of care to manage the risk to people and the environment. The Environment Protection Authority Victoria recommends specific guidelines compiled by CSIRO (CSIRO, 2006).

In addition to providing a valuable water resource, the collection and treatment of stormwater can reduce the environmental impact on natural waterways by reducing pollutant loads to those natural waterways (DSE, 2010b).

3.9. Reuse of treated effluent

Reuse of treated effluent is governed under the *Environment Protection Act* 1970 with supporting *Guidelines for Environmental Management: Use of Reclaimed Water EPA Publication No. 464.2* prepared in 2003. These documents place limits on the quality of treated effluent required for specific uses. The draft Gippsland Region Sustainable Water Strategy (DSE, 2010) re-iterated that treated effluent can be used to substitute potable water supplies but is not suitable for use in drinking water supplies.

Discharge and reuse volumes from South Gippsland Water's urban treatment plants and trade waste customers are shown in Table 3-7 and Table 3-8 respectively. The total volume available in 2009/10 was around 2.5 GL (excluding trade waste). This figure varies from year to year with changes in stormwater infiltration to the sewerage network under different climate conditions and changes in water demand. The discharge quality ranges from Class B (suitable for most agricultural and industrial applications) to Class C (suitable only for a smaller range of agricultural and industrial applications such as livestock grazing and golf courses).

South Gippsland Water currently utilises approximately 10% of wastewater from the wastewater treatment plants for pasture irrigation and the offset of potable water for recreational grounds in the regional towns. Potential exists for increasing the use of treated wastewater to offset potable mains water supply usage, supply for agricultural use, supplementing streamflow in streams where water is extracted for urban use, and for supply to wetlands. There are a number of studies underway to examine the feasibility of increased reuse of treated wastewater for offset of urban supply, and with the objective of decommissioning ocean outfalls.

Proposal – South Gippsland Water will pursue opportunities for regional and urban demand substitution through wastewater and stormwater reuse in all supply systems and continue developing opportunities for increased agricultural use and agricultural development as they arise.

- **Table 3-7 Wastewater reused by South Gippsland Water in 2009/10**

Wastewater Treatment Plant	Discharge Volume (ML/yr)	Target Discharge Quality	Current Treated Wastewater Use	Plan for reuse
Korumburra	638	Class B	Discharge to Inland Waters. 4-5ML reused from standpipe.	Reuse Water available at treatment plant stand pipe, environmental flow to Powlett River system
Leongatha	547	Class B	Discharge to Inland Waters. <1ML reused from standpipe.	Reuse Water available at treatment plant stand pipe. Potential reuse for Golf Club or pasture irrigation, environmental flow to Little Ruby Creek
Cape Paterson	85	Class C	Discharge to Ocean Waters	No short term reuse plan due to high cost to provide storage facility and pipeline infrastructure
Inverloch	370	Class C	Approx 20-30ML/y for pasture and crop irrigation during summer	Winter flow reuse would require winter balancing storage.
Wonthaggi	567	Class C	Discharge to Ocean Waters	Options being explored for long term reuse.
Wonthaggi, Cape Paterson and Inverloch			*Potential for wetland use for all 3 systems downstream of the outlet junction point*	
Foster	125	Class C	Discharge to Ocean Waters	Proposed additional treatment with pasture irrigation and closure of Outfall
Toora	52	Class C	2-3ML used by Toora Football Club during summer	Scheme proposal for Land discharge underway
Tarraville (Yarram and Port Albert)	101	Class C	100ML/y used for pasture irrigation	Continued pasture irrigation
Welshpool	41	Class B	Discharge to Land	Scheme underway for pasture irrigation
Waratah Bay	2	Class C	Discharge to Land	Total reuse on Land
TOTAL	2,528			

■ Table 3-8 Trade Waste Discharges in South Gippsland in 2009/10

Wastewater Treatment Plant	Discharge Volume (ML/yr)	Target Discharge Quality	Current Treated Wastewater Use	Plan for reuse
Leongatha Trade Waste Murray Goulburn	1,088	Class D	Discharged to Venus Bay Ocean outfall	High saline content – non pathogenic , non reusable
Korumburra Trade Waste Burra Foods	66	Partial treatment before discharge to Korumburra WWTP	Discharged to Korumburra WWTP	Included in Korumburra WWTP reuse plan

4. Water Demand Projections

4.1. Introduction

South Gippsland Water is expecting growth in demand for water from a number of sources, namely:

- Residential population growth
- Industrial and commercial expansion
- Servicing of currently unserviced towns

This section of the report sets out the background to the demand projections used in the WSDS. It includes incorporation of outcomes from the 2006 Census, which were not available at the time of preparing the 2007 WSDS.

4.2. Types of demand

For the purposes of forecasting growth in demand, total demand has been split into various types. Different growth rates are applied separately to each type. All demands include unaccounted for water. The demand components are:

- Residential/commercial demand – consists of domestic and non-domestic demand, but excludes major industrial customers. It includes some rural tappings.
- Major industrial demand – consists of major industrial customers such as Murray-Goulburn, Burra Foods, Esso, the Poowong Abattoir and Tabro Meats.
- Supply by agreement and concessions – includes customers such as municipal parks and gardens, and rural tappings supplied by agreement. Concession holders are defined such as churches, scout halls, not for profit groups, etc.
- Environmental demand, which is provided for by South Gippsland Water in minimum passing flows under bulk entitlements previously described in Section 3.2 and water not diverted or captured by South Gippsland Water.

Urban demand is assumed to grow in proportion to population. Growth in major industrial demand is considered on a case by case basis. No growth is assumed for supply by agreement and concession holders.

4.3. Current demand

Current demand for water in South Gippsland Water's supply systems is summarised in Table 4-1. The figures in this table represent the average annual supply from water sources and include losses. South Gippsland Water currently extracts around 6.0 GL/yr of raw water, of which 44% is used to supply residential customers, 35% supplies major industrial/commercial customers, 11% is for stock and domestic customers and 10% is utilised across South Gippsland Water's water treatment plants.

Table 4-1 Current average demand from supply sources[1]

Supply System	Towns Currently Supplied	Urban residential plus concessional (ML/yr)	Urban non-residential including major industrials (ML/yr)	Stock and domestic (ML/yr)	Treatment plant usage (ML/yr)	Total raw water demand (ML/yr)
Northern Towns						
Little Bass River	Poowong, Loch, Nyora	111	89	40	24	264
Coalition Creek	Korumburra	409	178	15	19	621
Ruby Creek	Leongatha, Koonwarra	583	1,067	18	225	1,893
Southern Towns						
Lance Creek	Wonthaggi, Cape Paterson, Inverloch	1,120	240	227	119	1,706
Central Towns						
Tarwin River East Branch	Dumbalk	13	2	2	0	17
Tarwin River	Meeniyan	48	3	12	2	65
Deep Creek/Foster Dam	Foster	74	20	36	10	140
Battery Creek	Fish Creek	19	22	83	12	136
Agnes River	Toora, Welshpool, Port Welshpool, Port Franklin	162	223	123	56	564
Eastern Towns						
Tarra River	Yarram, Alberton, Port Albert, Devon North	325	131	82	22	560
TOTAL		2,863	1,975	638	490	5,966

(1) Estimated at current level of population and industrial development over a long-term climate sequence (typically 40+ years) to account for differences in water demand in wet, average and dry years

Estimates of demand are based on a combination of bulk meter and property meter data, with adjustments made for longer term climate variability.

4.4. Growth in residential demand

Growth in residential demand is initially based on the *Victoria in Future* population projections, produced by Victorian State Government (DPCD, 2010). Information is available on a statistical local area (SLA) basis for the period 2006 to 2026, for larger statistical divisions for the period 2006 to 2036 and for regional Victoria for the period 2006 to 2056.

SLA population growth data was used to calculate the projected demands in accordance with DSE guidelines for the WSDS. There are five SLAs within the area supplied by South Gippsland Water, as shown in Table 4-2. Each demand centre was assumed to have the same growth rate as the SLA in which it is located. The assigning of towns to each SLA was determined using the Australian Bureau of Statistics website (www.ausstats.abs.gov.au).

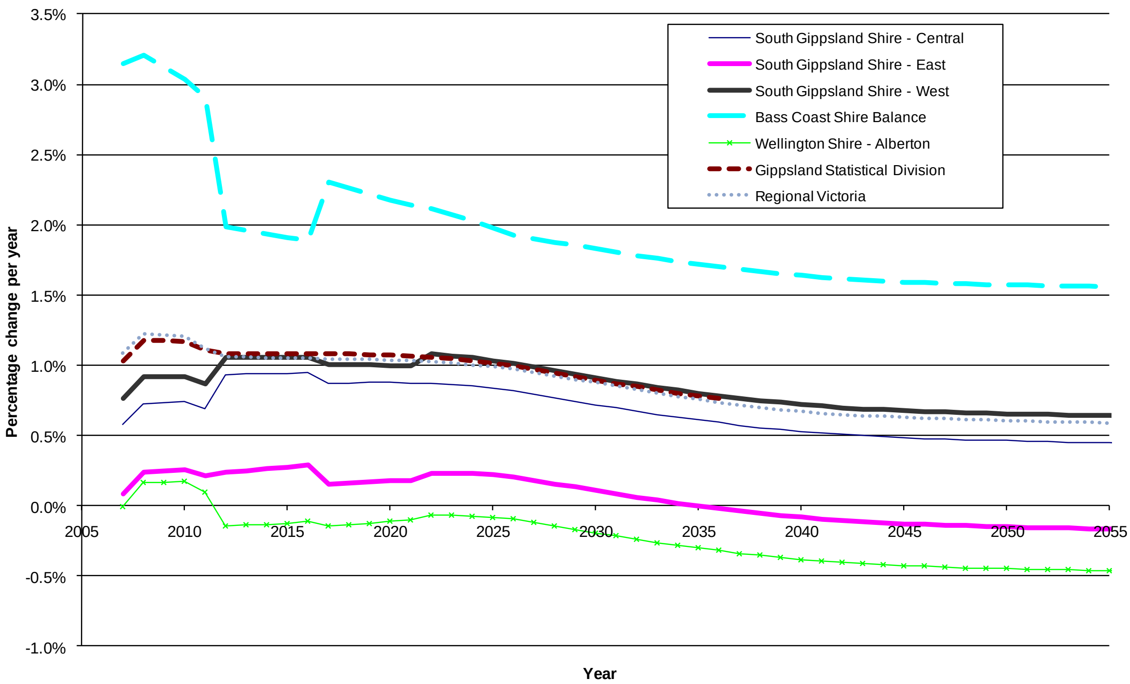
SLA population growth projections are only available to 2026. For the period 2027 to 2036 it was assumed that population in each of the SLAs changed at the same rate as that for the Gippsland Statistical Division and from 2037 to 2056 at the same rate as regional Victoria.

Figure 4-1 shows the projected growth rates for each of the SLAs and regional Victoria. It can be seen that South Gippsland (East) and Wellington (Shire) SLAs have a predicted decline in population. In contrast, the Bass Coast and South Gippsland (Central) SLAs are predicted to experience growth which is above the regional rate.

- **Table 4-2 Towns Located within Statistical Local Areas**

Statistical Local Area	**Towns supplied by South Gippsland Water within Statistical Local Area**
South Gippsland Shire – Central	Leongatha, Koonwarra, Meeniyan
South Gippsland Shire – East	Toora, Welshpool, Port Welshpool, Port Franklin, Dumbalk, Fish Creek, Foster
South Gippsland Shire – West	Korumburra, Poowong, Loch, Nyora
Bass Coast Shire Balance	Wonthaggi, Cape Paterson, Inverloch
Wellington Shire – Alberton	Yarram, Alberton, Port Albert, Devon North

■ **Figure 4-1 – *Victoria in Future* population growth rates for the South Gippsland region**



Comparison against previous demand projections, which were based on the 2001 census, is included within the discussion of each supply system. *Victoria in Future* growth in household numbers were also considered, however growth in number of households does not cover the full planning period of 50 years.

A higher alternative growth scenario, referred to as the Local Growth scenario, is presented for all supply systems to test the impact of higher growth and associated water requirements. This Local Growth scenario also takes into account the possibility of higher growth within urban centres relative to surrounding areas within a statistical local area.

4.5. Growth in major industrial demand

Growth in industrial demand has been considered for two scenarios. The Victoria in Future population growth scenario has been coupled with South Gippsland Water's estimate of future industrial demand based on best available information from those industrial water users. For the Local Growth scenario, South Gippsland Water provides for possible higher level industrial demands. Table 4-3 summarises the assumed major industrial demands for the two scenarios.

Long-term growth in major industrial demand is difficult to predict. Estimates of growth in major industrial demand are generally not forthcoming from major industries because their planning horizons are relatively short compared with the 50 year planning horizon of this Water Supply

Demand Strategy. Technological developments also play a major part in the ability of major industrial customers to reduce water consumption, which are difficult to predict as well.

Demand for water by Murray Goulburn at Leongatha is not expected to increase in line with production increases over the coming decades because it is anticipated that growth in demand for water will be met by improving water use efficiency within the processing plant. Murray Goulburn, with funding support from the State Government, has embarked on a 10 year, $135 million upgrade of its plant to improve efficiency of operations and to enable new products to be manufactured. Correspondence with Murray-Goulburn in 2008 indicated that it was anticipated that there would be a net reduction in demand for water from South Gippsland Water of around 370 ML/yr by 2009/10, with the potential for a further 220 ML/yr reduction by 2012/13. The anticipated reduction of 370ML/yr in 2009/10 was not achieved. South Gippsland Water's role in planning for the future needs of the Leongatha water system must consider and be cognisant of possible future water requirements of such a significant water user as Murray-Goulburn. South Gippsland Water is of the view that there are significant risks that Murray Goulburn will not achieve its water savings targets, and the local growth demand scenario for Leongatha assumes Murray Goulburn water demands will remain at current levels. The uncertainty surrounding future long-term demand for Murray Goulburn means that South Gippsland Water will continue to communicate with Murray Goulburn about their ongoing water requirements.

At Barry Beach in the Agnes River supply system, there has in recent years been a concept proposal to construct a brown coal to urea plant with associated residential and commercial development. The South Gippsland Shire Council (pers.comm. Jan 2011) advises that this proposal is not currently active. However, from a longer term water resource planning perspective, and also considering the potential for additional future water use associated with possible development of Barry Beach port facilities, a future demand of 2 ML/wk (104 ML/yr) has been assumed. This is in line with water resource investigations in 2008 (SKM, 2008a). For the purposes of this strategy, this increase in demand has been assumed to occur in 2020. Further details about the associated developments are currently uncertain and have not been explicitly included in the major industrial demand forecasts.

No further growth in major industrial demand is anticipated in the remaining supply systems at the current time. This includes assuming that major industrial demand will not alter due to climate change.

▪ **Table 4-3 Major industrial demand assumptions**

Supply system	Major industrial demand under Victoria in Future demand scenario	Major industrial demand under Local Growth demand scenario
Northern Towns		
Poowong, Loch, Nyora	89 ML/yr over planning horizon	89 ML/yr currently. Steadily increased to 230 ML/yr by the year 2060 for miscellaneous additional use
Korumburra	178 ML/yr over planning horizon	178 ML/yr currently Increased to 196 ML/yr in 2015 (+10%) Increased to 214 ML/yr in 2040 (+20%) Increased to 231 ML/yr in 2055 (+30%) For miscellaneous additional use
Leongatha	1067 ML/yr currently Decreased to 847 ML/yr in 2010/11 Decreased to 627 ML/yr in 2012/13 in line with Murray Goulburn's anticipated savings	1067 ML/yr currently Decreased to 1000 ML/yr in 2010/11 assuming Murray Goulburn savings not fully realised Increased to 1500 ML/yr in 2025/26 for increase due to new industrial water user(s) or step change in water requirement for Murray Goulburn
Southern Towns		
Wonthaggi, Cape Paterson, Inverloch	240 ML/yr over planning horizon	240 ML/yr currently Increased to 264 ML/yr in 2015 (+10%) Increased to 288 ML/yr in 2025 (+20%) Increased to 312 ML/yr in 2055 (+30%) For miscellaneous additional use
Central Towns		
Toora (Barry Beach)	223 ML/yr currently	223 ML/yr currently Increased to 327 ML/yr in 2019/20 for Barry Beach development
All other systems	Current demand	Current demand

4.6. Growth in supply by agreement and concessions demand

Growth in supply by agreement and concession holders was assumed to be zero for most supply systems. This was based on identification of the end use of water and discussions with a sample of those water users by Consulting Environmental Engineers, as noted in South Gippsland Water (2007).

The exception to this is the Fish Creek system, where the Local Growth Scenario includes an allowance for a potential increase in demand of 50 ML/yr from rural customers. Demand for water from these rural users has decreased significantly in recent years due to South Gippsland Water's WaterMap Initiative, which assists farmers in developing on-farm water supply in preference to reliance on supply from South Gippsland Water. These rural customers could nevertheless need to supplement their on-farm supplies in a drought year, which could see their demand for supply from South Gippsland Water return to a level similar to that seen prior to the implementation of the WaterMap initiative.

4.7. Summary of demand projections

The anticipated growth in demand for South Gippsland Water's supply systems based on *Victoria in Future* (ViF) predicted growth rates for the next 50 years is summarised in Table 4-4, whilst the Local Growth scenario demands are listed in Table 4-5. Any sensitivity analyses on these growth rates, including the potential effect of climate change, are discussed in the section on each supply system in this report. Total demand for raw water under this *Victoria in Future* scenario would be expected to increase from the current 6.0 GL/yr to around 8.0 GL/yr, whilst for the Local Growth scenario it is expected to increase to around 11.6 GL/yr.

- **Table 4-4 *Victoria in Future* long-term average annual demands for the year 2058**

Supply System	Towns Currently Supplied	Urban residential plus concessional (ML/yr)	Urban non-residential including major industrials (ML/yr)	Stock and domestic (ML/yr)	Treatment plant utilisation (ML/yr)	Total raw water demand (ML/yr)
Northern Towns						
Little Bass River	Poowong, Loch, Nyora	168	89	40	29	326
Coalition Creek	Korumburra	615	178	15	25	833
Ruby Creek	Leongatha, Koonwarra	877	627	18	206	1,728
Southern Towns						
Lance Creek	Wonthaggi, Cape Paterson, Inverloch	2,860	240	227	229	3,556
Central Towns						
Tarwin River East Branch	Dumbalk	13	2	2	0	17
Tarwin River	Meeniyan	67	3	12	3	84
Deep Creek/Foster Dam	Foster	76	20	36	10	142
Battery Creek	Fish Creek	20	22	83	12	137
Agnes River	Toora, Welshpool, Port Welshpool, Port Franklin	166	223	123	57	569
Eastern Towns						
Tarra River	Yarram, Alberton, Port Albert, Devon North	290	131	82	21	524
TOTAL		5,152	1,535	638	592	7,916

▪ **Table 4-5 *Local Growth* long-term average annual demands for the year 2058**

Supply System	Towns Currently Supplied	Urban residential plus concessional (ML/yr)	Urban non-residential including major industrials (ML/yr)	Stock and domestic (ML/yr)	Treatment plant utilisation (ML/yr)	Total raw water demand (ML/yr)
Northern Towns						
Little Bass River	Poowong, Loch, Nyora	280	230	40	54	605
Coalition Creek	Korumburra	848	214	15	33	1,110
Ruby Creek	Leongatha, Koonwarra	1209	1500	18	368	3,096
Southern Towns						
Lance Creek	Wonthaggi, Cape Paterson, Inverloch	4,140	312	227	229	4,908
Central Towns						
Tarwin River East Branch	Dumbalk	18	2	2	0	22
Tarwin River	Meeniyan	100	3	12	4	118
Deep Creek/Foster Dam	Foster	104	20	36	12	172
Battery Creek	Fish Creek	27	22	133	18	200
Agnes River	Toora, Welshpool, Port Welshpool, Port Franklin	228	327	123	75	753
Eastern Towns						
Tarra River	Yarram, Alberton, Port Albert, Devon North	367	131	82	24	605
TOTAL		7,321	2,761	688	817	11,589

4.8. Unserviced towns

For unserviced towns, per lot residential demand consumption was assumed to be as per a previous demand study by GHD (2003), with the exception of Tarwin, for which per lot consumption was reduced from 1.2 kL/d/lot to 0.5 kL/d/lot. The number of lots at existing unserviced towns has been updated using the 2006 census information, where available. Similar to the residential growth for serviced towns, growth in demand for water for unserviced towns was based on Local Growth rates. No further growth was assumed for major lot developments. The demand for water from unserviced towns is currently estimated at around 680 ML/yr, as shown in Table 4-6. This demand is expected to increase to 1,140 ML/yr by year 2058 due to *Victoria in Future* population growth and up to 1,610 ML/yr under Local Growth population projections. There remains much uncertainty about what future impact unserviced towns may have on existing supply systems. It may well be that innovative approaches to how additional water is provided to these existing communities will result in water requirements being much less than assumed in this study. From a supply planning perspective, the ability to be able to supply this potential additional water requirement has been assessed.

- **Table 4-6 Unserviced towns and future potential developments**

Town or development	No. of lots	Estimated Current Demand (ML/yr)	Estimated year 2058 *Victoria in Future* demand (ML/yr)	Estimated year 2058 Local Growth demand (ML/yr)
Bena	54	19	29	48
Tarwin	12	2	3	4
Venus Bay - existing	1,436	261	667	965
Tarwin Lower	92	17	43	62
Harmers Haven	65	12	31	44
Walkerville	167	43	44	61
Waratah Bay	110	28	29	39
Sandy Point	633	162	166	228
Yanakie	100	26	27	37
Greenmount	35	15	13	17
Won Wron	27	12	11	14
Woodside	55	24	21	27
Woodside Beach	46	20	18	23
Robertson's Beach	46	20	18	23
Manns Beach	20	5	4	6
McLoughlins Beach	50	13	12	15
TOTAL	2,948	679	1,136	1,613

4.9. Current demand reduction initiatives

South Gippsland Water is currently undertaking measures which are expected to result in per capita demand reduction over time. South Gippsland Water is part of the savewater!™ alliance through the Victorian Water Industry Association, which represents all of Victoria's water authorities. Details of the savewater! ™ initiative can be found at http://www.savewater.com.au. The site provides information on water conservation, runs competitions to win water conserving products and provides access to suppliers of water conserving products.

For estimating the effect of demand reduction initiatives, South Gippsland Water relies upon the detailed demand information derived from Melbourne's end-use model, which models property scale demand by considering the in-house and external water use of each property (WaterSmart, 2006a). It is acknowledged that there are some differences between consumer behaviour in

Melbourne and South Gippsland, however given the high degree of uncertainty surrounding demand reduction forecasts, this adoption of technical information from Melbourne with justifiable adjustments is considered appropriate.

In recent years, water conservation efforts by the water utilities and the Victorian Government have targeted all major aspects of residential water use with an emphasis on education and behaviour change. A rebate scheme for water conservation products has been operating since January 2003, which is currently known as the Water Smart Gardens and Homes Rebate Scheme. The most noteworthy regulatory changes affecting residential indoor water use have been:

- The introduction of a mandatory water efficiency labelling for appliances (commencing 2006) under the national Water Efficiency Labelling and Standards Scheme (WELS);
- The introduction of rising block tariffs, which result in higher charges for high water users; and
- The Five Star Home standards which require all new homes in Victoria to have water efficient showerheads, tapware, a pressure reducing valve where mains pressure is over 50 m, and either a solar hot water heater or a rainwater tank connected to the toilet (or equivalent saving through a dual pipe system).

Outdoor water use has been targeted through the introduction of permanent water saving measures, which include the requirement for a trigger nozzle on hoses, restricted times for garden watering, no hosing of paved areas and notification to be given to South Gippsland Water when filling a new pool. These Statewide measures are estimated to have resulted in a 2% reduction in total demand (TWGWSA, 2005).

South Gippsland Water has an active program promoting water conservation through local measures. This includes:

- Newsletters to customers accompanying each rate notice;
- Regular press releases;
- Displays and presentations at local community events;
- Schools education program;
- Regular meetings with high water consumption users;
- Grants to community groups for installation of facilities to reduce potable water demand;
- Interest free loans to rural customers for installation of water saving measures to reduce summer demand; and
- Consultation with issues and advisory based community groups.

A per capita demand reduction of 22% has been achieved in Melbourne over the last decade, however some of this demand reduction is due to recent water restrictions and hence a 15% per capita demand reduction is expected to be achievable when restrictions are lifted (Watersmart, 2006). This reduction includes water savings by industry, government and households. WaterSmart attributes this to water conservation programs, water pricing reform, water audits with major industrial water users (WaterMap program), the five star building standard, permanent water saving measures, water saving garden centres, savewater.com alliance, leak control programs and the national water efficiency labelling scheme. South Gippsland Water introduced permanent water saving measures in 2005/06, which are estimated to have resulted in a 2% reduction in demand (TWGWSA, 2005). For the remaining water saving measures, it could be argued that household disposable income, water corporation revenue and access to information are lower in regional areas than in Melbourne, so these water savings could be expected to lag those achieved in Melbourne. Quantifying this lag is difficult, hence it has been conservatively assumed that existing demand reduction measures will merely serve to maintain existing per capita demand, similar to what has been assumed in Melbourne.

Per capita residential demand in South Gippsland is low because the climate is wetter than other parts of Victoria and because many dwellings are only occupied during the summer months. South Gippsland Water's average annual household consumption, reported to the Essential Services Commission in 2009/10 (ESC, 2010), was 119 kilolitres per household per year, with 68 kilolitres per capita per year for residential water use by the permanent population. This equates to 186 litres per capita per day for permanent residents.

For the purposes of enabling broad comparisons over time and with other regions of Victoria, "per capita demand" has been calculated using the definition in the Central Region Sustainable Water Strategy, which includes industrial water use. Most towns in South Gippsland have a high proportion of major industrial water use and some rural water use, which artificially inflates estimates of per capita demand in South Gippsland when using this method of calculation relative to other regions of Victoria. Estimating per capita demands in South Gippsland is also problematic because of the difficulty in accurately assessing the population being serviced. The estimate of population from census information is only collected in winter and therefore significantly underestimates peak summer and Easter populations, which swell due to an influx of tourists to the region. The population at Inverloch, for instance, can increase significantly during peak holiday periods. Per capita demand estimates using census population data result in an overestimate of per capita demand. The 2006 winter population serviced by South Gippsland Water is estimated from 2006 census data to be approximately 22,900. If a seasonally weighted population of double the winter population is adopted (which may still be an underestimate in some towns), per capita demand would be 360 litres per capita per day, which is within the 300-400 litre per capita per day range observed by other water corporations, despite South Gippsland Water's high industrial water demand.

Estimating a change in per capita demand over time is equally problematic without knowledge of changes in seasonally weighted populations. This is because a change in winter population does not necessarily translate directly into a change in summer population, which is affected by the state economy (influencing disposable income and therefore travel decisions), weather conditions and accommodation capacity.

It is clear that demands in a number of South Gippsland Water's supply systems have decreased significantly in the last three years since the 2006/07 drought. Some of these shifts are attributable to specific events, such as step changes in major industrial demand, however most are more likely to be a result of demand management actions being undertaken by South Gippsland Water including more permanent shifts in customer water using patterns following in some cases extended restriction periods. The magnitude of these shifts is discussed in the sections of this report dealing with each supply system.

4.10. Future demand reduction initiatives

South Gippsland Water will actively pursue demand reduction in each supply system. South Gippsland Water has set itself a demand reduction target in line with State Government targets set for other water authorities across Victoria of:

- A 25% reduction in per capita demand by the year 2015 relative to 1990s average demand; and
- A 30% reduction in per capita demand by the year 2020 relative to 1990s average demand.

Assuming that the 22% reduction in per capita demand has already been achieved in South Gippsland, South Gippsland Water would require a 3% reduction in per capita demand from its customers by the year 2015 and an 8% reduction in per capita demand by the year 2020 in order to reach this target. This includes the 2% reduction in demand due to the previous introduction of permanent water saving measures.

A range of actions by South Gippsland Water and the State Government will be required to meet these targets. It is anticipated that the majority of these actions would be driven by the State Government and Melbourne's urban water utilities. Specific actions by South Gippsland Water include the following:

- South Gippsland Water will continue to work with its major customers to reduce the water use of those major customers.
- South Gippsland Water will continue to keep abreast of technological developments in water saving measures currently being investigated by Melbourne's urban water utilities through South Gippsland Water's membership of the Victorian Water Industry Association.

South Gippsland Water is supported by the Victorian State Government's ongoing water saving programs, such as the WaterMap, Water Smart Gardens and Homes Rebate Scheme, Showerhead Exchange Program and Trigger Nozzle Exchange Program. Target 155, which encourages Melbourne's water users to use less than 155 litres per person per day, has also been publicised outside of Melbourne through print, radio, television and internet media that extend beyond Melbourne.

The extent to which demand reduction targets are achievable in any given year will be influenced by the age profile of assets, particularly in small supply systems, of which South Gippsland Water operates several. As assets such as pipelines approach the end of their useful life, they are more likely to leak or burst, increasing water losses. In larger systems such as the Ruby Creek system supplying Leongatha, this will be balanced to a greater extent by having a range of assets of different ages at any given time, meaning that there is unlikely to be a large fluctuation in leakage rates for these systems.

Measuring the effectiveness of these actions against South Gippsland Water's target will be based on measuring the change in the per capita demand from the 397 litres per capita per day value presented in the 2007 WSDS to 385 litres per capita per day by 2015 and 365 litres per capita per day by 2020. These targets are based on an assumed seasonally weighted population of double the winter population. Meeting these targets also assumes that the seasonally weighted population increases in proportion to the increase in winter population for the period over which the targets have been set. When measuring these targets, an allowance will need to be made for any changes in water use from major industrial customers that is associated with changes in production. Water demand trend information, presented in subsequent chapters of the WSDS and the current estimate of South Gippsland Water's per capita (residential, rural and industrial) demand of 360 litres per day, suggests that South Gippsland Water and its customers have already reached these future targets.

4.11. Uncertainties surrounding future demand projections

There are many uncertainties surrounding future demand projections and hence these figures should be regarded as a guide to be reviewed as information is collected for subsequent WSDS updates every five years. There are uncertainties in population growth, which is largely affected by local, interstate and international migration, uncertainties in future household sizes, lot sizes and the availability and uptake of water saving technologies.

Changes in social patterns, including smaller families and people living longer mean that the number of persons per household continues to decline. This impacts on water use, because houses with lower occupancy rates use more water per person. For example, in Melbourne a single person house typically uses 250 L/cap/day, a two person house uses around 200 L/cap/day and a three person house uses around 170 L/cap/day. Thus the trend to fewer persons per household translates to an increased demand for water per head of population. Running against this trend is the tendency towards smaller lot sizes and apartment dwellings, which have a much lower outdoor water use than a detached house.

Towns served by South Gippsland Water have a relatively high proportion of households with a single, elderly person. When these houses are turned over to families of two or more persons, water use per property would be expected to increase.

There are also many uncertainties surrounding future commercial / industrial demand projections, and for this reason as well it will be necessary to update the WSDS at least every 5 years.

5. Sustainability Assessment Method for Demand and Supply Options

5.1. Approach

There are a range of different demand reduction and supply enhancement options that are available for individual supply systems. This section provides an overview of the method used to assess options against a range of economic, environmental and social criteria to enable broad scale comparison between options.

The assessment criteria help to identify critical potential impacts of each option and provide early warning of potential conflicts or opportunities presented by the option. The outputs of this assessment can be used to better inform the decision making process, but it does not provide a definitive answer of which is the best option. The assessment criteria and method developed for the Sustainable Water Strategies has been employed in this assessment (Table 5-1). These criteria and scoring systems were developed by the Department of Sustainability and Environment through extensive consultation with water authorities and have been adopted for WaterSmart and the Eastern Water Recycling Proposals as well as the Central Region Sustainable Water Strategy.

An additional financial indicator known as the long-run marginal cost has been included in the analysis to align the outputs from the WSDS with South Gippsland Water's Water Plan on pricing to the Essential Services Commission.

The sustainability assessments for the demand reduction and supply enhancement strategies shown in subsequent sections of the WSDS have been prepared for conceptual assessment only. South Gippsland Water will be undertaking functional design, environmental analysis and heritage studies to further assess sustainability impacts at the appropriate time to obtain the relevant Government approvals for demand reduction and supply enhancement works.

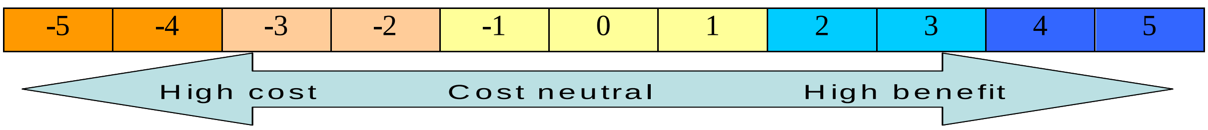
■ **Table 5-1 Assessment Criteria**

Criteria	Metric
Economic	
Long run marginal cost (LRMC)*	$/ML
Net Present Cost	$/ML
Effect on GDP (local) and development	Estimated effect on local GDP
Environmental	
Greenhouse Gas Emissions	Average Kg CO2 equivalent per ML per Year
Impact upon environmental flow objectives	Estimated relative impact
Impact on surface, ground and marine water quality	Estimated relative impact
Impact on terrestrial ecosystems	Estimated loss or gain of significant ecological vegetation classes
Social	
Acceptability	Estimated degree of opposition or acceptance by the local community

*Duplicate financial indicator required for input to Water Plan for Essential Services Commission.

5.2. Assessment criteria and scoring

All criteria are scored on a scale from -5 to +5, where -5 generally represents a relatively negative impact or cost and +5 generally represents a relatively high degree of benefit. Scores around 0 are generally neutral impacts or mid-range costs.



Details of the scoring system for each indicator are described below.

5.2.1. Net Present Cost

The net present cost is a financial assessment of the option. The values included as part of this assessment have been calculated based on potential volumes of recoverable water together with the estimated capital and operating and maintenance costs over a 50 year period. The figures represent the Net Present Cost (5.8% discount rate) divided by the total volume generated by the option over the 50 year period. Scoring is identical to that described in the CRSWS.

Score	Descriptor
-5	>$950/ML
-4	$850-950/ML
-3	$750-850/ML
-2	$650-750/ML
-1	$550-650/ML
0	$450-550/ML
1	$350-450/ML
2	$250-350/ML
3	$150-250/ML
4	$50-150/ML
5	<$50/ML

5.2.2. Effect on Local Gross Domestic Production (GDP)

GDP, a measure of the total value of produced goods of a region, is considered to be broadly representative of the economic flow-on benefits (such as employment) derived from additional water being made available for a major industry (e.g.: irrigated agriculture). For the purposes of this assessment the direct (or first order) regional economic impacts, that is those felt outside the South Gippsland Water region are considered to be negligible for each option, hence this criteria has been re-interpreted as effect on Local GDP.

The criteria has been scored according to the anticipated increase or decrease in GDP derived from the allocation of the water to new (not existing) agriculture. Compensating 'flow-on' effects to other regions or industries have not been included nor has the indirect benefits and costs passed to society (e.g. existence values relating to environmental quality). In practice, this comes down to whether the option makes new water available for irrigated agriculture within the region (a positive impact) or alternatively, results in less water available for irrigated agriculture. The base case is assumed to be no impact on the status quo (zero). Scoring is identical to that described in the CRSWS.

Score	Descriptor
-5	*Extreme* negative impact on local GDP (25% immediate output reduction for major industry)
-4	*Significant* negative impact on local GDP (10% immediate output reduction for major industry)
-3	*Moderate* negative impact on local GDP (25% immediate output reduction for minor industry)
-2	*Small* negative impact on local GDP (10% immediate output reduction for minor industry)
-1	*Marginal* negative impact on local GDP (negative impact to potential growth opportunities to minor or major industry)
0	Insignificant change to net regional output
1	*Marginal* increase in local GDP (positive impact to potential growth opportunities for minor or major Industry)
2	*Small* increase in local GDP and employment (10% Immediate output expansion for minor industry)
3	*Moderate* increase in local GDP and employment. Minor Industry; 25% Immediate output expansion
4	*Significant* increase in local GDP and employment. Major Industry; 10% Immediate output expansion
5	Extreme increase in local GDP and employment. Major Industry; 25% Immediate output expansion

5.2.3. Greenhouse Gas Emissions

This indicator reflects the estimated emissions (kg of CO_2 equivalent) per ML, based on the energy (assumed to be sourced from Victorian Brown coal) consumed in Operations and Maintenance of each option since this is assumed to be the major source of greenhouse gas emissions. It does not include the greenhouse gas emissions incurred in the construction or decommissioning stages of each option, but may take into account the potential greenhouse emissions associated with irrigated agriculture. Scoring is identical to that described in the CRSWS.

Score	Descriptor
-5	15,000 Kg/CO2e/ML/yr
-4	10,000 - 14,999 Kg/CO2e/ML/yr
-3	5,000 – 9,999 Kg/CO2e/ML/yr
-2	1,500 - 4,999 Kg/CO2e/ML/yr
-1	700 – 1,499 Kg/CO2e/ML/yr
0	580 - 699 Kg/CO2e/ML/yr
1	450 - 579 Kg/CO2e/ML/yr
2	200 - 449 Kg/CO2e/ML/yr
3	0 - 199 Kg/CO2e/ML/yr
4	-10,000 - -1 Kg/CO2e/ML/yr
5	-22,000 – 10,001 Kg/CO2e/ML/yr

5.2.4. Impact upon environmental flow objectives (river health)

Contribution to meeting environmental flow objectives is used a qualitative assessment (based on specialist advice) of the impact of each option on river health. In assessing the scores for River Health, the first step involved determining the relative importance of flow to the health of the river, and the current health of the river (or catchment). Once this was established, the impact of each option is scored (according to CRSWS ratings), taking into account the volume and the timing of extractions or additions, and how these influenced the different components of the flow (e.g. base flow, bank full, over bank, flushes and flood events).For some options, detailed flow and water resource studies are currently underway and new information could influence the scoring, which is identical to that used in the CRSWS.

Score	Descriptor
-5	*Extreme decline* in River Health from reduced flows.
-4	*Significant decline* in River Health from reduced flows.
-3	*Moderate decline* in River Health from reduced flows.
-2	*Small decline* in River Health from reduced flows.
-1	*Marginal decline* in River Health from reduced flows.
0	No change in flows and River Health from current condition.
1	*Marginal improvement* in River Health from improved flows.
2	*Small improvement* in River Health from improved flows.
3	*Moderate improvement* in River Health from improved flows.
4	*Significant improvement* in River Health from improved flows.
5	*Extreme improvement* in River Health from improved flows.

5.2.5. Surface, ground and marine water quality

For surface, ground and marine water quality, each option was assessed on the anticipated impact on the existing beneficial uses of the water resource affected. Where possible, existing data was used to inform the qualitative assessment, but in general this criterion has relied on specialist, general advice. Where appropriate, it also takes into account consideration of the impact of the released water from some of the options on the receiving environment and potential for leakage into groundwater from new irrigated agriculture. Scoring is identical to that described in the CRSWS.

Score	Descriptor
-5	Extreme decline in water quality with inability to meet existing beneficial uses all of the time.
-4	Significant decline in water quality with inability to meet existing beneficial uses for most of the time.
-3	Moderate decline in water quality with inability to meet existing beneficial uses some of the time.
-2	Small decline in water quality with inability to meet existing beneficial uses for limited periods.
-1	Marginal decline in water quality but continues to meet existing beneficial uses all of the time.
0	No change in water quality and beneficial uses from current conditions.
1	Marginal improvement in water quality for the existing beneficial uses all of the time.
2	Small improvement in water quality with ability to meet additional beneficial uses for limited periods.
3	Moderate improvement in water quality with ability to meet additional beneficial uses some of the time.
4	Significant improvement in water quality with ability to meet additional beneficial uses most of the time.
5	Extreme improvement in water quality with ability to meet additional beneficial uses all of the time.

5.2.6. Effect on terrestrial ecosystems

The impacts to terrestrial ecosystems have been assessed using a broad level qualitative approach based on general issues associated with each option and mapping using GIS datasets provided by South Gippsland Water and DSE. Ecological Vegetation Classes (EVCs) distinguish vegetation types on the basis of floristic communities, bio-geographic range and habitat requirements. This is a qualitative assessment that does not profess to take into account the precise location of infrastructure options (such as options involving significant pipelines).

Score	Descriptor
-5	*Extreme* decline in ecosystem condition as represented by loss of significant EVCs
-4	*Significant decline* in ecosystem condition as represented by loss of significant EVCs
-3	*Moderate decline* in ecosystem condition as represented by loss of significant EVCs
-2	*Small decline* in ecosystem condition as represented by loss of significant EVCs
-1	*Marginal decline* in ecosystem condition as represented by loss of significant EVCs
0	No change from current conditions
1	*Marginal improvement* in ecosystem condition as represented by gain of significant EVCs
2	*Small improvement* in ecosystem condition as represented by gain of significant EVCs
3	*Moderate improvement* in ecosystem condition as represented by gain of significant EVCs
4	*Significant improvement* in ecosystem condition as represented by gain of significant EVCs
5	*Extreme improvement* in ecosystem condition as represented by gain of significant EVCs

5.2.7. Recreation and heritage

The extent of support or opposition to the option as described has been estimated by considering likely changes in recreational use, aboriginal heritage and other cultural heritage.

Score	Descriptor
-5	*Extreme decline* in cultural, heritage or recreational value
-4	*Significant decline* in cultural, heritage or recreational value
-3	*Moderate decline* in cultural, heritage or recreational value
-2	*Small decline* in cultural, heritage or recreational value
-1	*Marginal decline* in cultural, heritage or recreational value
0	No change from current conditions
1	*Marginal improvement decline* in cultural, heritage or recreational value
2	*Small improvement decline* in cultural, heritage or recreational value
3	*Moderate improvement decline* in cultural, heritage or recreational value
4	*Significant improvement decline* in cultural, heritage or recreational value
5	*Extreme improvement* in cultural, heritage or recreational value

5.2.8. Acceptability

The extent of support or opposition to the option as described has been estimated based on our understanding of the community. These will be further tested as the various options are presented to the community.

Score	Descriptor
-5	*Extreme opposition* by the community
-4	*Significant opposition* by the community
-3	*Moderate opposition* by the community
-2	*Small opposition* by the community
-1	*Marginal opposition* by the community
0	Option is neither supported nor opposed by the community
1	*Marginal support* across the community
2	*Small support* across the community
3	*Moderate support* across the community
4	*Significant support* across the community
5	*Extreme support* across the community

5.2.9. Confidence of Success

Confidence is a measure of the extent of evidence base and reflects the inherent uncertainty in a preliminary assessment. Confidence will vary according to the extent of information available to support the particular option.

Score	Descriptor
1	*Low confidence*: Lack of understanding of risks that may impact on volumes being realised over the long term. Limited evidence in support.
2	*Medium confidence:* Reasonable understanding of risks that may impact on volumes being realised over the long term. Reasonable evidence in support.
3	*High confidence:* Wide agreement, multiple findings supported by research, high degree of consensus, considerable evidence. Considerable evidence in support.

5.2.10. Fairness

The fairness flag used in the Central Region Sustainable Water Strategy TBL assessment has not been adopted by South Gippsland Water. The concept of fairness has been incorporated into the social acceptability score.

6. Overall Approach to Assessing Demand Reduction and Supply Enhancement Options

The previous sections of this document present background information on the long-term planning objectives (Section 2), the regulatory framework within which the supply systems are managed and planned for (Section 3), current and projected demands over the 50 year planning horizon (Section 4), and a description of the assessment method used to compare the sustainability of alternative demand reduction and supply enhancement options (Section 5). The following sections of this document present, for each supply system:

- the supply and demand projections for each supply system over the planning horizon;
- whether level of service objectives are currently being met and whether they will continue to be met over the 50 year planning horizon with current operation and infrastructure; and
- actions proposed by South Gippsland Water to reduce demand and/or increase supply to continue to meet level of service objectives over the 50 year planning horizon, if required.

For a number of supply systems, current water availability is sufficient to meet projected demands over the next 50 years and no further actions are required, other than to continue demand management activities in line with other supply systems and to continue to manage operations efficiently and effectively.

For the supply systems where level of service objectives are unlikely to be met over the planning horizon with current operation and infrastructure, a range of options have been considered. Options that were previously considered to be infeasible or not cost-effective in past long-term planning strategies by South Gippsland Water have not been revisited in detail in this current document.

The towns of Poowong, Loch, Nyora, Korumburra, Leongatha and Koonwarra are referred to collectively as South Gippsland Water's "northern towns", whilst Wonthaggi, Cape Paterson and Inverloch are referred to as South Gippsland Water's "southern towns". For these northern and southern towns and nearby unserviced towns, there is the possibility of an interconnected supply system partly supplied from the Melbourne system. Given the possibility of this supply system integration, the supply and demand projections for each individual supply system are presented first under current operation and infrastructure arrangements in Sections 7-11. A collective strategy for these northern and southern towns is then presented in Section 12 under two broad approaches, namely with or without a connection to the Melbourne supply.

For the central towns, there is the potential to collectively supply Toora, Foster, Fish Creek and nearby unserviced towns. For these towns the supply and demand projections for each individual system are presented first under current operation and infrastructure arrangements in Sections 13-

18. A collective strategy for these towns is then presented in Section 19 under two broad approaches, namely for standalone systems (without supply to nearby unserviced towns) and a linked system (with supply to nearby unserviced towns). A potential connection of the Melbourne supply system to these towns was briefly considered but dismissed due to high costs and was not investigated further. The supply systems for Meeniyan and Dumbalk, which may be merged to minimise water treatment costs, are only considered as standalone systems in the WSDS as any decision to merge these two systems is not driven by consideration of water resource availability.

For the eastern towns of Yarram, Port Albert, Alberton and Devon North, which form the Tarra River supply system, the supply and demand projections under current operation and infrastructure are presented alongside the demand reduction and supply enhancement options in Section 20.

7. Supply and Demand Projections for Poowong, Loch and Nyora with Current Operation and Infrastructure

7.1. Introduction

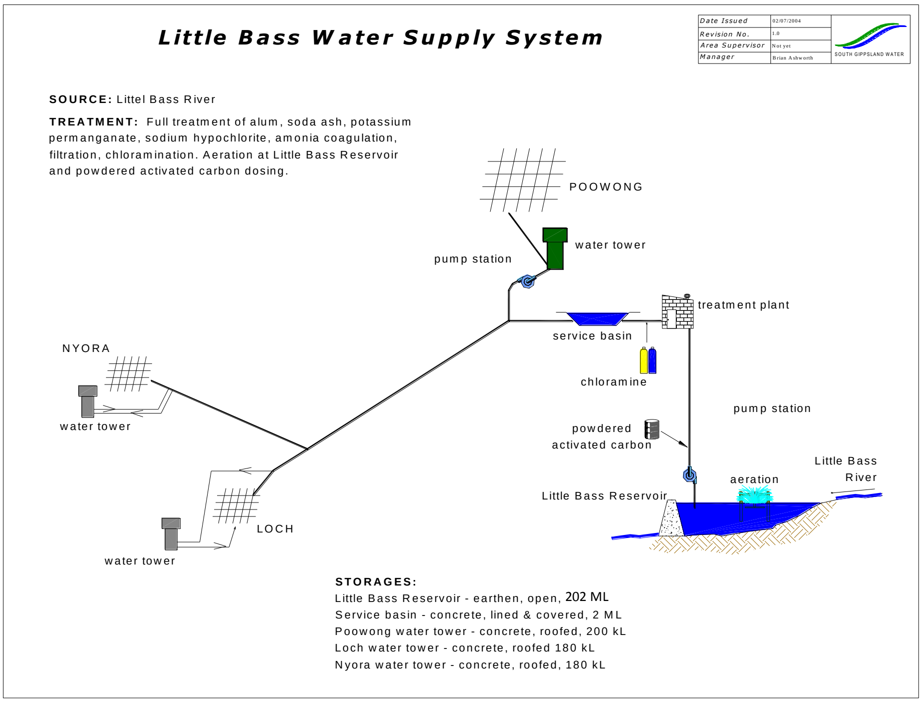
This section of the WSDS outlines the supply and demand projections for Poowong, Loch and Nyora over the next 50 years assuming current operation and infrastructure. It includes an overview of the current supply system configuration, current demand for water and current supply. It also includes supply and demand projections under future climate change and alternative growth scenarios over the 50 year planning horizon. South Gippsland Water's response to any shortfall in demand under the current operation and infrastructure scenarios is presented in Section 12 in conjunction with nearby towns.

7.2. Current water supply and demand

7.2.1. Supply system description

The Little Bass River supply system services the townships of Poowong, Loch and Nyora. A schematic representation of this system is shown in Figure 7-1. The system is supplied from the Little Bass Reservoir on the Little Bass River, approximately 2.5 km south-east of Poowong. The storage has a capacity of 202 ML. A pump operates at approx. 17 L/s (1.5 ML/d), with a maximum capacity of 22 L/s (1.9 ML/d) at the Little Bass Reservoir to pump water up the hill to the treatment plant.

■ **Figure 7-1 Little Bass Water Supply System Schematic**



7.2.2. Current legal entitlements to water

The bulk entitlement for Poowong, Loch and Nyora allows South Gippsland Water to divert up to a maximum of 420 ML/yr from the Little Bass River at the Little Bass Reservoir. The daily bulk entitlement is shown in Table 7-1.

■ **Table 7-1 Bulk entitlement volume for the Little Bass River**

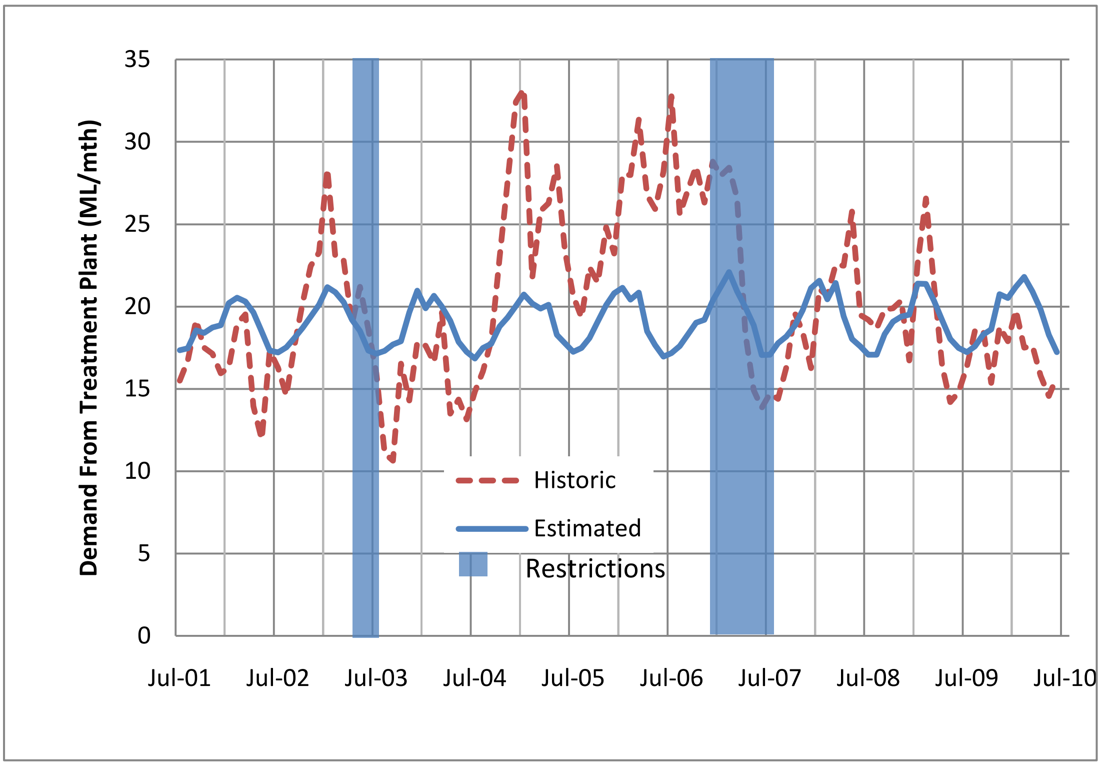
Source	Maximum annual volume (ML/yr)	Maximum diversion rate (ML/d)	Minimum passing flows
Little Bass River	420	2.7	Minimum of 0.5 ML/d or natural flow

South Gippsland Water also has a bulk entitlement to access up to 1,000 ML/yr from the Melbourne system to potentially supply Korumburra, Poowong Loch and Nyora when the desalination plant at Wonthaggi and Melbourne supply pipeline has been commissioned. A physical connection between Korumburra and the Melbourne supply system does not currently exist, so this supply source could only be accessed if South Gippsland Water decides to connect Korumburra to the Melbourne supply.

7.2.3. Current demand

Poowong, Loch and Nyora had populations of 265, 172 and 539 respectively in the 2006 census excluding visitors (DPCD, 2009). This corresponds to a total of 976 people for the three towns. A demand model was fitted to the recent unrestricted data to estimate a long-term average annual demand, which takes into account how current demands would vary under a wider range of natural climate variability. The historical and estimated long-term current demand is shown in Figure 7-2. The estimated long-term current demand is **264 ML/yr** at South Gippsland Water's treatment plant inlet, of which around 9% is utilised on average through the treatment plant. The variation in estimated demands throughout the year is shown in Figure 7-2, which shows that there is a relatively high base demand and that there is not a clear seasonal pattern of demand. This is believed to be due to the variable water use associated with the major customer of the Poowong Abattoir.

- **Figure 7-2 Long-term current monthly demands for Poowong, Loch and Nyora**



7.2.4. Current Reliability of Supply

Over the last decade, restrictions at Poowong, Loch and Nyora were put in place in 2003 and 2007. Since these restrictions were implemented, the level of demand has reduced and there has been a slight increase in the estimated available storage capacity in Little Bass Reservoir. Reliability of supply modelling over the period July 1950 to June 2007 indicated that restrictions at the current level of demand would be required much less frequently than has occurred over the last decade, with restrictions being required once every 19 years on average (i.e. 95% annual reliability). This meets South Gippsland Water's level of service objectives to not restrict supply more frequently than 1 year in 10. The estimate of current reliability of the supply system has increased since the previous WSDS estimate in South Gippsland Water (2007) for the reasons noted above. Further details on the water resource model used to assess reliability of supply (and yield) can be found in SKM (2009).

7.3. Environmental condition

Little Bass River is a tributary of the Bass River and flows into the Bass River south of Poowong. At Poowong the Little Bass River flows through steep and undulating cleared farmland, increases in width to about 4m downstream of Poowong with pools up to 110cm deep and riffles to 20cm deep (DPI, 2007). The river is in a stable condition with good riparian vegetation. The Little Bass River has rubble, gravel and sand substrate with areas of debris and excellent fish habitat (DPI, 2007). The river contains some brown trout (*Salmo trutta*) and short-finned eels (*Anguilla australis*) and also possibly other species that also occur in the Bass River. There are no Index of Stream Condition (ISC) sites on the Little Bass River and other information about the stream is limited.

It is difficult to assess the impact of changes in flow on the condition of the Little Bass River as detailed data on the flora and fauna is limited. However, the main risks would be from actions that reduced summer flows. Reduced summer flows could result in shallower pools with degraded water quality and reduced available habitat for fish and other aquatic fauna. In addition riffles may dry up reducing connectivity between pools along the river.

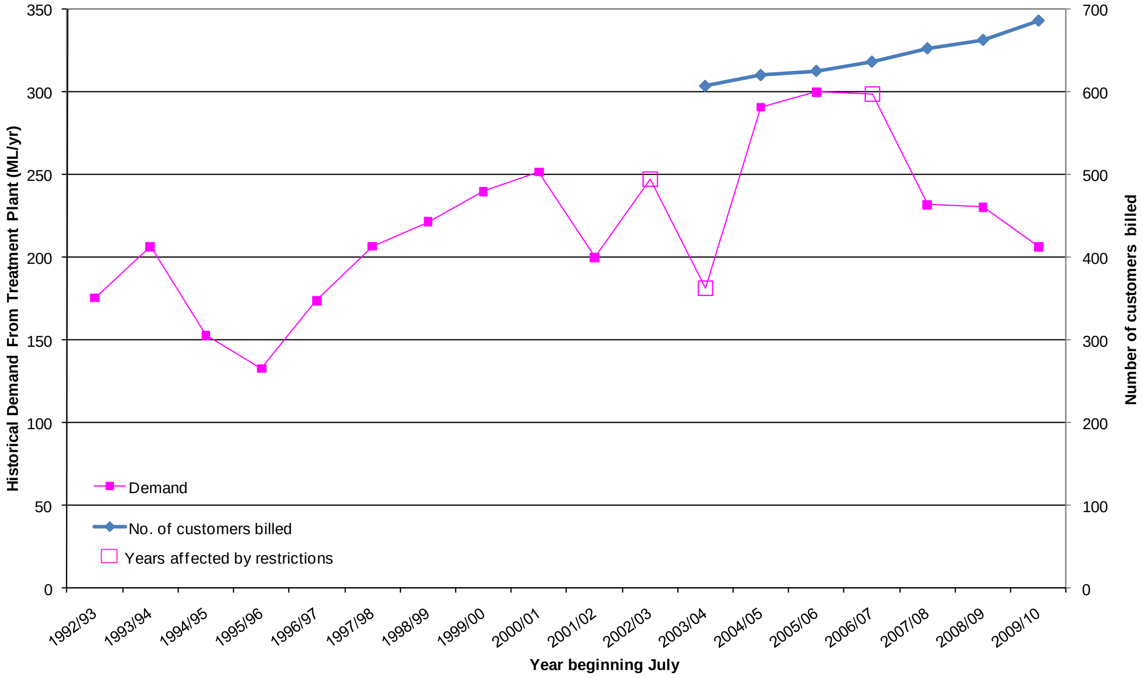
Lloyd Environmental et al. (2008) provided flow recommendations for the Little Bass River. The study reported that short periods of cease to flow provide conditions suitable for germination and growth of the herbs and sedges which run between natural pools. Summer low flows are required to maintain perennial habitat for semi-emergent aquatic vegetation, fringing emergent vegetation, fish and macroinvertebrate communities. A spring-summer recession flow was recommended to ensure successful recruitment of flat-headed gudgeon, river blackfish and to facilitate the parallel expansion of the macroinvertebrate population. Two low flow freshes per year were considered to allow local fish passage as well as supporting a range of other objectives, whilst less frequent low flow freshes of a higher volume were associated with short-finned eel migrations. Winter baseflows were associated with maintaining aquatic plants, whilst high flow freshes contributed to maintaining shrubland vegetation and promoting fish spawning. Bankfull flows were important for maintaining sediment transport to downstream reaches, whilst overbank flows at this location were not linked to any particular ecological objective and were considered insufficient to dislodge the build up of macrophytes in this reach.

