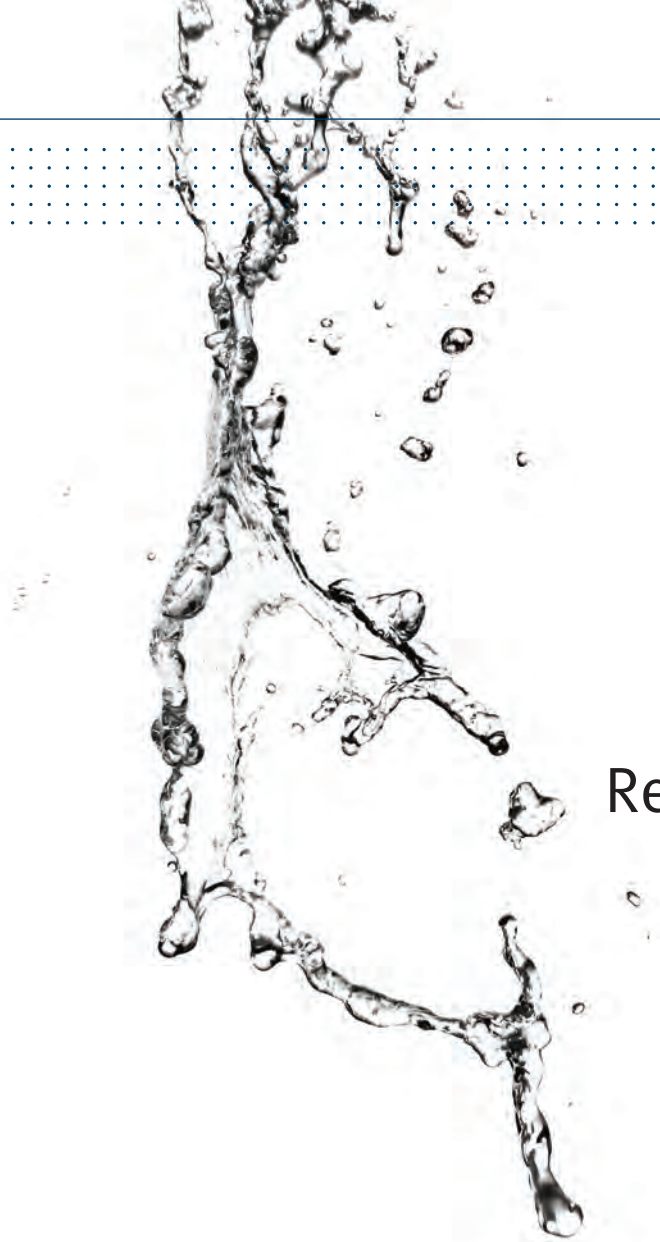

Regional Water Supply Security Assessment

Maryborough

Fraser Coast Regional Council

Wide Bay Water Corporation

Queensland Government

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This publication has been compiled by the Department of Energy and Water Supply.

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Image courtesy Wide Bay Water Corporation

Introduction

Maryborough is a regional city located on the Mary River approximately 255 km north of Brisbane and, along with many other regional centres in Queensland, is expected to continue to experience economic and population growth over the coming decades.

The Queensland Government Statistician's Office (QGSO) estimates the population of Maryborough, including the suburbs of Tinana and Granville, will increase from approximately 27 500 (June 2013) to approximately 33 500 by the mid-2030s.

Safe, secure and reliable water supplies are an essential resource for Maryborough, not only for the health and wellbeing of the community, but also for supporting Maryborough's economic growth and development. A significant agricultural sector surrounding Maryborough also relies heavily on the availability of water for irrigation and other purposes.

Wide Bay Water Corporation (WBWC), which is wholly owned by Fraser Coast Regional Council (Council), provides water and wastewater services to the Fraser Coast, including Maryborough. WBWC currently has in place an active program of Total Demand Management which is designed to reduce water losses from system leakage, while encouraging residents to use less water through financial incentives and free education programs. Fraser Coast residents connected to the reticulation network are now among the lowest water users in Queensland, with a daily residential use of around 200 litres per person.