7.4. Water supply and demand projections with current operation and infrastructure

7.4.1. Historical trends

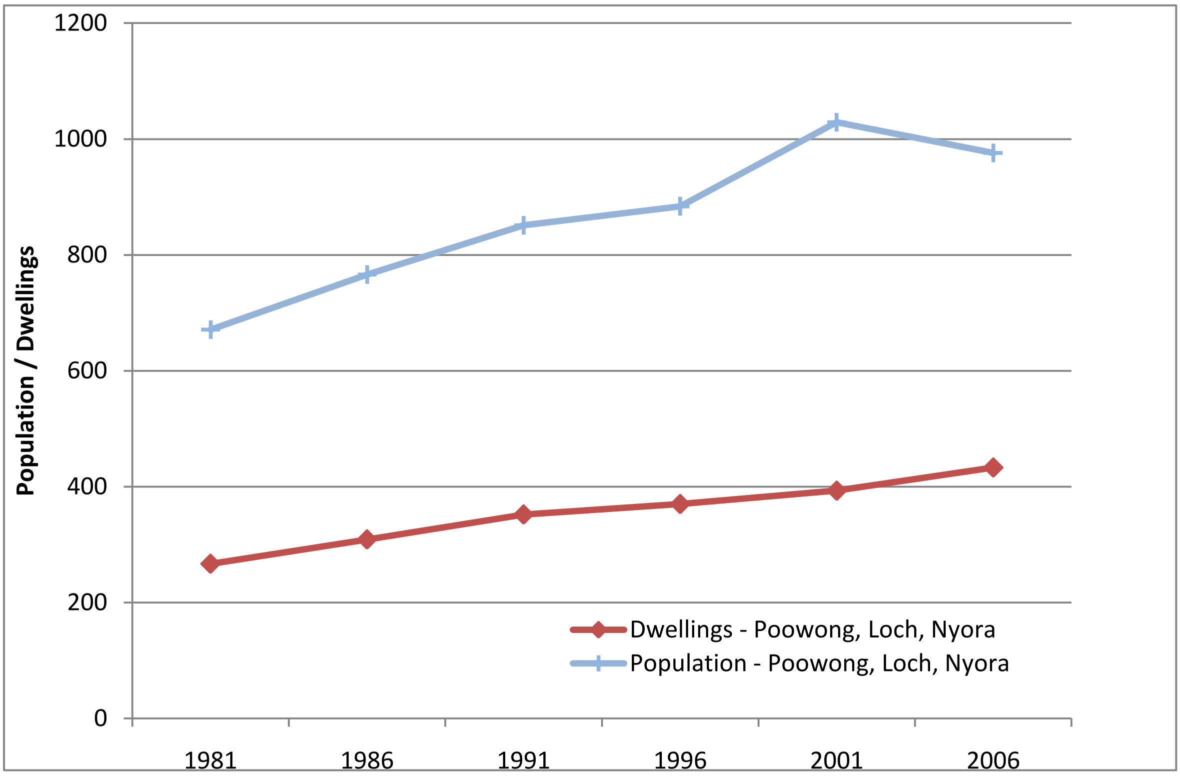
Historical demands at Poowong, Loch and Nyora have been steadily increasing since the mid 1990s, with the exception of the last two years, when demands have decreased markedly, as can be seen in Figure 7-3. These demands are recorded at the clear water storage outlet and do not include an allowance for treatment plant utilisation. The number of customers billed in this supply system has been steadily increasing over the last five years. This potentially indicates that significant water savings have been achieved by South Gippsland Water and its customers in recent years, however it should be noted that annual major industrial water use dropped by around 40 ML in the three years since 2006/07, which would account for much of the recent decline.

- **Figure 7-3 Historical demands and number of customers billed at Poowong, Loch and Nyora**



The population of Nyora has grown steadily over the last two decades, with population of the other two towns remaining relatively constant. The total population for all three towns increased from 671 people in 1981 to 971 people in 2006, as shown in Figure 7-4. Between 2001 and 2006 however there was a slight decline in population, due to a decline in population at Poowong and Loch and only a modest increase in population at Nyora. The number of dwellings increased at each individual town over the years 2001 to 2006.

▪ **Figure 7-4 Historical population in Poowong, Loch and Nyora**



7.5. Future demand projections

Two estimates of future growth in water demand were made in the previous strategy (South Gippsland Water, 2007). These included the *Victoria in Future* estimates, which are available at a Statistical Local Area (SLA) level, and a Local Growth scenario which considered the potential for stronger growth within towns at a rate greater than the surrounding SLA. There are five SLA's covering South Gippsland Water's water supply area. Poowong, Loch and Nyora are located within the South Gippsland Shire West SLA and account for around 12% of the population within the SLA.

A comparison of the 2006 census results for each town against the previous population projections from the 2001 census indicated that both the *Victoria in Future* and the Local Growth scenario overestimated population growth between 2001 and 2006. The *Victoria in Future* projections were closer to the growth which actually happened, which was a fall in population of 5% for the supply system. Given the uncertainty of future population, South Gippsland Water has considered two population forecasts, which include the *Victoria in Future* projections and a higher Local Growth scenario that allows for faster growth in urban centres within SLAs.

Victoria in Future projections include a growth in residential demand of between 0.6% to 1.1% per year and no change in major industrial demand. The Local Growth scenario assumes a 1.5% annual growth rate in residential demand up to the year 2015, then a 2.5% growth in demand to the year 2039 and a 1.5% growth rate thereafter. An allowance for an increase in major industrial demand from the current 89 ML to a future 230 ML by the end of the planning horizon has also been made in this Local Growth scenario.

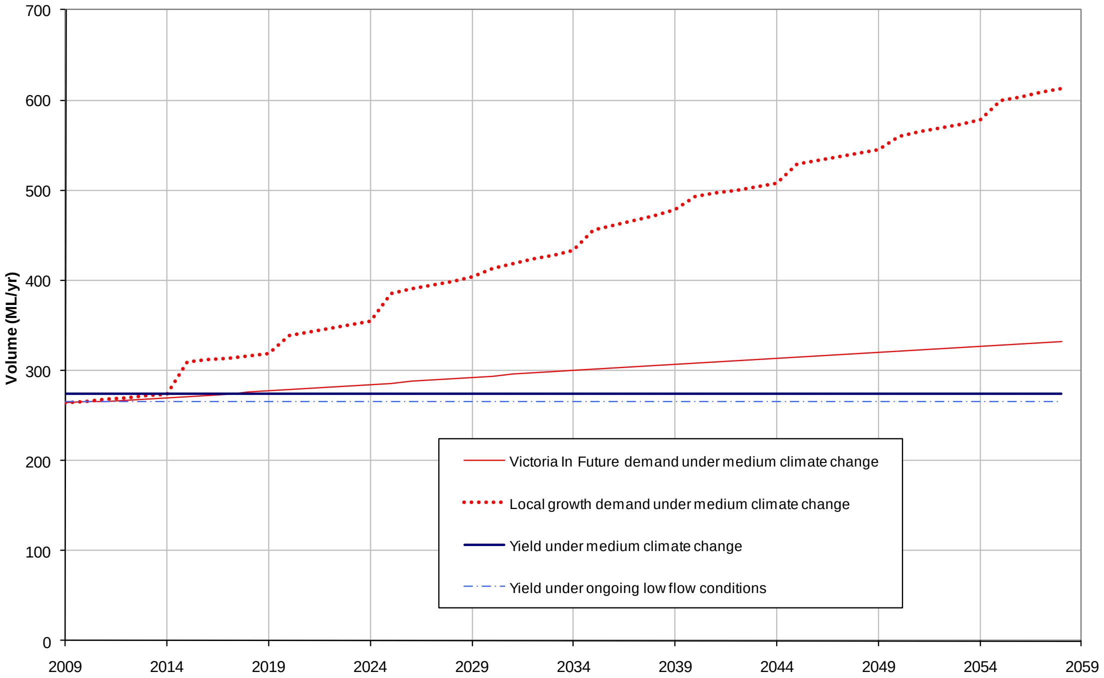
An additional 2.5% increase in residential and stock and domestic demand was assumed to occur over the next 50 years due to medium climate change for all population forecasts. This additional increase in demand is due to increased water use activities such as garden watering under drier and hotter climate change conditions and is consistent with DSE recommendations (DSE, 2005).

7.5.1. Future supply projections with current operation and infrastructure

Under the medium climate change scenario, runoff in the South Gippsland Basin in the year 2058 relative to the year 2009 is estimated to decrease by 15%, with a range of reduction of 7% to 28% under low and high climate change scenarios. Under the medium climate change scenario, this change in streamflow would be driven by a 3% reduction in rainfall and a 7% increase in evaporation. Under the ongoing low flow conditions scenario, Little Bass River streamflows upstream of Little Bass Reservoir have been reduced by 41% prior to July 1997.

The Current Operation and Infrastructure water supply and demand situation for the Little Bass supply system using the *Victoria in Future* population projection is shown in Figure 7-5. This figure illustrates that if no further action is taken and growth in demand for water occurs in accordance with *Victoria in Future* population projections, demand would exceed available supply at South Gippsland Water's level of service objective in the next year or two. For the higher Local Growth scenario, which is also shown in Figure 7-5, the shortfall in supply by the end of the 50 year planning horizon is significantly higher than the *Victoria in Future* growth scenario.

■ **Figure 7-5 Water Supply and Demand for Poowong, Loch and Nyora with current operation and infrastructure**



7.6. Sensitivity of projections

Three potential land use changes within the catchments supplying Poowong, Loch and Nyora were investigated to understand the potential risk they could pose to available supply.

Bushfires: Only 8% of the Little Bass River catchment has vegetation cover. This means that the risk of catchment yield decreasing significantly due to the effects of bushfires is low. There is no record of bushfires occurring in the catchment over the last few decades.

Logging: No logging is undertaken under regional forestry agreements in the water supply catchment for this supply system.

Plantations: There are no plantations in the water supply catchment for this supply system.

Further comments on the sensitivity of the demand projections to demand uncertainty are also presented.

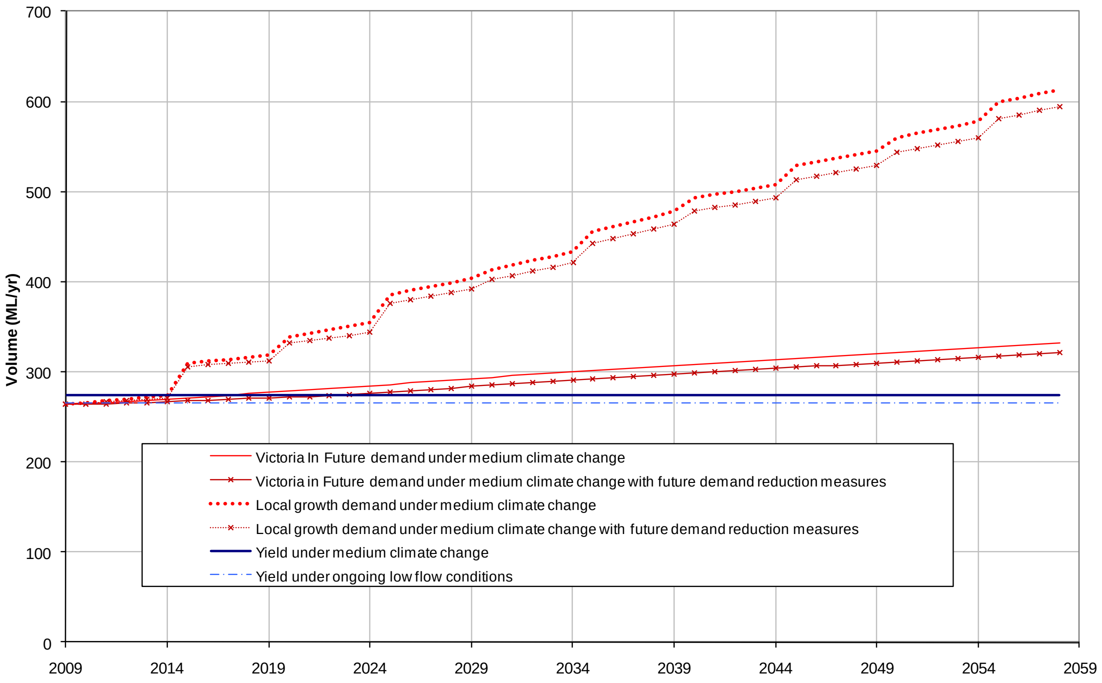
Future development: It is speculated that future residential development at the growth rates adopted in the Local Growth scenario may occur because the towns are within commuting distance to parts of Melbourne and because reticulated sewerage will be provided. An examination of the planning scheme for Nyora indicated that any future large scale lot development at Nyora would require an amendment to the planning scheme, which is typically a 1-2 year process. A discussion of the limited potential for future growth within the current planning scheme is presented in Appendix C.

Areas along the South Gippsland Highway closer to Melbourne have grown at a faster rate than Nyora in recent years and indicate the potential for growth at Nyora in the future. From 2001 to 2006, the City of Casey – Cranbourne Statistical Local Area (SLA) population increased by 28%, whilst the Shire of Cardinia – South SLA population, which includes Koo Wee Rup, increased by 7%. This is in contrast to Nyora, which did not grow in population over the 2001 to 2006 period. The Local Growth scenario takes the potential for higher population growth at Poowong, Loch and Nyora into account.

7.7. Additional demand reduction options

If the additional demand reduction options outlined in Section 4.10 are adopted for Poowong, Loch and Nyora, demands in the future would still remain above the available supply at South Gippsland Water's level of service objectives, as shown in Figure 7-6, however the magnitude of future supply augmentations would not need to be quite as high.

- **Figure 7-6 Effect of additional demand reduction options for Poowong, Loch and Nyora**



7.8. Summary of the supply and demand for Poowong, Loch and Nyora with current operation and infrastructure

In summary for Poowong, Loch and Nyora under the Current Operation and Infrastructure supply and demand scenarios:

- Existing supply is just sufficient to meet South Gippsland Water's current level of service objectives under medium climate change and is just below those service objectives under a continuation of the ongoing low flow conditions that have occurred since July 1997;
- Demand for water over the next few years is expected to exceed available supply at South Gippsland Water's level of service objectives due to population growth and growth in industrial demand for water, potentially creating a significant shortfall in supply in 50 years time;
- Demand for water has fallen in recent years, as has population, but the number of dwellings has increased; and
- Demand reduction initiatives will reduce the magnitude of any future supply enhancement, but some form of supply enhancement will still be required over the 50 year planning horizon.

South Gippsland Water's strategy to address this future supply shortfall is presented in Section 12.

8. Supply and Demand Projections for Korumburra with Current Operation and Infrastructure

8.1. Introduction

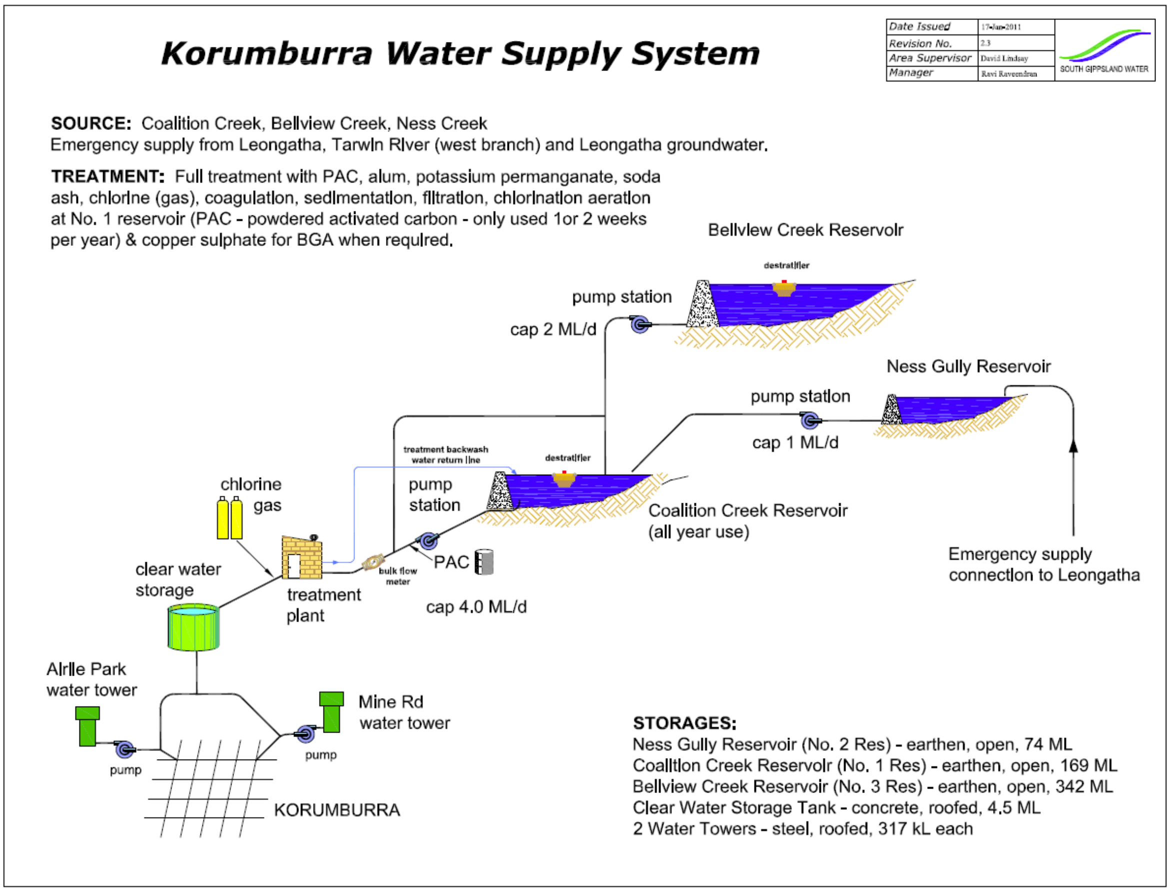
This section of the WSDS outlines the supply and demand projections for Korumburra over the next 50 years assuming current operation and infrastructure. It includes an overview of the current supply system configuration, current demand for water and current supply. It also includes supply and demand projections under future climate change and alternative growth scenarios over the 50 year planning horizon. South Gippsland Water’s response to any shortfall in demand under the current operation and infrastructure scenarios is presented in Section 12 in conjunction with nearby towns.

8.2. Current water supply and demand

8.2.1. Supply system description

Supply to Korumburra is from three service reservoirs located on three separate tributaries to the north of the township. The total live system storage capacity is 658 ML, with no assumed dead storage. The town’s water supply is drawn from the No. 1 Reservoir on Coalition Creek which has a current capacity of 222 ML. The outlet capacity from the No. 1 storage is 4.5 ML/day and water from the No. 2 Reservoir (Ness Creek - total capacity 74 ML) is pumped into the No. 1 Reservoir to top up the storage between mid-spring and mid-summer. The capacity for water transfer from the No. 2 storage to the No. 1 storage is 10 L/s. When the live volume in No. 1 storage drops below 160 ML, water is pumped from the No. 3 Reservoir (Bellview Creek, total capacity 362 ML) into the No. 1 storage. The outlet capacity from the No. 3 storage is 2 ML/d. If necessary, water can be pumped directly from the No. 3 Reservoir to the treatment plant. A schematic representation of the system is presented in Figure 8-1.

- **Figure 8-1 Coalition Creek Water Supply System Schematic**



8.2.2. Current legal entitlements to water

The bulk entitlement for Korumburra allows South Gippsland Water to divert up to a maximum of 1000 ML/yr from Coalition, Ness and Bellview Creeks, and up to 1,800 ML/yr from the Tarwin River West Branch. Daily bulk entitlements are shown in Table 8-1.

- **Table 8-1 Daily Bulk Water Entitlement and equivalent monthly volumes for Korumburra**

Source	Maximum annual volume (ML/yr)	Max diversion rate (ML/d)	Max diversion rate (ML/mth)	Minimum passing flows
Coalition Creek	1000	4.8	145.9	Minimum of 0.6 ML/d (18.24 ML/mth) or natural flow
Ness Creek		1.6 (Oct-Dec) 0.0 (Jan-Sep)	48.6 (Oct-Dec) 0.0 (Jan-Sep)	Minimum of 0.6 ML/d (18.24 ML/mth) or natural flow
Bellview Creek		3.0	91.2	Minimum of 1.0 ML/d (30.4 ML/mth) or natural flow
Tarwin River West Branch at Koonwarra(1)	1800(2)	10.0 (May-Nov) 5.0 (Dec-Apr)(3)	304.0 (May-Nov) 152.0 (Dec-Apr)	Minimum passing flow 90-100 ML/d Minimum passing flow 15-20 ML/d

(1) This supply to Korumburra is currently complex and difficult to operate and only suitable for use in severe drought.

(2) Less any water diverted under the Leongatha bulk entitlement from the Tarwin River West Branch or lower Coalition Creek. In a drought year this diversion to Leongatha is estimated to be in the order of 1200-1300 ML/yr

(3) Summer diversion only available until 30 June 2015 as an interim measure

During the 2006/07 water year, temporary pumping occurred from the Tarwin River West Branch to Korumburra and Leongatha. This was formalised into a qualification of rights to the Meeniyan bulk entitlement on 13 June 2008 prior to being incorporated into an amendment to the Korumburra and Leongatha bulk entitlements on 19 October 2010. The Current Operation and Infrastructure scenario for the WSDS assumes that pumping from the Tarwin River West Branch to Korumburra and Leongatha occurs in accordance with the amended bulk entitlement, but at the current diversion infrastructure capacities, which are lower than those allowable in the bulk entitlement amendment. Further detail on the assumed operation of the diversion from these sources is shown in Table 8-2, which assumes current diversion infrastructure capacities. It should be noted that the supply from the Tarwin River West Branch to Korumburra utilises existing obsolete infrastructure that is complex and difficult to operate. Hence this source of supply to Korumburra is currently only suitable for use in a severe drought.

Full use of the amended entitlement by upgrading diversion infrastructure capacities is discussed as a supply enhancement option later in this document (Section 12.2.2).

Table 8-2 Tarwin River West Branch Diversion Rules for Current Operation and Infrastructure Scenario

Pumping Rule	Tarwin River at Koonwarra (pumping to Ruby Creek Storages and Ness Gully Storage)	Coalition Creek at pump site (pumping to Ruby Creek Storages)
Minimum passing flow (ML/day)	100	10
Extraction volume (ML)	1800 minus Coalition Ck volume	800
Extraction period	May-Nov	May-Nov
Upper limit on pumping capacity (ML/day)	5 minus Coalition Ck rate	5
Capacity Sharing (Ruby Ck No 4 : Ness Gully No. 2)	3 ML/day maximum to Leongatha, 3 ML/day maximum to Korumburra(1)	To Ruby Creek Storages(2)
Pipe capacities	5 ML/d at extraction point. 3ML/d to Ness Gully, 3ML/d to Ruby Ck storages	5 ML/d

(1) This supply to Korumburra is currently complex and difficult to operate and only suitable for use in severe drought.
(2) Modelling assumes supply to No.4 reservoir. Current connection only extends to No. 3 reservoir, but temporary pumping arrangements could transfer up to No. 4 reservoir if required in practice.

The amendment to the Korumburra bulk entitlement in October 2010 also allows South Gippsland Water to increase storage capacity by 200 ML. This supply enhancement option is discussed later in this document (Section 12.2.2).

There are several groundwater bores in the Korumburra and Leongatha areas. The Current Operation and Infrastructure scenario in the WSDS assumes that groundwater pumping occurs as per the rules outlined in Table 8-3. These rules incorporate the licence conditions on the groundwater licence issued by Southern Rural Water in 2010, but conservatively assume that only 1.0 ML/d can be sustained from the bores rather than the 2.1 ML/d that has been licensed. Additional pumping above 1.0 ML/d may occur as an emergency supply measure in extreme drought.

- **Table 8-3 Groundwater Pumping Rules for Current Operation and Infrastructure Scenario**

Pumping Rule	Bores supplying Leongatha only	Bores supplying both Leongatha and Korumburra[(1)]
Bores	S9025900/2, 138891 and S9026806/1	S9029805/2
Total extraction rate (ML/d)	0.5	0.5
Relevant storages that trigger pumping	Ruby Creek	All storages in Leongatha and Korumburra system
Bore pumping triggers	During the period Oct-Dec: relevant storages at 75% of capacity triggers pumping to start and stop During the period March-May: relevant storages <50% of capacity triggers pumping to start, and 75% of capacity triggers pumping to stop	

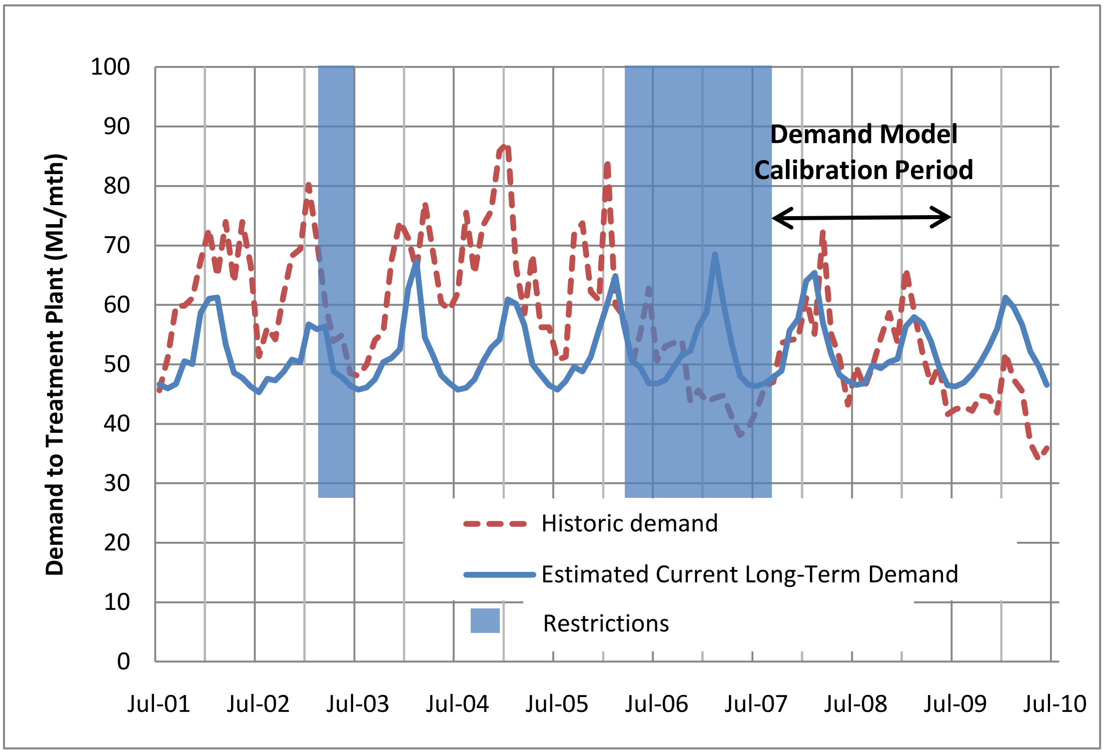
(1) This supply to Korumburra is currently complex and difficult to operate and only suitable for use in severe drought.

South Gippsland Water also has a bulk entitlement to access up to 1,000 ML/yr from the Melbourne system to potentially supply Korumburra, Poowong Loch and Nyora when the desalination plant at Wonthaggi and Melbourne supply pipeline has been commissioned. A physical connection between Korumburra and the Melbourne supply does not currently exist, so this supply source could only be accessed if South Gippsland Water decides to connect Korumburra to the Melbourne supply.

8.2.3. Current demand

Korumburra had a population of 2,974 people excluding visitors in the 2006 census (DPCD, 2009). Historical demand over the last three years has ranged from 530-640 ML/yr. Demand data prior to this was restricted. A demand model was fitted to the recent unrestricted data to estimate a long-term average annual demand, which takes into account how current demands would vary under a wider range of natural climate variability. The historical and estimated long-term current demand is shown in Figure 8-2. The estimated long-term current demand is **621 ML/yr** at South Gippsland Water's treatment plant inlet, of which around 3% is utilised on average through the treatment plant. The variation in demands throughout the year is also shown in Figure 8-2, which shows that demand varies seasonally with climate, but that base demand in winter is relatively high.

▪ **Figure 8-2 Long-term current monthly demands for Korumburra**



8.2.4. Current reliability of supply

Since the mid-1990s, restrictions have occurred in Korumburra in 2000/01, 2002/03, 2005/06 through to early 2007/08. Stage 4 (of 4 stages) restrictions were implemented in 2006/07. Since 2006/07 the supply and demand balance has been improved through a reduction in demand and the development of revised restriction triggers. Reliability of supply modelling over the period July 1950 to June 2007 indicated that restrictions would only have been required once over the last 57 years under a repeat of historical climate conditions, which meets South Gippsland Water's level of service objective for restrictions. The minimum storage volume reached under this scenario was estimated to be 165 ML. Further details on the water resource model used to assess reliability of supply (and yield) can be found in SKM (2009).

8.3. Environmental condition

Three creeks form the primary supply to Korumburra, namely Coalition Creek, Ness Creek and Bellview Creek. Coalition Creek is a tributary of the Tarwin River West Branch and is joined by Ruby Creek (supplying Leongatha) just before its confluence with the Tarwin River West Branch. Information about the environmental condition of Coalition Creek was assessed for South Gippsland Water in SKM (2006a) *Coalition Creek Preliminarily Environment Assessment*. The key outcomes of that assessment of relevance to the WSDS are:

- The creek flows through a predominantly rural setting through land that has been cleared for dairy farming.
- Many sections of the creek are infested with willows and other weeds, however some willow removal has occurred and revegetation at these sites is now starting to provide shade to the creek.
- Willow removal and subsequent revegetation is planned for a number of locations along the creek, which will require available water to assist in maintaining seedlings during the summer months.
- Pockets of remnant native vegetation require streamflows to be maintained to ensure maintenance of existing mature trees and to promote establishment of seedlings.
- The creek ceases to flow in summer, but in some areas there are permanent water pools which are an important summer refuge for aquatic fauna. Any premature drying of the pools due to changes in summer flow regime could impact on ability of small bodied fish to avoid larger predatory species.
- Water quality in the creek is generally poor and the benefit of permanent water pools for summer refuge may be reduced by poor water quality.
- In a previous fish survey, no native fish species were found in the creek. Access to Coalition Creek by many of the native migratory fish in the Tarwin River catchment would be limited by flow regime and existing fish barriers.

Ness Creek is a major tributary of Coalition Creek and the health of Coalition Creek largely reflects the health of Ness Creek. There are no Index of Stream Condition sites or water quality data on Ness Creek and available information is limited. It is difficult to assess the impact of changes in flow on the condition of Ness Creek, however the main risks to the aquatic fauna and flora are probably degradation of water quality, reduction of available habitat for aquatic fauna, and impacts that may affect the riparian vegetation.

The above assessment was confirmed in the environmental flow assessment for Coalition Creek in SKM (2009). The environmental flow assessment linked the provision of low flows to maintaining connectivity between pools, maintaining water quality in pools and to provide moisture for riparian and fringing plants. Summer freshes were important for preventing colonization of riparian areas by terrestrial plants, to entrain organic matter and transport nutrients downstream. Winter low flows were designed to maintain habitat and prevent colonisation of weeds, while high flow freshes were intended to maintain channel forming processes and to facilitate the upstream migration of Tupong and juvenile fish species. Bankfull flows were recommended to maintain channel forming processes and no overbank flows were specifically recommended.

Bellview Creek is a tributary of the Bass River. The conditions in the Little Bass River previously presented in the environmental description of that river for the Poowong, Loch and Nyora supply would be similar to Bellview Creek.

Information about the environmental condition of Tarwin River West Branch and the Tarwin River downstream of the confluence of the East and West Branches was assessed for South Gippsland Water in SKM (2006b) *Tarwin River Preliminarily Environment Assessment*. The main relevant outcomes of that assessment are discussed below.

Around 30 fish species have been recorded in the Tarwin River downstream of its confluence with the West Branch. One fish species (Australian grayling, *Prototroctes maraena*) recorded in the study area is listed nationally as vulnerable under the Environment Protection Biodiversity Conservation Act 1999 (National) and as threatened in Victoria under the Flora and Fauna Guarantee Act 1988 and one species (Australia whitebait, *Hyperlophus vittatus)* is listed as threatened in Victoria under the FFG Act 1988. The list of species found also included the two exotic species of carp and brown trout.

Recent work by the Department of Sustainability and Environment (DSE) has recorded substantial populations of Australian grayling in the Tarwin River immediately below the weir at Meeniyan. Consequently, both branches of the Tarwin River have been identified as having significance for populations of Australian grayling (Justin O'Connor, pers. com. DSE, Freshwater Ecology). Australian grayling spawn from about April through to July. At the time of spawning the juveniles move downstream and then move back upstream in October to November. It is believed Australian grayling need an increase in river flow to induce spawning (Justin O'Connor, pers. com.). Installation of a fish ladder at the weir at Meeniyan was identified as a priority by DSE (Justin O'Connor, pers. comm.) and has now been installed.

Water quality was found to be poor at the site on the West Branch of the Tarwin River near Koonwarra and was above the State Environment Protection Policy guideline values.

The above assessment was confirmed in the environmental flow assessment for the Tarwin River West Branch in SKM (2009). The environmental flow assessment linked the provision of low flows to maintaining habitat in pools for river blackfish, to maintain habitat, to allow fish movement, and to provide moisture for riparian and fringing plants. Summer freshes were important for preventing colonization of riparian areas by terrestrial plants, to entrain organic matter and transport nutrients downstream, whilst slightly higher, short duration transitional flows in summer were considered important for triggering fish migration. Winter low flows were designed to maintain habitat, inundate paperbarks and prevent colonisation of weeds, while high flow freshes were intended to maintain channel forming processes and to facilitate the upstream migration of Tupong and juvenile fish species, including Australian Grayling and Galaxiids.

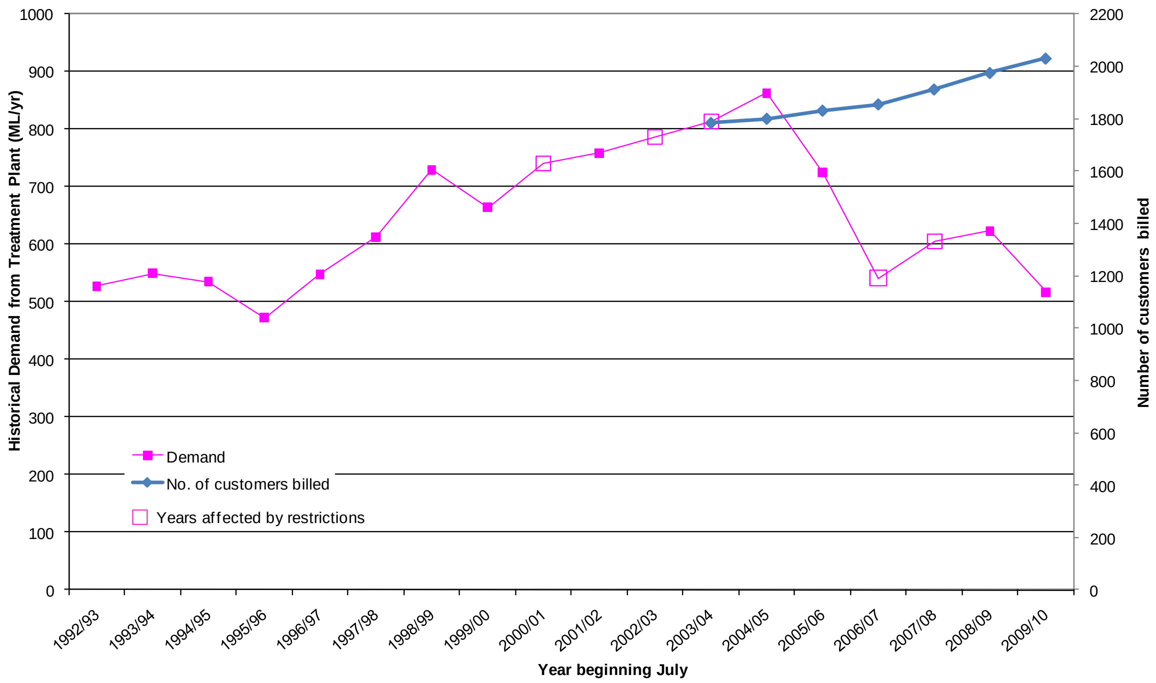
Bankfull flows were recommended to maintain channel forming processes and no overbank flows were specifically recommended.

8.4. Water supply and demand projections with current operation and infrastructure

8.4.1. Historical trends

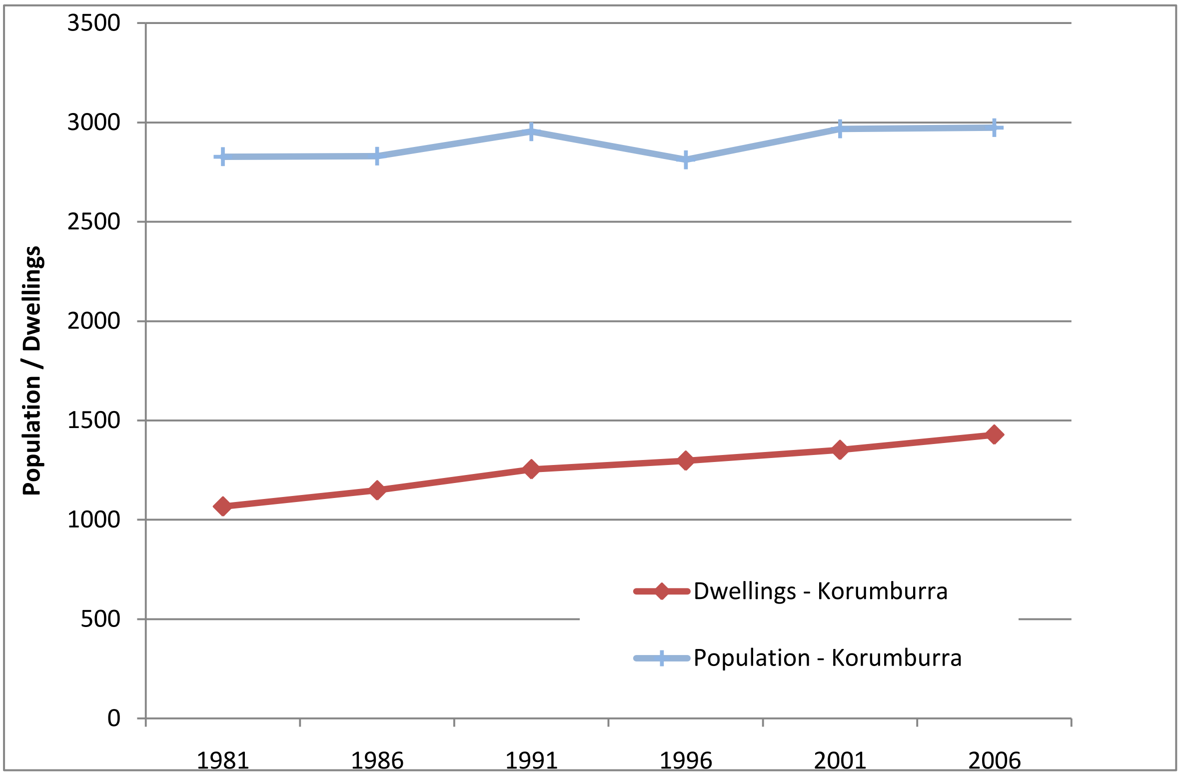
Historical demand at Korumburra decreased significantly from 2004/05 and in 2009/10 was around 40% lower than the peak annual demand in 2004/05, as shown in Figure 8-3. These demands are recorded at the clear water storage outlet and do not include an allowance for treatment plant utilisation. The number of customers billed has increased slightly despite the reduction in demand. This potentially indicates that significant water savings have been achieved by South Gippsland Water and its customers in recent years. Major industrial demand for water at Korumburra since 2006/07 has remained relatively constant and accounts for only a small portion of the observed variability in demand over the last few years.

- **Figure 8-3 Historical demand and number of customers billed at Korumburra**



The population of Korumburra has remained relatively static over the last few decades, as shown in Figure 8-4, with the population increasing only marginally from 2,954 in 1991 to 2,974 in 2006. The number of dwellings has however increased consistently in every census since 1981.

Figure 8-4 Historical population in Korumburra



8.4.2. Future demand projections

Two estimates of future growth in water demand were made in the previous strategy (South Gippsland Water, 2007). These included the *Victoria in Future* estimates, which are available at a Statistical Local Area (SLA) level, and a Local Growth scenario which considered the potential for stronger growth within towns at a rate greater than the surrounding SLA. There are five SLA's covering South Gippsland Water's water supply area. Korumburra is located within the South Gippsland Shire West SLA and accounts for around 37% of the population within the SLA.

A comparison of the 2006 census results for Korumburra against the previous population projections from the 2001 census indicated that both the *Victoria in Future* and the Local Growth scenarios overestimated population growth between 2001 and 2006. The *Victoria in Future* projections were closer to the growth which actually happened, which was an increase in population of 0.2% for the supply system. Given the uncertainty of future population, South Gippsland Water has considered two population forecasts, which include the *Victoria in Future* projections and a higher Local Growth scenario that allows for faster growth in urban centres within SLAs.

Victoria in Future projections include a growth in residential demand of between 0.6% to 1.1% per year and no change in major industrial demand. The Local Growth scenario assumes a 1.5% annual growth rate in residential demand over the planning horizon. It also assumes a 10% increase in major industrial demand in the year 2015 and a further 10% increase in the year 2040.

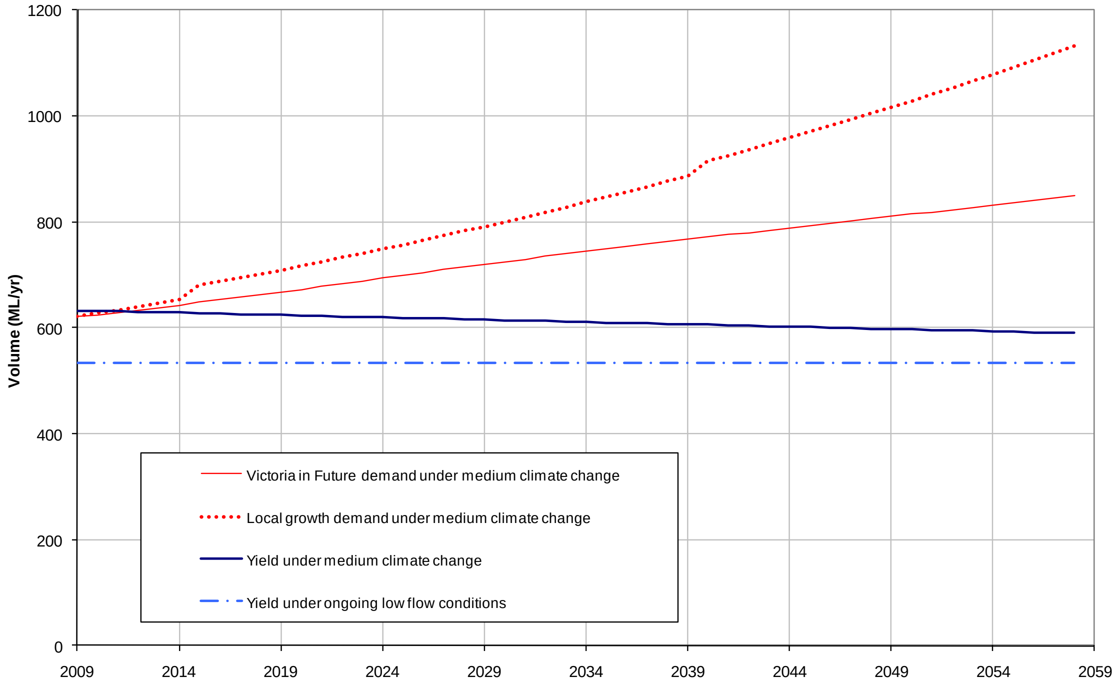
An additional 2.5% increase in residential and stock and domestic demand was assumed to occur over the next 50 years due to medium climate change for all population forecasts. This additional increase in demand is due to increased water use for activities such as garden watering under drier and hotter climate change conditions and is consistent with DSE recommendations (DSE, 2005).

8.4.3. Future supply projections with current operation and infrastructure

Under the medium climate change scenario, runoff in the South Gippsland Basin in the year 2058 relative to the year 2009 is estimated to decrease by 15%, with a range of reduction of 7% to 28% under low and high climate change scenarios. Under the medium climate change scenario, this change in streamflow would be driven by a 3% reduction in rainfall and a 7% increase in evaporation. Under the ongoing low flow conditions scenario, total inflows to the Korumburra storages have been reduced by 39-41% prior to July 1997.

The Current Operation and Infrastructure water supply and demand situation for the Korumburra supply system using the *Victoria in Future* population projection is shown in Figure 8-5. This figure illustrates that if no further action is taken and growth in demand for water occurs in accordance with population projections, demand will exceed available supply at South Gippsland Water's level of service objective within the next few years under the medium climate change scenario. South Gippsland Water's level of service objective is not currently being met under the ongoing low flow conditions scenario. For the higher Local Growth scenario, the shortfall in supply by the end of the planning horizon is greater than for the *Victoria in Future* growth scenario, as shown in Figure 8-5. Note that the Tarwin River West Branch and groundwater supply to Korumburra are excluded from the yield presented in Figure 8-5, because it is assumed that these supply sources are only utilised in severe droughts.

▪ **Figure 8-5 Water Supply and Demand for Korumburra with Current Operation and Infrastructure**



8.5. Sensitivity of supply to catchment land use change

Three potential land use changes within the catchments supplying Korumburra were investigated to understand the potential risk they could pose to available supply.

Bushfires: Only 12% of the Coalition, Ness and Bellview Creek catchment has vegetation cover. This means that the risk of catchment yield decreasing significantly due to the effects of bushfires is low. There is no record of bushfires occurring in the catchment over the last few decades.

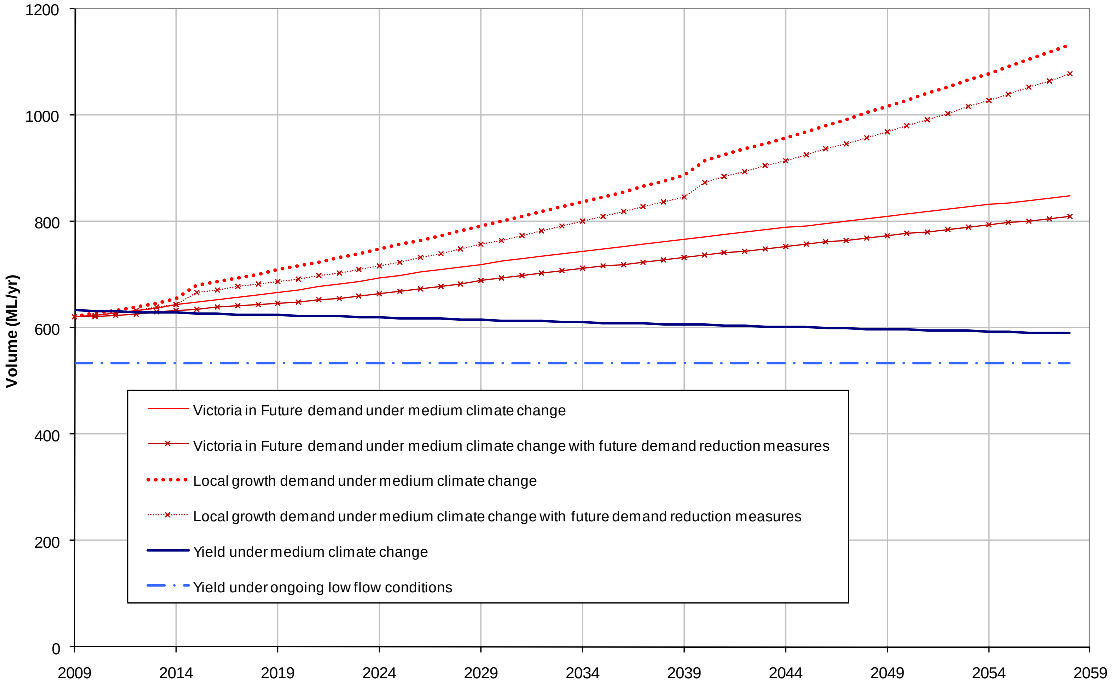
Logging: No logging is undertaken under regional forestry agreements in the water supply catchment for this supply system.

Plantations: There are no plantations in the water supply catchment for this supply system.

8.6. Additional demand reduction options

If the additional demand reduction options outlined in Section 4.10 are adopted for Korumburra, demands would still exceed available supply in the short-term, as shown in Figure 8-6. Whilst these demand reduction options are an action by South Gippsland Water, they will apply equally across all supply systems and have therefore been included in the discussion of Current Operation and Infrastructure supply and demand situation for each supply system. In Korumburra, this additional demand reduction would serve to reduce the size of any supply augmentation.

- **Figure 8-6 Effect of additional demand reduction options for Korumburra**



8.7. Summary of the supply and demand for Korumburra with current operation and infrastructure

In summary for Korumburra under the Current Operation and Infrastructure supply and demand scenarios:

- Existing supply just meets South Gippsland Water's current level of service objectives under the medium climate change scenario, but does not meet those objectives under the ongoing low flows scenario;
- Demand for water is expected to exceed available supply at South Gippsland Water's level of service objective over the next few years due to population growth and growth in industrial demand for water, potentially creating a significant shortfall in supply in 50 years time;
- Demand for water has fallen in recent years, whilst population has remained static and the number of dwellings has increased; and
- Demand reduction initiatives will reduce the magnitude of any future supply enhancement, but some form of supply enhancement will still be required over the 50 year planning horizon.

South Gippsland Water's strategy to address this future supply shortfall is presented in Section 12.

9. Supply and Demand Projections for Leongatha and Koonwarra with Current Operation and Infrastructure

9.1. Introduction

This section of the WSDS outlines the supply and demand projections for Leongatha and Koonwarra over the next 50 years assuming current operation and infrastructure. It includes an overview of the current supply system configuration, current demand for water and current supply. It also includes supply and demand projections under future climate change and alternative growth scenarios over the 50 year planning horizon. South Gippsland Water's response to any shortfall in demand under the current operation and infrastructure scenarios is presented in Section 12 in conjunction with nearby towns.

9.2. Current water supply and demand

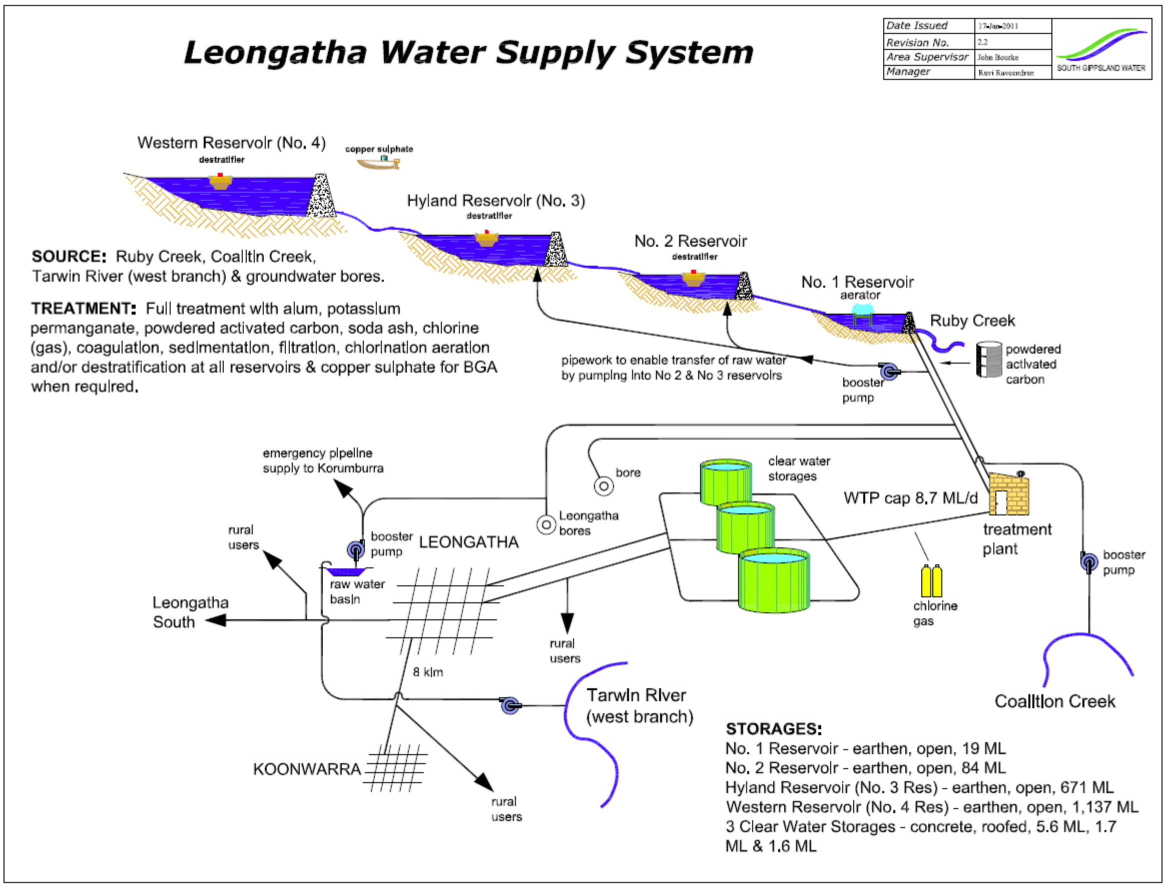
9.2.1. Supply system description

Leongatha derives its water supply by gravity from four reservoirs on Ruby Creek. These four reservoirs have a combined capacity of 1,911 ML with no dead storage. The capacity and construction history for each storage is shown in Table 9-1. The Ruby Creek system is the only source of supply for the township of Leongatha/Koonwarra and for several rural properties. It is also the supply source for the Murray Goulburn Milk factory. Figure 9-1 shows a schematic representation of the system. During the 2006/07 water year emergency pumping was undertaken from Coalition Creek and Tarwin River West Branch downstream of Coalition Creek. This emergency pumping was to aid the supply to Leongatha (South Gippsland Water, 2007).

- **Table 9-1 Leongatha water supply reservoirs (South Gippsland Water, 2007)**

Reservoir	Year constructed	Capacity (ML)
Reservoir No. 1	1906	19
Reservoir No. 2	1928	84
Reservoir No. 3 (Hyland)	1960	671
Reservoir No. 4 (Western)	1980	1,137
Total		1,911

▪ **Figure 9-1 Ruby Creek Water Supply System Schematic**



9.2.2. Current legal entitlements to water

The bulk entitlement for Leongatha allows South Gippsland Water to divert up to a maximum of 2,476 ML/yr from Ruby Creek, and up to 1,800 ML/yr from the Tarwin River West Branch and lower Coalition Creek. The daily and equivalent monthly bulk entitlement is shown in Table 9-2.

- **Table 9-2 Bulk entitlement volume for Ruby Creek (South Gippsland Water, 2007)**

Source	Maximum annual volume (ML/yr)	Maximum diversion rate (ML/d)	Minimum passing flows
Ruby Creek	2,476	17.3	Minimum of 0.5 ML/d (15 ML/mth) or natural flow
Coalition Creek at Spencers Road	1,800#	6.0 (May-Nov)	Minimum passing flow 10 ML/d
Tarwin River West Branch at Koonwarra		10.0 (May-Nov) 5.0 (Dec-Apr)*	Minimum passing flow 90-100 ML/d Minimum passing flow 15-20 ML/d

*Summer diversion only available until 30 June 2015 as an interim measure – this has therefore not been included in current yield estimates presented subsequently in this chapter.

#Less any water diverted to Korumburra under the Korumburra bulk entitlement from the Tarwin River West Branch. This supply to Korumburra is currently complex and difficult to operate and only suitable for use in severe drought, so volumes diverted to Korumburra are expected to be zero in almost all years and up to several hundred megalitres in a drought year.

During the 2006/07 water year, temporary pumping occurred from the Tarwin River West Branch to Korumburra and Leongatha. This was formalised into a qualification of rights to the Meeniyan bulk entitlement on 13 June 2008 prior to being incorporated into an amendment to the Korumburra and Leongatha bulk entitlements on 19 October 2010. The Current Operation and Infrastructure scenario for the WSDS assumes that winter pumping from the Tarwin River West Branch to Korumburra and Leongatha occurs in accordance with the amended bulk entitlement, but at the current diversion infrastructure capacities, which are lower than those allowable in the bulk entitlement amendment. No summer pumping is assumed. Further detail on the assumed operation of the diversion from these sources is shown in Table 9-3, which assumes current diversion infrastructure capacities. Full use of the amended entitlement by upgrading diversion infrastructure capacities is discussed as a supply enhancement option later in this document (Section 12.2.3).

▪ **Table 9-3 Tarwin River West Branch Diversion Rules for Current Operation and Infrastructure Scenario**

Pumping Rule	Tarwin River at Koonwarra (pumping to Ruby Creek Storages and Ness Gully Storage)	Coalition Creek at pump site (pumping to Ruby Creek Storages)
Minimum passing flow (ML/day)	100	10
Extraction volume (ML)	1800 minus Coalition Ck volume	800
Extraction period	May-Nov	May-Nov
Upper limit on pumping capacity (ML/day)	5 minus Coalition Ck rate	5
Capacity Sharing (Ruby Ck No 4 : Ness Gully No. 2)	3 ML/day maximum to Leongatha, 3 ML/day maximum to Korumburra(1)	To Ruby Creek Storages(2)
Pipe capacities	5 ML/d at extraction point. 3ML/d to Ness Gully, 3ML/d to Ruby Ck storages	5 ML/d

(1) This supply to Korumburra is currently complex and difficult to operate and only suitable for use in severe drought.
(2) Modelling assumes supply to No.4 reservoir. Current connection only extends to No. 3 reservoir, but temporary pumping arrangements could transfer up to No. 4 reservoir if required in practice.

There are several groundwater bores in the Leongatha area. The Current Operation and Infrastructure scenario in the WSDS assumes that groundwater pumping occurs as per the rules outlined in Table 9-4. These rules incorporate the licence conditions on the groundwater licence issued by Southern Rural Water in 2010, but conservatively assume that only 1.0 ML/d can be sustained from the bores rather than the 2.1 ML/d that has been licensed. Additional pumping above 1.0 ML/d may occur as an emergency supply measure in extreme drought.

▪ **Table 9-4 Groundwater Pumping Rules for Current Operation and Infrastructure Scenario**

Pumping Rule	Bores supplying Leongatha only	Bores supplying both Leongatha and Korumburra(1)
Bores	S9025900/2, 138891 and S9026806/1	S9029805/2
Total extraction rate (ML/d)	0.5	0.5
Relevant storages that trigger pumping	Ruby Creek	All storages in Leongatha and Korumburra system
Bore pumping triggers	During the period Oct-Dec: relevant storages at 75% of capacity triggers pumping to start and stop During the period March-May: relevant storages <50% of capacity triggers pumping to start, and 75% of capacity triggers pumping to stop	

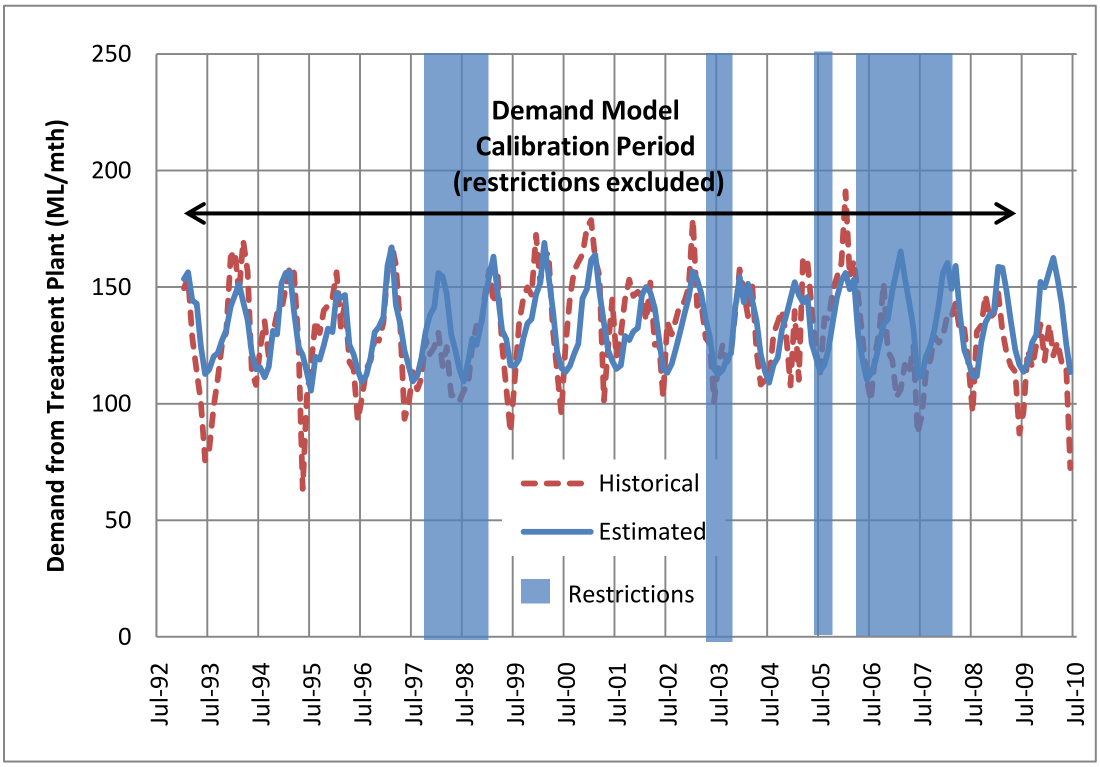
(1) This supply to Korumburra is currently complex and difficult to operate and only suitable for use in severe drought.

South Gippsland Water also has a bulk entitlement to access up to 3,000 ML/yr from the Melbourne system to potentially supply Leongatha when the desalination plant at Wonthaggi has been commissioned. A physical connection between Leongatha and the Melbourne supply does not currently exist, so this supply source could only be accessed if South Gippsland Water decides to connect Leongatha to the Melbourne system.

9.2.3. Current demand

Leongatha had a population of 4202 people excluding visitors in the 2006 census (DPCD, 2009). Separate population data is not available for Koonwarra. A demand model was fitted to the recent unrestricted data to estimate long-term average annual demand, which takes into account how current demands would vary under a wider range of natural climate variability. The historical and estimated long-term current demand is shown in Figure 9-2. The estimated long-term current demand for Leongatha and Koonwarra is **1,893 ML/yr** at South Gippsland Water's treatment plant inlet, of which around 12% is utilised on average through the treatment plant. The variation in demands throughout the year is shown in Figure 9-2, which shows that demand varies seasonally with climate. There is a relatively high base demand due to the Murray Goulburn milk factory. Murray-Goulburn demand currently accounts for around 70% of total water use at Leongatha.

- **Figure 9-2 Long-term monthly demands for Leongatha and Koonwarra**



9.2.4. Current reliability of supply

Leongatha has experienced regular restrictions over recent years. This included restrictions in 1997/98, 2002/03, and from 2005/06 to 2007/08. Stage 4 (of 4 stages) restrictions were implemented in 2006/07. Since 2006/07 the supply and demand balance has been improved through a reduction in demand, increases in groundwater supply, additional supply from the Tarwin River West Branch and the development of revised restriction triggers. Reliability of supply modelling over the period July 1950 to June 2007 indicated that restrictions would only have been required in 4 of the last 57 years (93% annual reliability) under a repeat of historical climate conditions, which meets South Gippsland Water's level of service objective for restrictions. The minimum storage volume reached under this scenario was estimated to be 175 ML. Further details on the water resource model used to assess reliability of supply (and yield) can be found in SKM (2009).

9.3. Environmental condition

Ruby Creek is a tributary of the lower Coalition Creek and the Tarwin River West Branch. Information about the environmental condition of Ruby Creek is limited, however many of the assessments and conclusions drawn in Section 8.3 about Coalition Creek and below about Wilkur Creek are likely to be broadly representative of those expected for Ruby Creek. The main difference between Ruby Creek and these neighbouring streams is the presence of Leongatha's four water supply storages, which act as a fish barrier and significantly reduce streamflows in the creek from natural flow conditions. Passing flow downstream of the reservoirs is 0.5 ML/d or natural flow, whichever is lower. The presence of these reservoirs inhibits the ability to achieve ecological improvements in Ruby Creek and lower Coalition Creek.

Information about the environmental condition of Tarwin River West Branch was assessed for South Gippsland Water in SKM (2006b) *Tarwin River Preliminarily Environment Assessment.* The main relevant outcomes were previously presented in the section on the ecological condition of water sources for Korumburra, which is repeated below for ease of reference.

Around 30 fish species have been recorded in the Tarwin River downstream of its confluence with the West Branch. One fish species (Australian grayling, *Prototroctes maraena*) recorded in the study area is listed nationally as vulnerable under the Environment Protection Biodiversity Conservation Act 1999 (National) and as threatened in Victoria under the Flora and Fauna Guarantee Act 1988 and one species (Australia whitebait, *Hyperlophus vittatus)* is listed as threatened in Victoria under the FFG Act 1988. The list of species found also included the two exotic species of carp and brown trout.

Recent work by the Department of Sustainability and Environment (DSE) has recorded substantial populations of Australian grayling in the Tarwin River immediately below the weir at Meeniyan. Consequently, both branches of the Tarwin River have been identified as having significance for populations of Australian grayling (Justin O'Connor, pers. com. DSE, Freshwater Ecology). Australian grayling spawn from about April through to July. At the time of spawning the juveniles move downstream and then move back upstream in October to November. It is believed Australian grayling need an increase in river flow to induce spawning (Justin O'Connor, pers. com.). Installation of a fish ladder at the weir at Meeniyan was identified as a priority by DSE (Justin O'Connor, pers. comm.) and has now been installed.

Water quality was found to be poor at the site on the West Branch of the Tarwin River near Koonwarra and was above the State Environment Protection Policy guideline values.

The above assessment was confirmed in the environmental flow assessment for the Tarwin River West Branch in SKM (2009). The environmental flow assessment linked the provision of low flows to maintaining habitat in pools for river blackfish, to maintain habitat, to allow fish movement, and to provide moisture for riparian and fringing plants. Summer freshes were important for preventing colonization of riparian areas by terrestrial plants, to entrain organic matter and transport nutrients downstream, whilst slightly higher, short duration transitional flows in summer were considered important for triggering fish migration. Winter low flows were designed to maintain habitat, inundate paperbarks and prevent colonisation of weeds, while high flow freshes were intended to maintain channel forming processes and to facilitate the upstream migration of Tupong and juvenile fish species, including Australian Grayling and Galaxiids. Bankfull flows were recommended to maintain channel forming processes and no overbank flows were specifically recommended.

Information about the environmental condition of Coalition Creek was assessed for South Gippsland Water in SKM (2006a) *Coalition Creek Preliminarily Environment Assessment*. The key outcomes of that assessment of relevance to the WSDS are:

- The creek flows through a predominantly rural setting through land that has been cleared for dairy farming.
- Many sections of the creek are infested with willows and other weeds, however some willow removal has occurred and revegetation at these sites is now starting to provide shade to the creek.
- Willow removal and subsequent revegetation is planned for a number of locations along the creek, which will require available water to assist in maintaining seedlings during the summer months.
- Pockets of remnant native vegetation require streamflows to be maintained to ensure maintenance of existing mature trees and to promote establishment of seedlings.
- The creek ceases to flow in summer, but in some areas there are permanent water pools which are an important summer refuge for aquatic fauna. Any premature drying of the pools due to changes in summer flow regime could impact on ability of small bodied fish to avoid larger predatory species.

- Water quality in the creek is generally poor and the benefit of permanent water pools for summer refuge may be reduced by poor water quality.
- In a previous fish survey, no native fish species were found in the creek. Access to Coalition Creek by many of the native migratory fish in the Tarwin River catchment would be limited by flow regime and existing fish barriers.

The above assessment was confirmed in the environmental flow assessment for Coalition Creek in SKM (2009). The environmental flow assessment linked the provision of low flows to maintaining connectivity between pools, maintaining water quality in pools and to provide moisture for riparian and fringing plants. Summer freshes were important for preventing colonization of riparian areas by terrestrial plants, to entrain organic matter and transport nutrients downstream. Winter low flows were designed to maintain habitat and prevent colonisation of weeds, while high flow freshes were intended to maintain channel forming processes and to facilitate the upstream migration of Tupong and juvenile fish species. Bankfull flows were recommended to maintain channel forming processes and no overbank flows were specifically recommended.

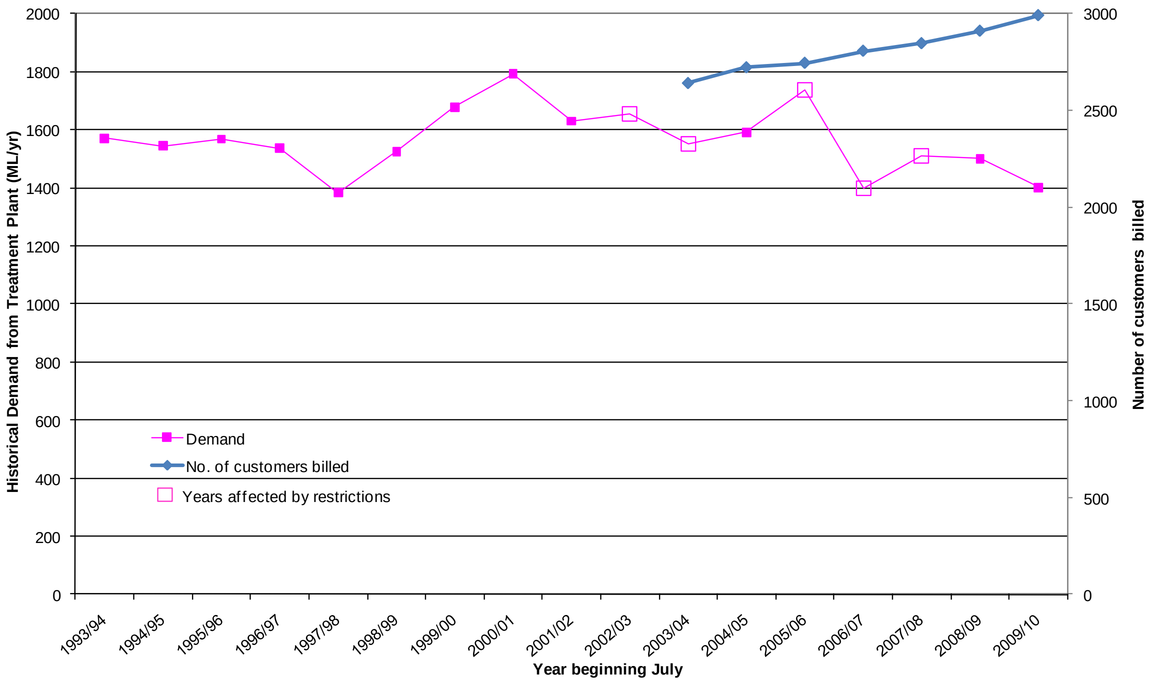
9.4. Water supply and demand projections with current operation and infrastructure

9.4.1. Historical trends

Historical demands for Leongatha and Koonwarra have remained relatively stable since 1993, as can be seen in Figure 9-3. These demands are recorded at the clear water storage outlet and do not include an allowance for treatment plant utilisation. Restrictions have affected demand over much of the recent period.

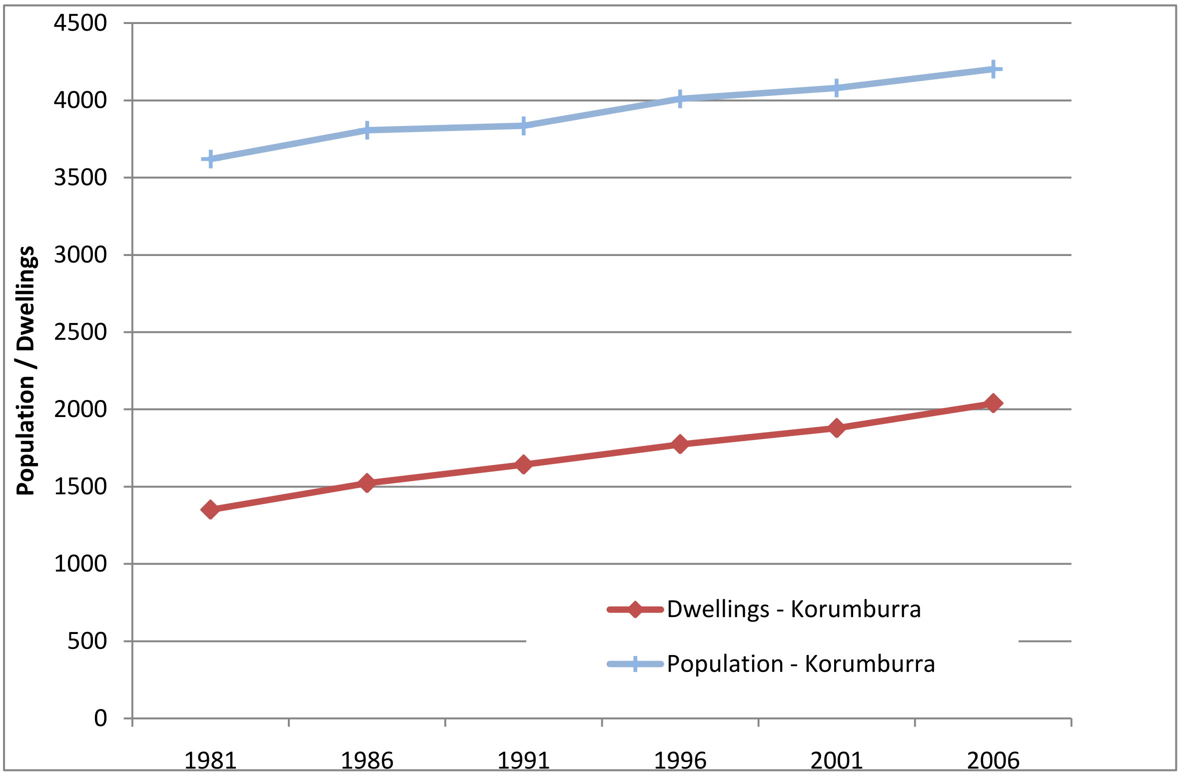
The number of customers billed in this supply system has however increased over the last few years, as shown in Figure 9-3. This potentially indicates that significant water savings have been achieved by South Gippsland Water and its customers in recent years. Major industrial demand for water at Leongatha has remained relatively constant over the last three years, but was slightly lower in the 2006/07 drought. This potentially indicates that proposed water savings at Murray Goulburn have not yet resulted in a reduction in demand for water at the factory.

- **Figure 9-3 Historical demands and number of customers billed at Leongatha and Koonwarra**



The population of Leongatha has grown steadily over the last two decades, as shown in Figure 9-4, with the total population increasing from 3,620 in 1981 to 4,202 in 2006. The number of dwellings has also increased at a similar rate.

▪ **Figure 9-4 Historical population in Leongatha and Koonwarra**



9.4.2. Future demand projections

Two estimates of future growth in water demand were made in the previous strategy (South Gippsland Water, 2007). These included the *Victoria in Future* estimates, which are available at a Statistical Local Area (SLA) level, and a Local Growth scenario which considered the potential for stronger growth within towns at a rate greater than the surrounding SLA. There are five SLA's covering South Gippsland Water's water supply area. Leongatha and Koonwarra are located within the South Gippsland Shire Central SLA and accounts for around 33% of the population within the SLA.

A comparison of the 2006 census results against the previous population projections from the 2001 census indicated that both the *Victoria in Future* and the Local Growth overestimated population growth between 2001 and 2006. The *Victoria in Future* projections were closer to the growth which actually happened, which was an increase in population of 3% for the supply system. Given the uncertainty of future population, South Gippsland Water has considered two population forecasts, which include the *Victoria in Future* projections and a higher Local Growth scenario that allows for faster growth in urban centres within SLAs.

Victoria in Future projections include a growth in residential demand of between 0.5% to 1.0% per year. Future Murray Goulburn demand was previously discussed in Section 4.5 and involves two anticipated water saving phases in the short-term with a total annual demand reduction of 440 ML. The Local Growth scenario assumes a 1.5% annual growth rate in residential demand over the planning horizon. It also assumes that Murray Goulburn demand only drops by 67 ML to 1000 ML and that a further 500 ML of industrial demand occurs in the year 2025.

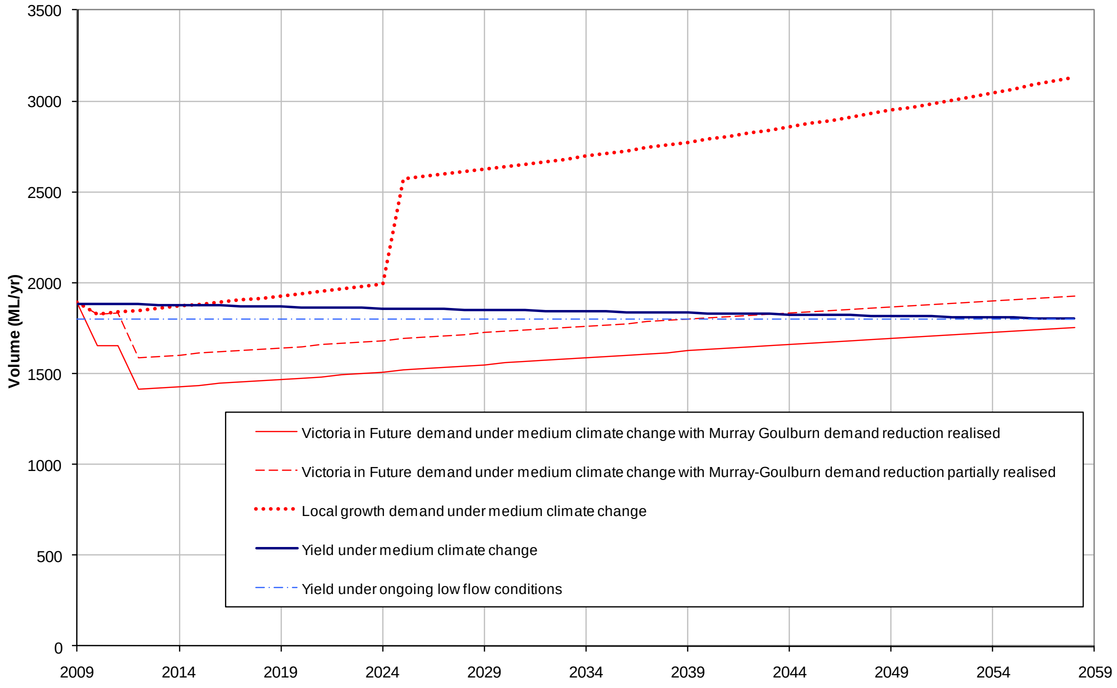
An additional 2.5% increase in residential and stock and domestic demand was assumed to occur over the next 50 years due to medium climate change for all population forecasts. This additional increase in demand is due to increased water use for activities such as garden watering under drier and hotter climate change conditions and is consistent with DSE recommendations (DSE, 2005).

9.4.3. Future supply projections with current operation and infrastructure

Under the medium climate change scenario, runoff in the South Gippsland Basin in the year 2058 relative to the year 2009 is estimated to decrease by 15%, with a range of reduction of 7% to 28% under low and high climate change scenarios. Under the medium climate change scenario, this change in streamflow would be driven by a 3% reduction in rainfall and a 7% increase in evaporation. Under the ongoing low flow conditions scenario, total inflows to the Leongatha storages have been reduced by 52% prior to July 1997.

The Current Operation and Infrastructure water supply and demand situation for the Ruby Creek system is shown in Figure 9-5. This figure illustrates that *Victoria in Future* demand is not expected to exceed supply at South Gippsland Water's level of service objective if Murray Goulburn achieves its anticipated reduction in demand of 440 ML/yr from water savings. If Murray Goulburn's anticipated demand reduction is only partially realised and demands only drop by 67 ML/yr (to 1,000 ML/yr) in Stage 1 of Murray Goulburn's demand reduction measures in 2010/11, then *Victoria in Future* demand would exceed supply at South Gippsland Water's level of service objective between 2040 and 2044 under the two alternative climate scenarios. Under the Local Growth demands, which assume the same 67 ML/yr reduction initially but then no further reduction in demand from Murray Goulburn, demand would exceed supply at South Gippsland Water's level of service objective at around the year 2015 under medium climate change conditions. Demand currently exceeds available supply at South Gippsland Water's level of service objective under the ongoing low flow conditions scenario.

■ **Figure 9-5 Current Operation and Infrastructure Water Supply and Demand for Leongatha and Koonwarra**



9.5. Sensitivity of projections

Three potential land use changes with the catchments supplying Leongatha and Koonwarra were investigated to understand the potential risk they could pose to available supply.

Bushfires: Only 14% of the Ruby Creek catchment has vegetation cover. This means that the risk of catchment yield decreasing significantly due to the effects of bushfires is low. There is no record of bushfires occurring in the catchment over the last few decades.

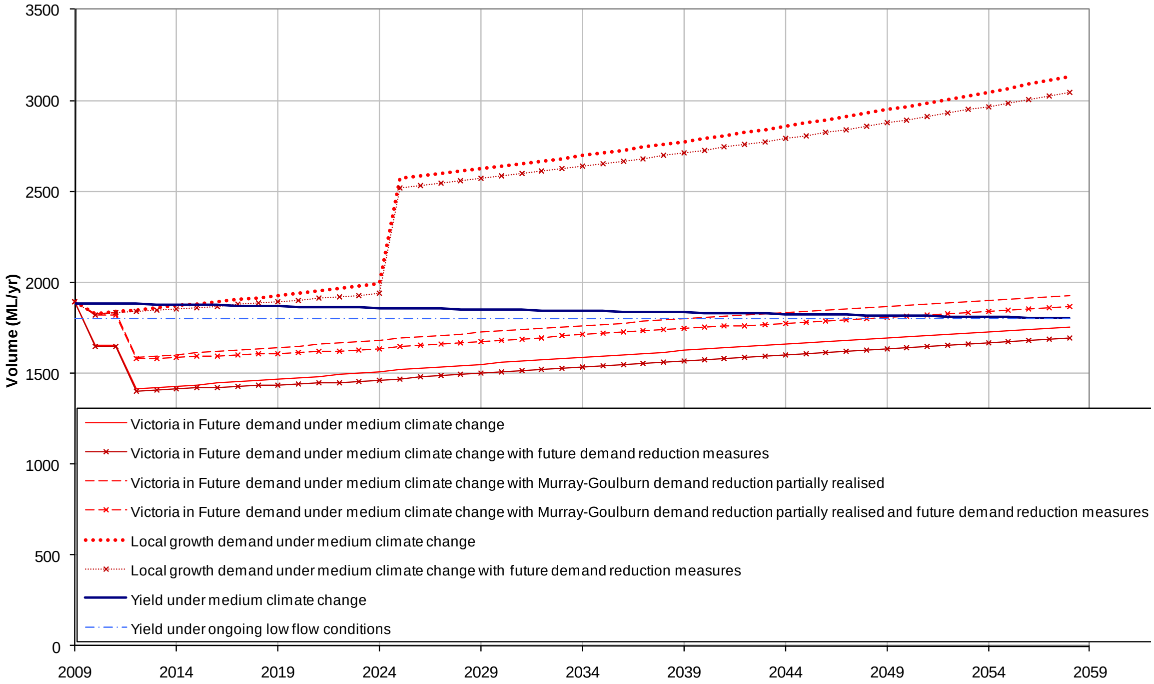
Logging: No logging is undertaken under regional forestry agreements in the water supply catchment for this supply system.

Plantations: There are no significant plantations in the water supply catchment for this supply system.

9.6. Additional demand reduction options

If the additional demand reduction options outlined in Section 4.10 are adopted for Leongatha and Koonwarra, the spare yield available would increase, as shown in Figure 9-6. Under the Local Growth scenario, this highlights the benefit of demand reduction measures in reducing the size of any future supply augmentations.

- **Figure 9-6 Effect of additional demand reduction options for Leongatha and Koonwarra**



9.7. Summary of supply and demand for Leongatha and Koonwarra with current operation and infrastructure

In summary for Leongatha and Koonwarra under the Current Operation and Infrastructure supply and demand scenarios:

- Existing supply just meets South Gippsland Water's current level of service objectives under the medium climate change scenario, but does not meet those objectives under the ongoing low flows scenario;
- Demand for water is not expected to exceed available supply at South Gippsland Water's level of service objectives over the 50 year planning horizon if Murray Goulburn achieves its anticipated water savings. If Murray Goulburn does not achieve these water savings then demand would be expected to exceed supply at South Gippsland Water's level of service objectives under the medium climate change scenario by around 2015;
- Demand for water has fallen in recent years, whilst population and the number of dwellings have increased; and
- Demand reduction initiatives will reduce the magnitude of any future supply enhancement, but some form of supply enhancement will still be required over the 50 year planning horizon if Murray Goulburn does not achieve its anticipated water savings.

South Gippsland Water’s strategy to address the potential future supply shortfall under the Local Growth scenario is presented in Section 12.

10. Supply and Demand Projections for Wonthaggi, Cape Paterson and Inverloch with Current Operation and Infrastructure

10.1. Introduction

This section of the WSDS outlines the supply and demand projections for Wonthaggi, Cape Paterson and Inverloch over the next 50 years assuming current operation and infrastructure. It includes an overview of the current supply system configuration, current demand for water and current supply. It also includes supply and demand projections under future climate change and alternative growth scenarios over the 50 year planning horizon. South Gippsland Water's response to any shortfall in demand under the current operation and infrastructure scenarios is presented in Section 12 in conjunction with nearby towns.

10.2. Current water supply and demand

10.2.1. Supply system description

The source of supply for the Wonthaggi/Inverloch system is from the 4,200 ML Lance Creek Reservoir. The dead storage is 960 ML but is reduced to 200 ML when a temporary pump is installed, as occurred in 2006/07. A treatment plant located at Lance Creek Reservoir services supplies to Wonthaggi, Inverloch and Cape Paterson. Water from the reservoir gravitates 4 km downstream via a 34.4 ML/d capacity pipeline to the junction with the Inverloch supply pipeline. It then travels a further 9 km via an 18.6 ML/d capacity pipeline to a 9 ML low level storage basin at the junction with the Wonthaggi-Cape Paterson pipeline.

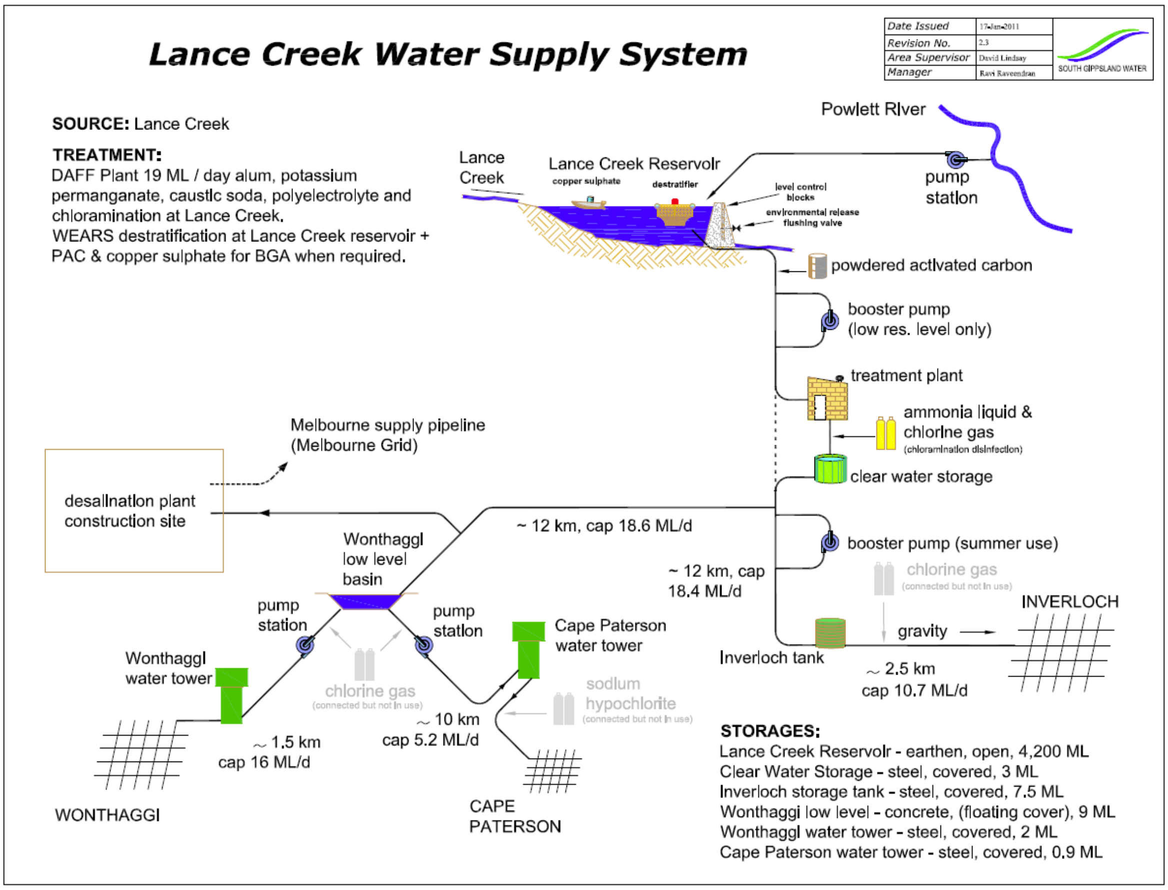
The main supply to Inverloch consists of one 18.4 ML/d gravity main from the Inverloch junction to a 7.5 ML storage tank. Flow is boosted to the storage tank in peak demand periods. From the tank, flow gravitates directly to Inverloch's reticulation system via a 10.7 ML/d capacity pipeline.

Pumping stations, located adjacent to the 9 ML low level concrete-lined service basin at the Wonthaggi-Cape Paterson junction, supply the townships of Wonthaggi at a rate of 16 ML/d and Cape Paterson at a rate of 8 ML/d.

A temporary diversion pump and pipeline was used in 2006/07 to divert water from the Powlett River at Wonthaggi to Lance Creek Reservoir, which can now be operated annually as a winterfill diversion.

A schematic of the supply system is shown in Figure 10-1.

■ **Figure 10-1 Lance Creek Water Supply System Schematic**



10.2.2. Current legal entitlements to water

The bulk entitlement for Wonthaggi/Inverloch allows South Gippsland Water to divert up to a maximum of 3,800 ML/yr from Lance Creek and 1,800 ML/yr from the Powlett River. The bulk entitlement details are shown in Table 10-1 and Table 10-2.

■ **Table 10-1 Bulk entitlement volume for Lance Creek**

Source	Maximum annual volume (ML/yr)	Maximum diversion rate (ML/d)	Minimum passing flows
Lance Creek	3,800	35	100 ML/yr when Lance Creek storage greater than 3,000 ML in December (wet years). No daily minimum passing flow.
Powlett River	1800	10	As per Table 10-2. Winterfill diversions only.

- **Table 10-2 Powlett River bulk entitlement**

Flow in the Powlett River upstream of offtake, F (ML/d)	Flow available for diversion (ML/d)	Minimum passing flow (ML/d)
> 17	10	F – 10
12 – 17	5	F – 5
≤ 12	0	F

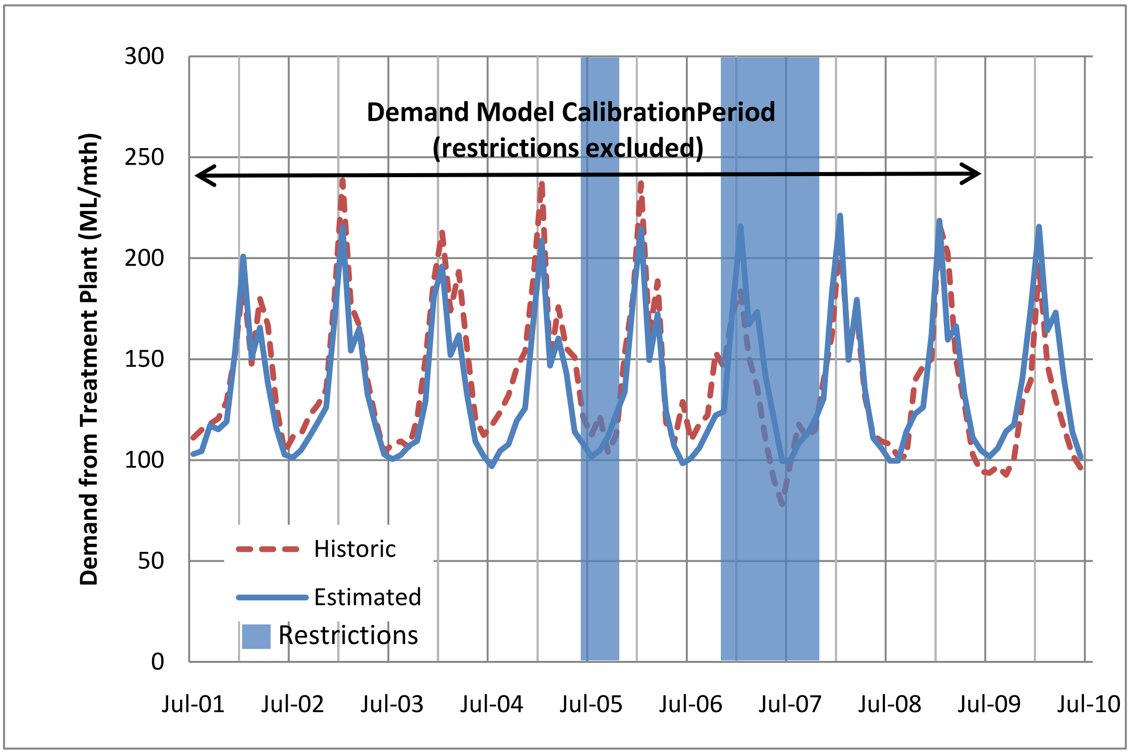
Note: F = flow in the Powlett River upstream of the offtake in ML/d.

South Gippsland Water also has a bulk entitlement to access up to 1,000 ML/yr from the Melbourne system to potentially supply Wonthaggi, Cape Paterson and Inverloch when the desalination plant at Wonthaggi has been commissioned. The desalination plant is due to be commissioned by July 2012. A physical connection of 10 ML/d between Lance Creek and the Melbourne supply has been constructed and can be used to access the Melbourne supply.

10.2.3. Current demand

Wonthaggi, Cape Paterson and Inverloch had populations of 6,191, 615 and 3,400 respectively in the 2006 census excluding visitors (DPCD, 2009). This corresponds to a total of 10,206 for the three towns. An additional 4,000 to 5,000 tourists are located in these towns in the summer months. A demand model was fitted to the recent unrestricted data to estimate a long-term average annual demand, which takes into account how current demands would vary under a wider range of natural climate variability. The historical and estimated long-term current demand is shown in Figure 10-2. The estimated long-term current demand is **1,706 ML/yr** at South Gippsland Water's treatment plant inlet, of which around 7% is utilised on average through the treatment plant. The variation in demands throughout the year is shown in Figure 10-2, which shows that demand varies seasonally with climate, with peak monthly demands being around double those in winter.

▪ **Figure 10-2 Long-term monthly demands for Wonthaggi, Cape Paterson and Inverloch**



10.2.4. Current reliability of supply

Prior to 2005, there were no instances of water restrictions in this supply system. From 2005 to 2009 there has been some form of restriction in every year, including Stage 4 restrictions in 2006/07. Part of the reason for severe restrictions in 2006/07 was due to the need to provide emergency supply to Westernport Water. The volume of dead storage in Lance Creek Reservoir has been reduced due to the use of a temporary pump, and drought response triggers were adjusted accordingly. The supply system is currently meeting South Gippsland Water's level of service objectives. Reliability of supply modelling over the period July 1892 to June 2007 indicated no restrictions would have been required at current demands over this historical climate period. The minimum storage reached was estimated to be 2115 ML. Further details on the water resource model used to assess reliability of supply (and yield) can be found in SKM (2009).

10.3. Environmental condition

Lance Creek is a tributary of the Powlett River. It is a small (1-4m wide) creek with high steep banks. Downstream of the Lance Creek Reservoir it is deeply entrenched in flat farmland, with riparian vegetation of swamp paperbark, blackberry and wattles (DPI, 2007). The creek has riffles up to 20cm deep, and small pools up to 70 cm deep. There is good habitat for small native fish but no information is available on fish species present (DPI, 2007). There are no Index of Stream Condition sites located on the creek. It is difficult to assess the impact of a change in flow on the condition of Lance Creek as detailed data on the flora and fauna is limited. However, the main risks to the aquatic fauna and flora in Lance Creek are probably from reduced flows during summer that may result in degradation of water quality and loss of connectivity between pools.

Two Index of Stream Condition (ISC) sites on the Powlett River were assessed in 2004. The site below Foster Creek was given a rating of moderate. Water quality data recorded in the Powlett River downstream of Foster Creek (gauge# 227236) and at Wonthaggi (gauge #227254) indicated that water quality in the river is poor and exceeds the recommended State Environment Protection Policy (Victorian Government, 2003) guideline values for most parameters.

An environmental flow assessment of the Powlett River downstream of South Gippsland Water's offtake near Wonthaggi was undertaken in Alluvium (2008). The environmental flow assessment linked the provision of low flows to maintaining habitat in pools for eels, galaxias, tupong, gudgeon and pygmy perch, as well as providing refuge from trout for small fish, preventing water quality decline, providing fish migration and maintaining clonal spread of swamp paperbark. Summer freshes were important for maintaining water quality, species migration, sediment transport, nutrient entrainment, sexual recruitment of swamp paperbark and to facilitate colonization of rushes and reeds. High flow freshes were and bankfull flows were considered to provide similar benefits to low flow freshes, but also promote fish migration and trigger spawning. No overbank flows were recommended due to the absence of identifiable ecological values on the floodplain.

No environmental flow recommendations were set for the Powlett River estuary in Alluvium (2008), however the report emphasised the importance of flow events to maintain estuary processes, such as keeping the estuary mouth open and periodically inundating salt marsh communities with fresh water.

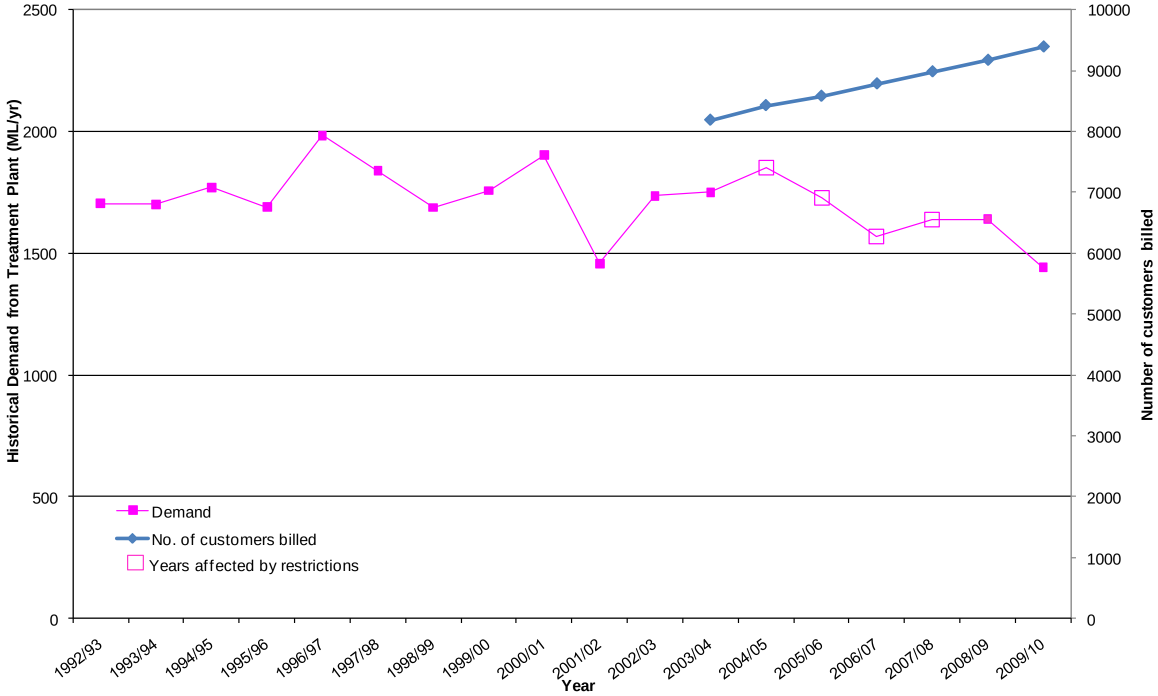
10.4. Water supply and demand projections with current operation and infrastructure

10.4.1. Historical trends

Historical diversions to Wonthaggi, Cape Paterson and Inverloch have remained relatively stable since 1992, as can be seen in Figure 10-3. These diversions are recorded at the clear water storage outlet and do not include an allowance for treatment plant utilisation since the plant became operational in 1997. Restrictions have affected demand over much of the recent period, however in 2008/09 restrictions were only in place for 6 weeks in winter, which means that data in that year was largely unrestricted.

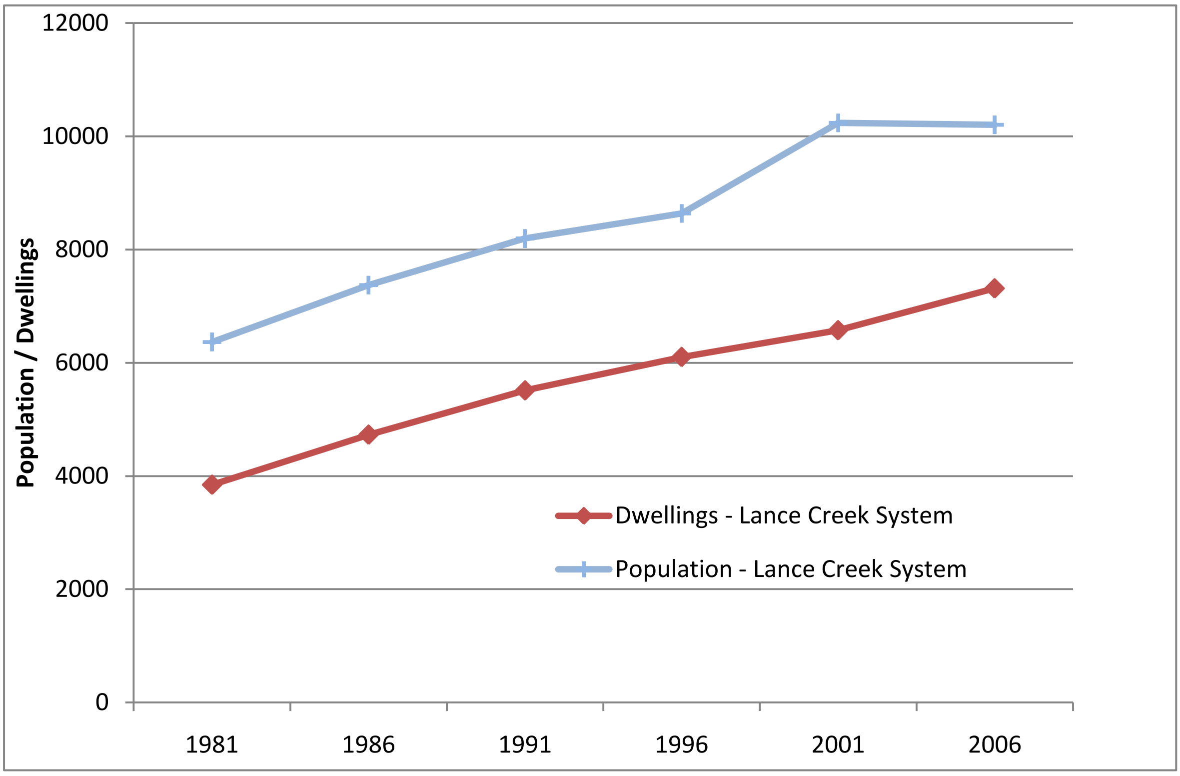
The number of customers billed in this supply system has however increased in this supply system over the last few years, as shown in Figure 10-3. This potentially indicates that significant water savings have been achieved by South Gippsland Water and its customers in recent years. The demand for the largest industrial water user in the supply system has remained relatively constant since 2006/07.

- **Figure 10-3 Historical diversions and number of customers billed at Wonthaggi, Cape Paterson and Inverloch**



The populations of all three towns have grown significantly over the last two decades, as shown in Figure 10-4, with the total population increasing from 6,368 in 1981 to 10,206 in 2006. Between the 2001 census and 2006 census there was a slight decline in total population, which was due to a reduction in residents at Inverloch. The number of dwellings was however shown to increase from 2001 to 2006.

▪ **Figure 10-4 Historical population in Wonthaggi, Cape Paterson and Inverloch**



10.4.2. Future demand projections

Two estimates of future growth in water demand were made in the previous strategy (South Gippsland Water, 2007). These included the *Victoria in Future* estimates, which are available at a Statistical Local Area (SLA) level, and a Local Growth scenario which considered the potential for stronger growth within towns at a rate greater than the surrounding SLA. There are five SLAs covering South Gippsland Water's supply area. Wonthaggi, Cape Paterson and Inverloch are located within the Bass Coast Shire Balance SLA and account for around 55% of the population within that SLA.

A comparison of the 2006 census results for each town against the previous population projections from the 2001 census indicated that both the *Victoria in Future* and the Local Growth overestimated population growth between 2001 and 2006. The *Victoria in Future* projections were closer to the change in population recorded in the census data, which was a decline in population of less than 1%. Given the uncertainty of future population, South Gippsland Water has considered two population forecasts, which include the *Victoria in Future* projections and a higher Local Growth scenario that allows for faster growth in urban centres within SLAs.

Victoria in Future projections include a growth in residential demand of between 1.5% to 3.2% per year. No growth in major industrial demand was assumed to occur. The Local Growth scenario assumes a 3.0% annual growth rate in residential demand to the year 2030, decreasing to a 2.5% annual growth rate thereafter over the planning horizon. It also assumes a 10% increase in major industrial demand in the year 2015 and a further 10% increase in the years 2025 and 2055.

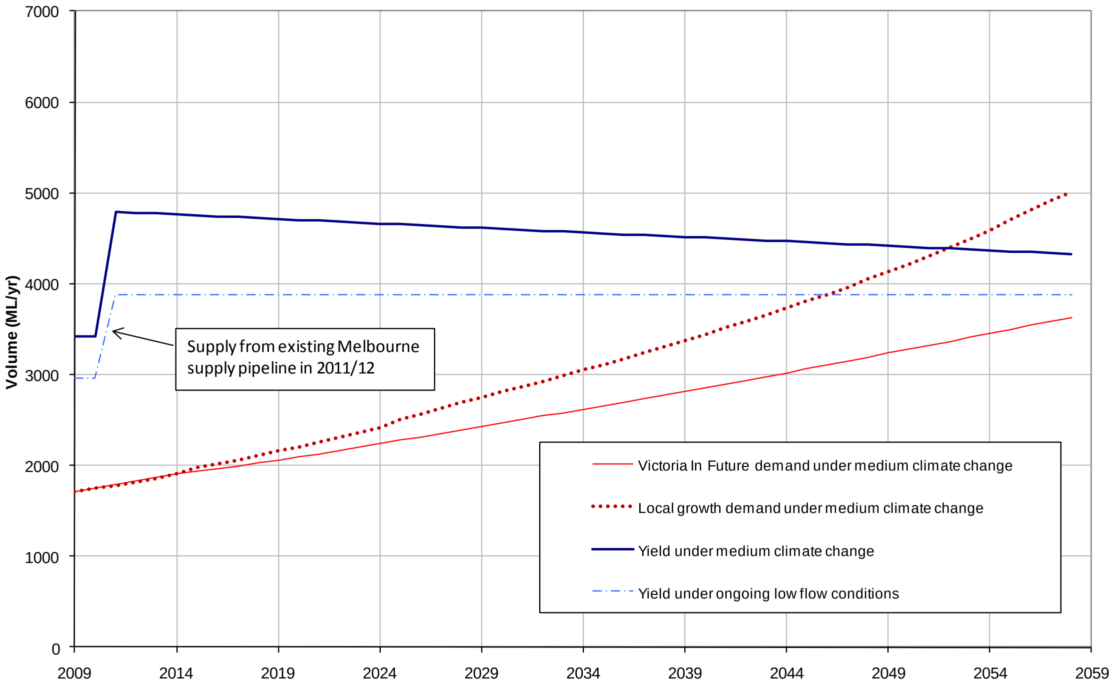
An additional 2.5% increase in residential and stock and domestic demand was assumed to occur over the next 50 years due to medium climate change for all population forecasts. This additional increase in demand is due to increased water use for activities such as garden watering under drier and hotter climate change conditions and is consistent with DSE recommendations (DSE, 2005).

10.4.3. Future supply projections with current operation and infrastructure

Under the medium climate change scenario, runoff in the South Gippsland Basin in the year 2058 relative to the year 2009 is estimated to decrease by 15%, with a range of reduction of 7% to 28% under low and high climate change scenarios. Under the medium climate change scenario, this change in streamflow would be driven by a 3% reduction in rainfall and a 7% increase in evaporation. Under the ongoing low flow conditions scenario, Lance Creek streamflows upstream of Lance Creek Reservoir have been reduced by 42% prior to July 1997.

The Current Operation and Infrastructure water supply and demand situation for the Lance Creek supply system using the *Victoria in Future* population projection is shown in Figure 10-5. This figure illustrates that if no further action is taken and growth in demand for water occurs in accordance with *Victoria in Future* population projections, supply will be sufficient to meet demands at South Gippsland Water's level of service objectives over the 50 year planning horizon. For the higher Local Growth scenario, which is also shown in Figure 10-5, augmentation of the supply system would be required between 2046 and 2052, depending on climate conditions.

▪ **Figure 10-5 Current Operation and Infrastructure Water Supply and Demand for Wonthaggi, Cape Paterson and Inverloch**



10.5. Sensitivity of projections

Three potential land use changes within the catchments supplying Wonthaggi, Cape Paterson and Inverloch were investigated to understand the potential risk they could pose to available water supply.

Bushfires: Only 5% of the Lance Creek catchment has vegetation cover. This means that the risk of catchment yield decreasing significantly due to the effects of bushfires is low. There is no record of bushfires occurring in the catchment over the last few decades.

Logging: No logging is undertaken under regional forestry agreements in the water supply catchment for this supply system.

Plantations: There are no plantations in the water supply catchment for this supply system.

Further comments on the sensitivity of the Current Operation and Infrastructure projections to demand uncertainty are also presented.

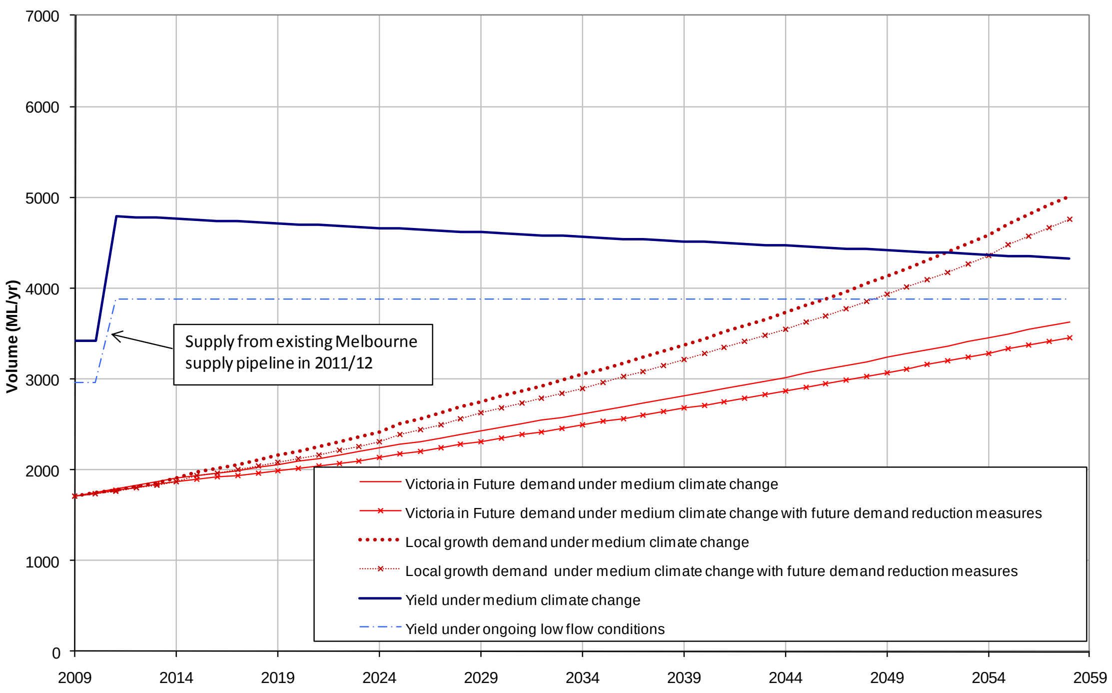
Future development: Advice from the Bass Coast Shire is that an increase in the population at Wonthaggi of 3000-3500 people is expected over the next 15-20 years, with growth at Cape Paterson and Inverloch being contained to a modest increase. These population increases are within the *Victoria in Future* projections used in the WSDS, which estimate an increase in population for the three towns of around 4,700 people from 2006 to 2022 (roughly a 15-20 year period).

The Minister for Planning (2009) made an assessment of the Environmental Effects Statement of the desalination plant at Wonthaggi. The Minister concluded that whilst there may be a short-term increase in the population of surrounding towns by several hundred people during the construction phase of the project, most of these people could be accommodated within existing accommodation. After completion of construction, ongoing accommodation would be required for in the order of 30-50 workers plus their families, which is a small percentage (<1%) of the current population in surrounding towns. It is therefore concluded that no specific adjustments need to be made to population projections for the desalination plant workforce.

10.6. Additional demand reduction options

If the additional demand reduction options outlined in Section 4.10 are adopted for Wonthaggi, Cape Paterson and Inverloch, the demand over the planning horizon would be reduced as shown in Figure 10-6.

- **Figure 10-6 Effect of additional demand reduction options for Wonthaggi, Cape Paterson and Inverloch**



10.7. Summary of the supply and demand for Wonthaggi, Cape Paterson and Inverloch with current operation and infrastructure

In summary for Wonthaggi, Cape Paterson and Inverloch under the Current Operation and Infrastructure supply and demand scenarios:

- Existing supply meets South Gippsland Water's current level of service objectives;
- Demand for water over the 50 year planning horizon is not expected to exceed available supply at South Gippsland Water's level of service under the Victoria in Future growth scenario. Under the local growth scenario, demand is not expected to exceed available supply at South Gippsland Water's level of service until between the years 2046 to 2052, depending on climate change assumptions;
- Demand for water has fallen in recent years, whilst population and the number of dwellings have increased; and
- Demand reduction initiatives will increase the spare yield available at the end of the 50 year planning horizon under the Victoria in Future growth scenario and will reduce the magnitude of any future supply enhancement under the Local Growth scenario.

South Gippsland Water's strategy to address the potential future supply shortfall under the Local Growth scenario is presented in Section 12.

11. Supply and Demand Projections for Unserviced Towns near Inverloch with Current Operation and Infrastructure

11.1. Introduction

This section of the WSDS outlines the demand projections for unserviced towns near Inverloch over the next 50 years assuming current operation and infrastructure. These towns include the existing towns of Venus Bay and Tarwin Lower. None of these towns are currently supplied by South Gippsland Water. These towns are expected to have sufficient demand for water within close proximity to an existing supply system to make their supply by South Gippsland Water financially feasible, particularly given the Melbourne supply connection to the nearby Lance Creek system. Venus Bay is only around 10 km from Inverloch, but is separated by the Tarwin River estuary.

South Gippsland Water’s response to supplying these unserviced towns is presented in Section 12 in conjunction with nearby serviced towns.

11.2. Current water supply and demand

11.2.1. Supply system description

Existing unserviced towns rely upon rainwater for their supply. New developments would need to identify a source of water supply as part of their planning activities.

11.2.2. Current legal entitlements to water

Residents in the unserviced towns can harvest rainwater in rainwater tanks. The availability of other entitlements, such as groundwater licences, is unknown.