The Department of Energy and Water Supply (DEWS), Council and WBWC have committed to a partnership to investigate and establish a shared understanding of the existing security of Maryborough's water supply system and its capacity to support future growth.

Arising from this partnership, this Regional Water Supply Security Assessment (RWSSA) provides valuable information to the community and water supply planners about Maryborough's water supply security, thereby providing a foundation for future water supply planning.

The communities of Maryborough and Hervey Bay are very close to each other and have the same water service provider. Maryborough and Hervey Bay have therefore been assessed concurrently, but separately because they have independent bulk water supply sources.

This assessment has considered a number of growth scenarios for Maryborough's population to identify the timing and magnitude of potential water supply risks. The scope of the assessment is limited to the volume of available water and does not address water quality issues that may affect water supplies. It is important to note that information presented in the assessment does not consider any changes to the capacity of the existing water supply system and associated infrastructure.

Water supply sources

Maryborough has two sources of water supply, comprising Teddington Weir on Tinana Creek and supplementary water from the lower Mary River as shown in Figure 1.

Primary water supply source

Maryborough's primary water supply source is the Teddington Weir Water Supply Scheme (WSS) on Tinana Creek, managed by WBWC. Tinana Creek is a tributary of the Mary River.

Water for Maryborough's reticulated network is extracted from Tinana Creek at Teddington Weir. Teddington Weir has a full supply volume of 3710 ML and a minimum operating volume of 400 ML. Water extracted from the weir is treated at the Teddington Water Treatment Plant located alongside the weir.

Upstream of Teddington Weir on Tinana Creek is Talegalla Weir, which acts as an auxiliary storage and has a full supply volume of 385 ML and a minimum operating volume of 0 ML. Tinana Creek from Teddington Weir to the upstream limit of the ponded area of Talegalla Weir forms the Teddington Weir WSS.

Supplementary water source

Water for Maryborough can be supplemented with water diverted from the Mary Barrage, which is part of the Lower Mary River WSS managed by SunWater.

SunWater's Lower Mary River WSS comprises the Mary River from the Mary Barrage to the upstream limit of the barrage's ponded area, as well as the reach of Tinana Creek from the base of Teddington Weir downstream to the Tinana Barrage, and a section of Minni Minni Creek.

Mary Barrage has a storage capacity of 12 000 ML with a minimum operating volume of 5050 ML, and provides water for the upstream township of Tiaro and for SunWater irrigation customers. A diversion channel at Owanyilla can be used to divert water from the ponded area of Mary Barrage to Tinana Creek.

To supplement SunWater's Lower Mary River WSS irrigation customers who extract water from Tinana Barrage, water is pumped from the lower Mary River via the Owanyilla Diversion Channel into Minni Minni Creek. In turn, Minni Minni Creek flows into Tinana Creek just downstream of Teddington Weir, with the water eventually being retained in the Tinana Barrage storage. Tinana Barrage storage provides water for irrigation of sugarcane crops near Maryborough.

To supplement customers in WBWC's Teddington Weir WSS, a 2.5 km long pipeline diverts water from the end of the Owanyilla Diversion Channel to the ponded area of Teddington Weir. This diverted water can be used to supply water to WBWC's irrigation customers who pump from the weir and to supplement urban supplies to Maryborough City when required.

Figure 1 Maryborough's water supply system

Image courtesy Tourism and Events Queensland

Image courtesy Tourism and Events Queensland

Water users and water use

Maryborough's reticulation network

Maryborough's reticulation network currently delivers water to a serviced population of approximately 24 750 people, or approximately 90 per cent of the combined population located within Maryborough, Tinana and Granville*. Maryborough's reticulated system supplies water for residential, commercial, municipal and industrial purposes within these areas. There are currently 8179 ML/annum of high priority (HP) water allocations in the Teddington Weir WSS (Table 1).