11.2.3. Current demand

Venus Bay and Tarwin Lower had populations of 440 and 107 respectively in the 2006 census excluding visitors (DPCD, 2009). This corresponds to a total of 547 for the two existing towns. Large numbers of tourists are located in these towns in the summer months. The current demand for individual towns and developments was previously presented in Section 4.8. The current demand from Venus Bay and Tarwin Lower is estimated to be 280 ML/yr. This figure excludes Harmers Haven and a future lot development at the RACV club, which are assumed to be already incorporated into the *Victoria in Future* demand projections for the Lance Creek system because of their proximity to the existing towns.

11.2.4. Current reliability of supply

Existing supply consists of privately owned rainwater tanks. It is estimated that reliability of supply could be improved by connection to a supply source managed by South Gippsland Water.

11.3. Environmental condition

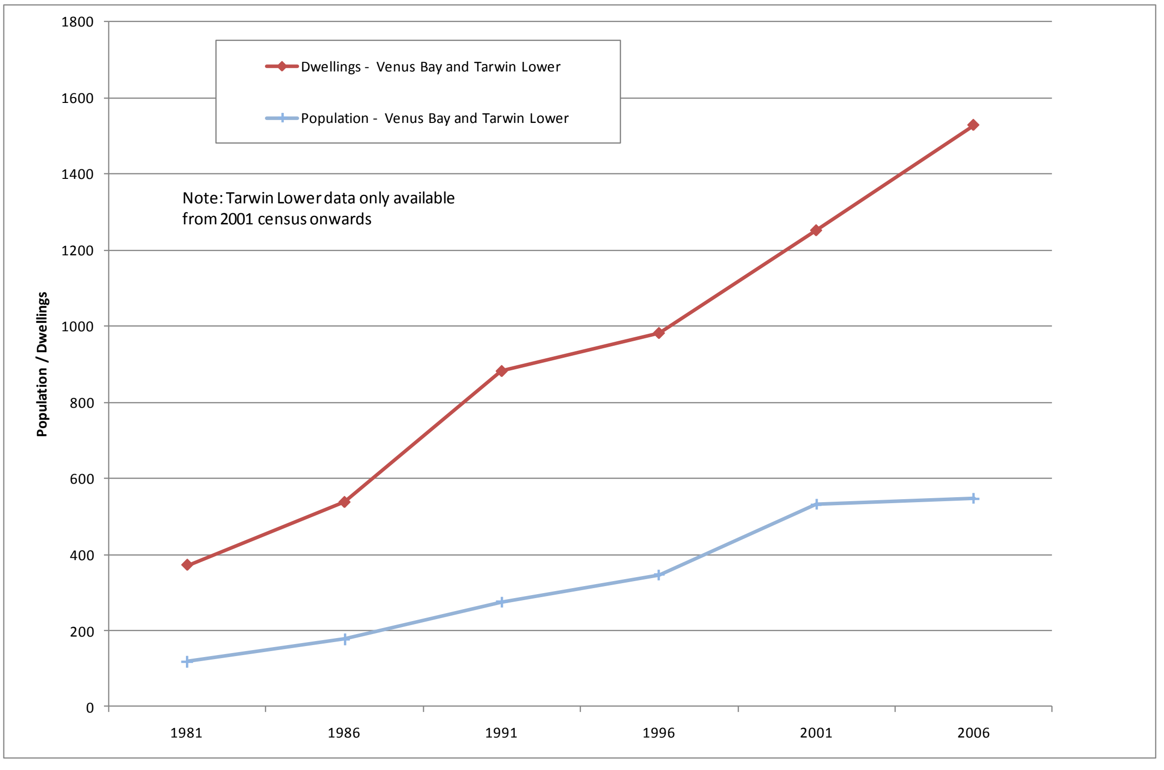
The environmental condition of the rivers supplying the Lance Creek system was previously discussed in Section 10.3.

11.4. Water supply and demand projections with current operation and infrastructure

11.4.1. Historical trends

The population at Venus Bay has grown significantly over the last two decades, as shown in Figure 11-1. The population at Tarwin Lower, which has only been collected since the 2001 census, declined slightly between 2001 and 2006. Current population for the two existing towns is 107 people at Tarwin Lower and 440 people at Venus Bay excluding visitors. The number of dwellings has increased significantly between each census over the last two decades.

■ **Figure 11-1 Historical population in Venus Bay and Tarwin Lower**

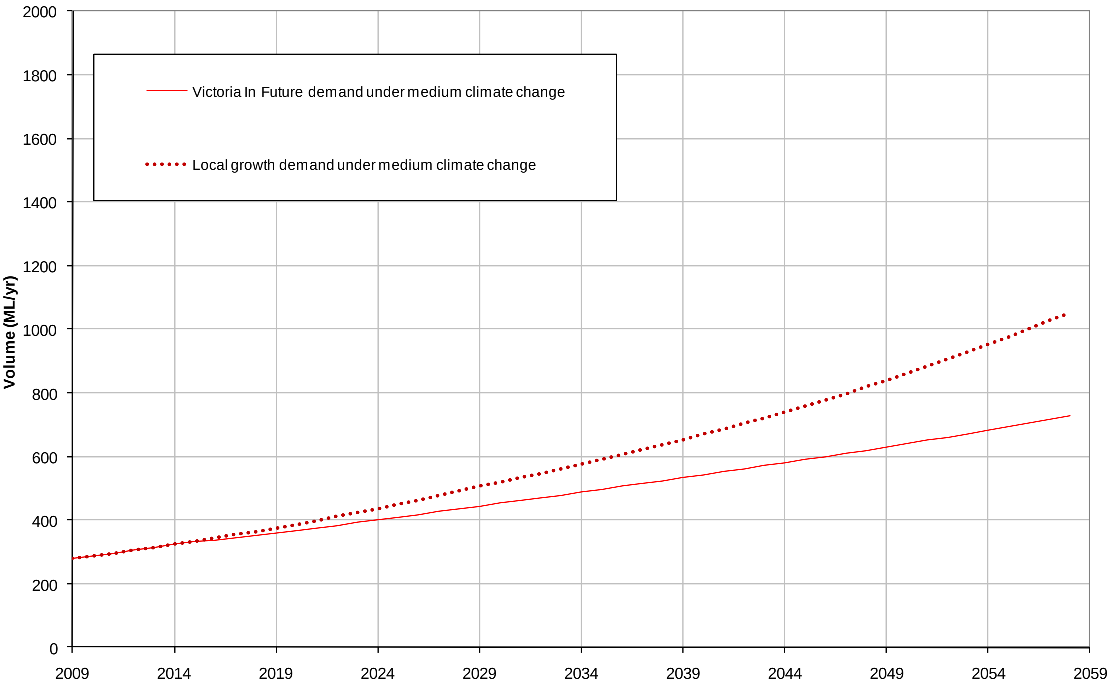


11.4.2. Future demand projections

Two estimates of future growth in water demand were made in the previous strategy (South Gippsland Water, 2007). These included the *Victoria in Future* estimates, which are available at a Statistical Local Area (SLA) level, and a Local Growth scenario which considered the potential for stronger growth within towns at a rate greater than the surrounding SLA. For the existing towns of Venus Bay and Tarwin Lower, the growth projections for Wonthaggi, Cape Paterson and Inverloch have been adopted.

An additional 2.5% increase in residential and stock and domestic demand was assumed to occur over the next 50 years due to medium climate change for all population forecasts. This additional increase in demand is due to increased water use for activities such as garden watering under drier and hotter climate change conditions and is consistent with DSE recommendations (DSE, 2005). The anticipated demand at the end of the 50 year planning horizon is estimated to be 700-1000 ML/yr, depending on growth assumptions.

- **Figure 11-2 Current Operation and Infrastructure water demand for unserviced towns near Inverloch**



11.4.3. Future supply projections

Supply projections are considered in Section 12 as part of the strategy for Wonthaggi, Cape Paterson and Inverloch. The timing of the connection of the unserviced towns to South Gippsland

Water's supply systems is uncertain and it has been assumed in the strategy that it could occur around the year 2025. This would allow sufficient time for South Gippsland Water to undertake its planning and design activities and then construct and commission the new supply system.

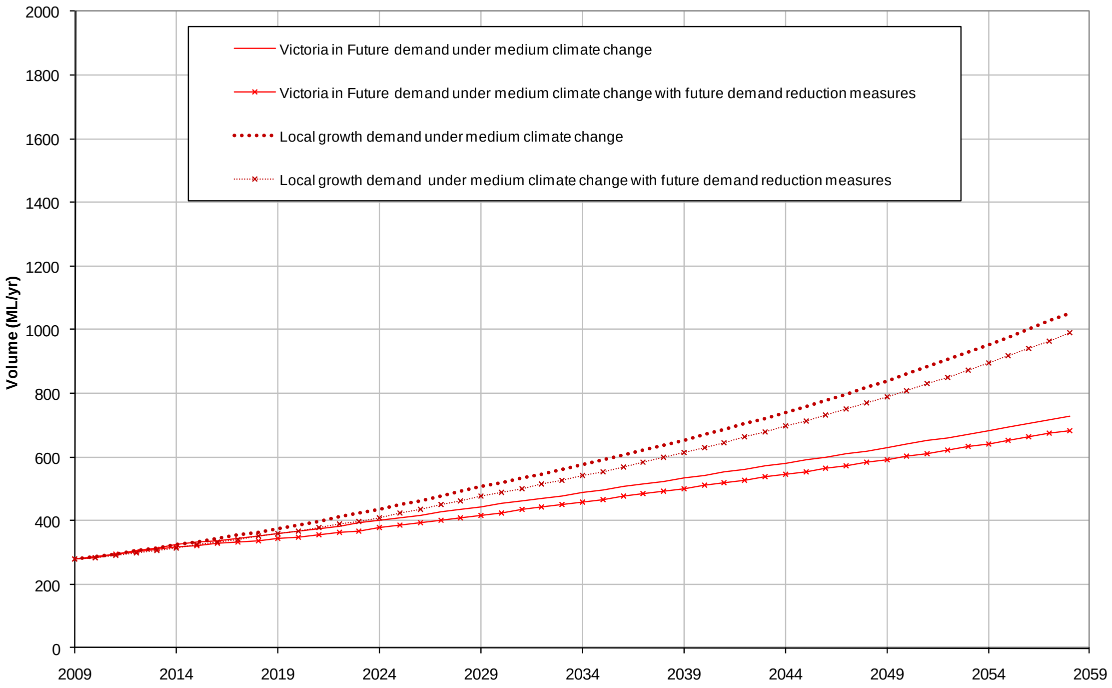
11.5. Sensitivity of projections

Three potential land use changes within the catchments supplying Wonthaggi, Cape Paterson and Inverloch were investigated to understand the potential risk they could pose to available water supply. These were previously documented in Section 10.5 and indicated that the risk of changes in supply due to bushfires, logging and plantations in the Lance Creek catchment was low.

11.6. Additional demand reduction options

If the additional demand reduction options outlined in Section 4.10 were adopted for Venus Bay and Tarwin Lower, the size of any future supply augmentation option could be minimised, as shown in Figure 11-3. This highlights the benefit of demand reduction measures in delaying the need for augmentation works for the Lance Creek system, which is the nearest supply source managed by South Gippsland Water.

- **Figure 11-3 Effect of additional demand reduction options for unserviced towns near Inverloch**



11.7. Summary of the supply and demand for unserviced towns near Inverloch with current operation and infrastructure

In summary for unserviced towns near Inverloch under the Current Operation and Infrastructure supply and demand scenarios:

- Existing supply consists of privately owned bores and rainwater tanks;
- Population and the number of dwellings have increased significantly over the last two decades. The number of people currently permanently residing in Venus Bay and Tarwin Lower is 547; and
- Demand for water is estimated to currently be in the order of 280 ML/yr, rising to between 700-1,000 ML/yr over the 50 year planning horizon;

South Gippsland Water's strategy to address the potential future supply is presented in Section 12.

12. Strategy for South Gippsland Water's Northern and Southern Towns

12.1. Introduction

This section of the document presents the demand reduction and supply enhancement strategy for towns west of the Tarwin River in South Gippsland Water's northern and southern regions. These towns include Poowong, Loch, Nyora, Korumburra, Leongatha, Koonwarra, Cape Paterson, Inverloch and Wonthaggi. The strategy for these towns is considered collectively, because one of the supply options involves sourcing water for all of these towns from the Melbourne supply system. The ability to supply Venus Bay and Tarwin Lower is also presented in this chapter.

The pros and cons of two strategies were considered by South Gippsland Water:

Supply from existing separate South Gippsland Water headworks – This strategy involves upgrading South Gippsland Water's existing supply infrastructure and operating the supply systems for South Gippsland Water's northern and southern towns independently. Details of this strategy for each town are presented in Section 12.2.

Supply from Melbourne – This strategy involves connecting both northern and southern towns to a single supply system sourced from a combination of Lance Creek Reservoir (prime source) and connection to the Melbourne supply system. Much existing supply system infrastructure for the Northern Towns would be decommissioned. Details of this strategy for each town are presented in Section 12.3.

When outlining each strategy, infrastructure has been sized to meet the requirements of the *Victoria in Future* demand projections, with the Local Growth scenario being used to test the robustness of the strategy under a higher growth rate.

A sustainability assessment comparing the strategies is presented in Section 12.4 followed by an action plan for South Gippsland Water in Section 12.5.

12.2. Supply from existing South Gippsland Water headworks

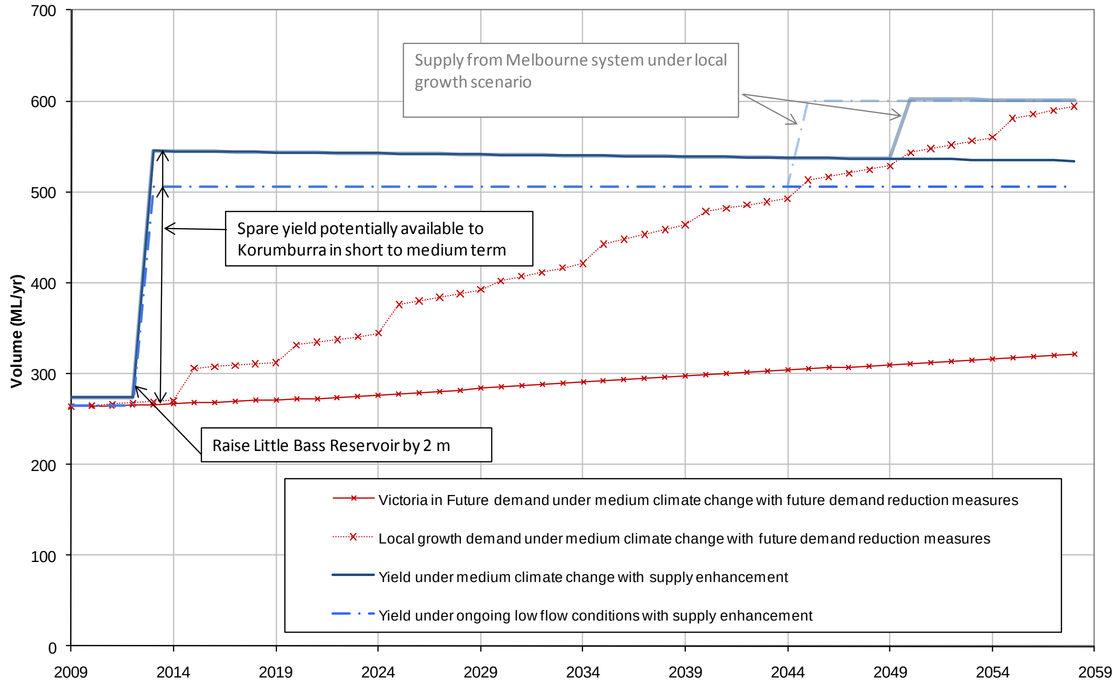
12.2.1. Supply from existing South Gippsland Water headworks for Poowong, Loch and Nyora

Available supply to Poowong, Loch and Nyora is not sufficient to cater for immediate future demands at South Gippsland Water's level of service objectives, even after considering additional demand reduction. Hence the Poowong, Loch and Nyora system will require supply enhancement. A range of supply enhancement options were considered in SKM (2004), which were narrowed in the 2007 WSDS (South Gippsland Water, 2007) to focus on the preferred option to raise Little Bass Reservoir by 2 metres.

Increasing the height of the dam wall in the Little Bass Reservoir by approximately 2m would increase the storage capacity by approximately 200 ML. This additional storage volume would then be used to harvest additional winter flows of 118 ML/yr under the Sustainable Diversion Limit available from the catchment upstream of the reservoir. This would require separate accounting of water in the additional storage. This additional winterfill volume would be accumulated over several years and then utilised in dry years. The yield increase from this action is shown in Figure 12-1. This increase in supply would be sufficient to meet the supply needs of Poowong, Loch and Nyora over the planning horizon of fifty years under *Victoria in Future* growth rates. At a higher growth rate, additional augmentation would be required after the year 2044, suggesting that this supply enhancement option is mildly sensitive to growth forecasts. A summary of the effect of this local supply enhancement option for Poowong, Loch and Nyora is shown in Figure 12-1.

Undertaking this supply enhancement may also improve the opportunities for connecting Little Bass Reservoir to the Korumburra system and utilising this additional water in Korumburra whilst Poowong, Loch and Nyora are still growing. This is dependent upon future water supply options for Leongatha and Korumburra, which are largely dependent on the future water supply needs of the major industrial customers in those towns. These industries find it difficult to provide demand projections for a 10 year planning horizon and are not able to underwrite an expansion in the water supply system with a 50 year or more service life. Linking the Little Bass supply system to Korumburra would not increase the reliability of supply or yield for Poowong, Loch and Nyora.

- **Figure 12-1 Supply from Existing South Gippsland Water Headworks for Poowong, Loch and Nyora**



The resilience of this augmentation option to severe prolonged drought was examined by estimating supply system behaviour under a repeat of the 2006/07 severe drought year. This analysis highlighted that even though local catchment inflows were negligible in this year from December to April, the availability of a large volume in storage relative to demand meant that South Gippsland Water is expected to be able to maintain supply through two consecutive years of repeating 2006/07 climate.

The alternative to this local supply enhancement option involves connection to the Melbourne supply system, which is presented in Section 12.3.1.

12.2.2. Supply from existing South Gippsland Water headworks for Korumburra

Available supply to Korumburra is not sufficient to cater for immediate future demands at South Gippsland Water's level of service objectives, even after considering additional demand reduction. Hence the Korumburra system will require supply enhancement. Water supply options for Korumburra were previously outlined in SKM (2004) and South Gippsland Water (2007) and included raising the existing storage, supplying water from Melbourne, supplying water from the Little Bass Reservoir and being able to permanently supply water from the Tarwin River via Leongatha. It was concluded from that analysis that raising the existing storages supplying Korumburra would be the most appropriate local supply option, combined with connecting Little

Bass Reservoir to Bellview Creek Reservoir. Any supply enhancement options should allow a buffer for potential increases in major industrial demand where it is feasible and cost-effective to do so.

Bellview Creek is located in the Bass River catchment, which does have some available winterfill volume available under Sustainable Diversion Limits. Increasing total storage in the Korumburra supply system by around 200 ML could be used to harvest additional winter flows under the Sustainable Diversion Limit to increase yield by around 90 ML. This would still fall well short of Korumburra's long-term water needs. The Bellview Creek Reservoir requires remedial works to ensure structural stability of the embankment, with those works programmed to occur around 2018 to 2020. There may be cost savings in raising the embankment and spillway at the same time as remedial works are carried out, as opposed to the cost of raising the embankment and spillway level at a subsequent time. The exact additional volume to which the storages could feasibly be raised would need to be confirmed by geotechnical investigations. South Gippsland Water secured a bulk entitlement amendment in October 2010 to raise the capacity of the Korumburra storages by 200 ML.

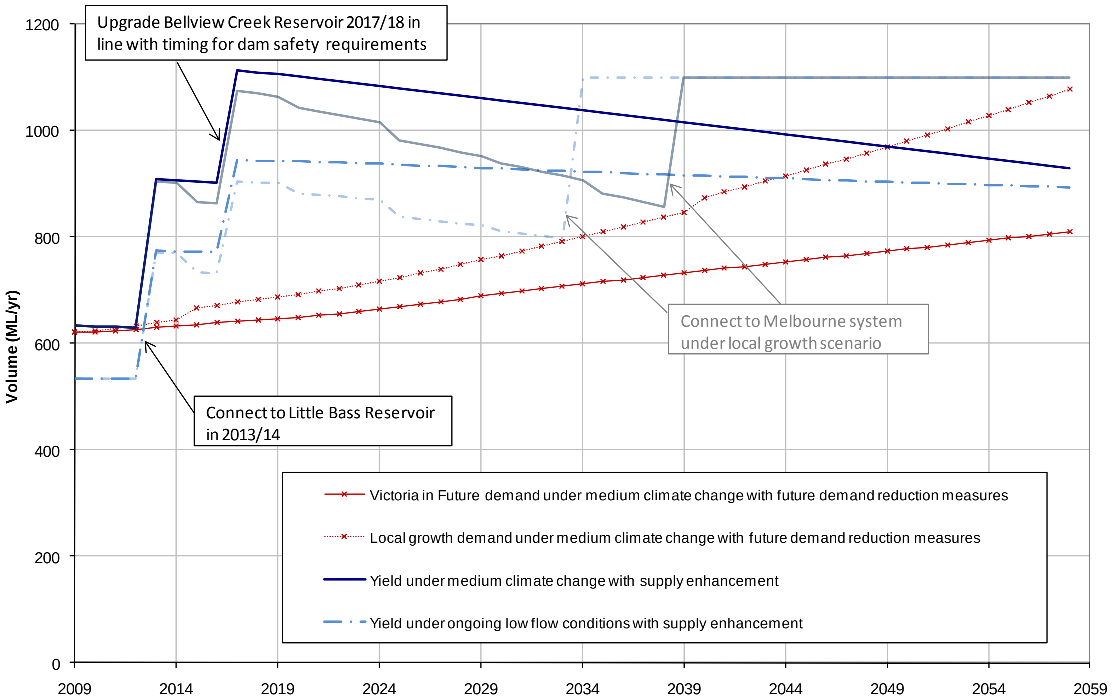
The increase in storage volume in the Korumburra supply system and the raising of Little Bass Reservoir would allow water from Little Bass Reservoir to be transferred across to the Korumburra supply system. It is estimated that around 200 ML/yr could be transferred through this mechanism over the next few decades, dependent on the rate of growth in Poowong, Loch and Nyora.

Since drafting the previous WSDS in 2007, the supply from the Tarwin River West Branch has been developed, which presents an alternative local supply enhancement option. Additional supply from the Tarwin River West Branch is permitted under the conditions of the bulk entitlement amendment obtained by South Gippsland Water in October 2010. This option provides less supply to Korumburra than the Little Bass Reservoir connection because the proposed upgrade of the Tarwin River West Branch supply infrastructure up to the entitlement volumes primarily benefits Leongatha rather than Korumburra. As mentioned previously, the infrastructure in place to transfer water from Leongatha to Korumburra utilises existing obsolete infrastructure that is complex and difficult to operate, and is currently only suitable for use in a severe drought.

A summary of the local supply enhancement option for Korumburra is shown in Figure 12-2 with Little Bass Reservoir connected to Korumburra. This option assumes an initial connection to the Little Bass Reservoir in 2013/14 (with Little Bass Reservoir capacity also being increased by 200 ML), followed by an additional 200 ML of storage at Bellview Creek Reservoir in 2017/18 when this reservoir is scheduled for a dam safety upgrade. It can be seen from this figure that this local supply enhancement option will provide adequate supply over the planning horizon under *Victoria in Future* growth projections. However it is evident that if the Local Growth scenario were to come to fruition, this supply option would not be capable of maintaining supply at South

Gippsland Water's level of service objective without requiring a second supply augmentation over the planning horizon. A connection to the Melbourne supply system would be required around 2035 under the Local Growth scenario.

- **Figure 12-2 Supply from Existing South Gippsland Water Headworks for Korumburra**



The resilience of this augmentation option to severe prolonged drought was examined by estimating supply system behaviour under a repeat of the 2006/07 severe drought year. This analysis highlighted that local catchment inflows were negligible throughout most of this year and considerably less than available storage capacity and annual demand. Transfers were modelled to occur from the Little Bass Reservoir, however the volume of the transfers was small in order to maintain storage in Little Bass Reservoir. The outcome of this investigation is that South Gippsland Water would be likely to struggle to maintain supply through two consecutive years of repeating 2006/07 climate with this augmentation option at Korumburra and that the supply system is vulnerable to prolonged severe drought. Emergency supply measures at Korumburra include the use of groundwater bores and the temporary connection to the Tarwin River West Branch.

12.2.3. Supply from existing South Gippsland Water headworks for Leongatha and Koonwarra

Various supply enhancement options were considered in the 2007 WSDS, including linking Leongatha to Korumburra and the Little Bass system, harvesting from the Tarwin River West Branch, additional storage, supply from groundwater and pumping from Coalition Creek upstream of Ruby Creek. Since the 2006/07 drought, South Gippsland Water implemented a range of drought response measures which have helped to clarify supply capability from these alternative sources. The current system now includes updated groundwater supply and winter diversion from the Tarwin River West Branch or Coalition Creek of up to 5 ML/d.

If Murray Goulburn can achieve water savings as anticipated, then no supply enhancement at Leongatha will be required, as shown in Figure 12-3. In the event that Murray Goulburn only partially achieves its anticipated water savings under the *Victoria in Future* projection, the Tarwin River West Branch supply would need to be upgraded at around the year 2050/51. If population growth occurs at the faster Local Growth rate, then additional supply enhancement could be required in 5-10 years time. Upgrading the Tarwin River West Branch supply would provide only a small increase in available supply but could lengthen the time to the next supply augmentation by up to 5-10 years. If a step increase in major industrial demand were to occur, as has been suggested in the Local Growth scenario, then additional supply enhancement would be required when that step change occurs. The diversion capacities under the option to increase supply from the Tarwin River West Branch are shown in Table 12-1, which include upgrading the diversion pipe at the offtake from 5 ML/d to 10 ML/d, but no increase in the diversion capacity to Korumburra. This increase in supply capacity could occur within the existing bulk entitlement.

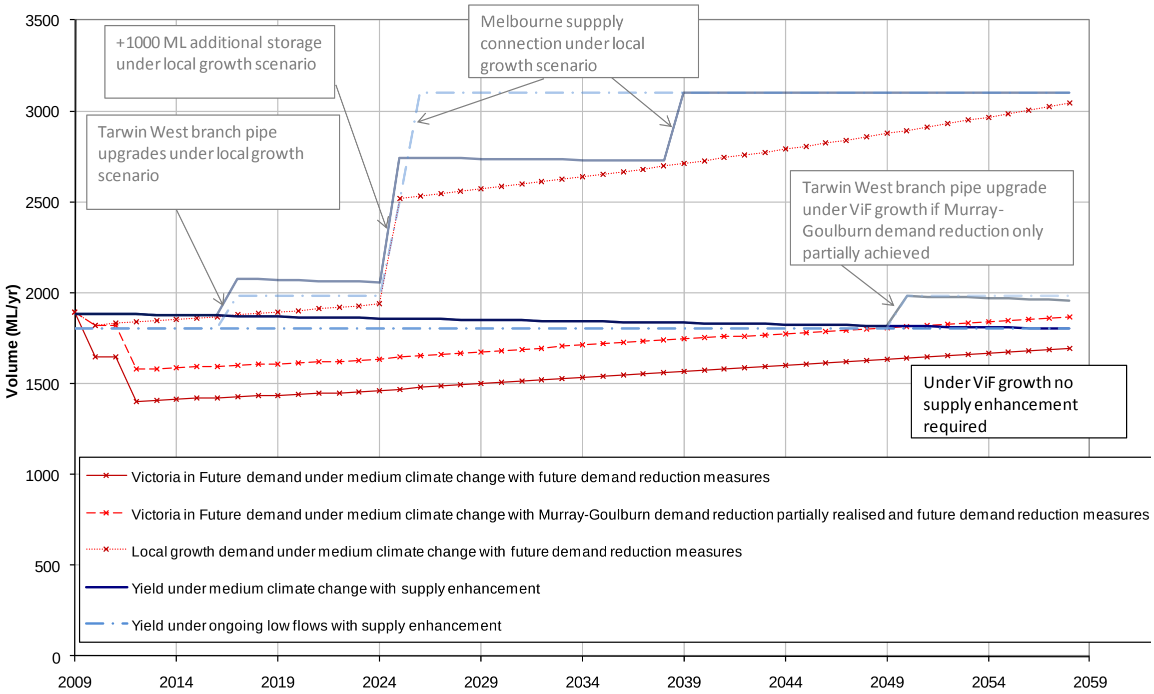
- **Table 12-1 Tarwin River West Branch Diversion Rules under Enhanced Diversion Infrastructure Capacities**

Pumping Rule	**Tarwin River at Koonwarra (pumping to Ruby Creek Storage 3 and Ness Gully Storage)**	**Coalition Creek at pump site (pumping to Ruby Creek Storage 3)**
Minimum passing flow (ML/day)	100	10
Extraction volume (ML)	1800 minus Coalition Ck volume	800
Extraction period	May-Nov	May-Nov
Upper limit on pumping capacity (ML/day)	10 minus Coalition Ck rate	6
Pipe capacities	10 ML/d at extraction point. 10ML/d to Ruby Ck storages	6 ML/d, feeding into 10ML/d Tarwin extraction pipe to Ruby Ck

An option which was previously considered in the 2007 WSDS (South Gippsland Water, 2007) involved constructing 1000 ML of additional storage on Ruby Creek and diverting from Wilkur Creek. This volume is the practical limit to storage size in the Ruby Creek valley, beyond which dam wall costs are likely to increase significantly. With the Tarwin River West Branch diversion, the option of diverting additional water from Wilkur Creek is no longer available. This is because the constraining Sustainable Diversion Limit catchment is downstream of both diversion locations. The additional 1000 ML of storage supplied with diversions from the Tarwin River increases yield by several hundred megalitres per year, but would still not be sufficient to meet the Local Growth requirements for water over the 50 year planning horizon. Similarly if up to 2,000 ML of additional storage is provided, modelling indicates that there are insufficient streamflows in most years to fill a reservoir of this size, resulting in a supply system yield that is still insufficient to meet future demands. This suggests that local supply enhancement options are likely to be of limited long-term value to South Gippsland Water if growth in demand accelerates beyond *Victoria in Future* projections.

The Leongatha Water Treatment Plant has a useful life up to around the year 2020. Maintaining the existing headworks for Leongatha and Koonwarra would require the treatment plant to be replaced at this time, which represents an additional cost relative to the Melbourne supply option considered later in this chapter.

- **Figure 12-3 Supply from Existing South Gippsland Water Headworks for Leongatha and Koonwarra**



The resilience of this augmentation option to severe prolonged drought was examined by estimating supply system behaviour under a repeat of the 2006/07 severe drought year. This analysis highlighted that local catchment inflows were negligible in this year from November to May and considerably less than available storage capacity and annual demand. The outcome of this investigation is that South Gippsland Water would be likely to struggle to maintain supply through two consecutive years of repeating 2006/07 climate with this augmentation option at

Leongatha and that the supply system is vulnerable to prolonged severe drought. Emergency supply measures at Leongatha include the use of groundwater bores.

12.2.3.1. Uncertainty in Murray Goulburn demand

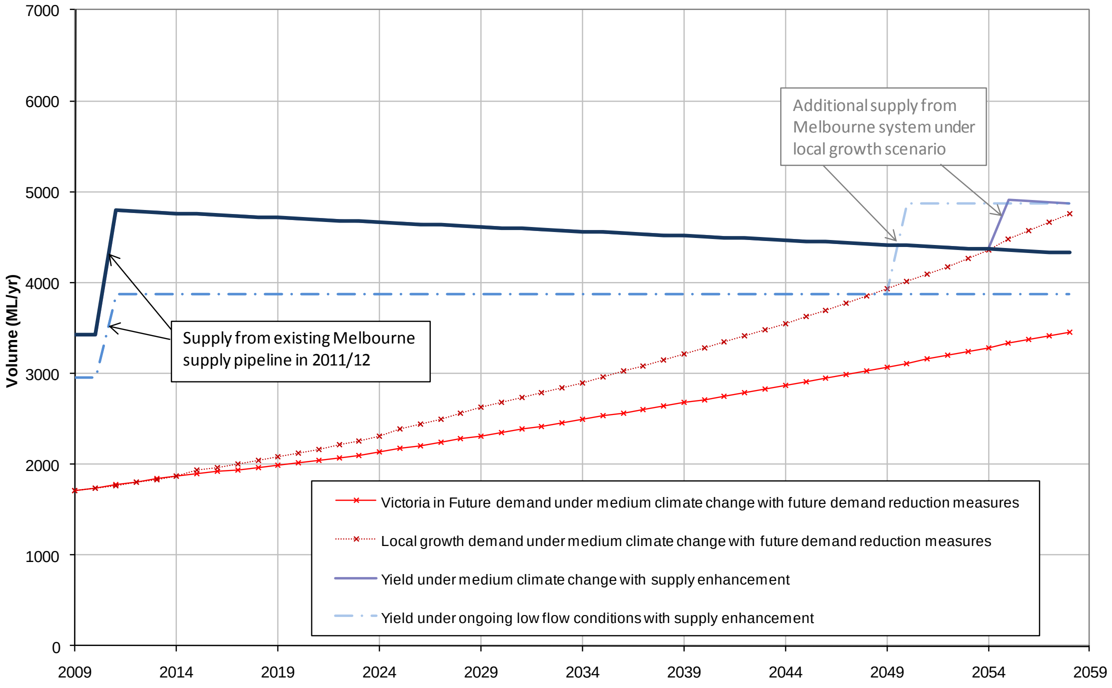
The Murray Goulburn milk factory currently uses around 70% of the total water supplied in the Leongatha system. Murray Goulburn has embarked on a $135 million upgrade of its factory to improve efficiency of operations and to enable new products to be manufactured. It has introduced water saving measures to date but the extent of water saving and reuse is limited by current cost and technology. Murray Goulburn has announced that it will be proceeding with a $9.2 million water recycling project at its Leongatha plant, with assistance from the State Government. According to Murray Goulburn, this project would reduce Murray Goulburn's town water demand by 220-400 ML in 2009/10, and a further 220 ML by 2012/13, which is a total of approximately 600 ML per annum by 2012/13 (B.Alcock, Murray Goulburn, pers.comm. 30/7/2009). Analysis of metered supply to Murray Goulburn and the steam generation plant up to the end of 2009/10 suggests that the water savings anticipated by Murray Goulburn in 2009 have not yet translated into a reduction in demand for water from South Gippsland Water's supply system. From South Gippsland Water's perspective there is therefore some uncertainty surrounding future demand for Murray Goulburn and hence it is essential that South Gippsland Water continue to communicate with Murray Goulburn about their water needs and ability to conserve water on an ongoing basis.

12.2.4. Supply from existing South Gippsland Water headworks for Wonthaggi, Cape Paterson and Inverloch

The current Lance Creek supply system is very reliable, however forecast rapid growth in demand for water in the region means that supply enhancement may be required in the future. A range of supply enhancement options were considered in the 2007 WSDS (South Gippsland Water, 2007). These included potential supply from Foster Creek and the Powlett River, and groundwater supply from the Wonthaggi Coal Mines. The supply from the Powlett River was formalised into a bulk entitlement amendment in 2009. Since the completion of that strategy document, the Victorian State Government announced the construction of a desalination plant at Wonthaggi. A 10 ML/d pipeline has been constructed and will connect the Melbourne supply to the Lance Creek system, which can supply the towns of Wonthaggi, Inverloch and Cape Paterson. The availability of this supply option provides a flexible, reliable and climate independent source of water. South Gippsland Water's bulk entitlement for the Melbourne supply allows up to 1,000 ML/yr to be diverted to Wonthaggi, Cape Paterson and Inverloch. Figure 12-4 shows that this existing supply will be sufficient to meet demands over the 50 year planning horizon at South Gippsland Water's level of service objective under the Victoria in Future growth projection. If growth occurs at the higher Local Growth rate, then additional water would need to be sourced from the Melbourne system from around 2050.

The proposed operation of the Melbourne supply is yet to be finalised. In the short-term it is expected that South Gippsland Water will develop operational triggers that could be used to best utilise the Melbourne supply after completion of the desalination plant. Those triggers would ideally take into account the cost of the Melbourne supply, the cost of restrictions, customer satisfaction associated with blending supply sources, and the physical ability to supply water from the Melbourne system to each demand centre.

- **Figure 12-4 Supply from Existing South Gippsland Water Headworks for Wonthaggi, Cape Paterson and Inverloch**



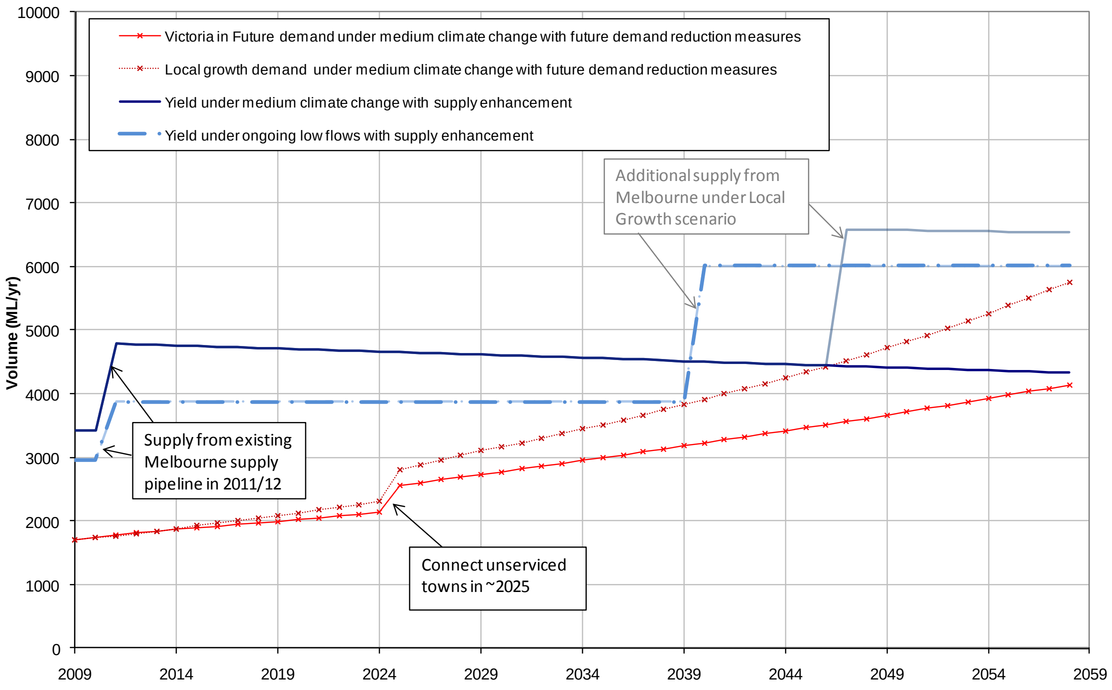
The resilience of this augmentation option to severe prolonged drought was examined by estimating supply system behaviour under a repeat of the 2006/07 severe drought year. This analysis highlighted that even though local catchment inflows were negligible in this year from October to April, the availability of a large volume in storage and access to the Melbourne system and Powlett River supplies means that South Gippsland Water would be able to maintain supply through two consecutive years of repeating 2006/07 climate.

12.2.5. Supply from existing South Gippsland Water headworks for Unserviced Towns near Inverloch

Venus Bay and Tarwin Lower are expected to have sufficient demand for water within close proximity to an existing supply system to make their supply by South Gippsland Water financially feasible. Supply could be from the Lance Creek Reservoir or from the mid Tarwin River above the saline wedge. Venus Bay is only around 10 km from Inverloch, which would be the most likely source of supply, but is separated by the Tarwin River estuary. Supply to the unserviced towns in this area could result in additional water sales of around 280 ML/yr for South Gippsland Water, rising to between 700-1,000 ML/yr in fifty years time, which would significantly increase South Gippsland Water's customer base. It has been assumed for the purposes of developing the Water Supply Demand Strategy that such demand would be supplied, but South Gippsland Water has no defined timeframes for servicing this demand. Timeframes shown in Figure 12-5 are therefore indicative only.

The ability of the Lance Creek supply system to meet demands from unserviced towns near Inverloch was assessed. This has been done on the basis of 10 ML/d being available from the Melbourne system, which is the current capacity of the transfer pipeline from the desalination plant. Figure 12-5 shows that after connection to the Melbourne supply there would be sufficient water available to supply Venus Bay and Tarwin Lower in addition to Wonthaggi, Cape Paterson and Inverloch under the *Victoria in Future* demand projection. Some additional Melbourne supply would be required after the year 2040 under the Local Growth scenario. The supply enhancement shown represents the estimated yield from the combined 10 ML/d Melbourne supply and the Lance Creek supply system, but with the annual cap on diversion from the Melbourne system increased.

- **Figure 12-5 Supply from Existing South Gippsland Water Headworks for Wonthaggi, Cape Paterson and Inverloch with supply to unserviced towns near Inverloch**



The resilience of this augmentation option to severe prolonged drought was examined by estimating supply system behaviour under a repeat of the 2006/07 severe drought year. This analysis highlighted that even though local catchment inflows were negligible in this year from October to April, the availability of a large volume in storage and access to the Melbourne and Powlett River supplies means that South Gippsland Water would be able to maintain supply through two consecutive years of repeating 2006/07 climate.

12.3. Supply from Melbourne

12.3.1. Supply from Melbourne for Poowong, Loch, Nyora, Korumburra, Leongatha and Koonwarra

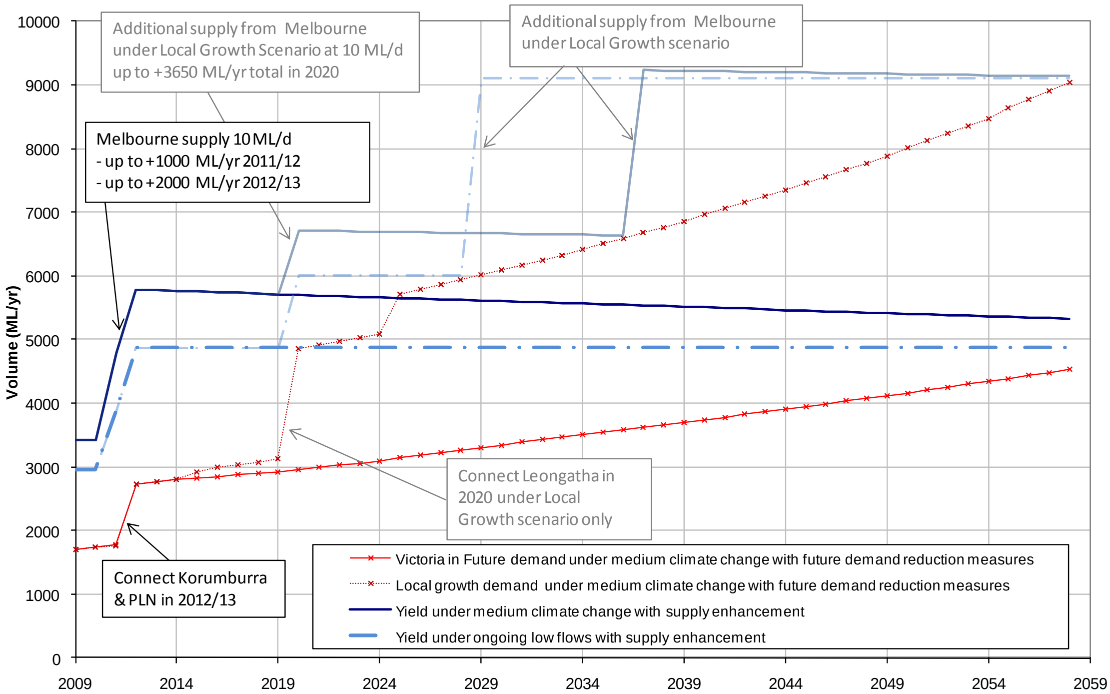
As an alternative to the local supply enhancement options for the northern towns, the option of supplying these towns from Lance Creek Reservoir and/or the Melbourne system was considered. It is assumed in this option that treated water would be provided to all towns north of Wonthaggi and that existing raw water supply and treatment plant infrastructure would be decommissioned. Alternative uses would be sought for raw water storages or they would be decommissioned

The supply and demand projections for this scenario are presented in Figure 12-6. Under the *Victoria in Future* growth rates, only Poowong, Loch, Nyora and Korumburra would require connection to the Melbourne supply. Leongatha would remain as a separate supply system with no supply augmentations. Under this scenario, supply from the Melbourne system would be sufficient to meet the demands of these towns over the 50 year planning horizon.

For the Local Growth scenario, it is assumed that Poowong, Loch, Nyora and Korumburra would again be connected to the Melbourne supply in 2012/13, but that Leongatha would also be connected to the Melbourne Supply in around 2020. Under these circumstances, the 10 ML/d Melbourne supply pipeline would be adequate to supply Local Growth demands from all connected towns to around the year 2029 to 2037, depending on climate conditions. Beyond these dates, the pipe capacity from the Melbourne supply would need to be upgraded to enable more water to be harvested from the Melbourne supply under South Gippsland Water’s existing bulk entitlement.

The *Victoria in Future* scenario with Murray Goulburn demands only partially realised has not been presented in the supply and demand projections with connection to the Melbourne system. This is because when the Melbourne supply augmentation occurs from 2020/21 onwards, the additional demand from the supply system can readily be catered for with only minor adjustment to the size of the connection under the *Victoria in Future* scenario.

- **Figure 12-6 Supply from Melbourne for Wonthaggi, Cape Paterson and Inverloch plus Poowong, Loch, Nyora, Korumburra, Leongatha and Koonwarra excluding supply to unserviced towns near Inverloch**



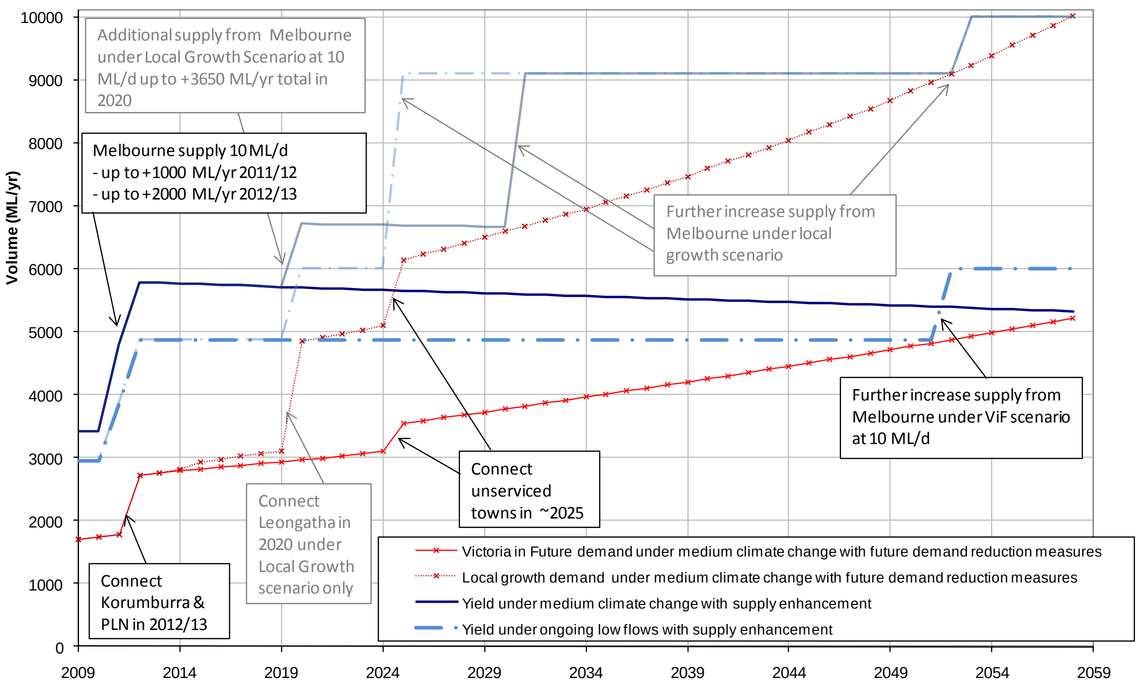
The resilience of this augmentation option to severe prolonged drought was examined by estimating supply system behaviour under a repeat of the 2006/07 severe drought year. This analysis highlighted that even though local catchment inflows were negligible in this year from October to April, the availability of a large volume in storage and access to the Melbourne supply means that South Gippsland Water would be able to maintain supply through two consecutive years of repeating 2006/07 climate.

12.3.2. Supply from Melbourne for Poowong, Loch, Nyora, Korumburra, Leongatha and Koonwarra plus unserviced towns near Inverloch

A further supply option would be to supply all northern towns plus Venus Bay and Tarwin Lower from Lance Creek Reservoir and the Melbourne system. Under the *Victoria in Future* growth rates, only Poowong, Loch, Nyora and Korumburra would require connection to the Melbourne supply. Leongatha would remain as a separate supply system with no supply augmentations. It has been assumed for the purposes of developing the Water Supply Demand Strategy that demand from Venus Bay and Lower Tarwin would be supplied, but South Gippsland Water has no defined timeframes for servicing this demand. Timeframes shown in Figure 12-7 are therefore indicative only. Under this scenario, supply from the Melbourne system would be sufficient to meet the demands of the northern, southern and unserviced towns over the 50 year planning horizon under medium climate change, with an increase in the annual cap for supply from the Melbourne system at around 2050. This volume could readily be transferred from the unused Leongatha entitlement from the Melbourne system.

For the Local Growth scenario, it is assumed that Poowong, Loch, Nyora and Korumburra would again be connected to the Melbourne supply in 2012/13, but that Leongatha would also be connected to the Melbourne Supply in around 2020. The unserviced towns are assumed to be connected around the year 2025. Under these circumstances, the 10 ML/d Melbourne supply pipeline would be adequate to supply Local Growth demands from all connected towns to around the year 2025 to 2030, depending on climate conditions and the timing of connection of the unserviced towns. Beyond these dates, the pipe capacity from the Melbourne supply would need to be upgraded to enable more water to be harvested from the Melbourne supply under South Gippsland Water's existing bulk entitlement.

- **Figure 12-7 Supply from Melbourne for Wonthaggi, Cape Paterson and Inverloch plus Poowong, Loch, Nyora, Korumburra, Leongatha and Koonwarra including supply to unserviced towns near Inverloch**



The resilience of this augmentation option to severe prolonged drought was examined by estimating supply system behaviour under a repeat of the 2006/07 severe drought year. This analysis highlighted that even though local catchment inflows were negligible in this year from October to April, the availability of a large volume in storage and access to the Melbourne supply means that South Gippsland Water would be able to maintain supply through two consecutive years of repeating 2006/07 climate.

12.4. Sustainability Assessment of Options

The introduction of demand reduction measures in line with other towns supplied by South Gippsland Water will serve to minimise infrastructure costs and delay the need for supply augmentations. On a sustainability assessment, demand reduction measures will be preferable to augmenting the supply system, however in order to meet future demands both actions will be required.

The sustainability assessment for the northern and southern towns compares the option to supply from enhancing existing separate headworks and the option to connect the northern and southern towns to supply from Lance Creek Reservoir and the Melbourne system. The outcome of the assessment is summarised in Table 12-2 and indicates that the supply from the Melbourne system has the advantage of being more robust to changes in streamflow under climate change and potential increases in demand under the Local Growth scenario. A definitive preferred strategy is dependent on the outcomes of the business case, which is currently being undertaken by South Gippsland Water. Only preliminary results from the business case were available at the time of preparing this WSDS. Key points to note about the sustainability assessment are as follows:

- There is a higher degree of confidence associated with the Melbourne supply option from a water resource availability perspective. This is because there is uncertainty in the ability to maintain supply towards the end of the 50 year planning horizon under the option to supply from separate headworks. The Melbourne system provides a climate independent source of water that is more reliable under future climate change and high growth in demand for water. The second source of uncertainty is the future major industrial demand, which is an area of uncertainty for both options. If major industrial demand were to decrease then the option to supply from separate headworks would be more robust, but if major industrial demand were to increase then the Melbourne supply option would be more robust. The Melbourne supply option is also considered more resilient to prolonged severe drought.
- There is likely to be a net improvement in river health under the Melbourne supply option but a slight reduction under the option to supply from enhanced separate headworks. This is because the Melbourne supply option is likely to increase flows in the Little Bass River, Bellview Creek, Ness Gully, Coalition Creek and Ruby Creek when these supply sources are decommissioned. The supply from separate headworks would result in greater harvesting of streamflows from all of the above streams. There would be an increase in water harvesting from Lance Creek under both options, which would be expected to have a very minor impact on the health of the Powlett River.

- Water quality under the Melbourne supply option would be expected to improve relative to current conditions whilst water quality under the option to supply from separate headworks would be expected to marginally decrease. This is because of changes to dilution flow in local streams in the Bass River and Tarwin River catchments outlined above.
- Other ecosystems are unlikely to be significantly affected as a result of either proposal. There is the possibility of a reduction in marine ecosystem health due to increased use from the desalination plant under the Melbourne supply option and due to decreased river flows to the Tarwin River estuary under the option to enhance separate headworks. For both options vegetation may need to be cleared along proposed pipeline routes if those routes cannot be located in an existing cleared serviced corridor. For the option to enhance separate headworks, minor loss of terrestrial habitat would be expected above the current full supply level of the Little Bass Reservoir, Coalition Creek storages and Ruby Creek storages associated with the increase in capacity of these storages.
- The preliminary cost estimates from the business case indicate that the two supply options have similar net present costs under both the Victoria in Future and Local Growth scenarios. These costs may be refined as more detail is included in the business case analysis.
- Both options would support more regional development, both through the construction phase of both options and by providing potable water supply to more customers. The Melbourne supply option provides greater flexibility to service demands under higher growth and drier climate change scenarios towards the end of the 50 year planning horizon.
- The greenhouse gas emissions are low for both options, but the emissions associated with the operation of the Melbourne supply option are higher than the supply from separate headworks. For the Melbourne supply option greenhouse gas emissions for water treatment are lower, because only one treatment plant is operated at Lance Creek instead of four separate plants, however power requirements to pump water from Lance Creek to the northern towns are significantly higher. The supply from the Melbourne system to Lance Creek is carbon neutral. Increases in greenhouse gas emissions during construction of either option have not been estimated.
- Both options are unlikely to have any impact on recreation and heritage activities in the area.
- Both options are likely to be socially acceptable. South Gippsland Water has done some preliminary consultation and found that stakeholders are amenable to both options, pending the outcome of the business case. There is some general public opposition to the desalination plant itself, which in turn could result in some opposition in the short-term to South Gippsland Water’s connection to the Melbourne system. Customer complaints could arise when the supply source is switched due to customer perception of minor differences in taste and/or odour.

▪ Table 12-2 Sustainability Assessment of Options for Northern and Southern Towns

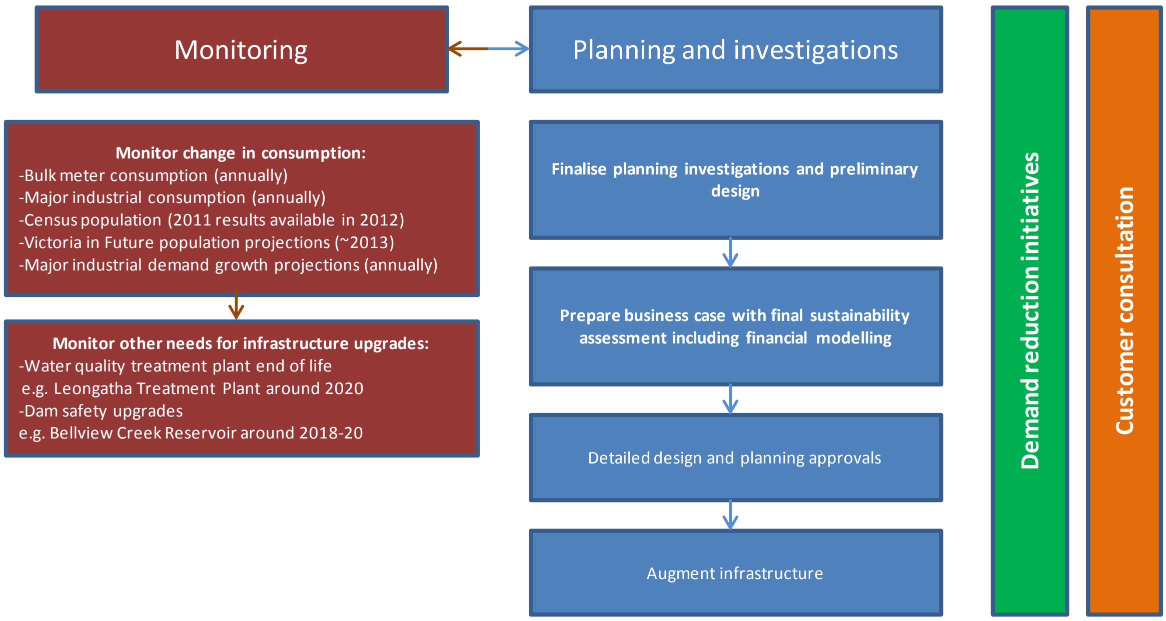
Net present cost	Regional development	Greenhouse emissions	River health	Water quality	Other ecosystems	Culture, recreation and heritage	Social acceptability	Confidence flag	LRMC ($/ML)
Option: Demand reduction measures									
5	1	5	1	0	0	0	3	2	n/a
Option: Local supply enhancement -Increase Little Bass Reservoir by 200 ML -Increase Korumburra Storages by 200 ML -Interconnect Little Bass, Coalition Ck and Ruby Ck systems -Upgrade Tarwin R West Branch Supply to 10 ML/d -Increase Ruby Ck Storages by 1000 ML -Source additional water from Melbourne system for unserviced towns									
-5	3	1	-1	-1	-1	0	3	2	tbc
Option: Supply from Melbourne system -Connect northern and southern towns -Decommission local raw water storages and treatment plants -Connect unserviced towns near Inverloch									
-5	3	2	1	1	-1	0	3	2	tbc

(1) For broad comparison of options only. See Section 5.1 for further details of the function of this sustainability assessment within the planning process.