Table 1 HP Water allocations in Teddington Weir WSS

Allocation holder	Volume (ML/annum)
WBWC	6819
WBWC	1000
SunWater	360

*Based on the ABS Statistical Area Level 2 boundaries

WBWC's 1000 ML/annum allocation and SunWater's 360 ML/annum allocation can, if necessary, be transferred from SunWater's Lower Mary River WSS into Teddington Weir via the Owanyilla pipeline when water levels in Teddington Weir are low (subject to conditions in the Mary Basin Resource Operations Plan).

Information from the Statewide Water Information Management database shows that the total volume of water sourced for the reticulation network between 2008–9 and 2012–13 ranged between a low of 2650 ML/annum (2011–12) and a high of 3277 ML/annum (2009–10). Based on the total volume of water sourced for the serviced population for that period, the average daily per capita water use was approximately 335 L/c/d (litres per capita per day), while average residential demand was approximately 201 L/p/d (litres per person per day).

The L/c/d water use figures include commercial, municipal and industrial water supplied from the reticulation network which, over the four years from 2009–10 to 2012–13, averaged 671.5 ML/annum (range 639–706 ML/annum), or approximately 28 per cent of the total water sourced for the reticulated system (range 25.8 per cent to 30.3 per cent).

Urban water demand can be impacted by variations in rainfall.

Urban water demand varies annually depending on various factors including climatic conditions such as rainfall, with higher demand usually occurring during drier periods. Maryborough's annual rainfall over the past 143 'water years' (July to June) ranged widely, as shown in Table 2.

Table 2 Maryborough's Rainfall 1872 to 2014 (water years)

Annual average	Historic low	Historic high
1145 mm	510 mm (in 1902)	2317 mm (in 1893)

Maryborough's water use is inversely correlated with rainfall for the five year period from 2008–9 to 2012–13 (Figure 2). Maryborough's rainfall in 2009–10 was particularly low, at 750 mm—only 10 per cent of years within the last 143 years have been at, or below, 750 mm. Maryborough's rainfall for the preceding year, 2008–9, was also below average at 992 mm.

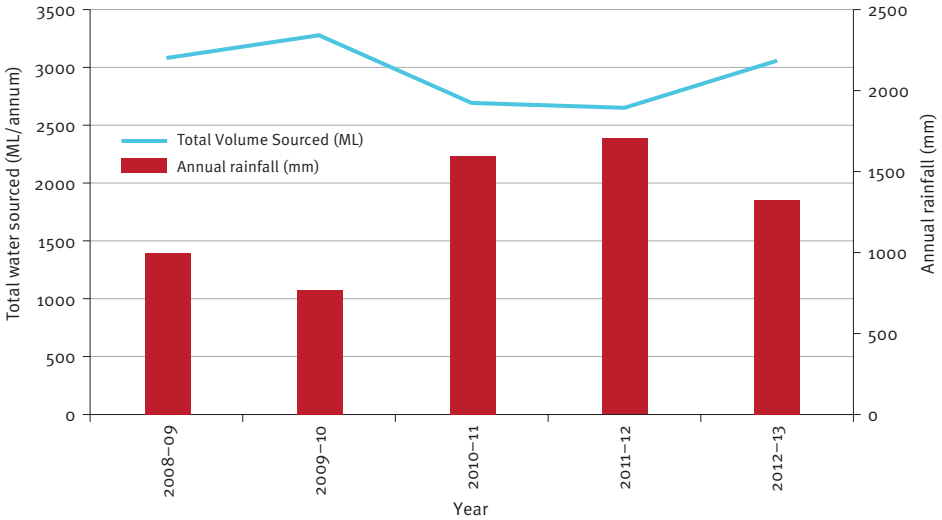

Figure 2 Annual rainfall and total water sourced for Maryborough's reticulation system

Other Users of the Bulk Water Supply Sources

Agriculture

There is currently a combined total of 2690 ML/annum of medium priority (MP) water allocations in the Teddington Weir zone (Teddington Weir to the upstream limits of the ponded area of Talegalla Weir) which provide irrigation water for agriculture.

During times of low water supply, water may also be sourced from the lower Mary River via the Owanyilla Diversion Channel, and an additional 736 ML/annum of MP water may be obtained through water trading with the Lower Mary River WSS.

However, water transfers and water trading are both subject to various conditions stated in the Mary Basin Resource Operations Plan, and the total volume of MP water that can be taken from Teddington Weir is capped at 3426 ML/annum.

Industry and Mining

Although there are industries within Maryborough that use water from the reticulated system (such as Downer, the Maryborough Sugar Factory and CQMS Razer), there are no additional major industries sourcing raw water from the Teddington Weir WSS.

Historical performance of Teddington Weir storage

The simulated historical storage behavior of the Teddington Weir storage, for the period 1978 to 2008 at a demand of 2800 ML/annum, is shown below in Figure 3. Although Teddington Weir has never, historically, run out of water, Figure 3 indicates modelled water levels in the weir falling to low levels on numerous occasions, as the storage volume of the weir is relatively small and relies heavily on seasonal inflows.

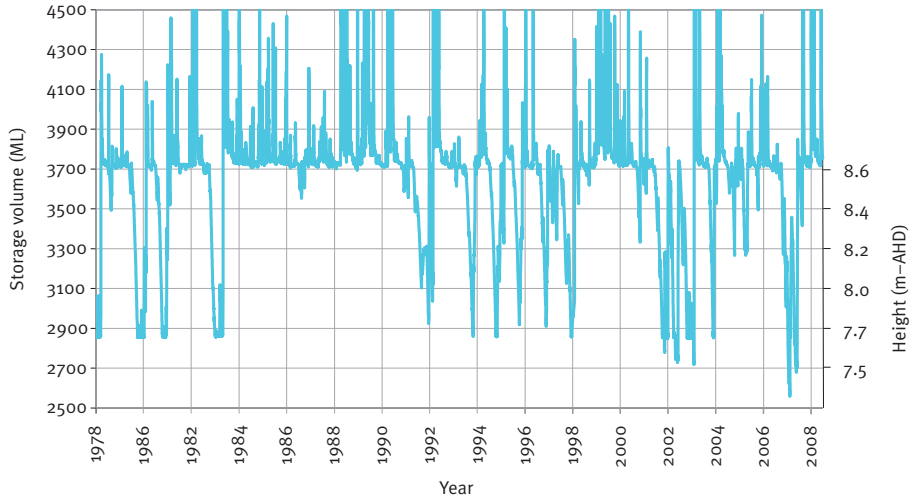

Figure 3 Simulated storage behavior of Teddington Weir

As illustrated by Figure 3, the seasonal inflows not only refill the weir's storage capacity but also frequently exceed the weir's full supply level (3710 ML). However, a reduction in inflows for one or more seasons can drastically reduce water levels in the weir, as can be seen occurring on several occasions.

Future water use

Effective water supply planning must be evidence-based and consider likely, and possible, changes in future water demand.

In developing an agreed forecast of Maryborough's future reticulated water demand, it is essential that the rates of residential water use and the larger volume of water sourced for all use across the reticulated network are identified and agreed upon. These projections will, of course, remain subject to ongoing monitoring of actual population growth and variations in water use trends (e.g. education may reduce consumption).

Maryborough's reticulation network

The current population of Maryborough is approximately 27 500. However, this population figure is predicted to grow to 28 700 by 2021 and to 33 500 by 2036. Consequently, it is expected that the population connected to the reticulated water supply will increase to around 26 650 by 2021 and to 32 400 by 2036.