12.5. Strategy Summary

There is some uncertainty in both the future demand and supply availability for South Gippsland Water's northern and southern towns. South Gippsland Water's planning approach is to monitor demand on an ongoing basis and adjust its plan of action accordingly. South Gippsland Water's monitoring activities in relation to long-term planning for these towns are shown in Figure 12-8. This monitoring also includes monitoring of asset condition for some of its ageing assets or those in need of upgrade for other reasons, such as dam safety. In parallel with this monitoring, South Gippsland Water will complete its planning investigations and preliminary design so that it can complete its business case of the various supply enhancement options available to better inform its sustainability assessment. Undertaking these planning investigations and preliminary design will also prepare South Gippsland Water to implement supply enhancement quickly if changes in supply or demand occur. The business case is expected to confirm a preferred strategy for South Gippsland Water, which will then lead into detailed design and planning approvals and finally commissioning of the new infrastructure. South Gippsland Water will implement its demand reduction initiatives throughout this process and will continue to consult with its customers on the outcomes of its ongoing planning activities.

- **Figure 12-8 South Gippsland Water strategy for South Gippsland Water's northern and southern towns and unserviced towns near Inverloch**



Whilst the course of action required will vary according to the outcomes of the business case and future monitoring of supply and demand, the approximate timing of infrastructure augmentations under the two growth scenarios is shown in Figure 12-9. This figure highlights that South Gippsland Water is expecting to implement augmentation options quickly after finalising the business case. Other actions will be timed to align with dam safety and treatment plant upgrades where practicable. As mentioned previously, the timing of these actions is subject to change as more information is collected by South Gippsland Water. It can be seen from Figure 12-9 that the supply from existing separate South Gippsland Water headworks still requires connection to the Melbourne system from 2025 onwards if demands follow the Local Growth trajectory.

- **Figure 12-9 Approximate timing of South Gippsland Water infrastructure augmentation**

Supply from Existing Separate South Gippsland Water Headworks

Approx. Timing	Action under Victoria in Future Growth	Action under Local Growth
2012/13	Raise Little Bass Reservoir and connect Korumburra to Little Bass Reservoir.	
2016/17	None	Upgrade Tarwin R West Branch supply to bulk entitlement limit.
2017/18	Raise Bellview Creek Reservoir whilst dam safety works are undertaken.	
~2025	Connect unserviced towns near Inverloch to Lance Creek system.	
~2025	None	Increase storage at Leongatha by 1000 ML
2025-2039	None	Connect Leongatha to Melbourne supply
2034-2039	None	Connect Korumburra to Melbourne supply
2040-2047	None	Increase supply to Lance Creek from Melbourne
2044-2049	None	Connect PLN to Melbourne supply

Supply from Melbourne

Approx. Timing	Action under Victoria in Future Growth	Action under Local Growth
2012/13	Connect Poowong, Loch, Nyora and Korumburra to Melbourne supply and decommission water treatment plants. Decommission or seek alternative uses for raw water storages.	
2020	None	Connect Leongatha to Melbourne supply, decommission Leongatha water treatment plant. Decommission or seek alternative uses for raw water storages.
~2025	Connect unserviced towns near Inverloch to Lance Creek system.	Increase supply from Melbourne to above 10 ML/d and connect unserviced towns near Inverloch to Lance Creek system.
2052-2058	Increase supply from Melbourne above 10 ML/d.	Further increase supply from Melbourne.

Immediate and ongoing actions which are applicable to both options are listed in Table 12-3. These include actions to monitor demands.

- **Table 12-3 Actions for towns east of the Tarwin River and unserviced towns near Inverloch**

Strategy	Actions
Reduce uncertainty in current estimate of consumer demand	- Compare quarterly or four monthly consumption data from property and bulk meters
Reduce uncertainty in future estimate of consumer demand	- Examine long-term trends in bulk water use independent of climate variability.
	- Continue monitoring Burra Foods demand and request an annual update on longer term water demand forecasts - Continue tracking Murray Goulburn and steam plant demand and request an annual update on its progress to achieve water savings
	- Proceed with planning investigations and design to supply unserviced towns near Inverloch
Encourage demand reduction	- Pursue additional demand reduction options after adoption by WaterSmart - Continue ongoing program of system leak reduction and inspections for unmetered tappings

13. Supply and Demand Projections for Dumbalk with Current Operation and Infrastructure

13.1. Introduction

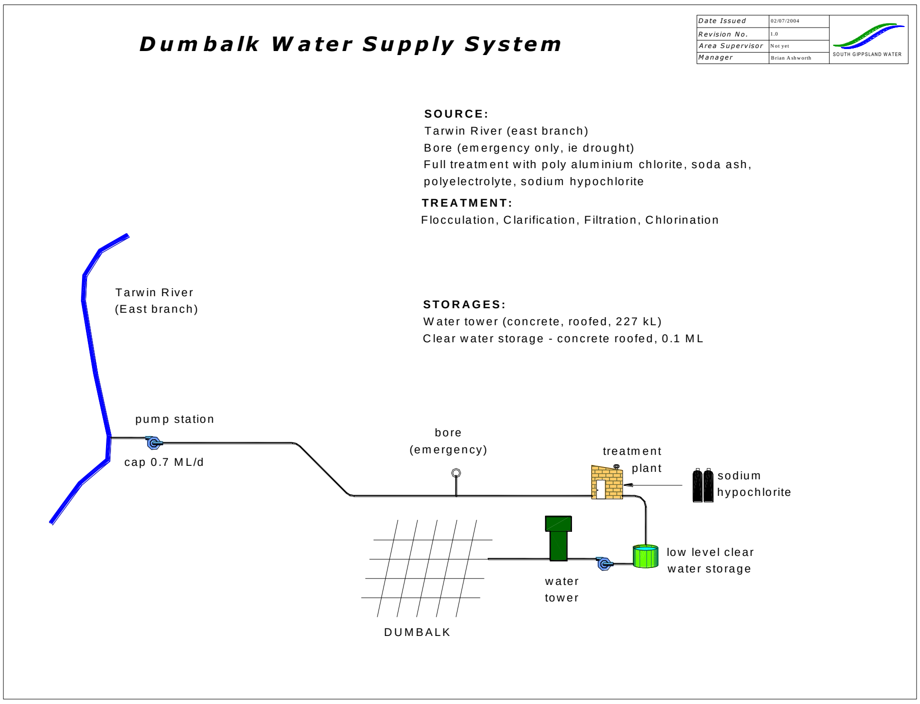
This section of the WSDS outlines the supply and demand projections for Dumbalk over the next 50 years assuming current operation and infrastructure. It includes an overview of the current supply system configuration, current demand for water and current supply. It also includes supply and demand projections under future climate change and alternative growth scenarios over the 50 year planning horizon. South Gippsland Water's response to any shortfall in demand under the current operation and infrastructure scenarios is presented in Section 19 in conjunction with nearby towns.

13.2. Current water supply and demand

13.2.1. Supply system description

Dumbalk receives water directly from the east branch of the Tarwin River via a pump station which is located adjacent to the river. The pump station transfers water to the water treatment plant via a 150 mm diameter rising main. The capacity of the pumped diversion is 0.7 ML/d (21.3 ML/mth). The water treatment plant has a capacity of 0.4 ML/d (12.2 ML/mth). A schematic of the Dumbalk water supply system is shown in Figure 13-1.

- **Figure 13-1 Tarwin East Water supply system schematic**



13.2.2. Current legal entitlements to water

The bulk entitlement for Dumbalk allows South Gippsland Water to divert up to a maximum of 100 ML/yr from the Tarwin River. The daily bulk entitlement is shown in Table 13-1.

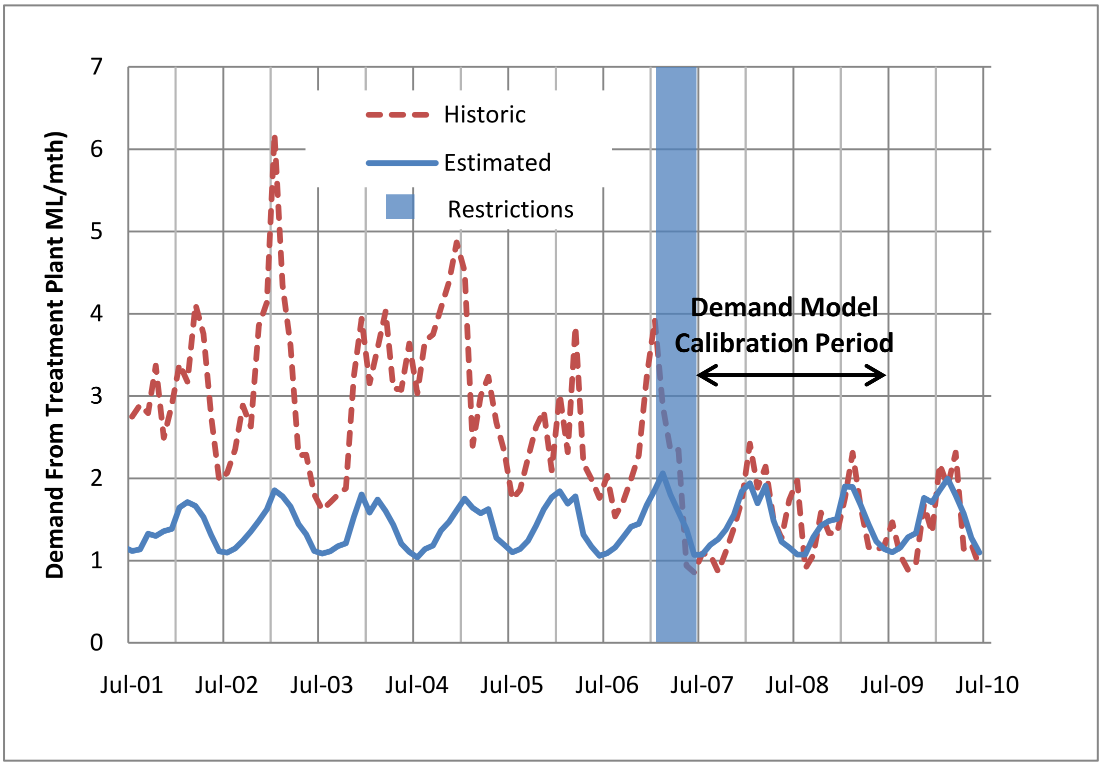
- **Table 13-1 Bulk entitlement volume for the Tarwin River at Dumbalk**

Source	Maximum annual volume	Maximum diversion rate	Minimum passing flows
Tarwin River at Dumbalk	100 ML/yr	0.72 ML/d (21.9 ML/mth)	No minimum passing flows

13.2.3. Current demand

Dumbalk had a population of 155 people excluding visitors in the 2006 census (DPCD, 2009). A demand model was fitted to the recent unrestricted data to estimate a long-term average annual demand, which takes into account how current demands would vary under a wider range of natural climate variability. The historical and estimate long-term current demand is shown in Figure 13-2. The estimate long-term current demand is **17 ML/yr** at South Gippsland Water's treatment plant inlet. There are no net losses across the treatment plant. Figure 13-2 shows that the long-term current demand is much lower than that which occurred historically and has been sustained for the last two years.

▪ **Figure 13-2 Long-term monthly demands for Dumbalk**



13.2.4. Current reliability of supply

Restrictions were introduced at Dumbalk from January to June 2007, which included several months of Stage 4 restrictions. Restrictions have not historically been required at any other time over the last 15 years. Since 2006/07 the supply and demand balance has been improved through a reduction in demand. Reliability of supply modelling over the period July 1950 to June 2007 indicated that restrictions would not have been required over that period under a repeat of historical climate conditions. This meets South Gippsland Water's level of service objective for restrictions. It should be noted however that it has been reported that in the 1967/68 and 1982/83 droughts there was a need to sandbag the Tarwin River East branch to secure supply for the town. Further details on the water resource model used to assess reliability of supply (and yield) can be found in SKM (2009).

13.3. Environmental condition

Dumbalk is located on the Tarwin River East Branch. Dumbalk currently extracts a negligible proportion of the available flow in the Tarwin River, even during low flow conditions and therefore has little influence on environmental condition. The Tarwin River East Branch flows from the Strzlecki Ranges in the north and east, flowing downstream to join the West Branch at Meeniyan. The river then flows into Andersons Inlet at Tarwin Lower. There are a few small undefined tributaries and drainage lines from low lying swamps that enter the river in the reaches below Meeniyan. The main tributary is Fish Creek which flows into the Tarwin River from the east a few kilometres upstream of Tarwin Lower.

Information about the environmental condition of Tarwin River West Branch and the Tarwin River downstream of the confluence of the East and West Branches was assessed for South Gippsland Water in SKM (2006b) *Tarwin River Preliminarily Environment Assessment*. The outcomes of that assessment, primarily for the Tarwin River below its confluence of the East and West Branches, are discussed below.

Around 30 fish species have been recorded in the Tarwin River downstream of its confluence with the West Branch. One fish species (Australian grayling, *Prototroctes maraena*) recorded in the study area is listed nationally as vulnerable under the Environment Protection Biodiversity Conservation Act 1999 (National) and as threatened in Victoria under the Flora and Fauna Guarantee Act 1988 and one species (Australia whitebait, *Hyperlophus vittatus)* is listed as threatened in Victoria under the FFG Act 1988. The list of species found also included the two exotic species of carp and brown trout.

Recent work by the Department of Sustainability and Environment (DSE) has recorded substantial populations of Australian grayling in the Tarwin River immediately below the offtake at Meeniyan. Consequently, both branches of the Tarwin River have been identified as having significance for populations of Australian grayling (Justin O'Connor, pers. com. DSE, Freshwater Ecology). Australian grayling spawn from about April through to July. At the time of spawning the juveniles move downstream and then move back upstream in October to November. It is believed Australian grayling need an increase in river flow to induce spawning (Justin O'Connor, pers. com.). Installation of a fish ladder at the offtake at Meeniyan has been identified as a priority by DSE (Justin O'Connor, pers. com.).

Clearing for agriculture and willow plantings have impacted on the structure and condition of riparian vegetation along the Tarwin River East Branch. In general, ISC assessments record the streamside zone and physical form of the river as poor. Tarwin River East Branch has a degraded riparian zone with little native vegetation. There are some bank instabilities that extend to the toe of the bank. The catchment is moderately flow stressed with greater stress in summer than in winter. Aquatic life ratings were excellent. In the basin downstream, artificial barriers are likely to affect migration of fish species. The degraded condition of the instream habitat and the riparian zone in the mid and lower parts of the catchment must be seen as a significant threat to the native fish community within the Tarwin River.

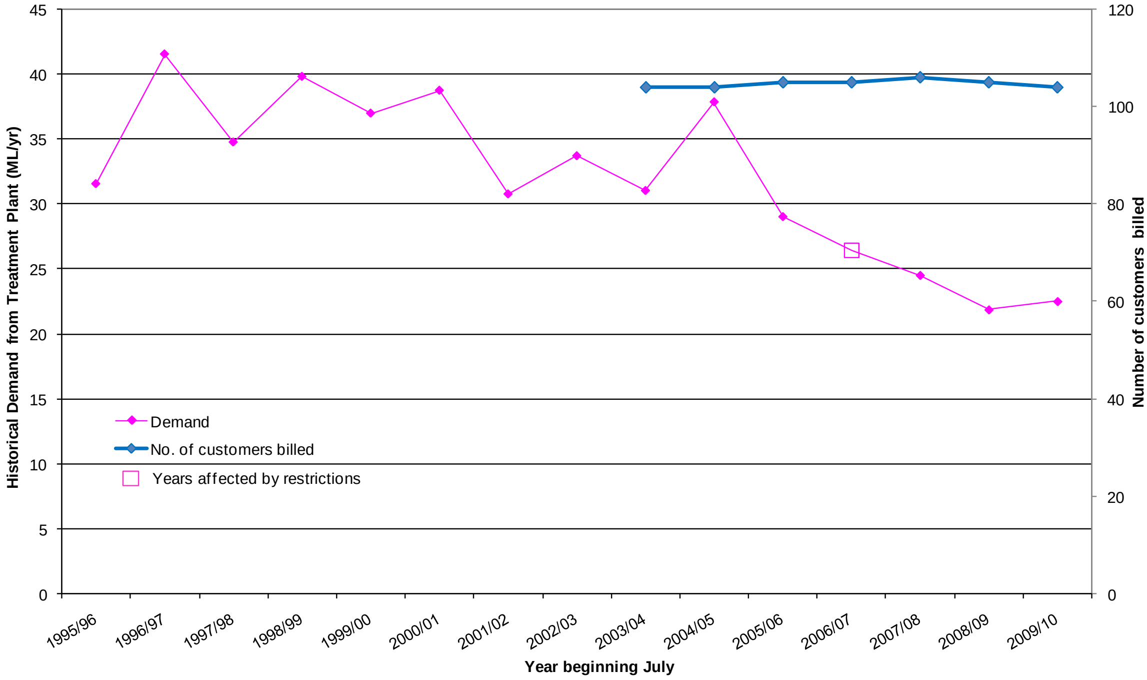
The above assessments were confirmed in the environmental flow assessment for the Tarwin River East Branch in SKM (2009). The environmental flow assessment linked the provision of low flows to maintaining habitat in pools for river blackfish, to maintain habitat, to allow fish movement, and to provide moisture for riparian and fringing plants. Summer freshes were important for preventing colonization of riparian areas by terrestrial plants, to entrain organic matter and transport nutrients downstream, whilst slightly higher, short duration transitional flows in summer were considered important for triggering fish migration. Winter low flows were designed to maintain habitat, provide water for reeds and rushes, and prevent colonisation of weeds, while high flow freshes were intended to maintain channel forming processes and to facilitate the upstream migration of juvenile fish species, including Australian Grayling and Galaxiids. Bankfull flows were recommended to maintain channel forming processes and no overbank flows were specifically recommended.

13.4. Water supply and demand projections with current operation and infrastructure

13.4.1. Historical trends

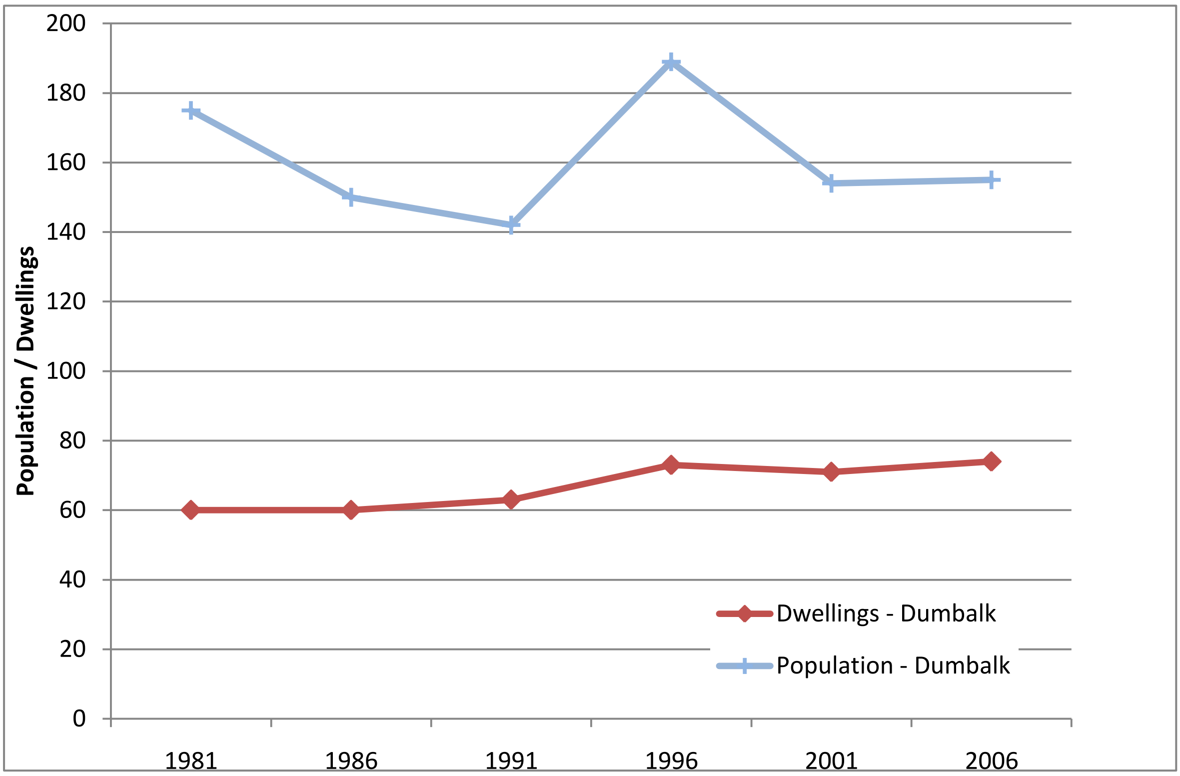
Historical demands to Dumbalk have decreased significantly over the last few years, as shown in Figure 13-3. These demands are recorded at the clear water storage outlet and do not include an allowance for treatment plant utilisation. The number of customers billed in this supply system has remained relatively static. This potentially indicates that significant water savings have been achieved by South Gippsland Water and its customers in recent years.

- **Figure 13-3 Historical demands and number of customers billed at Dumbalk**



The population of Dumbalk has fluctuated between approximately 140-190 people over the last few decades and there are no clear trends in the long-term, as shown in Figure 13-4. The number of dwellings has increased marginally in recent years.

▪ **Figure 13-4 Historical population in Dumbalk**



13.4.2. Future demand projections

Two estimates of future growth in water demand were made in the previous strategy (South Gippsland Water, 2007). These included the *Victoria in Future* estimates, which are available at a Statistical Local Area (SLA) level, and a Local Growth scenario which considered the potential for stronger growth within towns at a rate greater than the surrounding SLA. There are five SLAs covering South Gippsland Water's supply area. Dumbalk is located within the South Gippsland Shire East SLA and accounts for around 3% of the population within that SLA, hence SLA projections are only likely to be broadly representative of growth at Dumbalk.

A comparison of the 2006 census results for each town against the previous population projections from the 2001 census indicated that both the *Victoria in Future* and the Local Growth overestimated population growth between 2001 and 2006. The *Victoria in Future* projections were closer to the growth which actually happened, which was no change in population at Dumbalk. Given the uncertainty of future population, South Gippsland Water has considered two population forecasts, which include the *Victoria in Future* projections and a higher Local Growth scenario that allows for faster growth in urban centres within SLAs.

Victoria in Future projections include a growth in residential demand of up to 0.3% per year over the next few years and then falling to no growth by around 2035. The Local Growth scenario assumes a 0.7% annual growth rate in residential demand over the fifty year planning horizon.

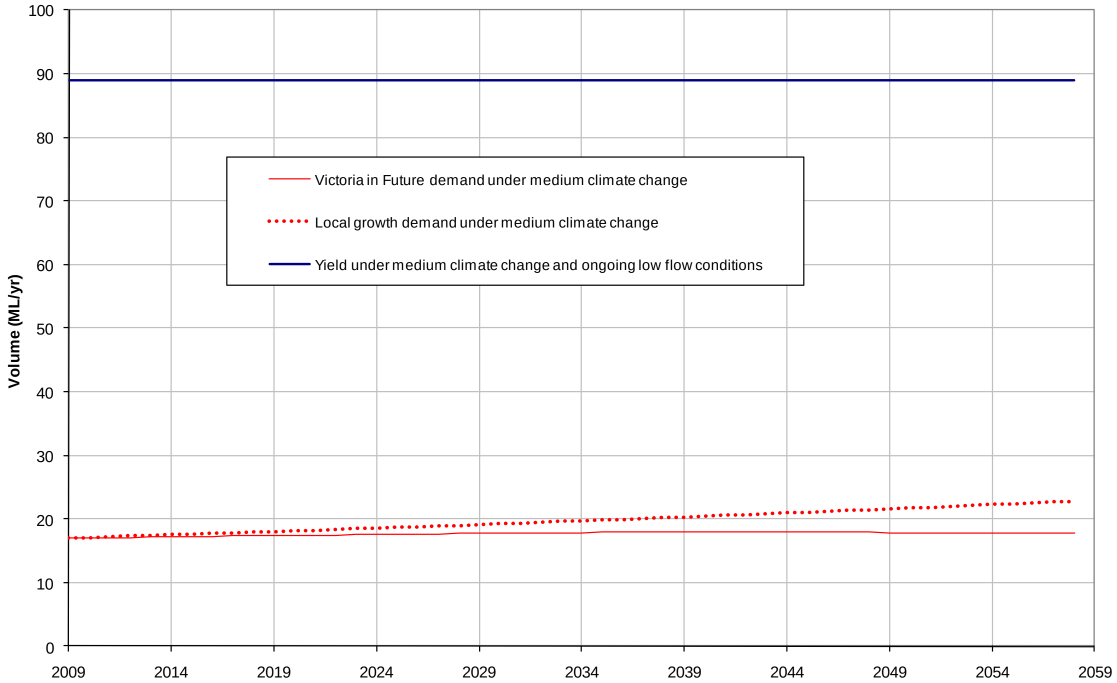
An additional 2.5% increase in residential and stock and domestic demand was assumed to occur over the next 50 years due to medium climate change for all population forecasts. This additional increase in demand is due to increased water use activities such as garden watering under drier and hotter climate change conditions, which is consistent with DSE recommendations (DSE, 2005).

13.4.3. Future supply projections with current operation and infrastructure

Under the medium climate change scenario, runoff in the South Gippsland Basin in the year 2058 relative to the year 2009 is estimated to decrease by 15%, with a range of reduction of 7% to 28% under low and high climate change scenarios. Under the medium climate change scenario, this change in streamflow would be driven by a 3% reduction in rainfall and a 7% increase in evaporation. Under the ongoing low flow conditions scenario, Tarwin River sub-catchment streamflows upstream of Dumbalk have been reduced by 34-41% prior to July 1997.

The Current Operation and Infrastructure water supply and demand situation for the Dumbalk supply system using the *Victoria in Future* population projection is shown in Figure 13-5. This figure illustrates that demand is not expected to exceed available supply in the foreseeable future.

- **Figure 13-5 Current Operation and Infrastructure Water Supply and Demand for Dumbalk**



13.5. Sensitivity of projections

Three potential land use changes within the catchment supplying Dumbalk were investigated to understand the potential risk they could pose to available supply.

Bushfires: Only 31% of the Tarwin River catchment upstream of Dumbalk has vegetation cover. This means that the risk of catchment yield decreasing significantly due to the effects of any future bushfires is low. There is no record of bushfires occurring in the catchment over the last few decades.

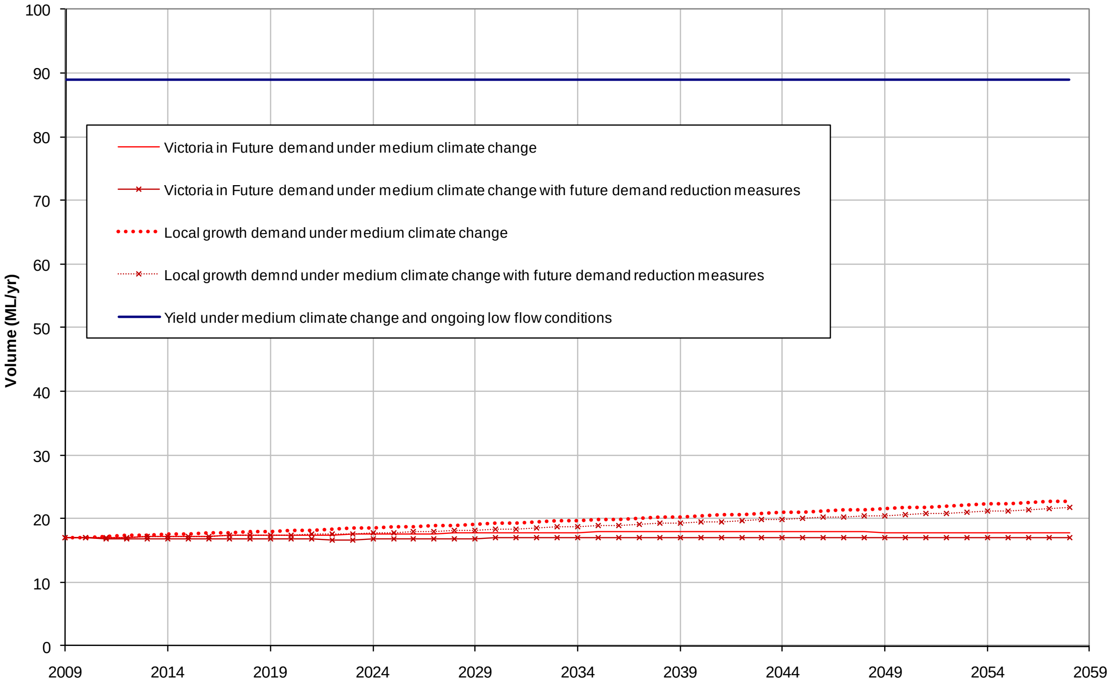
Logging: No logging is undertaken under regional forestry agreements in the water supply catchment for this supply system.

Plantations: There are no plantations in the water supply catchment for this supply system.

13.6. Additional demand reduction options

If the additional demand reduction options outlined in Section 4.10 are adopted for Dumbalk, demands would remain below the available supply, as shown in Figure 13-6.

▪ **Figure 13-6 Effect of additional demand reduction options for Dumbalk**



13.7. Summary of the supply and demand for Dumbalk with current operation and infrastructure

In summary for Dumbalk under the Current Operation and Infrastructure supply and demand scenarios:

- Existing supply is sufficient to meet South Gippsland Water's current level of service objectives over the 50 year planning horizon;
- Demand for water has fallen in recent years and population has slightly increased ; and
- Demand reduction initiatives will increase the spare yield available at the end of the 50 year planning horizon.

A summary of South Gippsland Water's strategy for Dumbalk in the context of South Gippsland Water's strategy for the central towns is presented in Section 19.

14. Supply and Demand Projections for Meeniyan with Current Operation and Infrastructure

14.1. Introduction

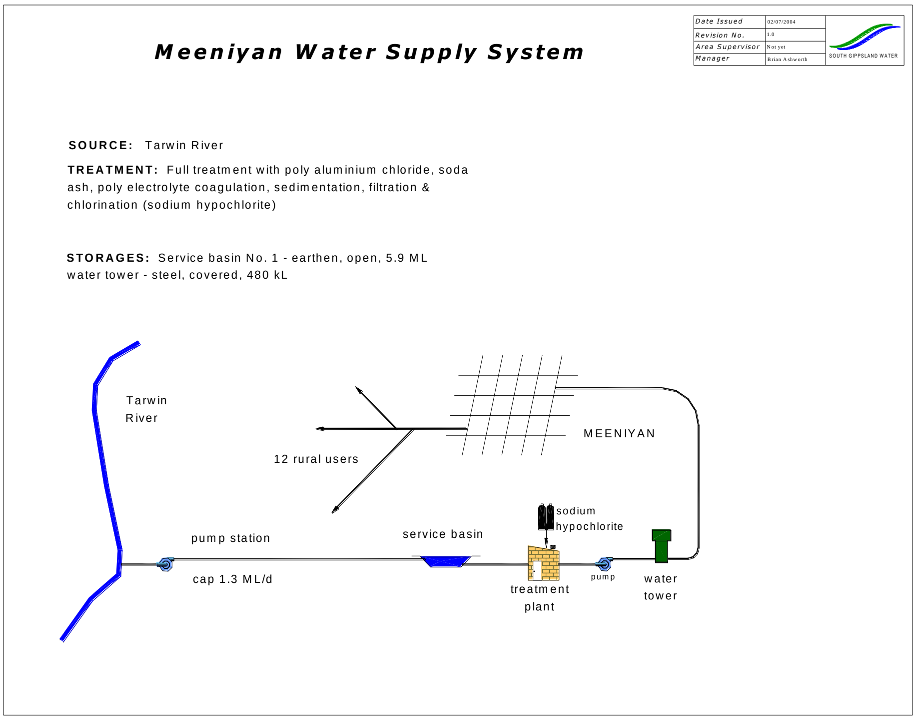
This section of the WSDS outlines the supply and demand projections for Meeniyan over the next 50 years assuming current operation and infrastructure. It includes an overview of the current supply system configuration, current demand for water and current supply. It also includes supply and demand projections under future climate change and alternative growth scenarios over the 50 year planning horizon. South Gippsland Water's response to any shortfall in demand under the current operation and infrastructure scenarios is presented in Section 19 in conjunction with nearby towns.

14.2. Current water supply and demand

14.2.1. Supply system description

Meeniyan's water supply is taken directly from the Tarwin River at Meeniyan (downstream of 227202). A pump station located adjacent to the river transfers water via a 150 mm diameter pipe to a small water storage basin (5.5 ML) located south of the town centre. A schematic of the Meeniyan water supply system is shown in Figure 14-1.

■ **Figure 14-1 Tarwin River Water Supply System Schematic**



14.2.2. Current legal entitlements to water

The bulk entitlement for Meeniyan allows South Gippsland Water to divert up to a maximum of 200 ML/yr from the Tarwin River. The daily bulk entitlement is shown in Table 14-1. A qualification of rights to this entitlement was granted in 2008, which allowed up to 1800 ML/yr to be diverted from Gwyther's Siding Road to supply Leongatha and Korumburra. This qualification of rights is being formalised into an amendment to the entitlements for Leongatha and Korumburra and is discussed in the sections of this WSDS for those supply systems.

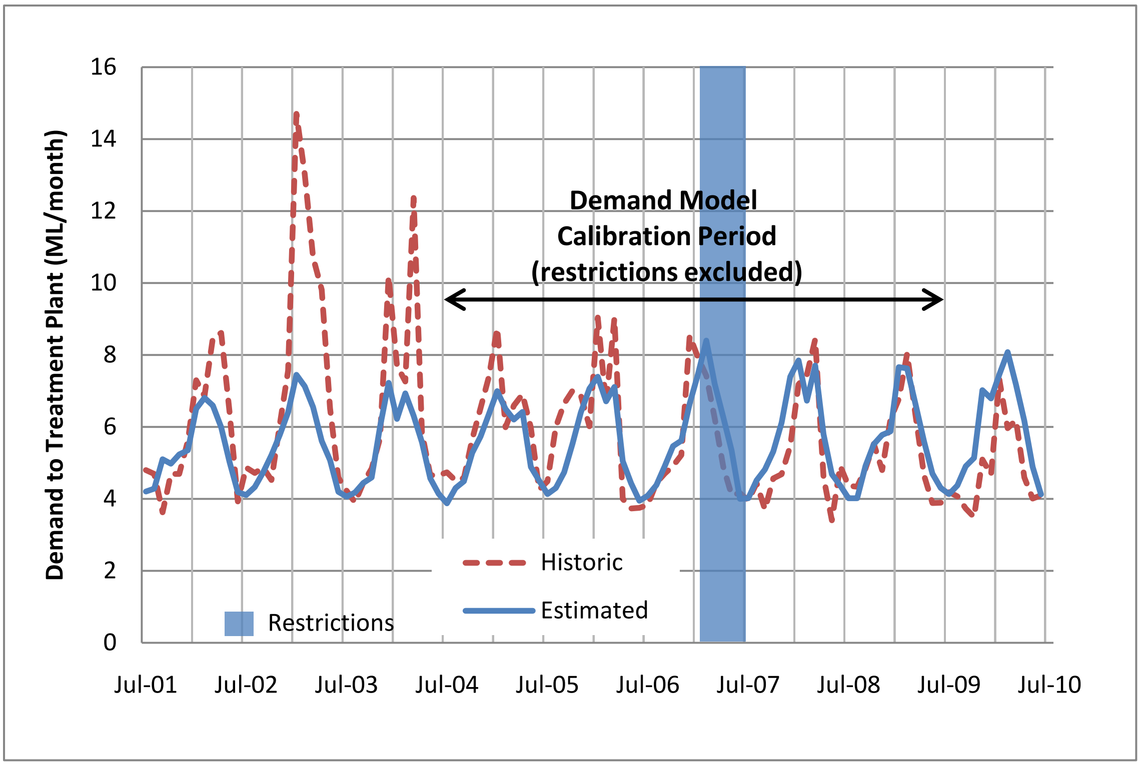
■ **Table 14-1 Bulk entitlement volume for the Tarwin River at Meeniyan (South Gippsland Water, 2007)**

Source	Maximum annual volume	Maximum diversion rate	Minimum passing flows
Tarwin River at Meeniyan	200 ML/yr	1.3 ML/d (39.5 ML/mth)	No minimum passing flows

14.2.3. Current demand

Meeniyan had a population of 413 people excluding visitors in the 2006 census (DPCD, 2009). A demand model was fitted to recent unrestricted data to estimate long-term average annual demand, which takes into account how current demands would vary under a wider range of natural climate variability. The historical and estimated long-term current demand is shown in Figure 14-2. The long-term average annual demand is **65 ML/yr** at South Gippsland Water's treatment plant inlet, of which around 3% is utilised on average through the treatment plant. Historical demand has remained relatively static since 2004/05.

- **Figure 14-2 Long-term monthly demands for Meeniyan**



14.2.4. Current reliability of supply

Restrictions were introduced at Meeniyan from January to June 2007, which included several months of Stage 4 restrictions. Restrictions have not historically been required at any other time over the last 15 years. Since 2006/07 the supply and demand balance has been improved through a sustained reduction in demand. Reliability of supply modelling over the period July 1950 to June 2007 indicated that restrictions would not have been required over that period under a repeat of historical climate conditions. This meets South Gippsland Water's level of service objective for restrictions. Further details on the water resource model used to assess reliability of supply (and yield) can be found in SKM (2009).

14.3. Environmental condition

Meeniyan is located on the Tarwin River just below the confluence of the East and West Branches. Meeniyan currently extracts a negligible proportion of the available flow in the Tarwin River, even during low flow conditions and therefore has little influence on flow volumes in the river. The Tarwin River flows from the Strzlecki Ranges in the north to Andersons Inlet at Tarwin Lower. There are a few small undefined tributaries and drainage lines from low lying swamps that enter the river in the reaches below Meeniyan. The main tributary is Fish Creek which flows into the Tarwin River from the east a few kilometres upstream of Tarwin Lower.

Information about the environmental condition of Tarwin River downstream of the confluence of the East and West Branches was assessed for South Gippsland Water in SKM (2006b) *Tarwin River Preliminarily Environment Assessment*. The main relevant outcomes of that assessment are discussed below.

Around 30 fish species have been recorded in the Tarwin River downstream of its confluence with the West Branch. One fish species (Australian grayling, *Prototroctes maraena*) recorded in the study area is listed nationally as vulnerable under the Environment Protection Biodiversity Conservation Act 1999 (National) and as threatened in Victoria under the Flora and Fauna Guarantee Act 1988 and one species (Australia whitebait, *Hyperlophus vittatus)* is listed as threatened in Victoria under the FFG Act 1988. The list of species found also included the two exotic species of carp and brown trout.

Recent work by the Department of Sustainability and Environment (DSE) has recorded substantial populations of Australian grayling in the Tarwin River immediately below the offtake at Meeniyan. Consequently, both branches of the Tarwin River have been identified as having significance for populations of Australian grayling (Justin O'Connor, pers. com. DSE, Freshwater Ecology). Australian grayling spawn from about April through to July. At the time of spawning the juveniles move downstream and then move back upstream in October to November. It is believed Australian grayling need an increase in river flow to induce spawning (Justin O'Connor, pers. com.). Installation of a fish ladder at the offtake at Meeniyan has been identified as a priority by DSE (Justin O'Connor, pers. com.).

Water quality and Index of Stream Condition were generally found to be poor along the Tarwin River.

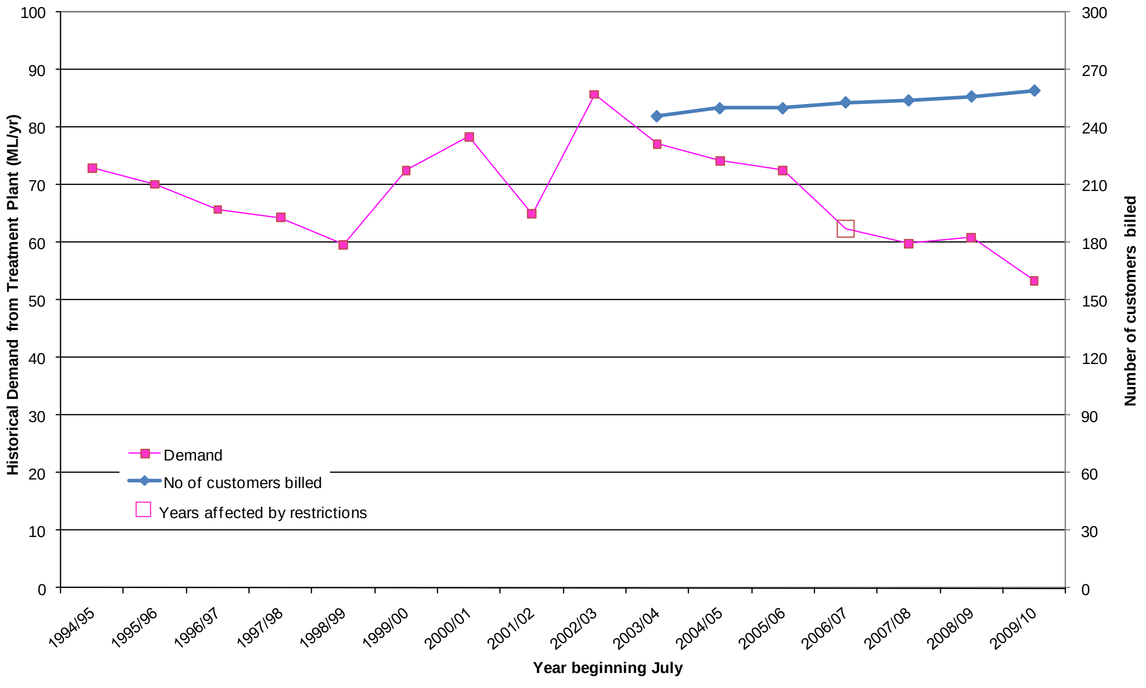
The above assessment was confirmed in the environmental flow assessment for the Tarwin River in SKM (2009). The environmental flow assessment linked the provision of low flows to maintaining habitat in pools for river blackfish, to maintain habitat, to allow fish movement, and to provide moisture for riparian and fringing plants. Summer freshes were important for preventing colonization of riparian areas by terrestrial plants, to entrain organic matter and transport nutrients downstream, whilst slightly higher, short duration transitional flows in summer were considered important for triggering fish migration. Winter low flows were designed to maintain habitat and prevent colonisation of weeds, while high flow freshes were intended to maintain channel forming processes and to facilitate the upstream migration of Tupong and juvenile fish species, including Tupong, Australian Grayling and Galaxiids. Bankfull flows were recommended to maintain channel forming processes and no overbank flows were specifically recommended.

14.4. Water supply and demand projections with current operation and infrastructure

14.4.1. Historical trends

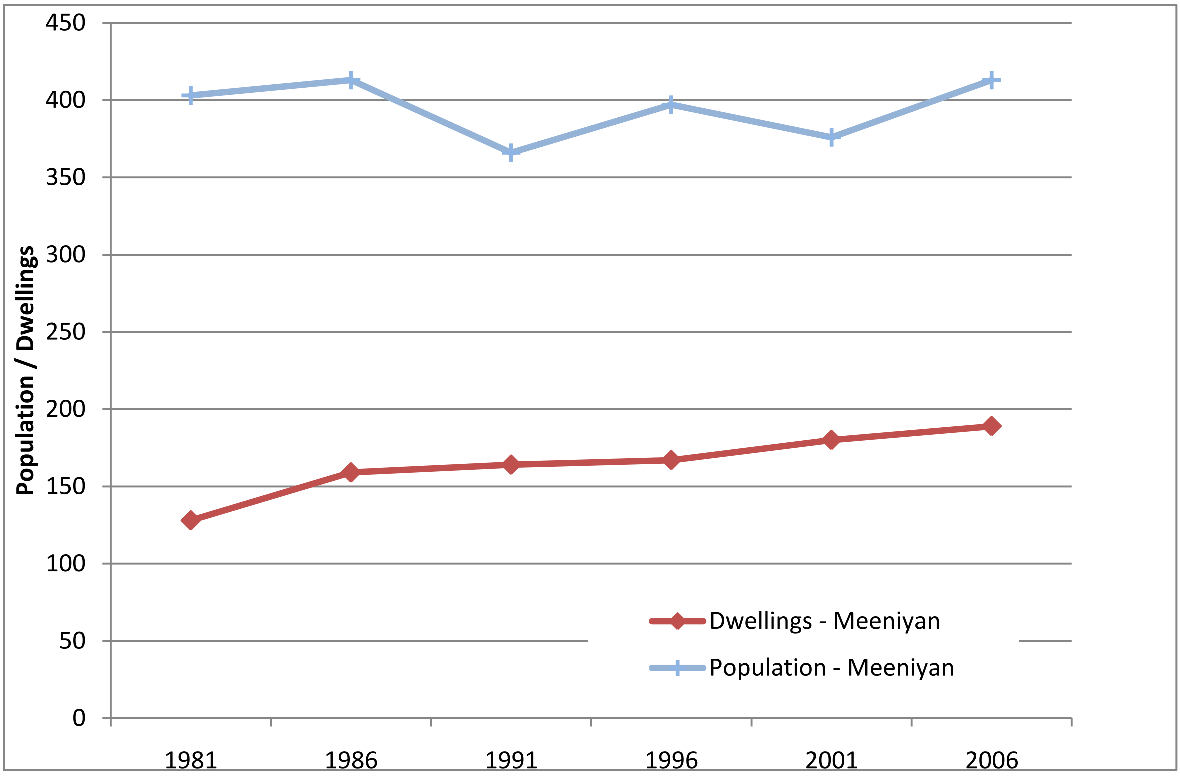
Historical demands for Meeniyan have decreased steadily over the last few years, as shown in Figure 14-3. These demands are recorded at the clear water storage outlet and do not include an allowance for treatment plant utilisation. The number of customers billed in this supply system has increased marginally. This potentially indicates that significant water savings have been achieved by South Gippsland Water and its customers in recent years.

▪ **Figure 14-3 Historical demands and number of customers billed at Meeniyan**



The population of Dumbalk has fluctuated between approximately 360-420 people over the last few decades and there are no clear trends in the long-term, as shown in Figure 14-4. The number of dwellings has increased marginally in recent years.

▪ **Figure 14-4 Historical population in Meeniyan**



14.4.2. Future demand projections

Two estimates of future growth in water demand were made in the previous strategy (South Gippsland Water, 2007). These included the *Victoria in Future* estimates, which are available at a Statistical Local Area (SLA) level, and a Local Growth scenario which considered the potential for stronger growth within towns at a rate greater than the surrounding SLA. There are five SLAs covering South Gippsland Water's supply area. Meeniyan is located within the South Gippsland Shire Central SLA and accounts for around 3% of the population within that SLA, hence SLA projections are only likely to be broadly representative of growth at Meeniyan.

A comparison of the 2006 census results for each town against the previous population projections from the 2001 census indicated that both the *Victoria in Future* and the Local Growth projections underestimated population growth between 2001 and 2006. However the change in population of 10% that occurred at Meeniyan over this period is within the natural variability observed between previous censuses over the last two decades and does not necessarily represent a departure from historically low growth rates. Small fluctuations in population can appear large in percentage terms for this small town. Given the uncertainty of future population, South Gippsland Water has considered two population forecasts, which include the *Victoria in Future* projections and a higher Local Growth scenario that allows for faster growth in urban centres within SLAs.

Victoria in Future projections include a growth in residential demand of 0.4-0.9% per year with growth rates peaking at around the year 2016. The Local Growth scenario assumes a 1.5% annual growth rate in residential demand over the fifty year planning horizon.

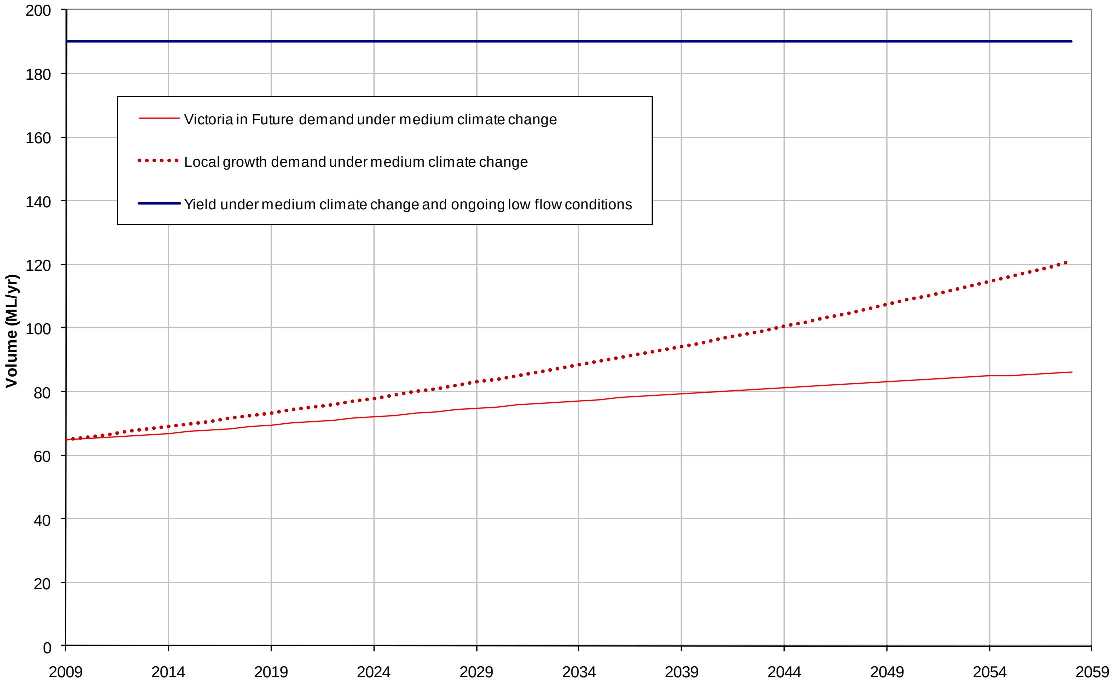
An additional 2.5% increase in residential and stock and domestic demand was assumed to occur over the next 50 years due to medium climate change for all population forecasts. This additional increase in demand is due to increased water use activities such as garden watering under drier and hotter climate change conditions, which is consistent with DSE recommendations (DSE, 2005).

14.4.3. Future supply projections with current operation and infrastructure

Under the medium climate change scenario, runoff in the South Gippsland Basin in the year 2058 relative to the year 2009 is estimated to decrease by 15%, with a range of reduction of 7% to 28% under low and high climate change scenarios. Under the medium climate change scenario, this change in streamflow would be driven by a 3% reduction in rainfall and a 7% increase in evaporation. Under the ongoing low flow conditions scenario, Tarwin River sub-catchment streamflows upstream of Meeniyan have been reduced by 34-52% prior to July 1997.

The Current Operation and Infrastructure water supply and demand situation for the Meeniyan supply system using the *Victoria in Future* population projection is shown in Figure 14-5. This figure illustrates that demand is not expected to exceed available supply in the foreseeable future.

- **Figure 14-5 Current Operation and Infrastructure Water Supply and Demand for Meeniyan**



14.5. Sensitivity of projections

Three potential land use changes within the catchment supplying Meeniyan were investigated to understand the potential risk they could pose to available supply.

Bushfires: Only 18% of the Tarwin River catchment upstream of Meeniyan has vegetation cover. This means that the risk of catchment yield decreasing significantly due to the effects of future bushfires is low. There is no record of bushfires occurring in the catchment over the last few decades.

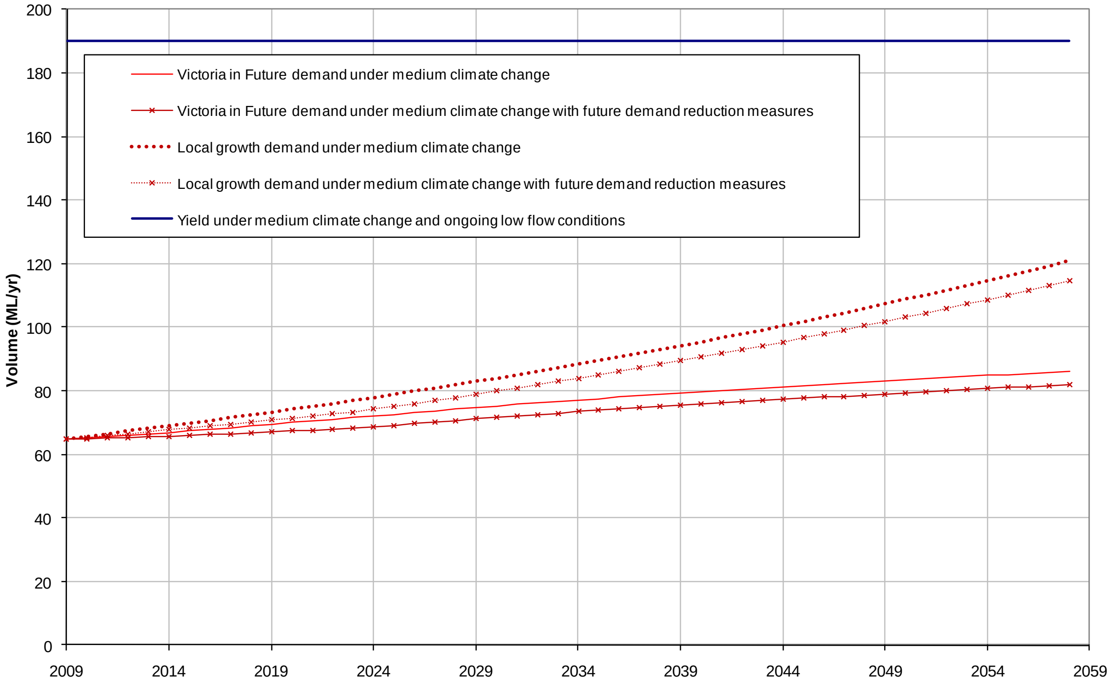
Logging: No logging is undertaken under regional forestry agreements in the water supply catchment for this supply system.

Plantations: There are no plantations in the water supply catchment for this supply system.

14.6. Additional demand reduction options

If the additional demand reduction options outlined in Section 4.10 are adopted for Meeniyan, demands would remain below the available supply, as shown in Figure 14-6.

▪ **Figure 14-6 Effect of additional demand reduction options for Meeniyan**



14.7. Summary of the supply and demand for Meeniyan with current operation and infrastructure

In summary for Meeniyan under the Current Operation and Infrastructure supply and demand scenarios:

- Existing supply is sufficient to meet South Gippsland Water's current level of service objectives over the 50 year planning horizon;
- Demand for water has fallen in recent years, population has remained static and the number of dwellings has increased; and
- Demand reduction initiatives will increase the spare yield available at the end of the 50 year planning horizon.

A summary of South Gippsland Water's strategy for Meeniyan in the context of South Gippsland Water's strategy for the central towns is presented in Section 19.

15. Supply and Demand Projections for Foster with Current Operation and Infrastructure

15.1. Introduction

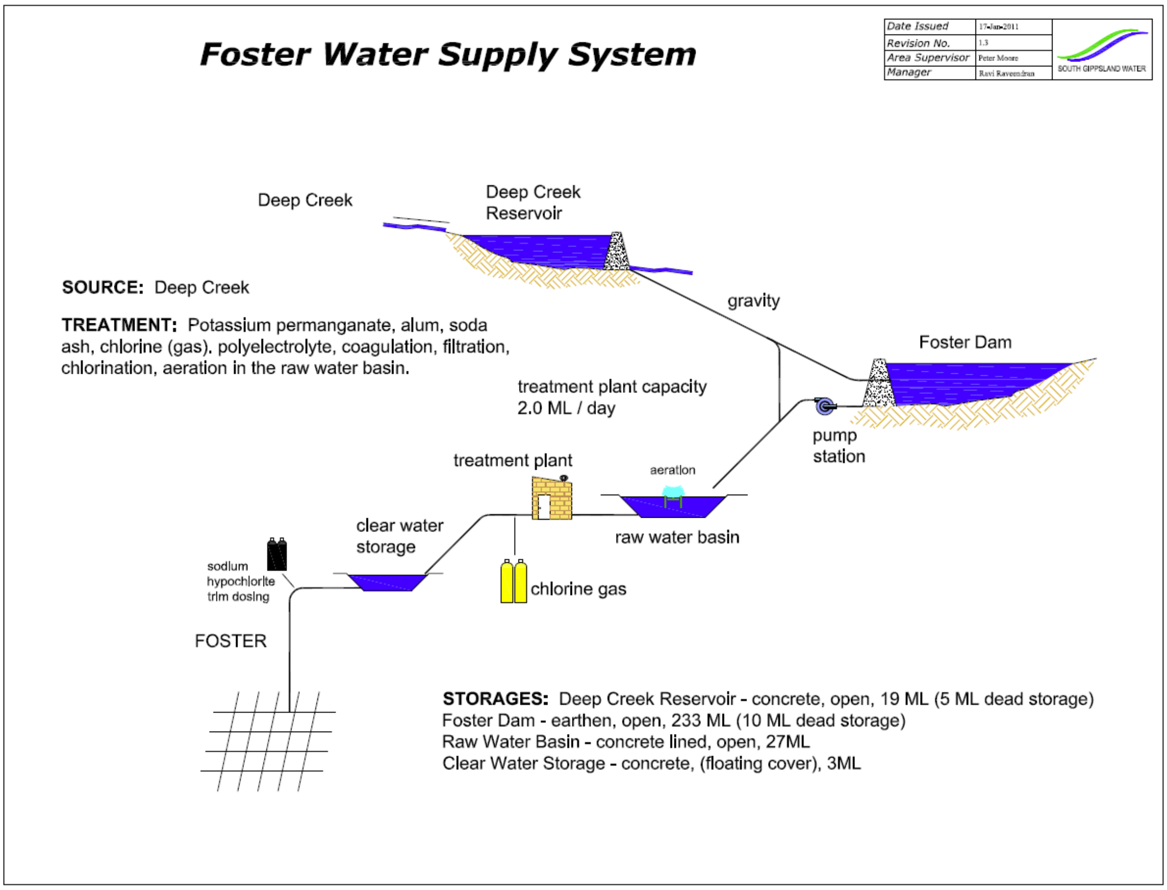
This section of the WSDS outlines the supply and demand projections for Foster over the next 50 years assuming current operation and infrastructure. It includes an overview of the current supply system configuration, current demand for water and current supply. It also includes supply and demand projections under future climate change and alternative growth scenarios over the 50 year planning horizon. South Gippsland Water's response to any shortfall in demand under the current operation and infrastructure scenarios is presented in Section 19 in conjunction with nearby towns.

15.2. Current water supply and demand

15.2.1. Supply system description

The Foster Water Supply System is comprised of an on-stream weir (total storage capacity = 19 ML, dead storage = 5 ML) located on Deep Creek and an off-stream storage constructed in 1997 (Foster Dam 233 ML, dead storage = 10 ML). Water is diverted from Deep Creek Reservoir all year round to Foster Dam storage through a gravity pipeline of 3.5 ML/d capacity. When the on-stream storage stops spilling there is no transfer of water to Foster Dam or the treatment plant via the supply pipeline, although it continues to supply raw water to 12 rural customers. From Foster Dam, the water is pumped to the treatment plant raw water basin. The pump and pipeline capacity from the basin to Foster is 2.6 ML/d. Figure 15-1 shows a schematic representation of the supply system.

▪ **Figure 15-1 Deep Creek Water Supply System Schematic**



15.2.2. Current legal entitlements to water

The bulk entitlement for Foster allows South Gippsland Water to divert up to a maximum of 326 ML/yr from Deep Creek. The daily bulk entitlement is shown in Table 15-1.

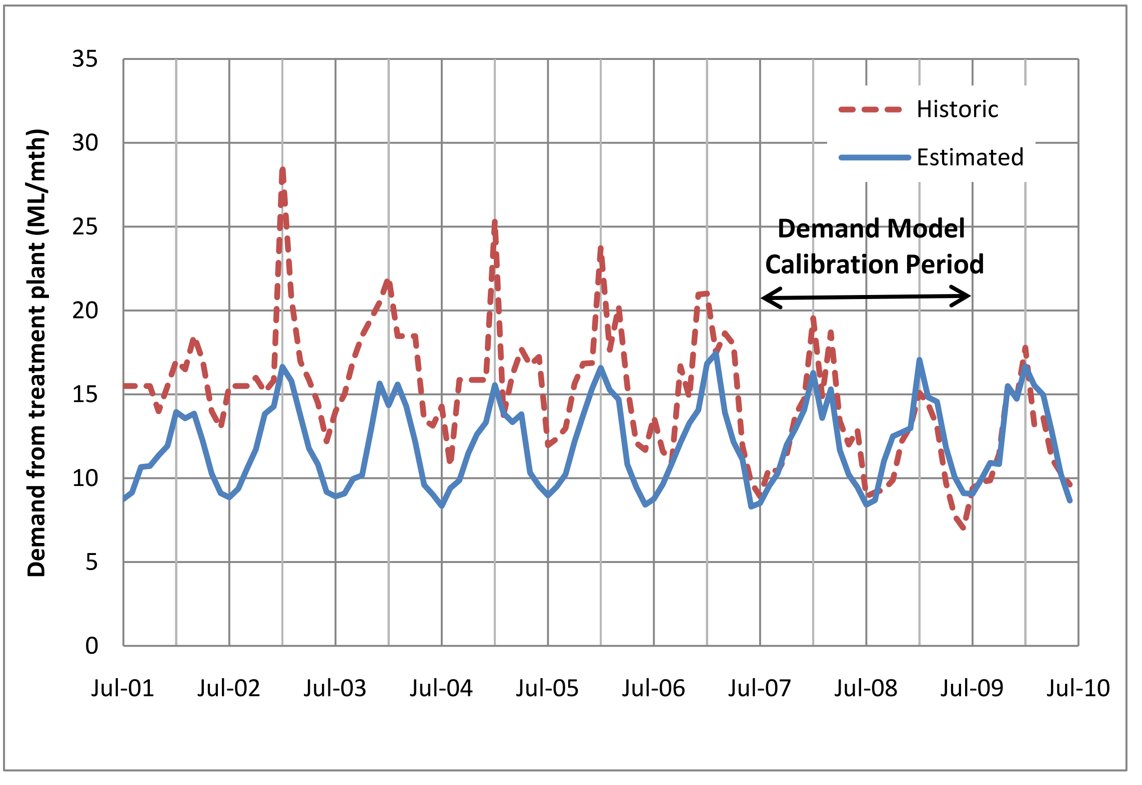
▪ **Table 15-1 Bulk entitlement volume for Foster**

Source	Maximum annual volume (ML/yr)	Maximum diversion rate (ML/d)	Minimum passing flows
Deep Creek	326	3.5	Minimum of 0.2 ML/d or natural flow

15.2.3. Current demand

Foster had a population of 947 people in the 2006 census excluding visitors (DPCD, 2009). A demand model was fitted to recent unrestricted data to estimate long-term average annual demand, which takes into account how current demands would vary under a wider range of natural climate variability. The historical and estimated long-term current demand is shown in Figure 15-2. The estimated long-term average annual demand is **140 ML/yr** at South Gippsland Water's treatment plant inlet, of which around 7% is utilised on average through the treatment plant.

▪ **Figure 15-2 Long-term monthly demands for Foster**



15.2.4. Current reliability of supply

There have been no recent water restrictions in Foster and the supply system currently meets level of service objectives. Reliability of supply modelling over the period July 1963 to June 2007 indicated no restrictions would have been required at current demands over this historical climate period. The minimum storage reached in this scenario was estimated to be 95 ML. Further details on the water resource model used to assess reliability of supply (and yield) can be found in SKM (2009).

15.3. Environmental condition

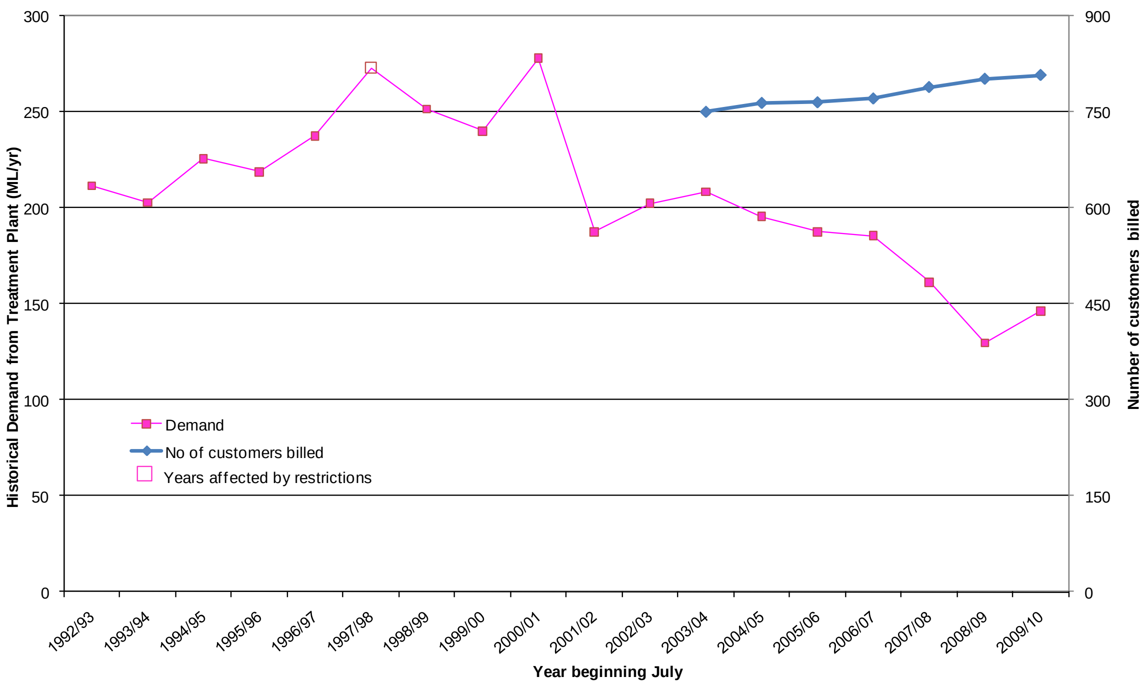
Deep Creek is a tributary of the Franklin River. No environmental condition assessment has been undertaken for Deep Creek. There are no Index of Stream Condition sites on Deep Creek, although the Index of Stream Condition for the lower Franklin River was assessed as moderate.

15.4. Water supply and demand projections with current operation and infrastructure

15.4.1. Historical trends

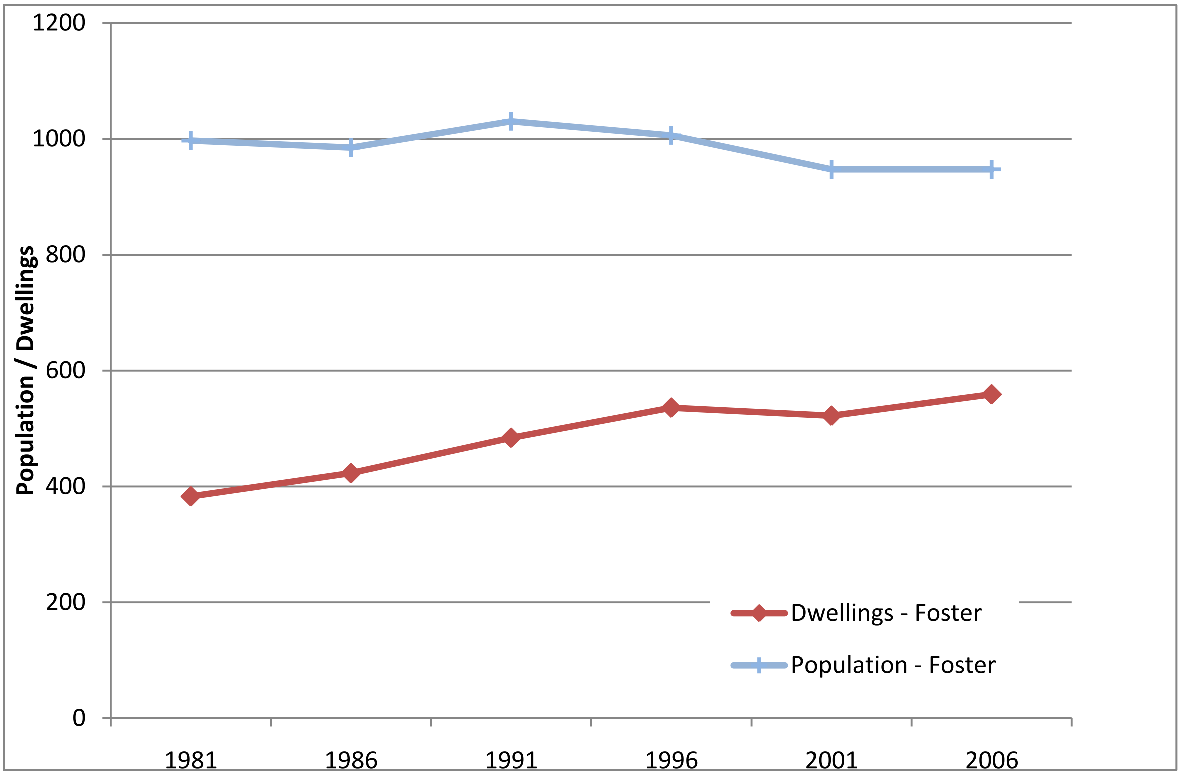
Historical demand at Foster declined sharply in the year 2000/01 and has steadily declined further over the last two years, as can be seen in Figure 10-3. These diversions are recorded at the clear water storage outlet and do not include an allowance for treatment plant utilisation. The number of customers billed in this supply system has increased in this supply system over the last few years, as shown in Figure 15-3. This potentially indicates that significant water savings have been achieved by South Gippsland Water and its customers in recent years.

- **Figure 15-3 Historical demand and number of customers billed at Foster**



The population of Foster has declined slightly over the last two decades, as shown in Figure 15-4, with the total population decreasing from 1,030 in 1991 to 947 in 2006. Between 2001 and 2006 the population remained static whilst the number of dwellings increased slightly.

■ **Figure 15-4 Historical population in Foster**



15.4.2. Future demand projections

Two estimates of future growth in water demand were made in the previous strategy (South Gippsland Water, 2007). These included the *Victoria in Future* estimates, which are available at a Statistical Local Area (SLA) level, and a Local Growth scenario which considered the potential for higher growth within towns at a rate greater than the surrounding SLA. There are five SLAs covering South Gippsland Water's supply area. Foster is located within the South Gippsland Shire East SLA and accounts for around 16% of the population within that SLA.

A comparison of the 2006 census results for each town against the previous population projections from the 2001 census indicated that both the *Victoria in Future* and the Local Growth overestimated SLA population growth between 2001 and 2006. The *Victoria in Future* projections were closer to the growth which actually happened, which was no change in population. However, given the uncertainty of future population, South Gippsland Water has considered two population forecasts, which include the *Victoria in Future* projections and a higher Local Growth scenario that allows for faster growth in urban centres within SLAs.

Victoria in Future projections include a growth in residential demand of up to 0.3% per year over the next few years and then falling to no growth by around 2035. The Local Growth scenario assumes a 0.7% annual growth rate in residential demand over the fifty year planning horizon.

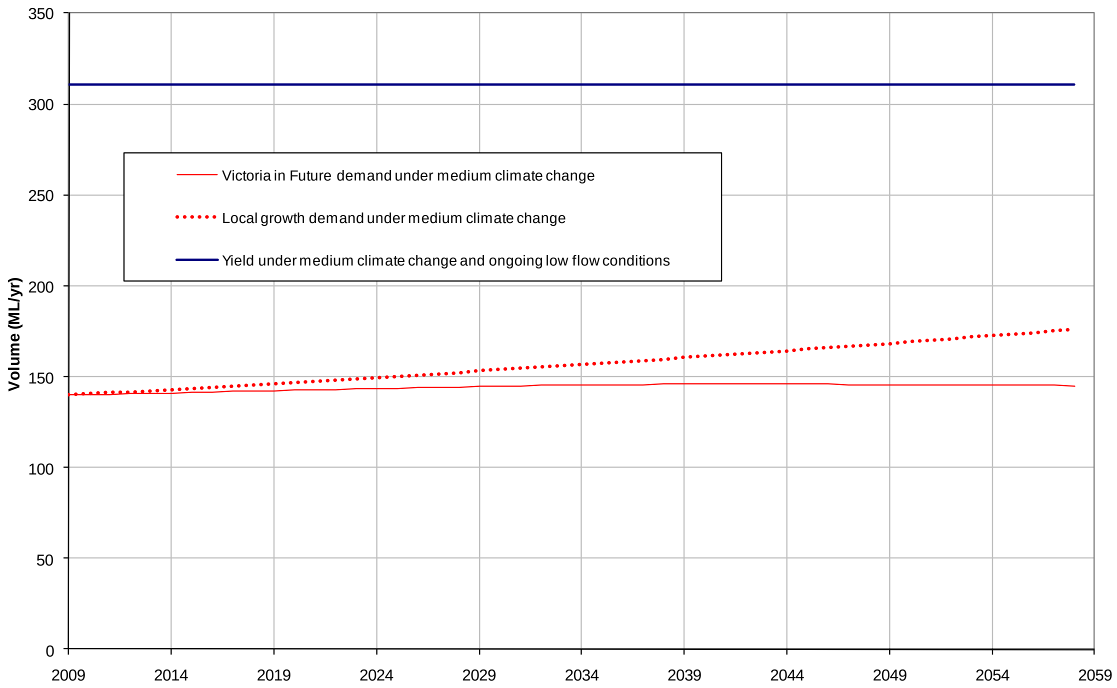
An additional 2.5% increase in residential and stock and domestic demand was assumed to occur over the next 50 years due to medium climate change for all population forecasts. This additional increase in demand is due to increased water use activities such as garden watering under drier and hotter climate change conditions, which is consistent with DSE recommendations (DSE, 2005).

15.4.3. Future supply projections with current operation and infrastructure

Under the medium climate change scenario, runoff in the South Gippsland Basin in the year 2058 relative to the year 2009 is estimated to decrease by 15%, with a range of reduction of 7% to 28% under low and high climate change scenarios. Under the medium climate change scenario, this change in streamflow would be driven by a 3% reduction in rainfall and a 7% increase in evaporation. Under the ongoing low flow conditions scenario, Deep Creek streamflows upstream of Deep Creek Reservoir have been reduced by 43% prior to July 1997.

The Current Operation and Infrastructure water supply and demand situation for the Deep Creek supply system using the *Victoria in Future* population projection is shown in Figure 15-5. This figure illustrates that demand is not expected to exceed available supply for the foreseeable future.

- **Figure 15-5 Current Operation and Infrastructure Water Supply and Demand for Foster**



15.5. Sensitivity of projections

Three potential land use changes within the catchment supplying Foster were investigated to understand the potential risk they could pose to available supply.

Bushfires: The maximum reduction in runoff after a bushfire typically occurs at around 10-20 years after the fire has occurred, and thereafter runoff progressively increases back to pre-bushfire levels. Approximately 55% of the Deep Creek catchment upstream of Foster has vegetation cover, however there is no record of recent bushfires occurring in the South Gippsland region. The effects of bushfire on catchment yield will therefore only be a concern if fires occur in this area in the future.

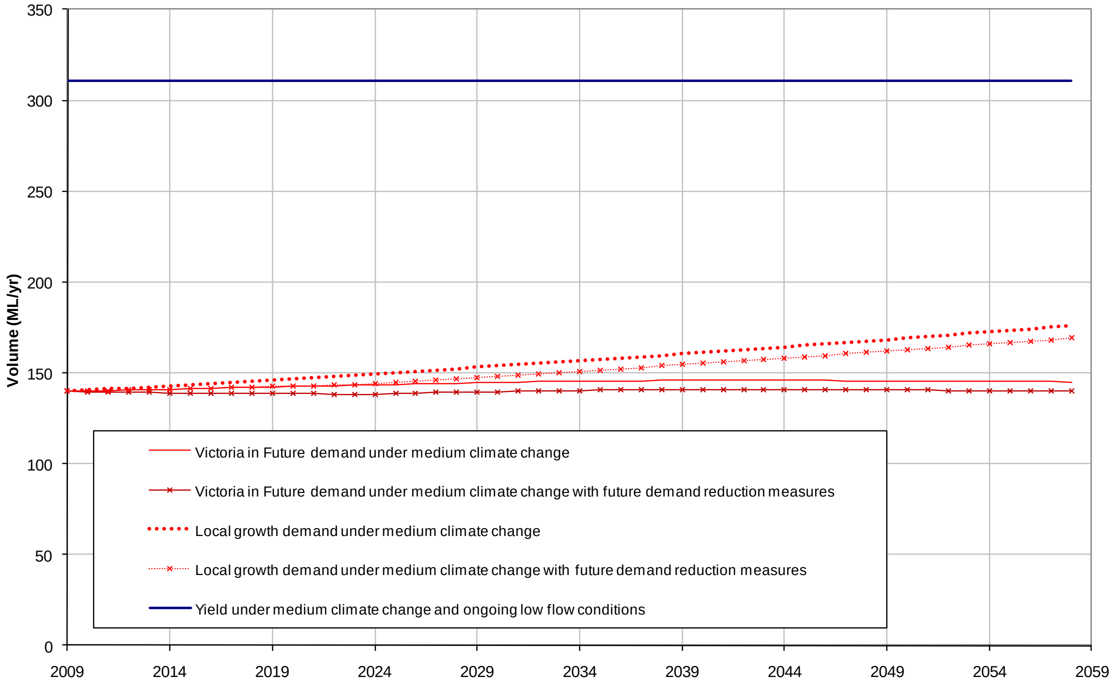
Logging: No logging is undertaken under regional forestry agreements in the water supply catchment for this supply system.

Plantations: There are no plantations in the water supply catchment for this supply system.

15.6. Additional demand reduction options

If the additional demand reduction options outlined in Section 4.10 are adopted for Foster, demands would remain below the available supply, as shown in Figure 15-6.

- **Figure 15-6 Effect of additional demand reduction options for Foster**



15.7. Summary of the supply and demand for Foster with current operation and infrastructure

In summary for Foster under the Current Operation and Infrastructure supply and demand scenarios:

- Existing supply is sufficient to meet South Gippsland Water's current level of service objectives over the 50 year planning horizon;
- Demand for water has fallen in recent years, population has remained static and the number of dwellings has increased; and
- Demand reduction initiatives will increase the spare yield available at the end of the 50 year planning horizon.

A summary of South Gippsland Water's strategy for Foster in the context of South Gippsland Water's strategy for the central towns is presented in Section 19.

16. Supply and Demand Projections for Fish Creek with Current Operation and Infrastructure

16.1. Introduction

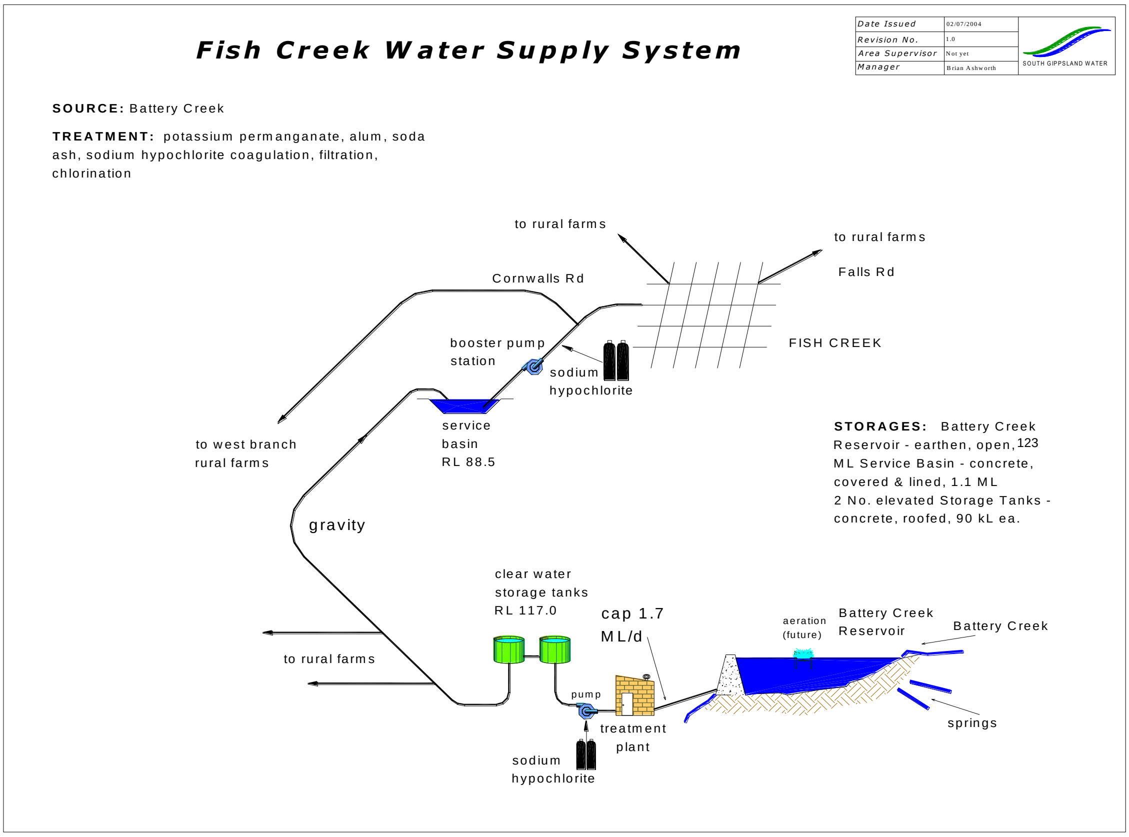
This section of the WSDS outlines the supply and demand projections for Fish Creek over the next 50 years assuming current operation and infrastructure. It includes an overview of the current supply system configuration, current demand for water and current supply. It also includes supply and demand projections under future climate change and alternative growth scenarios over the 50 year planning horizon. South Gippsland Water's response to any shortfall in demand under the current operation and infrastructure scenarios is presented in Section 19 in conjunction with nearby towns.

16.2. Current water supply and demand

16.2.1. Supply system description

The township of Fish Creek and the surrounding rural areas are supplied from a 119 ML reservoir (live storage = 123 ML and dead storage = 4 ML) located on Battery Creek. The water is transferred from the storage to a treatment plant of 2 ML/day (60.8 ML/mth) capacity through a pipeline of 1.7 ML/day (51.7 ML/mth) capacity, into a 1.1 ML lined and covered basin. The water is then supplied directly to the town via the mains pipes, and the rural demands are supplied via the same system. A schematic of the supply system is shown in Figure 16-1.

■ **Figure 16-1 Battery Creek Water Supply System Schematic**



16.2.2. Current legal entitlements to water

The bulk entitlement for Fish Creek allows South Gippsland Water to divert up to a maximum of 251 ML/yr from Battery Creek. The daily bulk entitlement is shown in Table 16-1.

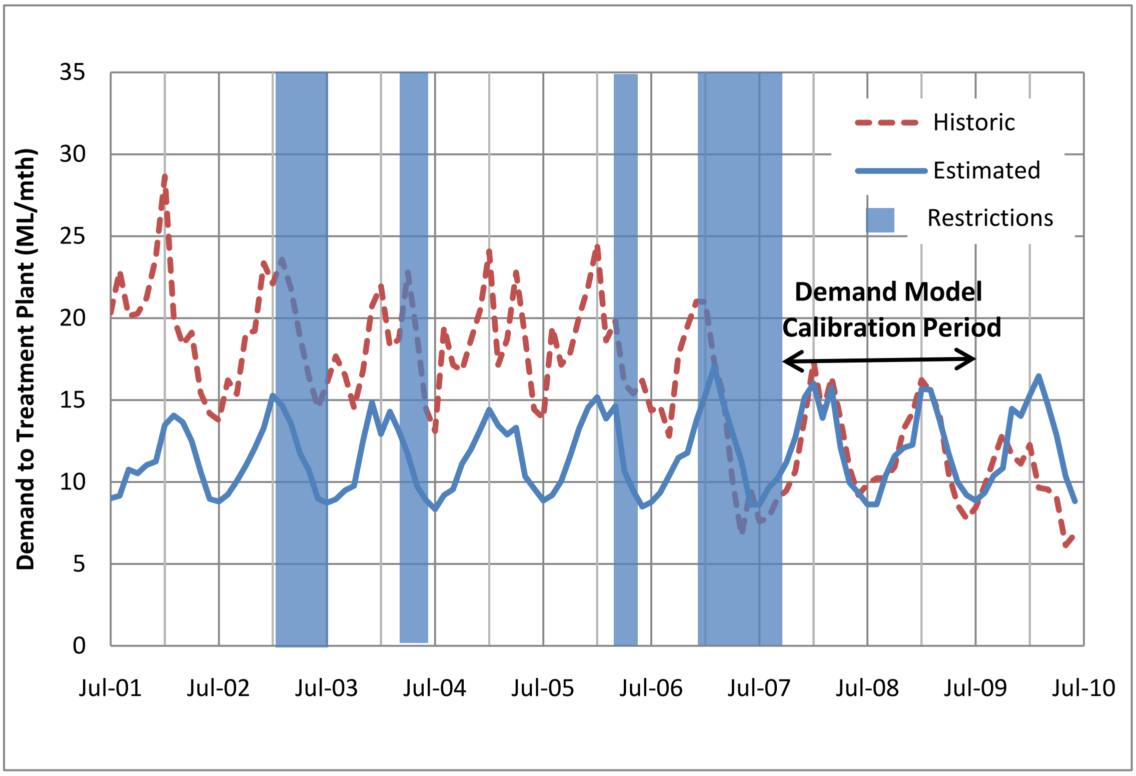
■ **Table 16-1 Bulk entitlement volume for Fish Creek**

Source	Maximum annual volume	Maximum diversion rate	Minimum passing flows
Battery Creek	251	1.0 ML/d (30.4 ML/mth)	No minimum passing flows

16.2.3. Current demand

Fish Creek had a population of 144 people excluding visitors in the 2006 census (DPCD, 2009). A demand model was fitted to the recent unrestricted data to estimate a long-term average annual demand, which takes into account how current demands would vary under a wider range of natural climate variability. The historical and estimated long-term current demand is shown in Figure 16-2. The long-term average annual demand is **140 ML/yr** at South Gippsland Water's treatment plant inlet, of which around 7% is utilised on average through the treatment plant. Note that this level of demand is significantly lower than historical water use, which is discussed further in Section 16.4.1 and is allowed for as part of the sensitivity analysis for Fish Creek in Section 16.5 and in the strategy for the central towns in Section 19.

- **Figure 16-2 Long-term monthly demands for Fish Creek**



16.2.4. Current reliability of supply

Fish Creek has historically experienced restrictions on average every second year over the last decade. This included severe restrictions (Stage 4 of 4 stages or equivalent) in 1999/2000, 2000/01, 2002/03, 2006/07 and 2007/08. Reliability of supply modelling over the period July 1950 to June 2007 indicated that restrictions would have been required on 4 occasions at current demands over this historical climate period. This corresponds to an annual reliability of supply of 93%, which meets South Gippsland Water's level of service objectives. The minimum storage reached was estimated to be 23 ML. Annual reliability of supply is estimated to be higher than that which has occurred historically and in the previous WSDS because of a reduction in current demand and a revision to restriction triggers. Further details on the water resource model used to assess reliability of supply (and yield) can be found in SKM (2009).

16.3. Environmental condition

Fish Creek is the main tributary that flows into the lower Tarwin River. Hoddle Creek and Battery Creek are tributaries of Fish Creek and it can be assumed that the health of Fish Creek partially reflects the health of Hoddle Creek and Battery Creek.

Water quality data provided for Fish Creek in WGCMA (2006), showed water quality was poor with low dissolved oxygen, high pH, EC and turbidity and orthophosphate (phosphorus) concentrations. SIGNAL scores for macroinvertebrates indicate mild pollution was probably occurring. In addition, there was greater than 80% of aquatic weeds and algae present which indicates high concentrations of nutrients in the river at this site. Results from the two ISC sites along Fish Creek indicated that the creek was degraded and stressed with lower flows occurring in summer. The banks were degraded with limited vegetation and some erosion occurring. Both ISC sites rate Fish Creek as Poor (VWQDW, 2007).

There were no ISC sites located on Battery and Hoddle Creeks and there is limited information is available on the ecology of these streams. Consequently, is difficult to assess the impact of changes in flow on the condition of these creeks.

The above assessments were confirmed in the environmental flow assessment for Fish Creek in SKM (2009). The environmental flow assessment linked the provision of low flows to maintaining habitat in pools for river blackfish, to maintain habitat, to allow fish movement, and to provide moisture for riparian and fringing plants. Summer freshes were important for preventing colonization of riparian areas by terrestrial plants, to entrain organic matter and transport nutrients downstream. Winter low flows were designed to maintain habitat and prevent colonisation of weeds, while high flow freshes were intended to maintain channel forming processes and to facilitate the upstream migration of juvenile fish species. Bankfull flows were recommended to maintain channel forming processes and to water swamp paperbarks. An overbank flow was recommended to provide connectivity to wetlands and support flood dependent taxa.

16.4. Water supply and demand projections with current operation and infrastructure

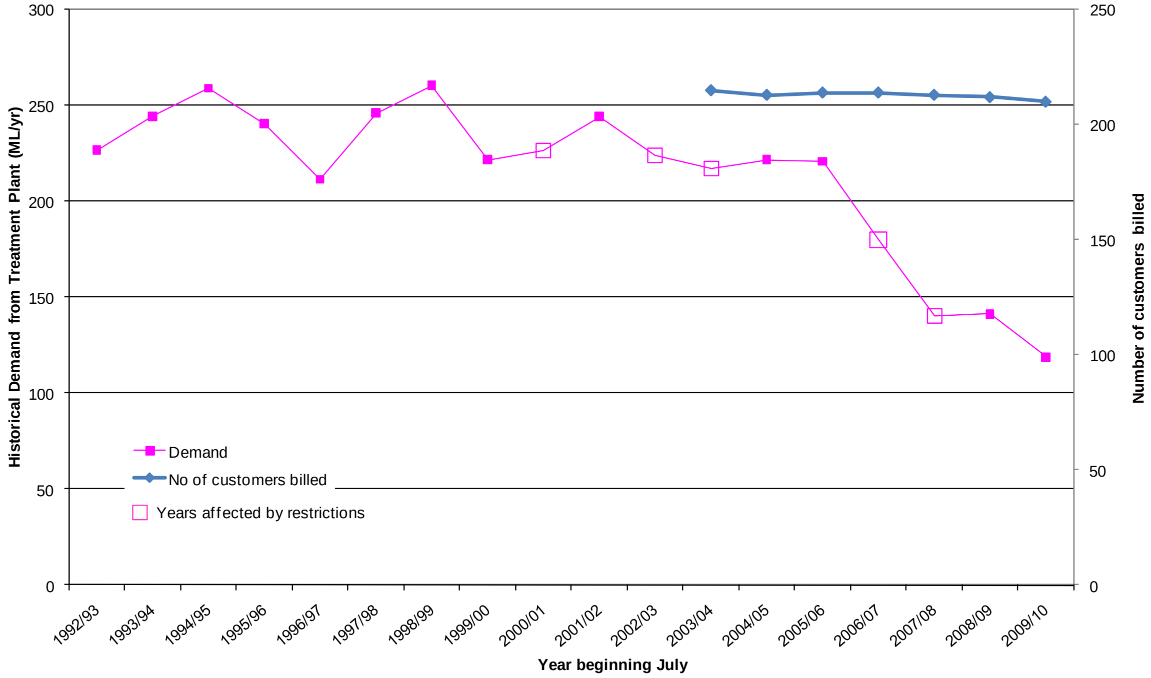
16.4.1. Historical trends

Historical demands at Fish Creek have declined significantly in the last four years, as can be seen in Figure 16-3. These diversions are recorded at the clear water storage outlet and do not include an allowance for treatment plant losses. Restrictions have affected demand over some of the recent period, however in 2008/09 restrictions were not in place and demand remained low.

The main reason for the reduction in demand is South Gippsland Water's WaterMap initiative, which offered interest free loans to rural customers to reduce their reliance on South Gippsland

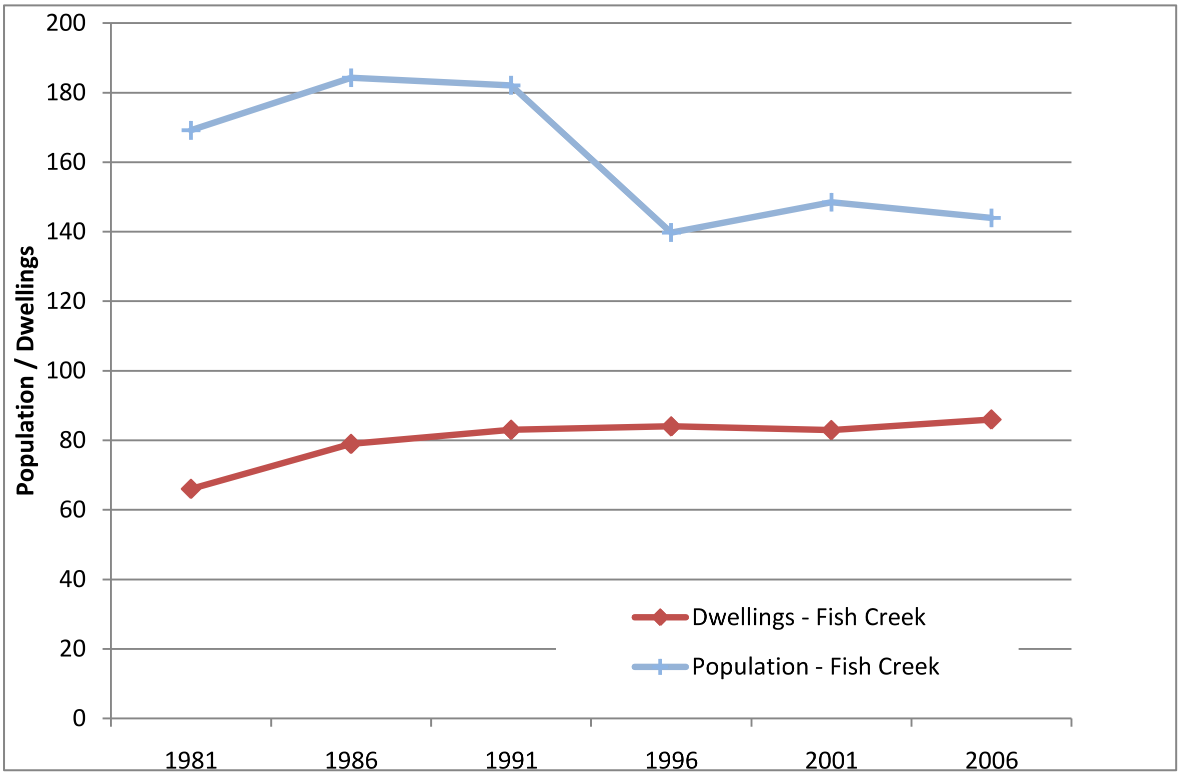
Water's water supply infrastructure. This program has reduced the rural water use from the system significantly in recent years.

▪ **Figure 16-3 Historical diversions and number of customers billed at Fish Creek**



The population of Fish Creek has declined significantly over the last decade, as shown in Figure 16-4, with the total population decreasing from 182 in 1991 to 144 in 2006. The number of dwellings has remained relatively constant over that period.

▪ **Figure 16-4 Historical population in Fish Creek**



16.4.2. Future demand projections

Two estimates of future growth in water demand were made in the previous strategy (South Gippsland Water, 2007). These included the *Victoria in Future* estimates, which are available at a Statistical Local Area (SLA) level, and a Local Growth scenario which considered the potential for stronger growth within towns at a rate greater than the surrounding SLA. There are five SLAs covering South Gippsland Water's supply area. Fish Creek is located within the South Gippsland Shire East SLA and accounts for around 2% of the population within that SLA.

A comparison of the 2006 census results for each town against the previous population projections from the 2001 census indicated that both the *Victoria in Future* and the Local Growth overestimated population growth between 2001 and 2006. The *Victoria in Future* projections were closer to the growth which actually happened, which was a decline in population by 3%. However, given the uncertainty of future population, South Gippsland Water has considered two population forecasts, which include the *Victoria in Future* projections and a higher Local Growth scenario that allows for faster growth in urban centres within SLAs.

Victoria in Future projections include a growth in residential demand of up to 0.3% per year over the next few years and then falling to no growth by around 2035. The Local Growth scenario assumes a 0.7% annual growth rate in residential demand over the fifty year planning horizon. The Local Growth Scenario also includes an allowance for a potential increase in demand of 50 ML/yr from rural customers. This scenario assumes that rural customers could need to supplement their on-farm supplies in a drought year, which would see their demand for supply from South Gippsland Water return to a level similar to that seen prior to the implementation of the WaterMap initiative.

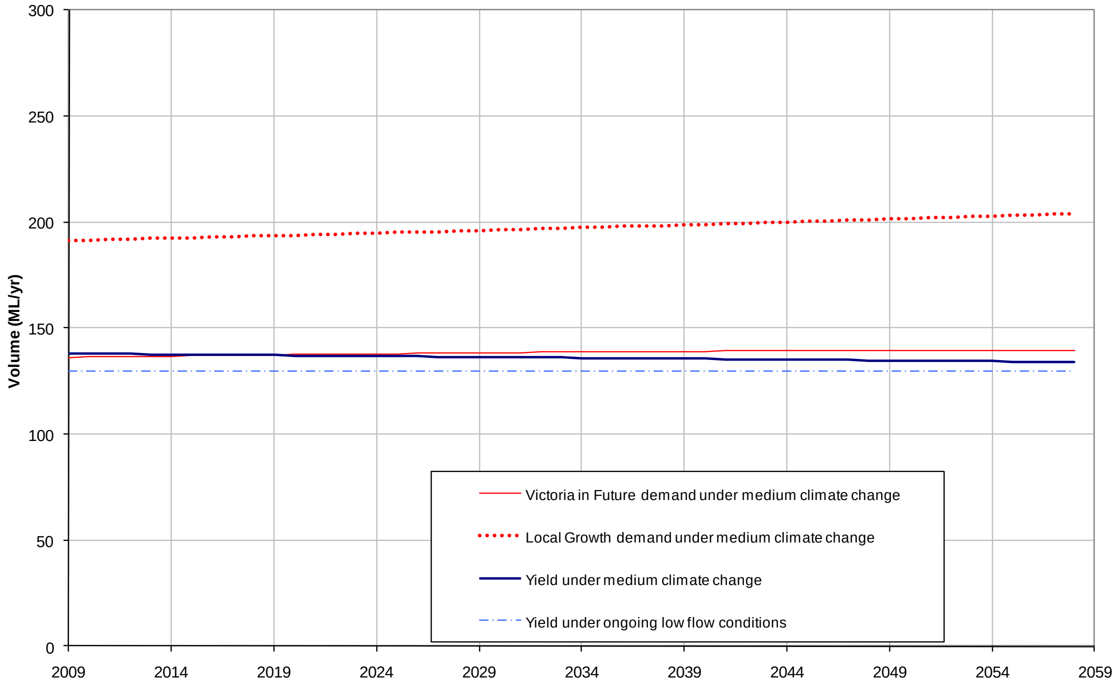
An additional 2.5% increase in residential and stock and domestic demand was assumed to occur over the next 50 years due to medium climate change for all population forecasts. This additional increase in demand is due to increased water use activities such as garden watering under drier and hotter climate change conditions, which is consistent with DSE recommendations (DSE, 2005).

16.4.3. Future supply projections with current operation and infrastructure

Under the medium climate change scenario, runoff in the South Gippsland Basin in the year 2058 relative to the year 2009 is estimated to decrease by 15%, with a range of reduction of 7% to 28% under low and high climate change scenarios. Under the medium climate change scenario, this change in streamflow would be driven by a 3% reduction in rainfall and a 7% increase in evaporation. Under the ongoing low flow conditions scenario, Battery Creek streamflows upstream of Battery Creek Reservoir have been reduced by 41% prior to July 1997.

The Current Operation and Infrastructure water supply and demand situation for the Battery Creek supply system using the *Victoria in Future* population projection is shown in Figure 16-5. This figure illustrates that demand exceeds available supply at South Gippsland Water's level of service objective under the ongoing low flow scenario and is expected to exceed supply by around 2024 under the medium climate change scenario if no further action is taken and growth in demand for water occurs in accordance with population projections.

- **Figure 16-5 Current Operation and Infrastructure Water Supply and Demand for Fish Creek**



16.5. Sensitivity of projections

Three potential land use changes within the catchment supplying Fish Creek were investigated to understand the potential risk they could pose to available supply. Additional information on potential future growth in demand for rural customers, who are a significant component of this supply system, is also presented.

Bushfires: Only 27% of the Battery Creek catchment has vegetation cover. This means that the risk of catchment yield decreasing significantly due to the effects of bushfires is low. There is no record of bushfires occurring in the catchment over the last few decades.

Logging: No logging is undertaken under regional forestry agreements in the water supply catchment for this supply system.

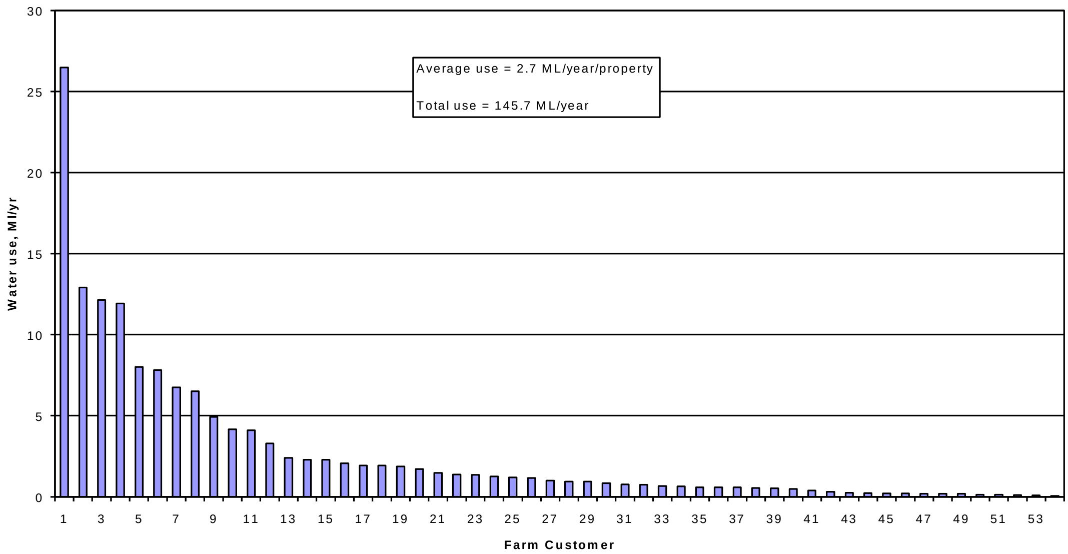
Plantations: There are no plantations in the water supply catchment for this supply system.

Growth in water demand: CEE (2006) held discussions with individual landholders to investigate rural water use. The range of water used on individual farms is shown in Figure 16-6. In the farms with high water use, water is used for washing out dairies, cleaning milk equipment, drinking water for stock and supplying residences on the farms. The farms using little water are generally only supplying the farmhouse. Discussions with two large farm water users revealed that:

- Dairy herd sizes were slowly increasing with time, but water use was not expected to increase much in the future;
- Farmers were conscious of the need to conserve water - for example, water was used to cool and clean equipment and then reused to wash the dairy area;
- Yard wash water was collected in a dam and used to irrigate the adjacent land;
- Farmers complied with water restrictions at their households but were not able to reduce water use by cows or in their dairy (this is consistent with the State policy that water restrictions do not apply to industry or where there may be a public health impact);
- Farm size was slowly increasing and hence there would be fewer farms in the future;
- Some productive farms were being converted to hobby farms or grazing properties;
- Leaks were a significant cause of occasional high water use (up to 1 ML per leak) and were difficult to detect in wet seasons;
- Farmers were sensitive to the cost of water; and
- Water demand by farmers is likely to stay much the same as at present.

The reductions in rural water use associated with South Gippsland Water's WaterMap initiative have been sustained since the 2006/07 drought. These rural water users are however still connected to the South Gippsland Water supply system and it is possible that they may draw upon South Gippsland Water's supply system in a severe drought to complement their on-farm water supplies. If this were to occur, then demand from the system in a very dry year could return to above 200 ML/yr. This risk is considered as part of the strategy for South Gippsland Water's central towns, presented subsequently in Section 19.

■ Figure 16-6 Water use by farmers in Fish Creek (from CEE, 2006)

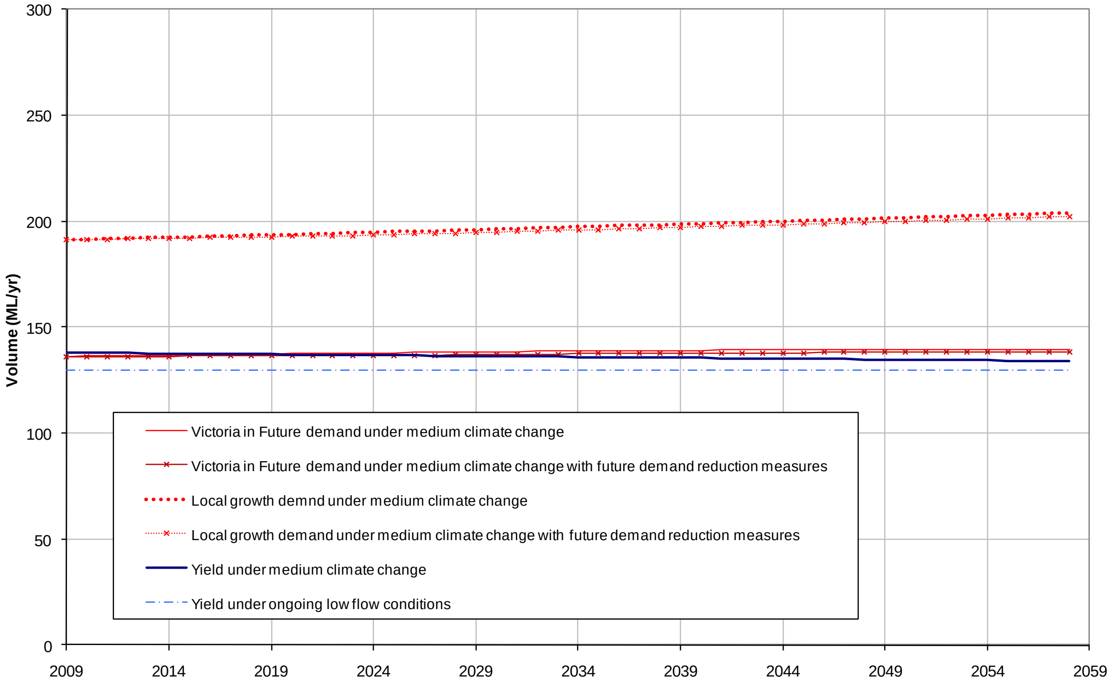


When considering household water use in the town, CEE (2006) concluded that there was scope for demand to increase in the majority of households as properties currently held by elderly singles or couples were passed on to younger families.

16.6. Additional demand reduction options

If the additional demand reduction options outlined in Section 4.10 are adopted for Fish Creek, the time to augmentation under the medium climate change scenario would be extended slightly, as shown in Figure 16-7.

- **Figure 16-7 Effect of additional demand reduction options for Fish Creek**



16.7. Summary of the supply and demand for Fish Creek with current operation and infrastructure

In summary for Fish Creek under the Current Operation and Infrastructure supply and demand scenarios:

- Existing supply is just sufficient to meet South Gippsland Water's current level of service objectives under medium climate change and is just below those service objectives under a continuation of the ongoing low flow conditions that have occurred since July 1997;
- Under the medium climate change scenario, demand for water is expected to exceed available supply by around 2029;
- Demand for water has fallen in recent years, primarily due to a reduction in rural water use associated with South Gippsland Water's WaterMap program. These rural users are still connected to the supply system and could temporarily increase demand from South Gippsland Water's supply system in a severe drought; and
- Demand reduction initiatives will reduce the magnitude of any future supply enhancement, but some form of supply enhancement will still be required over the 50 year planning horizon.

A summary of South Gippsland Water's strategy for Fish Creek in the context of South Gippsland Water's strategy for the central towns is presented in Section 19.

17. Supply and Demand Projections for Toora, Welshpool, Port Welshpool and Port Franklin with Current Operation and Infrastructure

17.1. Introduction

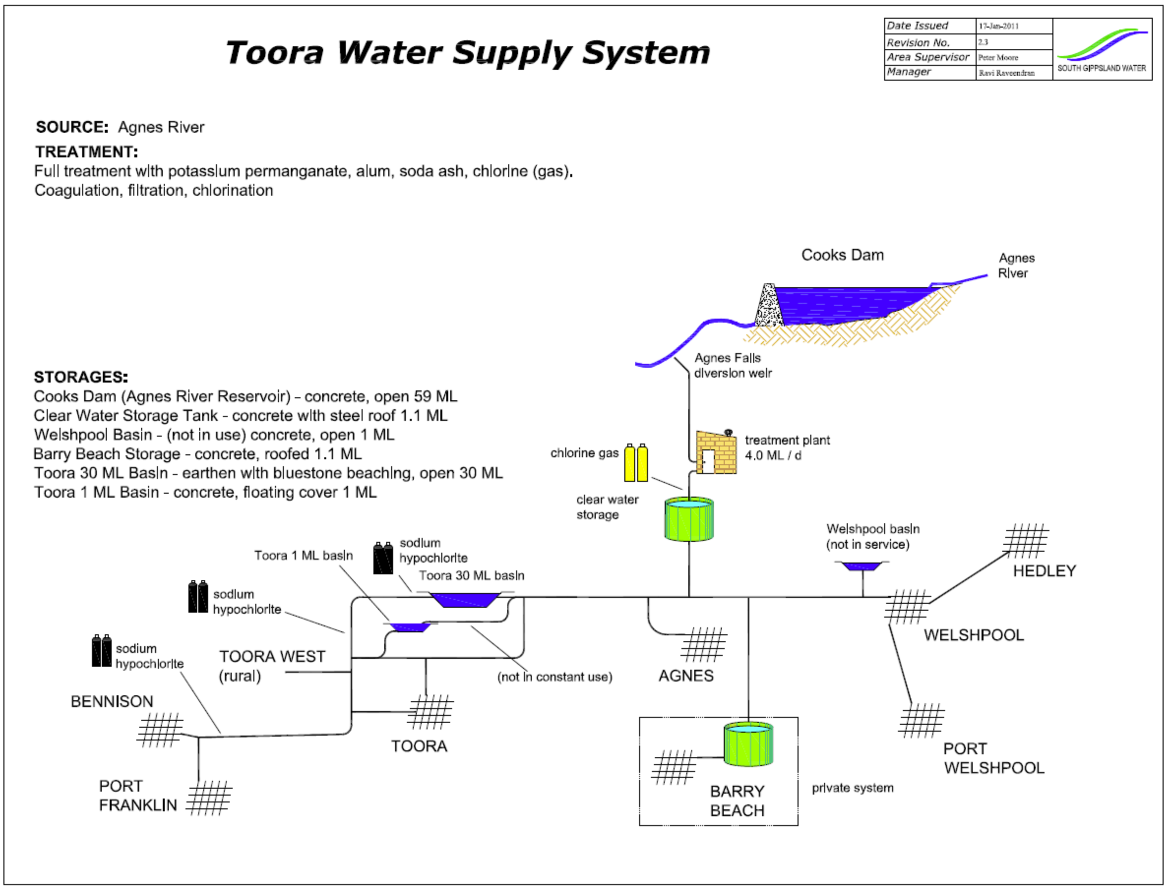
This section of the WSDS outlines the supply and demand projections for Toora, Welshpool, Port Welshpool and Port Franklin over the next 50 years assuming current operation and infrastructure. It includes an overview of the current supply system configuration, current demand for water and current supply. It also includes supply and demand projections under future climate change and alternative growth scenarios over the 50 year planning horizon. South Gippsland Water's response to any shortfall in demand under the current operation and infrastructure scenarios is presented in Section 19 in conjunction with nearby towns.

17.2. Current water supply and demand

17.2.1. Supply system description

The Agnes River water supply system consists of a 58.7 ML storage at Cooks Dam on the Agnes River, with a diversion weir located 2 km downstream of the storage. Cooks Dam is used to provide additional security to the system when the flows are low in dry periods. From the diversion weir a 4.8 ML/day pipeline supplies water to the treatment plant which then transfers water to a 30 ML off-stream balancing storage. Water is then distributed to customers. A schematic is shown of the system in Figure 17-1.

■ **Figure 17-1 Agnes River Water Supply System Schematic**



17.2.2. Current legal entitlements to water

The bulk entitlement for Toora allows South Gippsland Water to divert up to a maximum of 1,617 ML/yr from the Agnes River. The daily bulk entitlement is shown in Table 17-1.

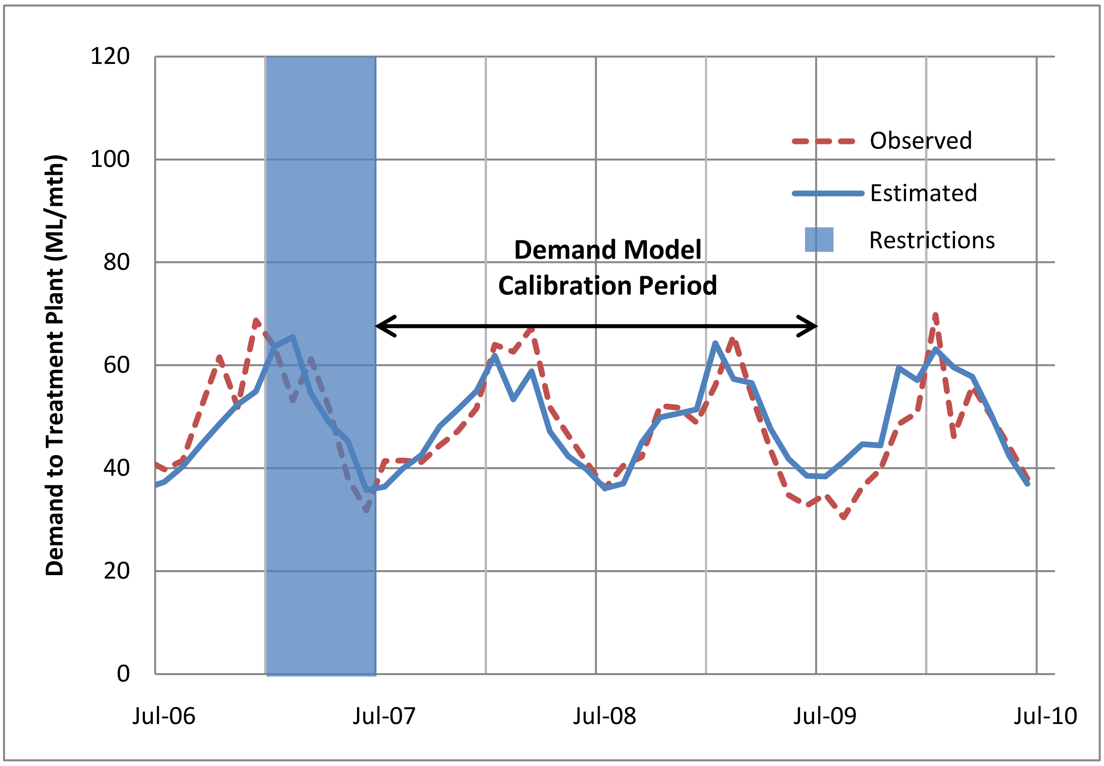
■ **Table 17-1 Bulk entitlement volume for Toora**

Source	Maximum annual volume (ML/yr)	Maximum diversion rate (ML/d)	Minimum passing flows
Agnes River	1617	4.8	Minimum of 1.0 ML/d or natural flow

17.2.3. Current demand

Toora, Welshpool, Port Welshpool and Port Franklin had populations of 454, 146, 172 and 115 people respectively in the 2006 census excluding visitors (DPCD, 2009). This corresponds to a total of 887 people for the four towns. A demand model was fitted to the recent unrestricted data to estimate a long-term average annual demand, which takes into account how current demands would vary under a wider range of natural climate variability. The historical and estimated long-term current demand is shown in Figure 17-2. Data prior to July 2006 was subject to meter errors and was not used in the estimation of current demands. The long-term average annual demand is **564 ML/yr** at South Gippsland Water's treatment plant inlet meter, of which around 10% is utilised on average through the treatment plant.

- **Figure 17-2 Long-term monthly demands for Toora, Welshpool, Port Welshpool and Port Franklin**



17.2.4. Current reliability of supply

Restrictions have historically been very infrequent in this supply system, however they have increased in recent years. From 1996 to 2009, Stage 6 (of 8 stages) restrictions occurred for a period of two weeks in March 2001, whilst Stage 2 and then Stage 4 (of 4 stages) restrictions were introduced from January to June 2007. Since 2006/07 the supply and demand balance has been improved slightly through the development of revised restriction triggers and a reduction in demand. Reliability of supply modelling over the period July 1950 to June 2007 indicated that restrictions would have been required only once over this period when using the current set of restriction triggers at the current level of demand. This corresponds to an annual reliability of supply of 98%, which meets South Gippsland Water's level of service objective. The minimum storage reached was 7 ML. Further details on the water resource model used to assess reliability of supply (and yield) can be found in SKM (2009).