Information collated for the past 5 years suggests a value of 335 L/c/d represents the average water demand on the reticulated network to support residential water users and associated commercial, municipal and industrial water users. It is important to note that this figure of 335 L/c/d represents average demand, rather than high demand such as may occur during drier periods, and therefore the daily demand level will sometimes be exceeded (e.g. low rainfall conditions leading to higher water demand). However, the use of average demand figures provides a means of directly comparing future demand projections to determine when demand is likely to exceed available supply. For planning purposes, this also means an appropriate balance can be reached between the cost of water supply and the demand for available water.

As previously mentioned, existing water demand from industry is currently met through the reticulated system. Any future growth in this demand is expected to be approximately proportionate to population growth and, as such, growth in demand from industry will be reflected in the growth figures for urban demand.

Image courtesy Wide Bay Water Corporation

Using the growth figures predicted for the residential population of Maryborough and a total water demand figure of 335 L/c/d, Figure 4 shows the projected average total annual water demand for Maryborough's reticulation network.

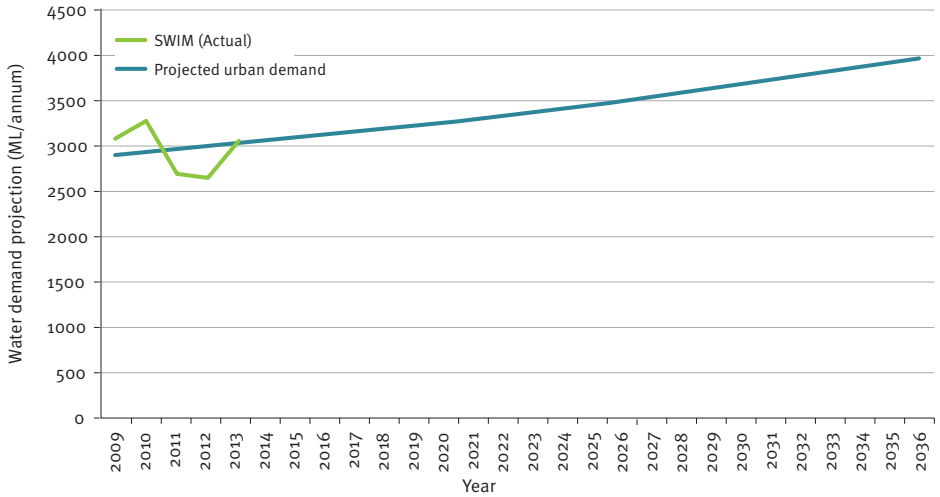

Figure 4 Projected water demand for Maryborough's reticulation network

Figure 4 shows that Maryborough's average total annual water demand is expected to increase by around 30 per cent to approximately 4000 ML/a by the year 2036.

Agriculture

Nearly half of the land use in Tinana Creek catchment is forestry, with around 39 per cent of the catchment planted with pine and supporting the region's forestry industry to meet the current market demand. As such, there is very limited availability of further agricultural land in Tinana Creek catchment. However, a future change in land use from forestry to horticulture or cropping could result in some increased demand for agricultural water from within the Teddington Weir WSS, or its catchment area.

As the volume of water available for agriculture from this system is currently restricted by the volume of MP water allocations available, a change in agricultural land use is not expected to impact on the performance of Maryborough's existing urban supply system. However, a change in land use may see water trading occur more frequently as a means of satisfying increased rural demand and, as mentioned earlier, an additional 736 ML/annum of MP water may be available through water trading with the Lower Mary River WSS.

Industry and Mining

Considerable exploration has been occurring within the Maryborough Basin, and there has been some speculation within the media that Maryborough could soon become a significant mining hub. Such a change could well place significant additional demand on the town's water supply as the population would be likely to increase, the number and productivity of mining-associated industries may increase and water may be required for the mining activities themselves.

However, it should be noted that it is far more likely that bulk water demands for mining activities would be met from sources other than Tinana Creek. For example, SunWater advertise on their website that they still have surplus water available (water allocations for sale or lease) from the lower Mary River. Additionally, the magnitude of any impacts on water demand arising from any new mining activities will very much depend on the exact location and scale of those mining operations.