17.3. Environmental condition

The Agnes River is a perennial stream that rises on the southern slopes of the Strzlecki Ranges in South Gippsland. The headwaters of the stream are within the Strzlecki State Park, but downstream of the park, sections of the upper catchment are under plantation and some areas have been cleared for agriculture (mainly grazing and dairy). The middle and lower catchment have been totally cleared for agriculture on the hills with some pockets of native vegetation along the river where the river is confined between steep hills.

The river flows out of the Strzelecki Ranges to the coastal plain near the township of Agnes. On the coastal plain, the river continues to flow south through a small section of paperbark swamp (*Melaleuca ericifolia*) and mangroves (*Avicennia marina*) to enter Corner Inlet and Noorumunga Marine and Coastal Parks at Barry Beach.

Information about the environmental condition of Agnes River was assessed for South Gippsland Water in SKM (2007) *Agnes River Preliminarily Environment Assessment*. The key outcomes of that assessment of relevance to the WSDS are:

- The Agnes River Falls are 59 m high and a natural barrier to fish movement through the catchment.
- There is limited native riparian vegetation and extensive willow infestation along the river in most parts of the middle and lower catchments. Willows have been removed in some reaches of the river and successfully revegetated with native riparian species.
- The main risks to the aquatic fauna and flora in the Agnes River downstream of the Agnes River Falls from reduced flows as a result of a reduction in low flows are likely to be:
  - potential degradation of water quality;
  - reduced available habitat for aquatic fauna (i.e. native fish); and
  - potential impact on the condition of riparian vegetation and revegetation.
- Water quality data indicates turbidity, total phosphorus and total nitrogen are above State Environment Protection Policy guideline values. Consequently, any reduction in flow may result in further lowering of water quality.
- Willow removal and subsequent revegetation is planned for a number of locations along the creek, which will require available water to assist in maintaining seedlings during the summer months.
- Pockets of remnant native vegetation require streamflows to be maintained to ensure maintenance of existing mature trees and to promote establishment of seedlings.
- Fourteen native fish species have been recorded in the Agnes River. Cox's Gudgeon (*Gobiomorphus coxii*) and Australian Grayling (*Prototroctes maraena*) are considered

threatened in Victoria. Specifically, Cox's Gudgeon is considered *endangered* and Australian Grayling is considered *vulnerable.* Both species are listed under the Victorian *Flora and Fauna Guarantee Act* (FFG) 1988 and Australian Grayling is also listed as *vulnerable* under the Commonwealth *Environment Protection and Biodiversity Conservation Act* (EPBC) 1999. There is no record of the number of each of these species and it is uncertain whether these two species are still present in the catchment as they have not been reported in recent surveys.

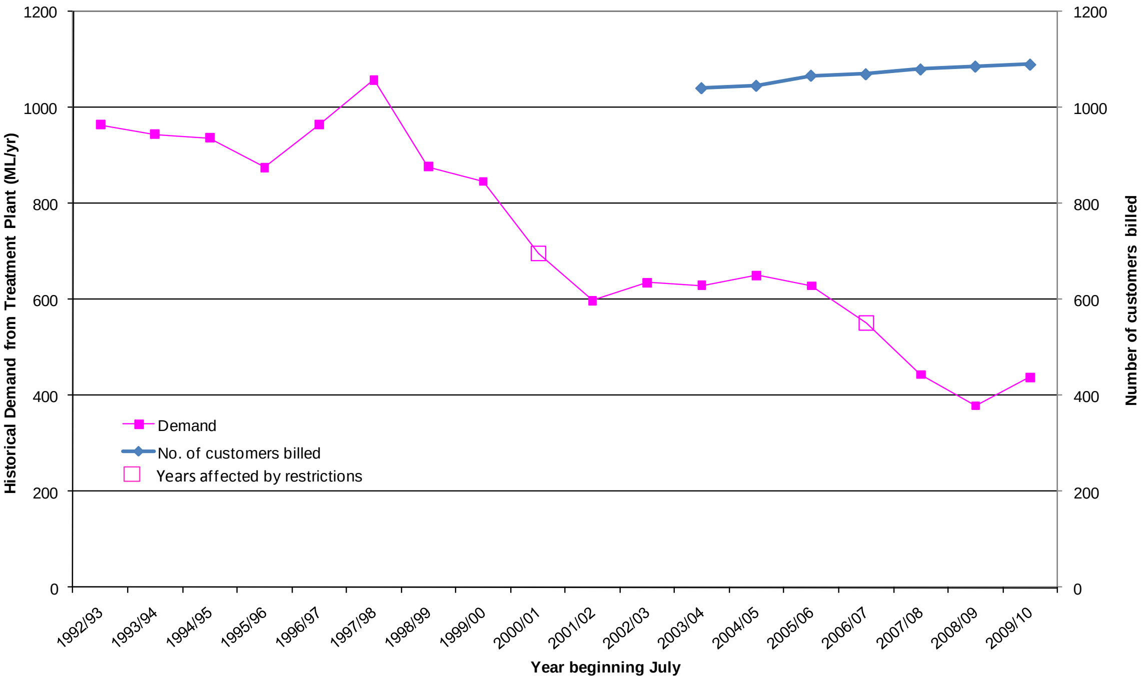
- Water pools are an important summer refuge for aquatic fauna. Any premature drying of the pools due to changes in summer flow regime could impact on ability of small bodied fish to avoid larger predatory species.
- Water quality in the creek is generally poor and the benefit of permanent water pools for summer refuge may be reduced by poor water quality.

17.4. Water supply and demand projections with current operation and infrastructure

17.4.1. Historical trends

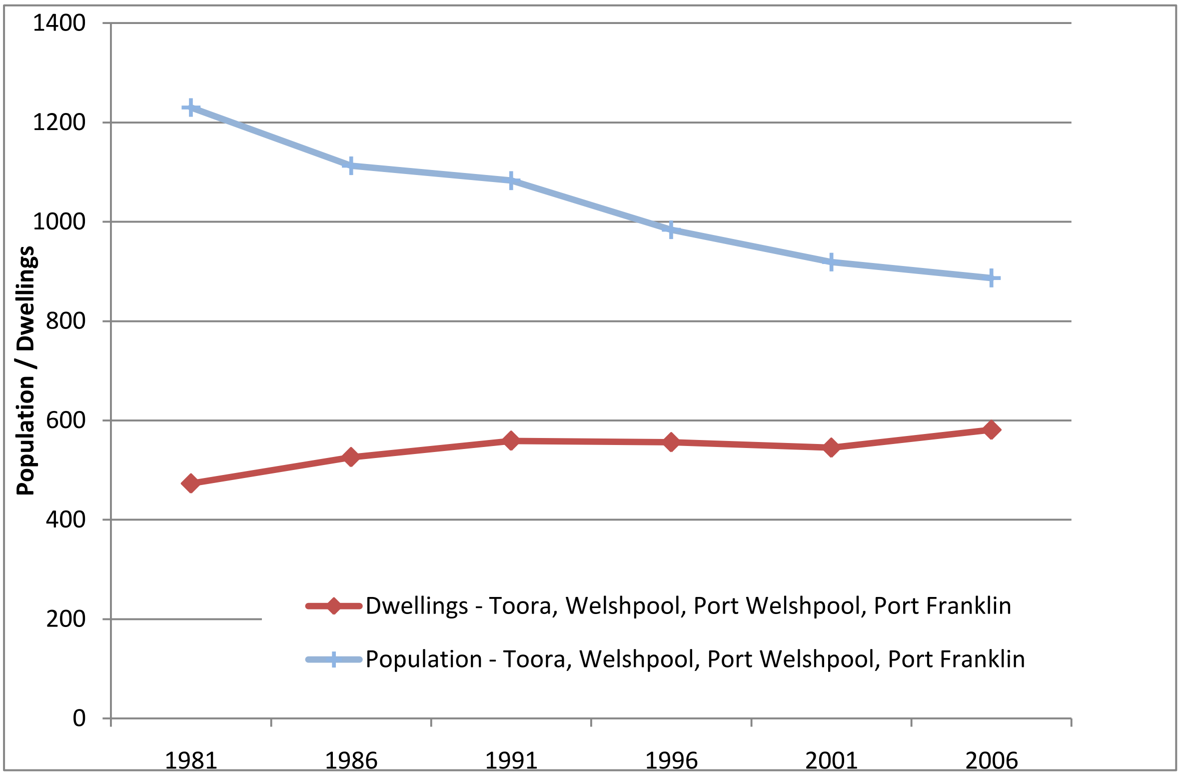
Historical diversions to Toora, Welshpool, Port Welshpool and Port Franklin have declined significantly in recent years, as shown in Figure 17-3. These diversions are recorded at the clear water storage outlet and do not include an allowance for treatment plant utilisation. The decrease in diversions is largely associated with reductions in major industrial demand. The closure of the Bonlac Dairy in 2006 is the main reason for the most recent decline. The number of total customers billed has increased marginally over the last few years. Major industrial water use excluding Bonlac has fluctuated between 15-25 ML/yr from 2006/07 onwards.

▪ **Figure 17-3 Historical diversions and number of customers billed at Toora, Port Welshpool, Welshpool and Port Franklin**



The populations of the four towns have decreased significantly over the last two decades, as shown in Figure 17-4, with the total population decreasing from 1230 in 1981 to 887 in 2006. The number of dwellings increased slightly from 2001 to 2006.

▪ **Figure 17-4 Historical population in Toora, Port Welshpool, Welshpool and Port Franklin**



17.4.2. Future demand projections

Two estimates of future growth in water demand were made in the previous strategy (South Gippsland Water, 2007). These included the *Victoria in Future* estimates, which are available at a Statistical Local Area (SLA) level, and a Local Growth scenario which considered the potential for stronger growth within towns at a rate greater than the surrounding SLA. There are five SLAs covering South Gippsland Water's supply area. Toora, Welshpool, Port Welshpool and Port Franklin are located within the South Gippsland Shire East SLA and account for around 15% of the population within that SLA.

A comparison of the 2006 census results for each town against the previous population projections from the 2001 census indicated that both the *Victoria in Future* and the Local Growth scenario overestimated population growth between 2001 and 2006. Both growth projections anticipated positive population growth when there was actually a decline in population. The *Victoria in Future* projections were closer to the growth which actually happened. However, given the uncertainty of future population, South Gippsland Water has considered two population forecasts, which include the *Victoria in Future* projections and a higher Local Growth scenario that allows for faster growth in urban centres within SLAs.

Victoria in Future projections include a growth in residential demand of up to 0.3% per year over the next few years and then falling to no growth by around 2035. The Local Growth scenario assumes a 0.7% annual growth rate in residential demand over the fifty year planning horizon. Major industrial and lot development demand is an area of uncertainty for the future demand projections. An allowance for an increase in demand of 104 ML/yr to the Barry Beach port development has been explicitly allowed for in the Local Growth demand projections. The timeframe for this demand has notionally been set to occur around the year 2020. This timeframe is indicative only.

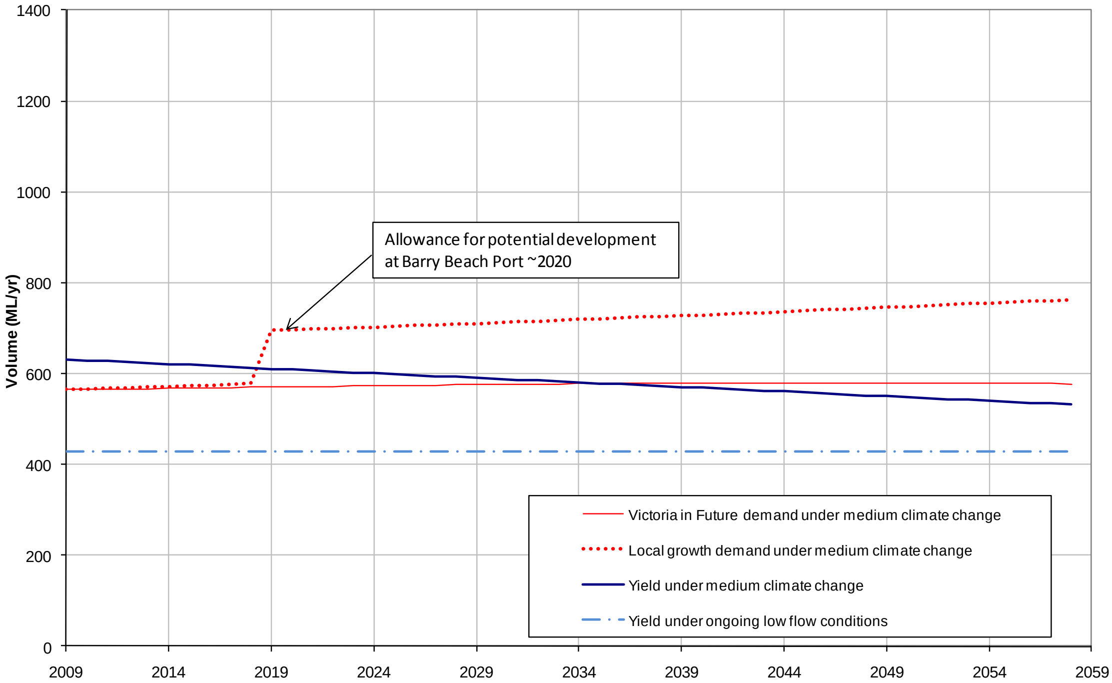
A 2.5% increase in residential and stock and domestic demand over the next 50 years was assumed to occur due to medium climate change. This additional increase in demand is due to increased water use for activities such as garden watering under drier and hotter climate change conditions and is consistent with DSE recommendations (DSE, 2005).

17.4.3. Future supply projections with current operation and infrastructure

Under the medium climate change scenario, runoff in the South Gippsland Basin in the year 2058 relative to the year 2009 is estimated to decrease by 15%, with a range of reduction of 7% to 28% under low and high climate change scenarios. Under the medium climate change scenario, this change in streamflow would be driven by a 3% reduction in rainfall and a 7% increase in evaporation. Under the ongoing low flow conditions scenario, Agnes River streamflows upstream of Cook's Dam have been reduced by 33% prior to July 1997.

The Current Operation and Infrastructure water supply and demand situation for the Agnes River supply system using the *Victoria in Future* population projection is shown in Figure 17-5. This figure illustrates that if no further action is taken and growth in demand for water occurs in accordance with population projections, demand under medium climate change is likely to exceed available supply at South Gippsland Water's level of service objective if development occurs at Barry Beach Port or by approximately 2034, whichever occurs earlier. Demand already exceeds supply at South Gippsland Water's level of service objective under the ongoing low flow conditions scenario.

▪ **Figure 17-5 Current Operation and Infrastructure Water Supply and Demand for Toora, Welshpool, Port Welshpool and Port Franklin**



17.5. Sensitivity of projections

Three potential land use changes within the Agnes River catchment were investigated to understand the potential risk that they could pose to available supply.

Bushfires: The maximum reduction in runoff after a bushfire typically occurs at around 10-20 years after the fire has occurred, and thereafter runoff progressively increases back to pre-bushfire levels. 60% of the Agnes River catchment upstream of Cooks Dam has vegetation cover, however there is no record of recent bushfires occurring in the South Gippsland region. The effect of bushfire on catchment yield should therefore only be a problem if fires occur in this area in the future.

Logging: No logging is undertaken under regional forestry agreements in the water supply catchment for this supply system.

Plantations: Plantations over a large proportion of a catchment can significantly reduce runoff to downstream areas, particularly when those plantations are established on previously cleared land. Up to one third of the Toora water supply catchment is covered by plantations, so this may have a significant effect on catchment yield, depending on the age profile of the plantations.

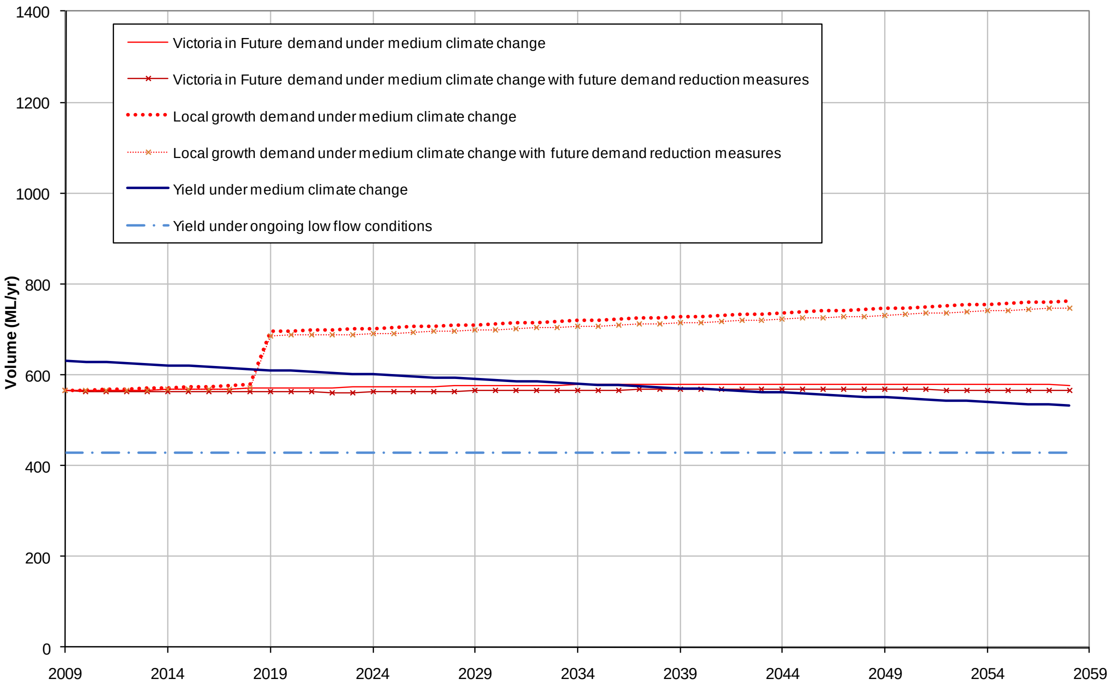
Further comments on the sensitivity of the Current Operation and Infrastructure projections to demand uncertainty are also presented.

Future development: At Barry Beach in the Agnes River supply system, there has in recent years been a concept proposal to construct a brown coal to urea plant with associated residential and commercial development. The South Gippsland Shire Council (pers.comm. Jan 2011) advises that this proposal is not currently active. However, from a longer term water resource planning perspective, and also considering the potential for additional future water use associated with possible development of Barry Beach port facilities, a future demand of 2 ML/wk (104 ML/yr) has been assumed. This is in line with water resource investigations in 2008 (SKM, 2008a). For the purposes of this strategy, this increase in demand has been assumed to occur in 2020. Further details about the associated developments are currently uncertain and have not been explicitly included in the major industrial demand forecasts.

17.6. Additional demand reduction options

If additional demand reduction options outlined in Section 4.10 are adopted for the Agnes River system, the magnitude of future augmentation options would be slightly reduced, as shown in Figure 17-6.

- **Figure 17-6 Effect of additional demand reduction options for Toora, Welshpool, Port Welshpool and Port Franklin**



17.7. Summary of the supply and demand for Toora, Welshpool, Port Welshpool and Port Franklin with current operation and infrastructure

In summary for Toora, Welshpool, Port Welshpool and Port Franklin under the Current Operation and Infrastructure supply and demand scenarios:

- Existing supply is just sufficient to meet South Gippsland Water's current level of service objectives under medium climate change and is below those service objectives under a continuation of the ongoing low flow conditions that have occurred since July 1997;
- Under the medium climate change scenario, demand for water is expected to exceed available supply when the initial phase of the Barry Beach port development commences or by approximately the year 2034, whichever occurs earlier;
- Demand for water has fallen in recent years, primarily due to a reduction in major industrial water use; and
- Demand reduction initiatives will reduce the magnitude of any future supply enhancement, but some form of supply enhancement will still be required over the 50 year planning horizon.

A summary of South Gippsland Water's strategy for Toora, Welshpool, Port Welshpool and Port Franklin in the context of South Gippsland Water's strategy for the central towns is presented in Section 19.

18. Supply and Demand Projections for Unserviced Towns South of Fish Creek with Current Operation and Infrastructure

18.1. Introduction

This section of the WSDS outlines the demand projections for unserviced towns south of Fish Creek over the next 50 years assuming current operation and infrastructure. These towns include the existing towns of Walkerville, Waratah Bay, Sandy Point and Yanakie. None of these towns are currently supplied by South Gippsland Water. Sandy Point, which is the largest of these four towns, is approximately 15 km south of Fish Creek. South Gippsland Water's response to supplying these unserviced towns is presented in Section 19 in conjunction with nearby serviced towns.

18.2. Current water supply and demand

18.2.1. Supply system description

Existing unserviced towns rely upon rainwater for their supply. New developments would need to identify a source of water supply as part of their planning activities.

18.2.2. Current legal entitlements to water

Residents in the unserviced towns can harvest rainwater in rainwater tanks. The availability of other entitlements, such as groundwater licences, is unknown.

18.2.3. Current demand

Sandy Point had a population of 205 in the 2006 census excluding visitors (DPCD, 2009). This was less than one third of the number of dwellings, many of which are likely to be summer holiday houses that were not occupied when the census was undertaken in winter. Census information was not available for the remaining three unserviced towns. Large numbers of tourists are located in all of these towns in the summer months. The current demand for individual towns and developments was previously presented in Section 4.8. The current demand from these four towns is estimated to total 259 ML/yr, of which 162 ML/yr is for Sandy Point.

18.2.4. Current reliability of supply

Existing supply consists of privately owned rainwater tanks. It is estimated that reliability of supply could be improved by connection to a supply source managed by South Gippsland Water.

18.3. Environmental condition

Information on the environmental condition of the nearby Battery Creek, Deep Creek and Agnes River supply systems was previously presented in the respective chapters on demand and supply with current operation and infrastructure for Fish Creek, Foster and Toora respectively.

18.4. Water supply and demand projections with current operation and infrastructure

18.4.1. Historical trends

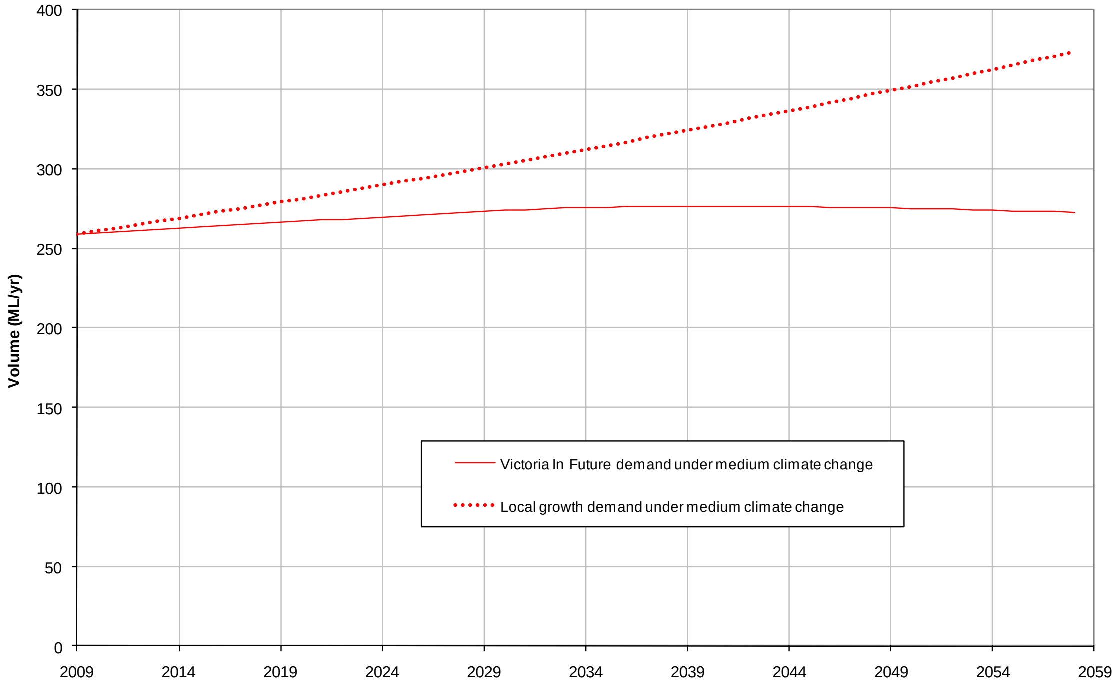
The population and number of dwellings at Sandy Point were not collected in censuses prior to 2006, hence there is no census information from which to derive historical trends in population or the number of dwellings. The 2011 census will provide an indication of any trends in population or the number of dwellings at Sandy Point. Trends at the remaining unserviced towns are unknown.

18.4.2. Future demand projections

Two estimates of future growth in water demand were made in the previous strategy (South Gippsland Water, 2007). These included the *Victoria in Future* estimates, which are available at a Statistical Local Area (SLA) level, and a Local Growth scenario which considered the potential for stronger growth within towns at a rate greater than the surrounding SLA. For the central towns, both demand scenarios have been retained for this current strategy. The unserviced towns south of Fish Creek have been assumed to grow at the same rate as Fish Creek, which for the *Victoria in Future* projections include a growth in residential demand of up to 0.3% per year over the next few years and then falling to no growth by around 2035. The Local Growth scenario assumes a 0.7% annual growth rate in residential demand over the fifty year planning horizon.

An additional 2.5% increase in residential and stock and domestic demand was assumed to occur over the next 50 years due to medium climate change for all population forecasts. This additional increase in demand is due to increased water use for activities such as garden watering under drier and hotter climate change conditions and is consistent with DSE recommendations (DSE, 2005).

■ **Figure 18-1 Current Operation and Infrastructure water demand for unserviced towns south of Fish Creek**



18.4.3. Future supply projections

Supply projections are considered in Section 19 as part of the strategy for Fish Creek, Foster and Toora. The timing of the connection of the unserviced towns to South Gippsland Water's supply systems is uncertain and it has been assumed in the strategy that it could occur around the year 2025. This would allow sufficient time for South Gippsland Water to undertake its planning and design activities and then construct and commission the new supply system.

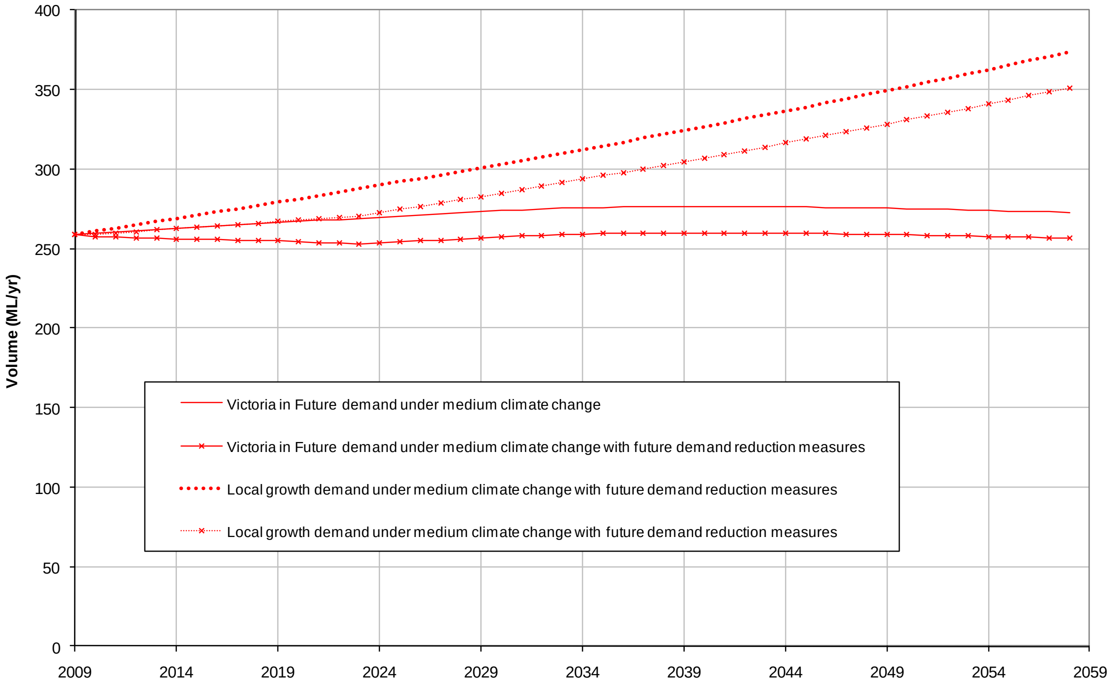
18.5. Sensitivity of projections

Potential land use changes within the catchments supplying Fish Creek, Foster and Toora were investigated to understand the potential risk they could pose to available water supply. These were previously documented in Sections 15.5, 16.5 and 17.5 respectively, and indicated that the risk of changes in supply due to bushfires, logging and plantations in these catchments was low.

18.6. Additional demand reduction options

If the additional demand reduction options outlined in Section 4.10 were adopted for the unserviced towns south of Fish Creek, the size of any future supply augmentation option could be minimised, as shown in Figure 18-2.

- **Figure 18-2 Effect of additional demand reduction options for unserviced towns near Inverloch**



18.7. Summary of the supply and demand for unserviced towns south of Fish Creek with current operation and infrastructure

In summary for unserviced towns south of Fish Creek under the Current Operation and Infrastructure supply and demand scenarios:

- Existing supply consists of privately owned rainwater tanks;
- The number of people currently permanently residing in Sandy Point is 205. This was less than one third of the number of dwellings, many of which are likely to be summer holiday houses that were not occupied when the census was undertaken in winter; and
- Demand for water is estimated to currently be in the order of 259 ML/yr, but could increase up to 350 ML/yr over the planning horizon;

South Gippsland Water's strategy to address the potential future supply to these unserviced towns is presented in Section 19.

19. Strategy for Central Towns

19.1. Introduction

This section of the document presents the demand reduction and supply enhancement strategy for towns in South Gippsland Water's central region. These include the towns of Dumbalk, Meeniyan, Foster, Fish Creek, Toora, Welshpool, Port Welshpool and Port Franklin. The strategy for these towns is considered collectively, because one of the supply options involves interconnecting the supply systems. The ability to supply unserviced towns south of Fish Creek, namely Sandy Point, Walkerville, Waratah Bay and Yanakie, is also presented in this chapter.

The pros and cons of two strategies were considered by South Gippsland Water:

Supply from existing separate South Gippsland Water headworks – This strategy involves upgrading South Gippsland Water's existing supply infrastructure and operating the supply systems independently. Under this strategy, the unserviced towns would not be supplied by South Gippsland Water. Details of this strategy for each town are presented in Section 19.2.

Supply from a linked system – This strategy involves connecting the Agnes River, Deep Creek and Battery Creek systems to supply existing towns, with the option to supply unserviced towns south of Fish Creek. Details of this strategy for each town are presented in Section 19.3.

A potential connection of the Melbourne system to these towns was briefly considered but dismissed due to high costs and was not investigated further. The supply systems for Meeniyan and Dumbalk, which may be merged to minimise water treatment costs, are only considered as standalone systems in the WSDS as any decision to merge these two systems is not driven by consideration of water resource availability.

19.2. Supply from existing South Gippsland Water headworks

19.2.1. Supply from existing headworks for Dumbalk, Meeniyan and Foster

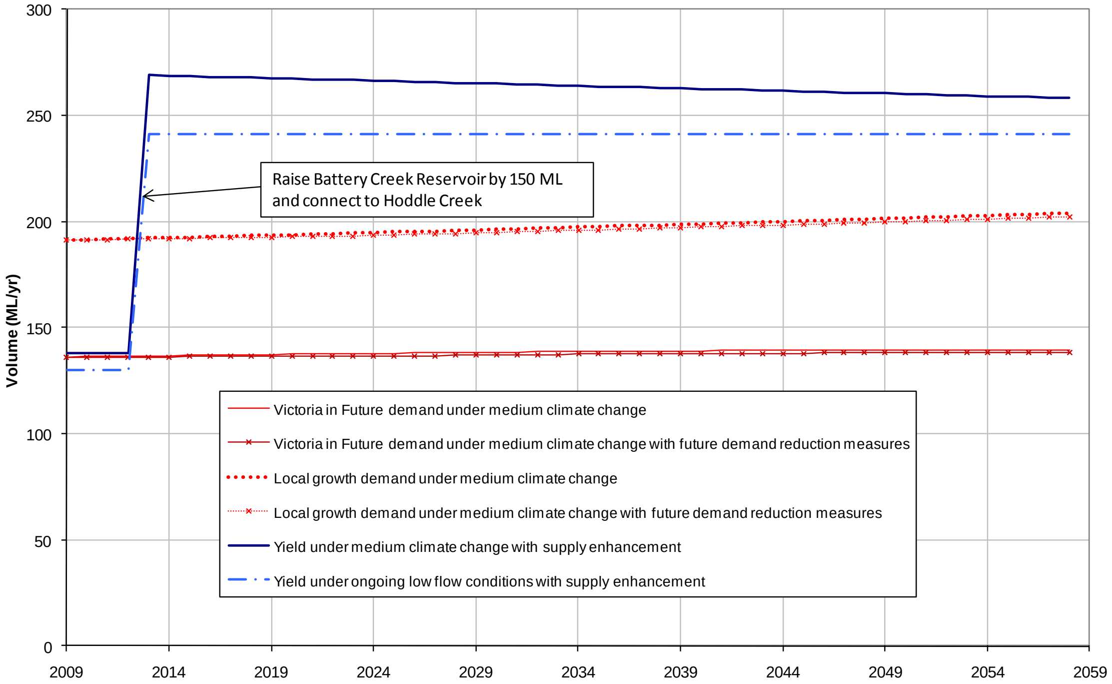
The current operation and infrastructure supply and demand projections presented in previous chapters of this document highlighted that existing supply is sufficient to meet South Gippsland Water's current level of service objectives over the 50 year planning horizon. If operated as standalone supply systems, no supply enhancement options would be required for these systems.

19.2.2. Supply from existing headworks for Fish Creek

Available supply to Fish Creek is not sufficient to cater for demands at South Gippsland Water's level of service objectives, even after considering additional demand reduction. Hence the Battery Creek supply system will require supply enhancement. Water supply options for Fish Creek were previously outlined in SKM (2004) and included raising Battery Creek Reservoir and diverting water from nearby Hoddle Creek into Battery Creek Reservoir. Raising Battery Creek Reservoir by 150 ML in combination with supply from Hoddle Creek was found to increase the available yield sufficient to meet current and future demands at Fish Creek. It also provides sufficient supply if demands from rural water users in severe droughts were to return to the higher demand levels observed prior to the 2006/07 drought and prior to the implementation of South Gippsland Water's WaterMap initiative. Supply from Hoddle Creek was found to add limited supply to Fish Creek unless it was accompanied by additional storage, which would most likely involve raising Battery Creek Reservoir. This is because additional supply from Hoddle Creek would be within Sustainable Diversion Limits during the winterfill period only.

The Battery Creek Reservoir has leakage and stability problems, which could result in piping failure if remedial works are not undertaken. This need for remedial works provides an opportunity for South Gippsland Water to save costs by undertaking both the remedial works and the raising of the dam wall at the same time.

- **Figure 19-1 Effect of supply enhancement for Fish Creek**



The resilience of this augmentation option to severe prolonged drought was examined by estimating supply system behaviour under a repeat of the 2006/07 severe drought year. This analysis highlighted that even though local catchment inflows were negligible in this year from

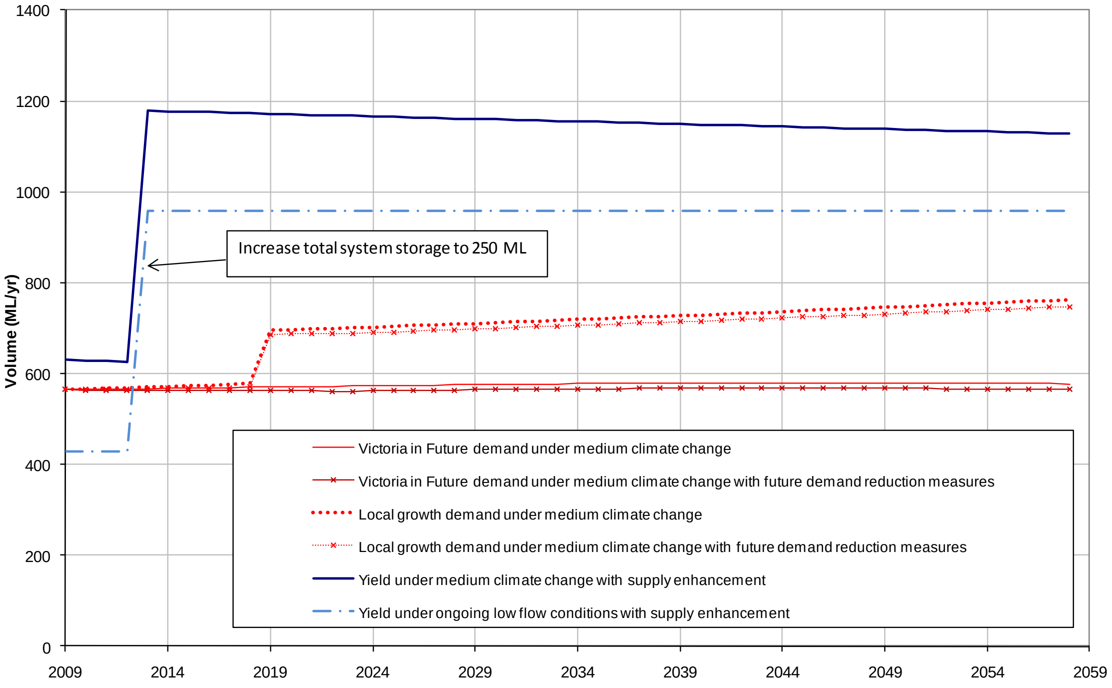
October to April, the availability of a large volume in storage means that South Gippsland Water would be able to maintain supply through two consecutive years of repeating 2006/07 climate.

19.2.3. Supply from existing headworks for Toora, Welshpool, Port Welshpool and Port Franklin

Supply enhancement options for the Agnes River supply system were previously investigated in SKM (2004), with further work being done to size an off-stream storage in SKM (2008a). The 2007 WSDS indicated that an additional 50 ML of storage would be sufficient to meet future demands. Since that time, the 2006/07 drought occurred and developments are being proposed at Barry Beach which could result in significantly increased demand.

SKM (2008a) provided a range of potential off-stream storage sizes. For the purposes of the WSDS, a total system storage of 250 ML has been assumed (i.e. a net increase of 191 ML), which was the largest storage size increase recommended in SKM (2008a). The option of staging the storage increase was examined for South Gippsland Water in SKM (2010), which concluded that a smaller storage could be adopted if the Barry Beach demand does not increase. Cook's Dam is assumed to not be part of the supply system under normal operation, with all active storage becoming off-stream. Under the demand assumptions in the WSDS, this results in yield exceeding projected demands, however there is a high degree of uncertainty in future demands, which could be much larger if future developments proceed. Decisions around an appropriate future storage size are also affected by water quality considerations. The supply demand balance with this supply enhancement option is shown in Figure 19-2.

▪ **Figure 19-2 Effect of supply enhancement for Toora, Welshpool, Port Welshpool and Port Franklin under medium climate change**



The resilience of this augmentation option to severe prolonged drought was examined by estimating supply system behaviour under a repeat of the 2006/07 severe drought year. This analysis highlighted that even though local catchment inflows were zero or negligible in December and January, the availability of a suitable volume in storage means that South Gippsland Water would be able to maintain supply through two consecutive years of repeating 2006/07 climate.

19.2.4. Supply from existing headworks for unserviced towns south of Fish Creek

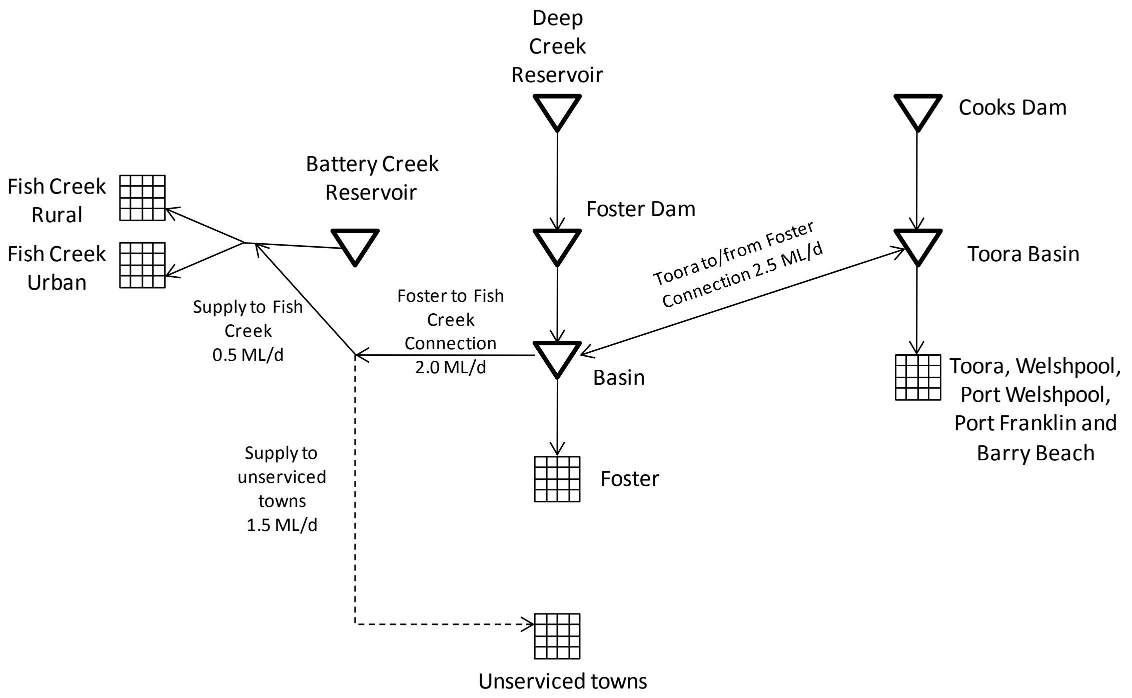
The ability to enhance supply in the Battery Creek supply system is limited, hence it is not considered feasible to connect the unserviced towns south of Fish Creek to the Battery Creek supply system, particularly given the potential for Fish Creek rural demands to increase in severe drought years.

19.3. Supply from a linked system

As an alternative to the local supply enhancement options for Fish Creek and Toora, the option of linking the supply systems for these towns together with the Deep Creek system was considered. This option is only currently able to be considered because of a reduction in demand at all three towns over the last few years which makes a linked system more feasible.

A schematic of the proposed linked system is shown in Figure 19-3. This proposed configuration assumes that treated water would be transferred between the clear water storages at Toora and Foster, as well as from the clear water storage at Foster to the Fish Creek supply system. The Foster to Fish Creek connection is sized to enable connection to the unserviced towns in the future.

- **Figure 19-3 Schematic of proposed linked system**



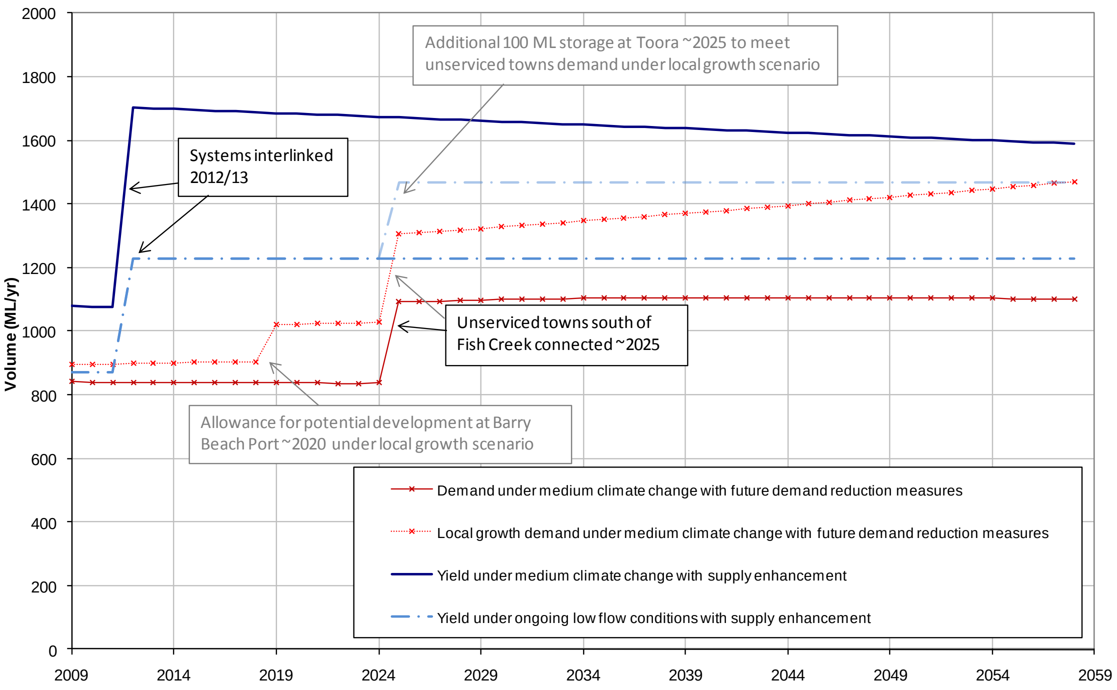
A raw water transfer option was also considered but was dismissed due to higher costs associated with longer pipe lengths.

The results of water resource modelling of the linked treated water supply option are shown in Figure 19-4. The yield from the linked system is estimated to be 1,230 ML/yr, which under the Victoria in Future scenario would be sufficient to provide supply to the three towns plus the unserviced towns if connected around 2025. It would also provide a supply buffer if Fish Creek rural demands increase in a very dry year prior to connecting the unserviced towns or if Barry Beach demand increases beyond the demands during the construction phase. If the Local Growth demand were to eventuate, then an additional 100 ML of off-stream storage would be required at Toora under ongoing low flow conditions when the unserviced towns are connected.

Future demand at Barry Beach could potentially increase well beyond the current anticipated demand. If the interlinking of the supply systems is combined with additional storage, then yield could be further increased to cater for additional demand as required. Under ongoing low flow conditions, additional storage of 100 ML at Toora would increase total system yield to

1,470 ML/yr, whilst an additional storage of 250 ML at Toora would increase yield to 1,830 ML/yr. Beyond this level of storage, South Gippsland Water's bulk entitlement limits for diversion from the Agnes River are reached and additional yield achieved with additional storage is small.

- **Figure 19-4 Supply from linked system for Fish Creek, Foster, Toora, Welshpool, Port Welshpool and Port Franklin**



The resilience of this augmentation option to severe prolonged drought was examined by estimating supply system behaviour under a repeat of the 2006/07 severe drought year. This analysis highlighted that even though local catchment inflows were negligible in this year over the summer period, the availability of a large volume in storage at Foster means that South Gippsland Water would be able to maintain supply through two consecutive years of repeating 2006/07 climate.

19.4. Sustainability assessment of options

The introduction of demand reduction measures in line with other towns supplied by South Gippsland Water will serve to minimise infrastructure costs and delay the need for supply augmentations. On a sustainability assessment, demand reduction measures will be preferable to augmenting the supply system, however in order to meet future demands both actions will be required for some towns.

The sustainability assessment for the central towns compares the option to supply from enhancing existing headworks as standalone systems and the option to interlink the Deep Creek, Battery Creek and Agnes River supply systems. The outcome of the assessment is summarised in Table 19-1 and indicates that the supply from an interlinked system has the advantage of greater flexibility and robustness to potential future changes in demand and provides South Gippsland Water with the option to provide reticulated supply to towns south of Fish Creek. A definitive preferred strategy is dependent on the outcomes of further financial analysis, which is currently being undertaken by South Gippsland Water. Key points to note about the sustainability assessment are as follows:

- The cost of upgrading the existing separate headworks on a comparable basis with the cost of interlinking the systems is yet to be determined. South Gippsland Water is in the process of undertaking this financial analysis.
- The interlinked system would support more regional development by providing access to a potable supply in the unserviced coastal towns south of Fish Creek and by providing greater flexibility to service potential future industrial growth at Barry Beach in a staged manner. It would also provide the ability to meet any increase in rural demands at Fish Creek in a very dry year prior to the connection of the unserviced towns.
- Greenhouse gas emissions associated with operation are low for both options, but marginally higher under the interlinked supply option due to increased pumping. The greenhouse costs associated with construction have not been included in this assessment.
- River health would be similar for both options. River health would be expected to decline in Hoddle Creek due to winter harvesting of water and construction of a weir on the creek under the option to upgrade existing separate headworks. The interlinked option would involve harvesting more water from the Agnes River and Deep Creek, but in both cases the volume harvested would be within South Gippsland Water's current legal entitlements for water, which include passing flows for river health.
- Changes in water quality in local waterways would be expected to be negligible under both options.
- Both options would have a minor impact on other ecosystems. For the interlinked system, vegetation would need to be cleared along the proposed pipeline route if it cannot be located in an existing cleared service corridor. For the separate existing headworks option, there would be expected to be minor loss of terrestrial habitat above the current full supply level of Battery Creek Reservoir (but an increase in aquatic habitat) and a loss of terrestrial habitat at the Agnes River off-stream storage site.
- Both options are unlikely to have any impact on recreation and heritage activities in the area. Interlinking the Deep Creek and Agnes River systems would allow more water to flow over

the Agnes River Falls, however the change in flow for recreational purposes may not be noticeable to visitors.

- Both options are likely to be socially acceptable, however some individuals may be affected by either option. Raising Battery Creek Reservoir may result in the loss of some private land due to inundation, whereas the connecting pipes for the interlinking option may need to cross private land, depending on the final pipeline route selected.
- There is a moderate degree of confidence associated with both options. The confidence associated with the interlinked system is slightly higher, because it is less reliant on a single supply source if water availability in any one of the Agnes River, Deep Creek or Battery Creek were to change under climate change.

Table 19-1 Sustainability Assessment of Options for Central Towns(1)

Net present cost	Regional development	Greenhouse emissions	River health	Water quality	Other ecosystems	Culture, recreation and heritage	Social acceptability	Confidence flag	LRMC ($/ML)
Option: Demand reduction measures									
5	1	5	1	0	0	0	3	2	n/a
Option: Local supply enhancement (raise Battery Ck Reservoir with supply from Hoddle Ck and increase storage at Toora up to 250 ML)									
tbc	1	-1	-1	0	-1	0	3	2	tbc
Option: Interlink Battery Ck, Deep Ck and Agnes River treated water supply									
tbc	2	-1	-1	0	-1	0	3	2	tbc

(1) For broad comparison of options only. See Section 5.1 for further details of the function of this sustainability assessment within the planning process.

19.5. Strategy summary

For the towns of Meeniyan and Dumbalk, no specific actions are required to maintain adequate supply over the 50 year planning horizon, other than to introduce demand reduction measures in line with other towns. Any decision to merge these two systems to minimise water treatment costs is not driven by and will not affect water resource availability, and hence is not considered further in this WSDS.

For the remaining central towns, the main uncertainty is associated with the potential demand for water from Barry Beach and the unserviced towns south of Fish Creek. Whilst the interlinked system offers greater flexibility and robustness to any increases in demand, South Gippsland Water will undertake a financial analysis of these two proposed options in order to better understand the risk profile of these options from a financial perspective. Pending the outcome of the financial analysis, South Gippsland Water has presented a strategy below which considers the approach for both strategies. South Gippsland Water will continue to monitor proposed developments at Barry Beach as they are formed into more concrete proposals.

The approximate timing of infrastructure augmentation under each option is shown in Figure 19-5.

- **Figure 19-5 Approximate timing of South Gippsland Water infrastructure augmentation to maintain reliability of supply**

Supply from Existing Separate South Gippsland Water Headworks

Approx. Timing	Action under Victoria in Future Growth	Action under Local Growth
2012/13	Construct off-stream storage up to 250 ML at Toora	
2012/13	-Obtain bulk entitlement to divert from Hoddle Creek -Raise Battery Creek Reservoir by 2 metres -Construct weir on Hoddle Creek and diversion pipeline	
~2025	Connect some or all unserviced towns south of Fish Creek from Foster or from new water source	

Supply from Interlinked System

Approx. Timing	Action under Victoria in Future Growth	Action under Local Growth
2012/13	Connect Toora, Foster and Fish Creek treated water systems	
~2025	Connect some or all unserviced towns south of Fish Creek	Connect some or all unserviced towns south of Fish Creek with additional 100 ML off-stream storage at Toora
In response to concrete development proposal at Barry Beach	Consider increasing off-stream storage at Toora in stages up to 250 ML	

Immediate and ongoing actions which are applicable to both options are listed in Table 19-2. These include actions to monitor demands.

- **Table 19-2 Immediate and Ongoing Actions for Central Towns**

Strategy	Actions
Reduce uncertainty in current estimate of consumer demand	- Compare quarterly or four monthly consumption data from property and bulk meters
Reduce uncertainty in future estimate of consumer demand	- Examine long-term trends in water use independent of climate variability
Encourage demand reduction	- Pursue additional demand reduction options after adoption by WaterSmart - Continue ongoing program of system leak reduction and inspections for unmetered tappings - Arrange interest free finance to farmers for installation of facilities to reduce demand

20. Strategy for Eastern Towns

20.1. Introduction

This section of the WSDS outlines the demand and supply strategy for Yarram, Port Albert, Alberton and Devon North over the next 50 years. It includes an overview of the current supply system configuration, current demand for water and current supply. It also includes Current Operation and Infrastructure supply and demand projections under future climate change and any actions required to ensure that demand does not exceed supply in the long-term.

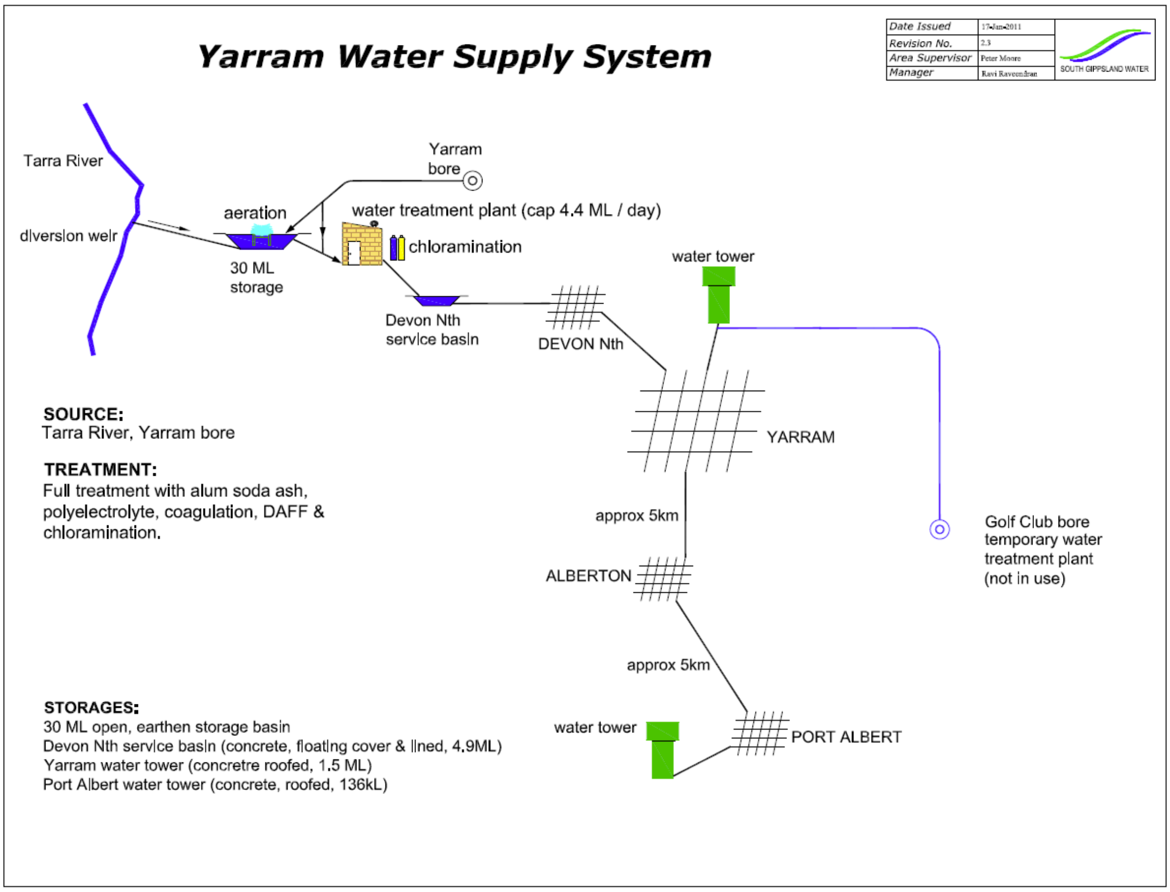
20.2. Current water supply and demand

20.2.1. Supply system description

An offtake weir on the Tarra River supplies water to the townships of Yarram, Alberton, Port Albert and rural areas in their proximity including Devon North. A schematic of the supply system is shown in Figure 20-1. The river supplies other parties including rural users who utilise it for domestic and stock purposes. From the offtake weir the supply gravitates to two storages at Devon North of 3.4 ML and 30 ML capacity respectively. The 30 ML storage acts as raw water storage. From here it passes through a treatment plant and is then transferred to the covered and lined 3.4 ML clear water storage. From here the supply gravitates to Yarram, Alberton and Port Albert. The useable storage (“live” storage) in the system is estimated to be 31 ML. At Yarram there is a 270 kL capacity elevated tower, but this is not used because the minimum hydraulic grade line in the reticulation system is always higher than the top water level of the tank. There is a 136 kL elevated tower at Port Albert. Enroute from the Devon North storages to Yarram, supply is provided to the community of Devon North and adjoining rural areas. Other rural supplies are provided to properties between Yarram and Port Albert. Supply under specific agreement is provided to properties between the offtake weir and the Devon North storages. Included in the agreement is provision requiring the consumer to install security water storage tanks with a minimum capacity of 45.4 kL. These properties are outside the South Gippsland Water’s district and the supply is unchlorinated.

South Gippsland Water has obtained in-principle approval from the licensing authority Southern Rural Water to purchase up to 400 ML/yr of groundwater licences at Yarram for extraction at the South Gippsland Water bore at a rate of up to 4 ML/d. This groundwater bore provides water to the raw water basin at Devon North. South Gippsland Water also has a licence to extract groundwater from a bore at the Yarram Golf Club at a rate of 1.0 ML/d up to a total annual volume of 60 ML. This groundwater bore is not directly connected to the reticulated supply of the Yarram supply system and temporary arrangements have to be made in times of drought to make this emergency supply functional.

- **Figure 20-1 Tarra River Water Supply System schematic**



20.2.2. Current legal entitlements to water

The bulk entitlement for Yarram allows South Gippsland Water to divert up to a maximum of 853 ML/yr from the Tarra River. The daily bulk entitlement is shown in Table 20-1.

- **Table 20-1 Bulk entitlement volume for Yarram**

Source	Maximum annual volume (ML/yr)	Flow in Tarra River upstream of offtake weir, F (ML/d)	Flow available for diversion (ML/d)	Minimum passing flow (ML/d)
Tarra River	853	> 12	6	F – 6
		6 – 12	0.5 * F	0.5 *F
		3 – 6	F – 3	3.0
		< 3	0	F

Note: F = flow in the Tarra River upstream of the offtake weir in ML/d

Details of South Gippsland Water's groundwater licences at Yarram are shown in Table 20-2. As mentioned previously, South Gippsland Water has obtained in-principle approval from the licensing authority Southern Rural Water to purchase up to 400 ML/yr of groundwater licences at

Yarram for extraction at the South Gippsland Water bore. The current permissible consumptive volume from the Yarram Water Supply Protection Area is 25,317 ML/yr and peak annual usage in the 2006/07 drought was only around 17,000 ML/yr (SRW, 2010), which suggests that trade of currently unused licences to South Gippsland Water is likely to be readily achievable in the short-term. Temporary transfer of licences is also possible in the interim if required prior to permanent transfers occurring.

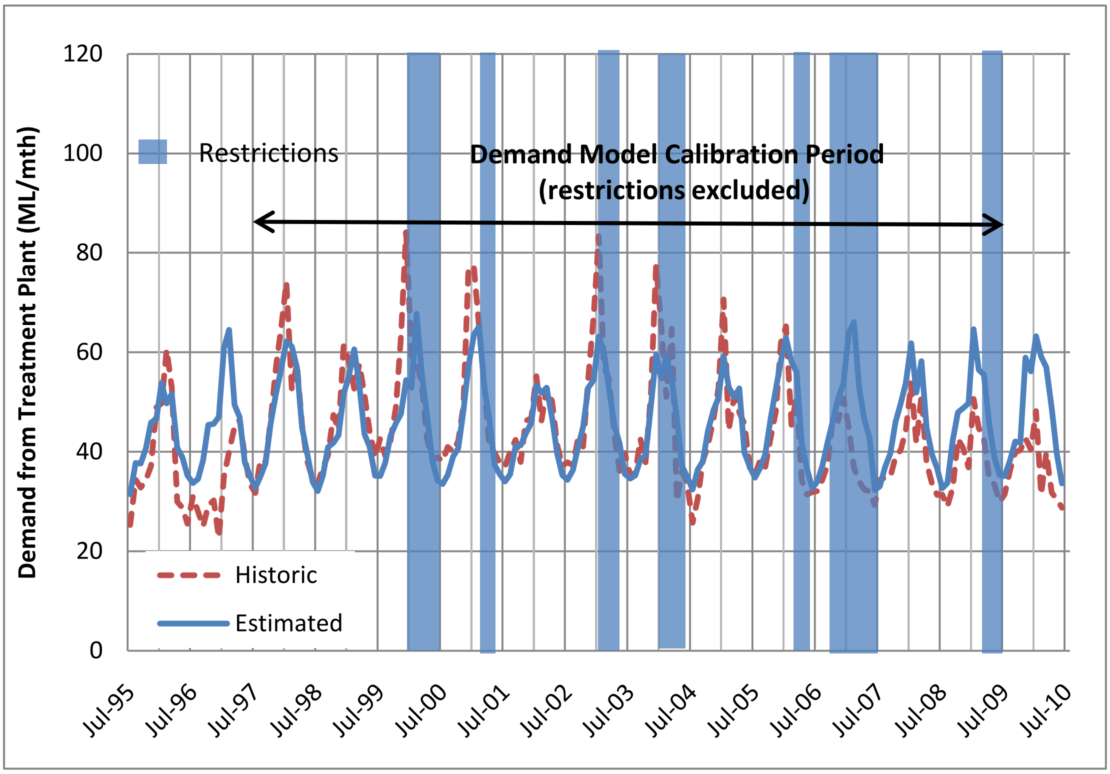
- **Table 20-2 Groundwater licence for Yarram**

Location	Annual licensed volume (ML/yr)	Maximum extraction rate (ML/d)
Yarram – Golf Course	60	1
Yarram – South Gippsland Water Bore	Transfer process underway	4

20.2.3. Current demand

Yarram, Port Albert and Alberton had populations of 1589, 231 and 154 respectively excluding visitors in the 2006 census (DPCD, 2009). This corresponds to a total of 1,974 for the three towns. Population data for Devon North was not available. A demand model was fitted to the recent unrestricted data to estimate a long-term average annual demand, which takes into account how current demands would vary under a wider range of natural climate variability. The historical and estimated long-term current demand is shown in Figure 20-2. The long-term average annual demand is **560 ML/yr** at South Gippsland Water's treatment plant inlet, of which around 4% is utilised on average through the treatment plant.

▪ **Figure 20-2 Long-term monthly demands for Yarram, Port Albert, Alberton and Devon North**



20.2.4. Current reliability of supply

Restrictions have occurred relatively frequently in recent years at Yarram, with restrictions being implemented around every second year on average over the last decade. This included severe restrictions (Stage 4 of 4 stages or equivalent) in 2000/01, 2003/04, 2005/06 and 2006/07. Since 2006/07, the supply and demand balance has been improved through a reduction in demand and through South Gippsland Water's access to additional groundwater supply at Devon North. Reliability of supply modelling, which incorporates 400 ML/yr of additional groundwater supply, indicated that restrictions would not have been required at current demands over the period of modelling from July 1961 to June 2007. This meets South Gippsland Water's level of service objectives to have restrictions not more frequently than in 10% of years. Further details on the water resource model used to assess reliability of supply (and yield) can be found in SKM (2009).

20.3. Environmental condition

The Tarra River catchment lies on the south face of the Strzelecki Ranges. Three tributaries join the Tarra River, namely Macks Creek, Greig Creek and Bodman Creek. Spring Creek joins Bodman Creek upstream of the Tarra River confluence. The Tarra River, Macks Creek and Greig Creek originate within the Tarra Bulga National Park. The Tarra Bulga National Park has mountainous terrain characterised by high rainfall and is covered by tall open forest of Mountain Ash

(*Eucalyptus regnans*), Messmate (*Eucalyptus obliqua*) and Blackwood (*Acacia melanoxylon*) on the hills and slopes and cool temperate rainforest of Myrtle Beech (*Nothofagus cunninghamii*), Southern Sassafras (Atherosperma moschatum), Austral Mulberry (*Exocarpus cupressiformis*) and Banyallas (*Pittosporum bicolor*) within the gullies (WGCMA, 2005). After leaving the national park, the Tarra River flows through lowland hills in a predominantly rural landscape. The main landuse in the area consists of sheep grazing and dairy production. From the hills, the change of slope for the catchment is quite rapid and the mid to lower sections are quite flat and characterised by lower rainfall than the upper catchment with an average annual rainfall of 600mm compared to greater than 700 mm in the upper catchment (WGCMA, 2005). The Tarra River flows for approximately 57 km from the headwaters, through Yarram, and continues to flow south to the estuary before discharging to the sea downstream of Tarraville (Lieschke and Zampatti, 2001).

Information about the environmental condition of Tarra River was assessed for the West Gippsland Catchment Management Authority in SKM (2006c). The key outcomes of that assessment of relevance to the WSDS are:

- The Tarra River has been identified as a Representative River in the Victorian River Health Strategy and supports a number of significant species that have evolved with or rely directly or indirectly on the natural flow regime of the Tarra River.
- The natural flow regime of the Tarra River system has been significantly altered since European settlement by the diversion of water for off stream uses. The change in flow regime has had the greatest impact during the summer low flow period. There has been an increase in the duration of low flows and a reduction in the magnitude of high flows following significant rain events.
- Once the rivers and creeks emerge from the Tarra Bulga National Park there is little native vegetation along the creeks except for some pockets of remnant vegetation.
- Water quality is generally moderate to good throughout the Tarra River catchment.
- Nineteen species of native freshwater and estuarine species and one exotic fish species were surveyed within the reaches of the Tarra River catchment. A number of marine species have also been recorded in the river mouth and estuarine sections of the river (Lieschke and Zampatti, 2001). Eleven of the native species are migratory and two are considered threatened in Victoria. Cox’s Gudgeon (*Gobiomorphus coxii*) is listed as endangered within Australia and the Australian Grayling (*Prototroctes maraena*) is listed as vulnerable within Victoria under the *Flora and Fauna Guarantee Act* 1988) (Lieschke and Zampatti, 2001). Australian Grayling is also listed as vulnerable under the *Environment Protection and Biodiversity Conservation Act* (EPBC) 1999.

- The presence of Mountain Galaxias (*Galaxias olidus*) was confirmed in a survey in Spring Creek which is outside its normal altitudinal range of this species (Lieschke and Zampatti, 2001).

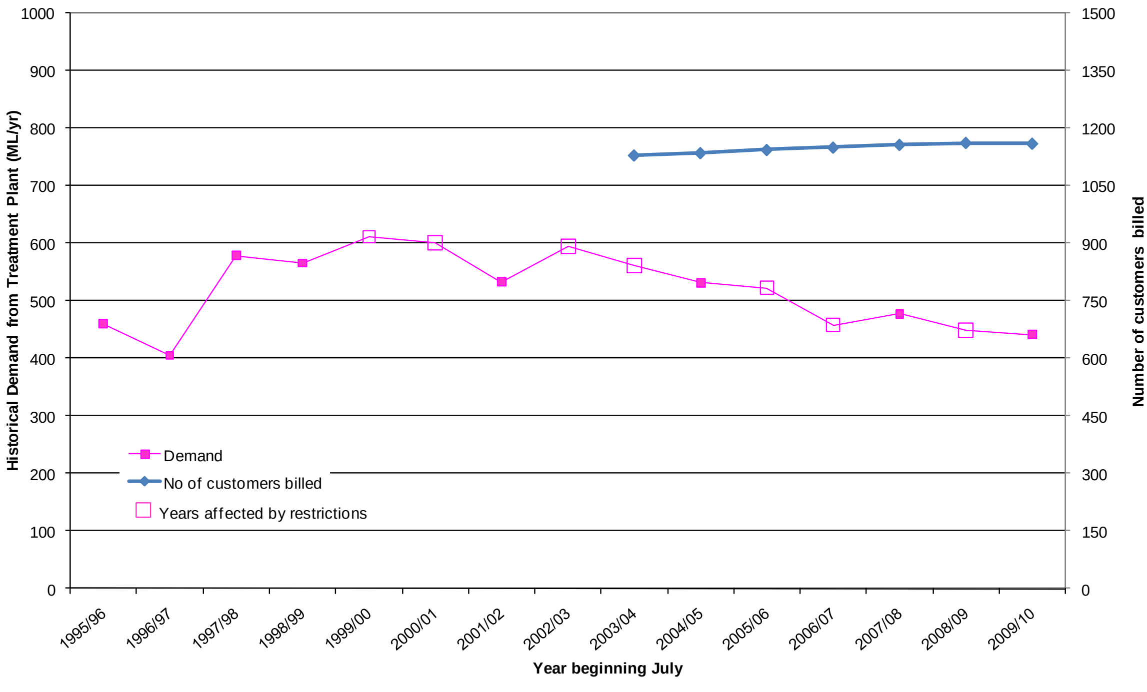
Two species of burrowing crayfish, classified as rare in Victoria, have been recorded in the catchment. These are the south Gippsland Spiny Crayfish (*Euastacus neodiversus*) and the Strzelecki Burrowing Crayfish (*Engaeus rostrogaleatus*) (Lieschke and Zampatti, 2001).

20.4. Water supply and demand projections with current operation and infrastructure

20.4.1. Historical trends

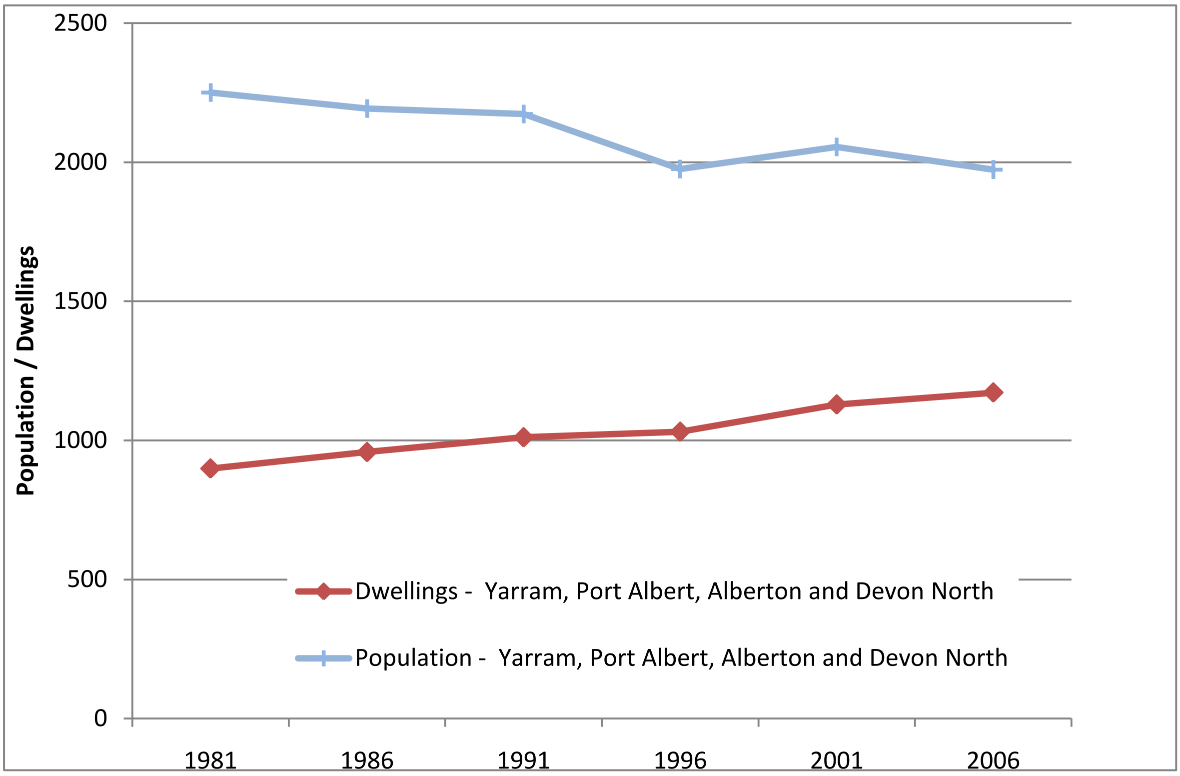
Historical diversions to Yarram, Port Albert, Alberton and Devon North have declined slightly in recent years, however most years have been affected by restrictions, so it is difficult to discern any clear trends, as can be seen in Figure 20-3. These demands are recorded at the treatment plant outlet and do not include an allowance for treatment plant utilisation. The number of customers billed in this supply system has increased slightly over the last few years. This potentially indicates that significant water savings have been achieved by South Gippsland Water and its customers in recent years.

- **Figure 20-3 Historical diversions and number of customers billed at Yarram, Port Albert, Alberton and Devon North**



The population in the Tarra River system has declined in recent years, as shown in Figure 20-4, with the total population decreasing from 2,055 in 2001 to 1,974 in 2006. This was largely due to a decline in population at Yarram. There was a slight increase in population at Port Albert. The number of dwellings was however shown to increase steadily over the last two decades.

- **Figure 20-4 Historical population in Yarram, Port Albert, Alberton and Devon North(1)**



(1) No census data available for Devon North. Alberton data only available from 2001 onwards.

20.4.2. Future demand projections

Two estimates of future growth in water demand were made in the previous strategy (South Gippsland Water, 2007). These included the *Victoria in Future* estimates, which are available at a Statistical Local Area (SLA) level, and a Local Growth scenario which considered the potential for stronger growth within towns at a rate greater than the surrounding SLA. There are five SLAs covering South Gippsland Water's supply area. Yarram, Port Albert, Alberton and Devon North are located within the Wellington Shire Alberton SLA and account for around 35% of the population within that SLA.

A comparison of the 2006 census results for each town against the previous population projections from the 2001 census indicated that both the *Victoria in Future* and the Local Growth scenario overestimated population growth between 2001 and 2006. The *Victoria in Future* projections were closer to the growth which actually happened, which was a decline in population of 4%. However, given the uncertainty of future population, South Gippsland Water has considered two population forecasts, which include the *Victoria in Future* projections and a higher Local Growth scenario that allows for faster growth in urban centres within SLAs.

Victoria in Future projections include a growth in residential demand of up to 0.2% per year over the next few years, with a decline in population anticipated from 2012 onwards of up to 0.5% per year. The Local Growth scenario assumes a 0.25% annual growth rate in residential demand over the fifty year planning horizon.

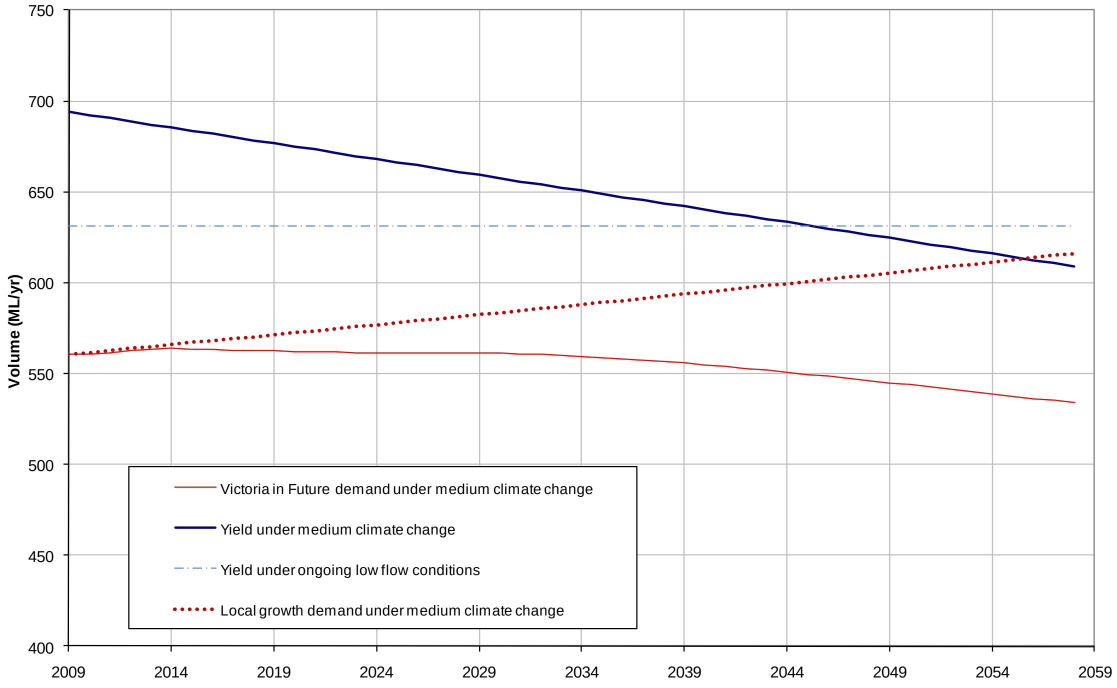
A 2.5% increase in residential and stock and domestic demand over the next 50 years was assumed to occur due to medium climate change. This additional increase in demand is due to increased water use for activities such as garden watering under drier and hotter climate change conditions and is consistent with DSE recommendations (DSE, 2005).

20.4.3. Future supply projections with current operation and infrastructure

Under the medium climate change scenario, runoff in the South Gippsland Basin in the year 2058 relative to the year 2009 is estimated to decrease by 15%, with a range of reduction of 7% to 28% under low and high climate change scenarios. Under the medium climate change scenario, this change in streamflow would be driven by a 3% reduction in rainfall and a 7% increase in evaporation. Under the ongoing low flow conditions scenario, Tarra River streamflows upstream of the town offtake have been reduced by 50% prior to July 1997.

The Current Operation and Infrastructure water supply and demand situation for the Tarra River supply system using the *Victoria in Future* population projection is shown in Figure 20-5. This figure illustrates that demand is not expected to exceed available supply in the foreseeable future for the *Victoria in Future* scenario. Under the Local Growth scenario, demand would be expected to exceed supply at South Gippsland Water's level of service objective just before the end of the fifty year planning horizon.

▪ **Figure 20-5 Current Operation and Infrastructure Water Supply and Demand for Yarram, Port Albert, Alberton and Devon North**



20.5. Sensitivity of projections

Several potential land and water use changes within the Tarra River catchment were investigated to understand the potential risk that they could pose to available supply.

Bushfires: The maximum reduction in runoff after a bushfire typically occurs at around 10-20 years after the fire has occurred, and thereafter runoff progressively increases back to pre-bushfire levels. Approximately 88% of the Tarra River catchment upstream of the Yarram offtake is covered by vegetation and could be susceptible to bushfire. There is no record of bushfires occurring in this water supply catchment in recent decades. The effects of bushfire on catchment yield will therefore only be a concern if fires occur in this area in the future.

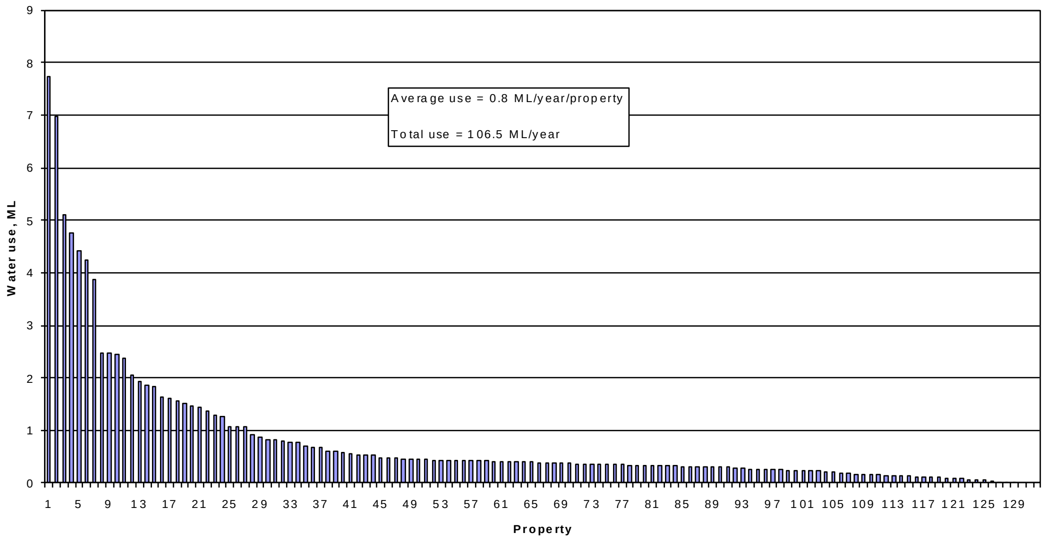
Logging: Only a very small proportion (<5%) of the water supply catchment is covered by areas subject to logging under Regional Forestry Agreements. Water supply to Yarram is therefore not considered to be at risk due to logging.

Plantations: A significant proportion (~40-60%) of the Yarram water supply catchment is covered by plantations. Plantations over a large proportion of a catchment can significantly reduce runoff to downstream areas, particularly when those plantations are set up on previously cleared land or where the species is switched from native forest to pine plantations. A significant proportion of the Yarram water supply catchment is covered by plantations, so this may have a significant effect on catchment yield, depending on the age profile of the plantations. Local operators estimate the age of the plantations to be around 20-30 years, that they consist of a mixture of eucalypt and pine plantations and that they were originally planted on previously cleared land. On this basis, it is likely that streamflow yields per unit catchment area have changed over time such that the historical streamflow record does not accurately represent current streamflow conditions. DSE recently developed a tool for estimating changes in runoff associated with changes in land use type, which may provide South Gippsland Water with useful information about how its water availability will change over time as a result of harvesting and replanting of the plantations.

Groundwater level decline: Groundwater levels in the Gippsland coastal region near Yarram have been declining at around 1 m/yr for the last twenty years predominantly due to off-shore oil, water and gas extraction (SRW, 2010). This trend is expected to continue for the next few decades. South Gippsland Water has designed its groundwater bore and pump to be able to cope with regional reductions in groundwater level over the design life of the bore. The Yarram WSPA Groundwater Management Plan (SRW, 2010), which governs the management of groundwater extraction in the region, acknowledges this decline. There are not currently any defined triggers for cessation or restriction of groundwater pumping across the region associated with the decline. The Groundwater Management Plan is subject to annual reporting by Southern Rural Water, which would indicate any proposed changes to plan rules. Any such changes must be publically consulted on prior to adoption.

Growth in water demand: CEE (2006) held discussions with individual landholders to investigate rural water use. The range of water used on individual farms is shown in Figure 20-6. In the farms with high water use, water is used for washing out dairies, cleaning milk equipment, drinking water for stock and supplying residences on the farms. The farms using little water are generally only supplying the farmhouse. Discussions with two large farm water users revealed that demand for water is expected to stay much the same as at present.

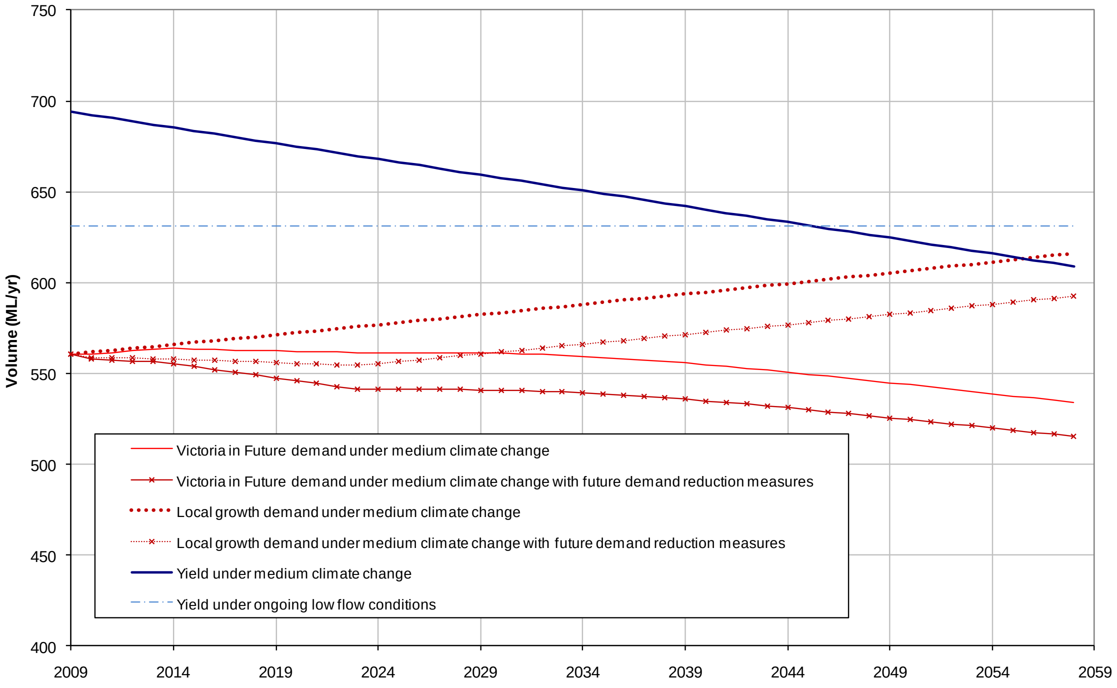
■ **Figure 20-6 Water use by farmers in the Tarra River urban supply system (from CEE, 2006)**



20.6. Additional demand reduction options

If the additional demand reduction options outlined in Section 4.10 are adopted for Yarram, Alberton, Port Albert and Devon North, demands would remain below the available supply, as shown in Figure 20-7. With demand reduction measures, supply enhancement under the Local Growth scenario would no longer be required near the end of the fifty year planning horizon.

■ **Figure 20-7 Effect of additional demand reduction options for Yarram, Alberton, Port Albert and Devon North**



20.7. Supply enhancement options

Available supply is expected to remain above future demands, even after considering climate change, hence Yarram does not require any supply enhancement over the 50 year planning horizon of this strategy.

South Gippsland Water's previous WSDS (South Gippsland Water, 2007) investigated the option of additional off-stream surface water storage at Yarram, because the rules governing future groundwater supply at that time were uncertain. However with the finalisation of the Yarram Water Supply Protection Area Groundwater Management Plan in 2010 (SRW, 2010) this uncertainty was reduced and groundwater supply was considered to provide much greater reliability of supply at lower cost for the eastern towns than pursuing additional off-stream surface water storage.

The resilience of the supply system to severe prolonged drought was examined by estimating supply system behaviour under a repeat of the 2006/07 severe drought year. This analysis highlighted that even though local catchment inflows were negligible in this year from October to April, the availability of groundwater supply means that South Gippsland Water would be able to maintain supply through two consecutive years of repeating 2006/07 climate.

20.8. Sustainability assessment of options

The only actions for South Gippsland Water in managing its eastern towns is to continue its purchasing of groundwater licences up to the pre-approved limit and secondly to introduce demand reduction measures in line with other towns supplied by South Gippsland Water. Whilst there is no specific need for demand reduction for the eastern towns, implementing demand reduction initiatives in these towns will ensure a consistent demand reduction message across South Gippsland. It will also provide a buffer if strong growth does subsequently occur, despite current predictions. The installation of water efficient devices, such as shower heads, will have a design life of several decades and retrofitting is an expensive exercise.

- **Table 20-3 Sustainability Assessment of Options for Yarram, Alberton, Port Albert and Devon North(1)**

Net present cost	Regional development	Greenhouse emissions	River health	Water quality	Other ecosystems	Culture, recreation and heritage	Social acceptability	Confidence flag	LRMC ($/ML)
Option: Demand reduction measures									
5	1	5	1	0	0	0	3	2	n/a

(1) For broad comparison of options only. See Section 5.1 for further details of the function of this sustainability assessment within the planning process.

20.9. Strategy summary

A summary of the long-term Water Supply Demand Strategy for Yarram, Alberton, Port Albert and Devon North is shown in Table 20-4.

▪ **Table 20-4 Strategy for Yarram, Alberton, Port Albert and Devon North**

Strategy	**Actions**	**Timing**
Reduce uncertainty in current estimate of consumer demand	- Compare quarterly or four monthly consumption data from property and bulk meters	Immediate
Reduce uncertainty in future estimate of consumer demand	- Examine long-term trends in water use independent of climate variability	ongoing
Encourage demand reduction	- Pursue additional demand reduction options after adoption by WaterSmart - Continue ongoing program of system leak reduction and inspections for unmetered tappings	2010 onwards ongoing
Maintain reliability of supply	- Continue transferring groundwater licences from existing users up to the 400 ML/yr pre-approved limit	Immediate

21. Strategy for Other Unserviced Towns

In addition to the unserviced towns near Inverloch and south of Fish Creek, which were previously discussed in Sections 11 and 18 respectively, there are a number of small towns in the South Gippsland region that are not currently connected to water or sewerage services. The viability of supplying these towns was discussed in SKM (2004) and included the following geographical groupings:

- Bena, which is a small town of around 54 lots located between Korumburra and Loch.
- Tarwin, which is a hamlet of around 12 lots between Koonwarra and Meeniyan.
- Towns east of Yarram, which include Greenmount, Won Wron, Woodside, Woodside Beach, Robertson's Beach, Manns Beach and McLoughlins Beach. All of these towns have less than 50 lots each.

Current and future demand for water from these towns was presented in Section 4.8 and totalled an additional 130 ML/yr over the 50 year planning horizon. As previously noted in Section 4.8, there remains much uncertainty about what future impact unserviced towns may have on existing supply systems. It may well be that innovative approaches to how additional water is provided to such existing communities will result in water requirements being much less than the values assumed in this study.

Bena and Tarwin are currently considered too small to feasibly connect them to existing supply systems, because the cost of connecting pipelines would be too high relative to the return from customers supplied.

For the towns east of Yarram, South Gippsland Water's 2004 long-term planning strategy (SKM, 2004) identified potential pipeline routes to connect these towns to the Yarram system. Supply from groundwater or local desalination may also be options to supply these towns. A discussion of the general pros and cons of various alternative water supply options to these unserviced towns is presented in Appendix B. Given that there is currently no demand for a reticulated supply in these towns and given the likely high cost of supplying water to these small towns, South Gippsland Water is not pursuing further investigations into supplying these unserviced towns at the current time.

22. Conclusions

This Water Supply Demand Strategy (WSDS) for South Gippsland Water (South Gippsland Water) provides a 50 year outlook of the supply and demand balance for each of South Gippsland Water's supply systems. Future planning has been based on considering two climate change scenarios and making an allowance for anticipated future population and industry growth under two alternative growth scenarios. The key outcomes from the assessment process were:

- Significant water savings have been achieved by South Gippsland Water and its customers in recent years.
- Further demand reduction will be pursued in all supply systems with a target set for:
  - 25% reduction in per capita demand by the year 2015 relative to 1990s average demand;
  - 30% reduction in per capita demand by the year 2020 relative to 1990s average demand.
- These demand reductions will be insufficient to maintain supply at South Gippsland Water's level of service objective for reliability of supply in some supply systems over the 50 year planning horizon. Supply augmentation will be required in these systems.
- **For South Gippsland Water's northern and southern towns**, which includes Poowong, Loch, Nyora, Korumburra, Leongatha, Wonthaggi, Cape Paterson and Inverloch:
  - Supply enhancement is required within the next few years for Poowong, Loch, Nyora and Korumburra.
  - Future supply requirements for Leongatha are dependent on whether proposed water savings at Murray Goulburn result in a reduction in demand from South Gippsland Water's reticulated supply. Additional supply would be required by around 2020 if Murray Goulburn demands remain at current levels.
  - A business case is currently underway which is considering the financial costs and benefits and associated risk profile for two alternative supply strategies for the northern and southern towns. These include supply from enhancing existing separate South Gippsland Water headworks or supply from an interlinked system connected to Lance Creek Reservoir and the Melbourne supply.
  - Preliminary outcomes from the business case and this WSDS indicate that the connection to the Melbourne supply option has the advantage of being more robust to changes in streamflow under climate change and potential increases in demand under the Local Growth scenario. It is also more resilient to severe prolonged drought. This option also potentially improves river health with the possibility of decommissioning existing on-stream storages in the Tarwin and Bass River catchments. Both options were of similar cost at the preliminary costing stage. A definitive preferred strategy is dependent on the outcomes of the business case.

  - Both options would allow the potential to connect the nearby unserviced towns of Venus Bay and Tarwin Lower, which would increase South Gippsland Water's customer base by up to 1,000 ML/yr at the end of the 50 year planning horizon.
- **For South Gippsland Water's central towns**, which includes Dumbalk, Meeniyan, Foster, Fish Creek, Toora, Port Welshpool, Welshpool and Port Franklin:
  - Dumbalk, Meeniyan and Foster have sufficient supply to meet demands at South Gippsland Water's level of service objective for reliability of supply over the 50 year planning horizon.
  - Supply enhancement is required within the next few years for Fish Creek and towns currently supplied by the Agnes River (Toora, Port Welshpool, Welshpool and Port Franklin).
  - Two alternative supply strategies were considered for the central towns, namely enhancing existing separate South Gippsland Water headworks or supply from an interlinked system connecting Foster, Fish Creek and Toora.
  - A preliminary assessment indicated that the interlinked system has the advantage of greater flexibility and robustness to potential future changes in demand at Barry Beach and provides South Gippsland Water with the option to provide reticulated supply to the currently unserviced towns south of Fish Creek. These unserviced towns include Sandy Point, Walkerville, Waratah Bay and Yanakie. A definitive preferred strategy is dependent on the outcomes of further financial analysis, which is currently being undertaken by South Gippsland Water.
- **For South Gippsland Water's eastern towns**, which include Yarram, Port Albert, Alberton and Devon North:
  - South Gippsland Water's current program to purchase up to 400 ML/yr of groundwater licences from existing licence holders for use at its newly constructed bore is expected to be sufficient to meet South Gippsland Water's level of service objective for reliability of supply over the 50 year planning horizon.

A plan of system wide actions is shown in Table 22-1, along with specific actions for each group of towns in Figure 22-1 to Figure 22-3.

The WSDS will be reviewed and updated every 5 years to incorporate additional hydrologic data, changes in demand for water, changes in community expectations and improvements in scientific knowledge. There are several areas of uncertainty for South Gippsland Water in developing the WSDS, which will need to be monitored on an ongoing basis.

Table 22-1 Action plan – system wide actions

A. Demand Management	
1	Reduce uncertainty in current and future estimates of consumer demand through ongoing monitoring and metering, particularly for major industrial water users
2	Continue current successful water conservation initiatives, including the WaterMap program for major industrial and rural customers
3	Actively pursue opportunities for the use of treated wastewater to offset potable supply
B. System Management	
4	Reduce water leaks and wastage in reticulation systems and water treatment processes
5	Secure dams against leakage and future failures
C. Management for Forward Planning	
6	Monitor stream flows and possible climate change
7	Monitor catchments to ensure reliable supply and quality of water
8	Encourage the use of alternative water sources where appropriate
9	Develop long term plan to extend water supply to unserviced towns
10	Monitor demographic trends, and hence potential demand for water, in cooperation with DSE and local planning authorities

Figure 22-1 Action Plan for Northern and Southern Towns (preferred option dependent on business case outcomes)

Supply from Existing Separate South Gippsland Water Headworks

Approx. Timing	Action under Victoria in Future Growth	Action under Local Growth
2012/13	Raise Little Bass Reservoir and connect Korumburra to Little Bass Reservoir.	
2016/17	None	Upgrade Tarwin R West Branch supply to bulk entitlement limit.
2017/18	Raise Bellview Creek Reservoir whilst dam safety works are undertaken.	
~2025	Connect unserviced towns near Inverloch to Lance Creek system.	
~2025	None	Increase storage at Leongatha by 1000 ML
2025-2039	None	Connect Leongatha to Melbourne supply
2034-2039	None	Connect Korumburra to Melbourne supply
2040-2047	None	Increase supply to Lance Creek from Melbourne
2044-2049	None	Connect PLN to Melbourne supply

Supply from Melbourne

Approx. Timing	Action under Victoria in Future Growth	Action under Local Growth
2012/13	Connect Poowong, Loch, Nyora and Korumburra to Melbourne supply and decommission water treatment plants. Decommission or seek alternative uses for raw water storages.	
2020	None	Connect Leongatha to Melbourne supply, decommission Leongatha water treatment plant. Decommission or seek alternative uses for raw water storages.
~2025	Connect unserviced towns near Inverloch to Lance Creek system.	Increase supply from Melbourne to above 10 ML/d and connect unserviced towns near Inverloch to Lance Creek system.
2052-2058	Increase supply from Melbourne above 10 ML/d.	Further increase supply from Melbourne.

Figure 22-2 Action Plan for Central Towns (preferred option dependent on financial analysis outcomes)

Supply from Existing Separate South Gippsland Water Headworks

Approx. Timing	Action under Victoria in Future Growth	Action under Local Growth
2012/13	Construct off-stream storage up to 250 ML at Toora	
2012/13	-Obtain bulk entitlement to divert from Hoddle Creek -Raise Battery Creek Reservoir by 2 metres -Construct weir on Hoddle Creek and diversion pipeline	
~2025	Connect some or all unserviced towns south of Fish Creek from Foster or from new water source	

Supply from Interlinked System

Approx. Timing	Action under Victoria in Future Growth	Action under Local Growth
2012/13	Connect Toora, Foster and Fish Creek treated water systems	
~2025	Connect some or all unserviced towns south of Fish Creek	Connect some or all unserviced towns south of Fish Creek with additional 100 ML off-stream storage at Toora
In response to concrete development proposal at Barry Beach	Consider increasing off-stream storage at Toora in stages up to 250 ML	

Figure 22-3 Action Plan for Eastern Towns

Approximate Timing	Action
2011	Continue purchasing groundwater licences up to 400 ML/yr from existing licence holders

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Appendix A Self-audit checklist

This self-audit checklist from the WSDS guidelines has been included to confirm that the document includes the necessary components of a WSDS.

- **Table 23-1: Self-Audit Checklist, Expected Outputs**

Checklist Item	**Yes/No ?**	**Reference in WSDS**
Description of Current Water Supplies		
Has the existing water supply system been briefly described?	Yes	Section 1.2 and X.2
Has a map or schematic of the water supply area been included?	Yes	Section 1.2
Has a list of regulatory plans governing water resources management in the supply area and their relevance to the WSDS been compiled?	Yes	Section 3
Has any recent long-term planning undertaken by the water authority been summarised?	Yes	Section 1.3
Have the authority's legal entitlements to water been listed?	Yes	Section 3
Has the current average annual demand from the system been quantified?	Yes	Section 4.3
Has the yield of the system, and associated system reliability criteria been quantified?	Yes	Section X.2.4
Have the current demand and system yield been compared?	Yes	Section X.4
Forecasting of Water Demand		
Have current demand management initiatives and their effectiveness to date been summarised?	Yes	Section 4.9
Has the forecast "current condition" average annual demand been forecast over the 50 year period of assessment for residential /commercial, industrial and supply by agreement customers?	Yes	Section 4.4, 4.5 and 4.6
Have key assumptions behind the demand forecast been described?	Yes	Section 4.4, 4.5 and 4.6
Reduction of Demand and Enhancement of Supplies		
Has future demand and existing system yield been graphically depicted?	Yes	Section X.4
Has the magnitude of any future demand that cannot be met through existing system yield been graphically depicted?	Yes	Section X.4

Checklist Item	Yes/No ?	Reference in WSDS
Has the target reduction in water consumption to be achieved over the next two regulatory periods been defined?	Yes	Section 4.10
Has the target reduction in both raw and per capita water consumption to be achieved over the period of assessment been defined?	Yes	Section 4.10
Has a description been provided on the measures to be employed to achieve these reductions, particularly those that rely on government policy, including the social, environmental, economic and technical aspects associated with those measures?	Yes	Section 4.10
Has the evaluation of options for water supply option investigations considered social, environmental, economic and technical aspects?	Yes	Section 12.4, 19.4, 20.8
Has the authority confirmed that proposed supply options accord with current regulations, legislation, and Victorian Government policy?	Yes	Section 3, 12, 19, 20
Has the authority identified and investigated the place of alternative water resources in future supply options such as; recycled water, rainwater, stormwater, and groundwater for both existing serviced areas, and in particular new growth areas?	Yes	Section 12, 19, 20, Section 3, Section 4.10
Have future investigations been proposed and lead times identified to refine and then implement specific supply options?	Yes	Section 12, 19, 20
Management of Risk and Uncertainty		
Have the major uncertainties associated with water supply and demand forecasts been defined?	Yes	Section X.5
Have those major uncertainties been addressed by contingencies in the timeline to implement the outcomes of the WSDS?	Yes	Section X.5
As part of the identification of major uncertainties, has the uncertainty of supply and demand projections due to climate change been assessed:	Yes	Section X.5
For small supply systems: with a qualitative assessment based on readily available information?	Yes	Section X.5
For large supply systems: with a quantitative assessment based on a representative case study with the water authority’s supply area?	Yes	Section X.5
For cities: with a quantitative assessment of the supply system?	N/a	N/a

Checklist Item	**Yes/No ?**	**Reference in WSDS**
Assessment of Options and Development of Plans		
Has the process used to assess and rank options been described?	Yes	Section 5
Is there a list of preferred actions for the next five years arising from the WSDS?	Yes	Section 12, 19, 20
Is there a prioritised list of long-term actions for the next fifty years arising from the WSDS?	Yes	Section 12, 19, 20
Have the socio-economic, environmental and financial costs and benefits associated with those preferred actions been assessed?	Yes	Section 12, 19, 20
Does the financial analysis include the up-front capital cost, annual operation and maintenance costs, net present cost and net present cost per ML or incremental yield (where relevant)?	Yes	Section 12, 19, 20
Does the social analysis include consideration of any potential impacts on other consumptive water users?	Yes	Section 12, 19, 20
Consultation with Stakeholders		
Has the consultation process and the key stakeholders consulted been documented?	Yes	Section 1.6
Have the outcomes of the consultation process been documented?	Yes	Section 1.6

Note: “X” refers to individual chapters of the supply and demand projections under current operation and infrastructure.

Appendix B Alternative Water Supply Options for Unserviced Coastal Towns and Developments

This appendix provides an introduction to alternative water supply options for unserviced coastal towns and developments. Most the coastal towns in the South Gippsland region are remote from South Gippsland Water's existing infrastructure. This means that connecting them to South Gippsland Water's existing supply network is not necessarily the most cost-effective solution, because of the long pipe and pump networks required. It may therefore be more viable to develop local alternative supply options. This appendix discusses some of the advantages and disadvantages associated with five different alternative supply options for isolated coastal towns:

- Bore water
- Rain water
- Grey water
- Storm water
- Local desalination of sea water

B.1 Summary

The relative advantages and disadvantages of each alternative supply option can vary for each particular coastal town, however general statements can be made about each option for the region, as listed in Table 23-2. Each of these options has been assessed in qualitative terms relative to one another and not relative to connecting to South Gippsland Water's existing water supply network. Key points to note are as follows:

- **Only groundwater and desalination provide a total water supply solution**. Rainwater, greywater and stormwater can be valuable components of an alternative water supply system, but will not be adequate in isolation because of low reliability and/or high treatment costs to create a potable supply.
- **Desalination viability is relatively invariable**, subject to environmental sensitivities surrounding discharge of the waste stream at individual sites.
- **Groundwater viability is highly site specific**, as groundwater quality and yield vary considerably from site to site.
- **Existing unserviced towns will already have rainwater tanks.** The incremental cost of supplying unserviced towns will be lower if existing rainwater tanks can be utilised as part of the water supply system for these towns.
- **Rainwater, greywater and stormwater can be important source substitution measures for new developments.** The cost effectiveness of introducing rainwater tanks, greywater systems and stormwater systems can be greatly improved if these systems are integrated into the design

of new developments. This requires the Authority to work closely with developers to provide them with appropriate design parameters.

Table 23-2 Summary of relative advantages and disadvantages

Relative performance measure	Alternative supply option				
	Groundwater	Rainwater	Greywater(1)	Stormwater(1)	Local Desalination
Capital cost	Moderate	Low	Low	Moderate	High
O&M cost	Moderate	Low	Low	Moderate	High
Reliability of supply	High	Low	Moderate	Low	High
Energy consumption	High	Low	Low	Low	High
Health risk	Low	Moderate	High	High	Low
Suitability for potable supply	High	High	Low	Low	High

(1) Assumed to be untreated for non-potable use only

Coming up with an integrated solution will need to consider the costs and benefits of each option, as well as combinations of options for each individual town or development. The incremental cost to South Gippsland Water customers associated with the preferred supply option combination will then need to be estimated and consulted upon with the relevant community.

More information on each particular alternative supply option is provided below.

B.2 Bore water

Groundwater has the advantage of being generally cheaper than other supply options if aquifers are located close to towns and because the supply is generally very reliable. Groundwater has historically been a less favoured source of supply for South Gippsland Water because aquifers close to towns are typically low yielding and often have high iron and manganese content which can be difficult to treat as part of a blended supply.

High yielding, good quality aquifers to the east of Yarram (for Greenmount, Robertsons Beach, Manns Beach, Won Wron, Woodside, Woodside Beach and McLoughlins Beach) are already fully allocated within the Yarram Water Supply Protection Area and cannot be accessed without purchasing licences from existing licence holders.

Yields across much of Gippsland can be as low as 15 ML/yr per bore, as documented in SKM (2004) for each of South Gippsland Water's supply systems, indicating that dispersed borefields rather than individual bores would be required at most unserviced towns.

Groundwater supply was considered for supplying the unserviced towns of Sandy Point, Waratah Bay, Yanakie and Walkerville in SKM (2004), which concluded that such a supply would only be financially feasible for the two smaller towns of Yanakie and Walkerville and that there was significant uncertainty surrounding the technical feasibility without further drilling investigations.

Groundwater will continue to be a supply option for servicing small towns from local aquifers and as a drought response measure, but is not considered a feasible alternative to cheaper surface water options in this region of relatively low yielding aquifers.

A groundwater management area has been declared around the Tarwin area despite relatively low groundwater usage in the area. This is because of concerns about seawater intrusion and contamination of regional groundwater by septic tanks at Venus Bay. Appropriate strategies to deal with potential health risks would need to be taken into account in the feasibility of supplying towns in the vicinity of Venus Bay with groundwater.

B.3 Rainwater

Rainwater is used widely in rural Australia for domestic purposes such as drinking, food preparation and bathing. Rainwater can provide a practical way of supplementing a town's water supply as it is a low health risk alternative to reticulated water supply.

The quality of water collected in household tanks is generally understood not to be as consistently high as that provided through a reticulated system[1]. This is because maintenance of the system is the responsibility of householders, who do not necessarily undertake that maintenance regularly or appropriately. Poor water quality has also been linked to the presence of lead flashing on some roofs. There is also a particular risk for sub-surface tanks in which surface run-off can infiltrate into the water supply causing contamination, but these types of tanks are generally rare in domestic applications.

Rainwater tanks are increasingly being used for non-potable use, such as watering gardens and toilet flushing. The Victorian Government's five-star home standards requires new homes to have a rainwater tank that provides water for toilet flushing (or equivalent volumes delivered through communal stormwater or reuse) if a solar hot water system is not included in the design[2].

Rainwater is not recommended as a sole source of water as it is generally not sufficiently reliable. On a national scale, the Bureau of Meteorology classifies annual rainfall variability in South Gippsland as low to moderate, indicating that rainfall has historically been very reliable[3]. Rainfall in South Gippsland in individual years can nevertheless vary considerable. Under dry conditions, rainwater tanks are at risk of failure and residents are likely to require water sourced by other means.

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[1] EnHealth (2004) *Guidelines for the use of Rainwater Tanks*

[2] Watersmart (2006) *Water Supply-Demand Strategy for Melbourne 2006-2055*. Draft.

[3] Bureau of Meteorology (2006) http://www.bom.gov.au/climate/map/variability/VARANN.GIF

B.4 Greywater

Grey water encompasses all household wastewater excluding that derived from toilets and urinals. The quality of greywater varies significantly depending on the source and activity within the household but it can contain microbial pathogens, cleaning solutions and other contaminants. In light of this, it has the potential to be hazardous to human health if not adequately treated.

Although it is possible to treat grey water to a level that is safe for human consumption it is not cost effective to treat it to a level which is suitable for drinking, food preparation, personal washing and spa and pool top-ups[4]. In addition to cost considerations, the human health consequences of treatment failure are potentially high.

The risks associated with use of greywater for laundry trough, toilet flushing, outdoor use, fire-fighting and surface irrigation are classed as medium. Treatment systems must consistently achieve a high standard of treatment due to the potentially high degree of pathogens that may be present.

Greywater is a diffuse source of water, meaning that it is difficult to collect and supply at anything other than a property scale. An example of community greywater recycling is the Bridgewater development in Western Australia, where all greywater from 380 homes is recycled for irrigation. This scheme is effective at a community scale because it was integrated into the design of the new development rather than being retrofitted.

B.5 Stormwater

Stormwater in urban surface water runoff captured from rain events. The quality of stormwater varies according to the source area. Stormwater may contain a variety of contaminants including microbial pathogens, oils and grease, leachate from vegetation and nutrients.

Like greywater it is possible to treat stormwater to a standard suitable for domestic purposes such as drinking and food preparation. This treatment is costly and the risk to human health of failure of treatment is considerable[5]. In light of this the use of stormwater for these purposes is not recommended.

The risk for personal washing, swimming pools and spas, laundry trough and washing machines is classified as medium after treatment[6]. For multiple sites, treatment should include catchment management, storage management, clarification (removal of solids) and disinfection.

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[4] Hyder Consulting (2005) *Alternative Urban Water Supplies- Regulatory Review*

[5] Hyder Consulting (2005) *Alternative Urban Water Supplies- Regulatory Review*

[6] Hyder Consulting (2005) *Alternative Urban Water Supplies- Regulatory Review*

Stormwater has been successfully harvested in the City of Salisbury in South Australia[7]. This particular scheme uses an artificial wetland to capture and treat stormwater, let it infiltrate into groundwater and then later pump that water from groundwater when it is required to meet urban demands.

Applications for residential water use tend to be less favoured than other source substitution options such as rainwater tanks and recycling of treated effluent. Stormwater is typically generated in large volumes over short periods of time and therefore usually needs to be stored if it is to be used for urban use. The cost of storage is greater than most other alternative supply options presented in this paper. Stormwater harvesting at a scale larger than an individual property can also require a third pipe system to deliver the stormwater. Third pipe systems (for recycling of treated wastewater) have been installed for example in the Aurora (Victoria) and Mawson Lakes (South Australia) residential developments[8].

Harvesting stormwater can have water quality benefits to downstream waterways. Ladson et.al. demonstrated a relationship between the amount of impervious area in a catchment with water quality of downstream waterways[9].

B.6 Local desalination of sea water

Desalination is a process which separates dissolved minerals and impurities from sea water, salty water or treated wastewater. Desalinated water is suitable for drinking and food preparation.

The key advantage of desalination is that it uses sea water and therefore is independent of climate variability. This means that is provides a reliable source of water and removes the pressure from existing surface and groundwater sources.

Although the cost of the technologies used in desalination of seawater has reduced significantly it is still a costly option. There are also environmental concerns associated with desalination. In the first instance it is a high energy option and therefore has consequences in terms of greenhouse gas emissions if those energy costs are not offset. In addition, the removal of fresh water means that hyper-saline solution is discharged into the sea. This can have negative consequences for the marine environment and can require costly diffusers extending into the sea over long distances. Desalination package plants of 0.5 ML/d can typically be installed for several hundred thousand dollars, with the costs of disposing of the waste brine stream being in addition to this.

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[7] Hyder Consulting (2005) *Alternative Urban Water Supplies- Regulatory Review*

[8] http://www.goldcoast.qld.gov.au/t_gcw.asp?pid=5894

[9] Ladson et.al. (2005) *Improving Stream Health in Urban Areas by Reducing Runoff Frequency from Impervious Surfaces.* 29th Hydrology and Water Resources Symposium, Canberra, 21-23 February 2005.

Appendix C Nyora Planning Controls

Nyora is located within the Shire of South Gippsland. The South Gippsland Shire Council is responsible for governing the use and development of all land within the municipality. They exercise this governance through zoning. Each zone outlines a specific use that is allowed on the site and the requirements of any development or works. Figure E-1 shows the zones surrounding the township of Nyora.

As can be seen from Figure E-1, the land uses surrounding the township of Nyora are a *Low Density Residential Zone* (LDRZ), a *Rural Living Zone* (RLZ), and a *Farming Zone* (FZ). These zones allow varying levels of density of residential development thus influencing future population growth. Table E-1 outlines the size of lots permitted and the number of dwellings allowed on each lot.

Figure E-1: Zone Map of Nyora Township and Surrounding Land

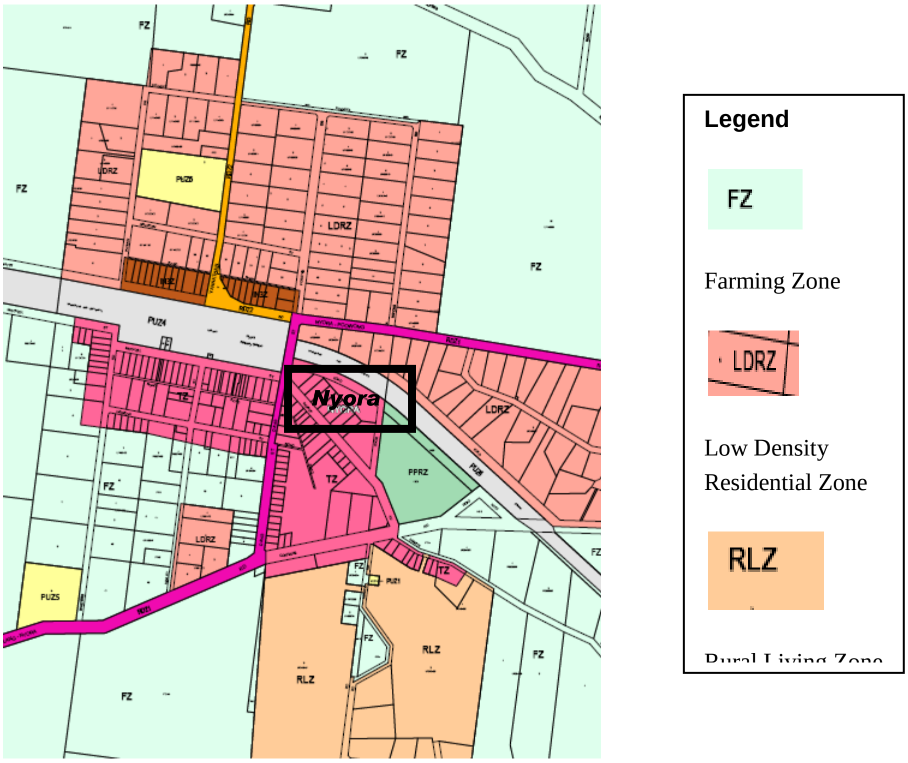

Table E-1: Summary of Density Controls for Relevant Zones

	Density Controls
LDRZ	Each lot must be at least 0.4 hectare. There must be only one dwelling on each lot.
RLZ	Each lot must be at least 8 hectares. There must be only one dwelling on each lot.
FZ	The lot must be at least 40 hectares. There must be only one dwelling on each lot.

Source: http://www.dse.vic.gov.au/planningschemes/southgippsland

Clause 21.02-3 of the *Municipal Strategic Statement* in the South Gippsland Shire Planning Scheme states that there is “a need to plan for housing and facilities to cater for anticipated population growth in the north-west of the Shire” (which includes Nyora). This is relevant as it indicates a willingness to allow additional residential development in the area in the future.

Based on a desktop assessment, it appears that the area surrounding Nyora has already been developed to the full capacity allowed by the existing planning controls. Most lots appear to already have the one dwelling permitted. There may be capacity for a small number of new dwellings in the LDRZ and RLZ, however this number is small enough to not significantly affect future population growth or demand in this town. An amendment to the planning scheme would be required to allow further significant development, which is typically a process which takes 1-2 years to complete.