Therefore, while future mining and/or growth in mining related activity has some potential to place additional demand on Maryborough's reticulated water supply, such demand is likely to be correlated with population figures and would be accounted for through the population projections in this RWSSA.

Nonetheless, the possibility remains that demand for water may grow at a faster rate than currently projected if Maryborough's population grows faster than anticipated as a result of mining developments.

Water Supply System Capability

Maryborough's Water Supply Network

Hydrologic assessments have been undertaken to ascertain the capability of Maryborough's existing water supply system (including existing operational arrangements and water entitlements) to meet current and projected future water demands.

Both historical and stochastic modelling was used to simulate the performance of Maryborough's water supply sources.

Stochastic modelling involves generating data sequences that incorporate key statistical indicators from the historical record. Stochastic modelling accounts for a wider variation of potential climatic scenarios than the historical record. One hundred replicates of 10 000 years of stochastic data were generated for the Teddington Weir and Lower Mary River WSSs. The results were aggregated and the median output used to identify the likelihood of water supply shortfalls for the system. Using the median output means that half of the sequences had a lower likelihood and half had a higher likelihood of an event occurring. The median is used as it is always representative of the centre of the data, whereas the mean (average) is only representative if the distribution of the data is symmetric.

The hydrological assessments assumed that all existing water entitlements accessing the water supply schemes described above were fully developed and operational, with the exception of the water entitlements used to supply the Maryborough reticulation network. Maryborough's demands were represented at various total annual demand levels in accordance with projected growth.

The hydrologic assessments included the application of the water restriction regime for Maryborough's reticulated network as shown in Table 3. In the same way that, under water sharing rules irrigators are no longer permitted to access MP water when the level in Teddington Weir falls below 7.7 m, these water restrictions are designed to reduce HP water demand and prolong the supply capability of the system. When the level in Teddington Weir is below 7.7 m, HP water may also be transferred from Mary Barrage (subject to other conditions in the Mary Basin Resource Operations Plan).

Table 3 Water restriction trigger levels and assumed water demand reduction

Water restriction level	Level in Teddington Weir (m AHD)	Response	Effect on per capita water consumption
Level 1 (permanent)	8.68	Nil	335 L/c/d
Level 2	7.66*	5% target demand reduction*	318 L/c/d
Level 3	7.26*	20% target demand reduction*	268 L/c/d
Level 4	6.56*	40% target demand reduction*	201 L/c/d

*Note: Trigger levels and reduction targets are subject to review and amendment as determined by WBWC from time to time.

Frequency of water supply shortfalls and water restrictions

A water supply shortfall is defined as an event where water supply is unable to meet water demand. Therefore, if water demand is 10 ML for a particular day and, due to limited availability or operational constraints the system is only able to supply 8 ML, this would be identified as a supply shortfall.

Stochastic modelling results indicate that, at current and projected future demands to 2036, Maryborough's reticulation network should not experience a water supply shortfall. These assumptions are based on the assumptions that the restriction regime listed in Table 3 is implemented, and that current patterns of water use and rainfall continue to be experienced.

As indicated earlier, Maryborough's urban water is supplied from the Teddington Weir WSS and can be supplemented from the Lower Mary River WSS. WBWC is developing a revised water restrictions regime, drought management plan and associated policy, which is based on water levels in Teddington Weir, demands and time of year. These restrictions are intended to reduce water use during drier periods and thereby extend the duration of the available water supply.

Figure 5 provides an indication of the likelihood that water restrictions, described in Table 3, could be expected to be triggered for Maryborough's reticulation network.

As illustrated by Figure 5, as Maryborough's water demand increases, the frequency at which trigger levels for water restrictions are reached will also increase, with the consequent potential effects on the community. For example, the average recurrence interval of Level 2 water restrictions (represented by the blue line) being imposed at a water demand level of 2800 ML/annum is 10 years (Point A), whereas at a demand level of 4000 ML/annum it is 8.4 years (Point B), and at a demand level of 7819 ML/annum it is 4.6 years (Point C).

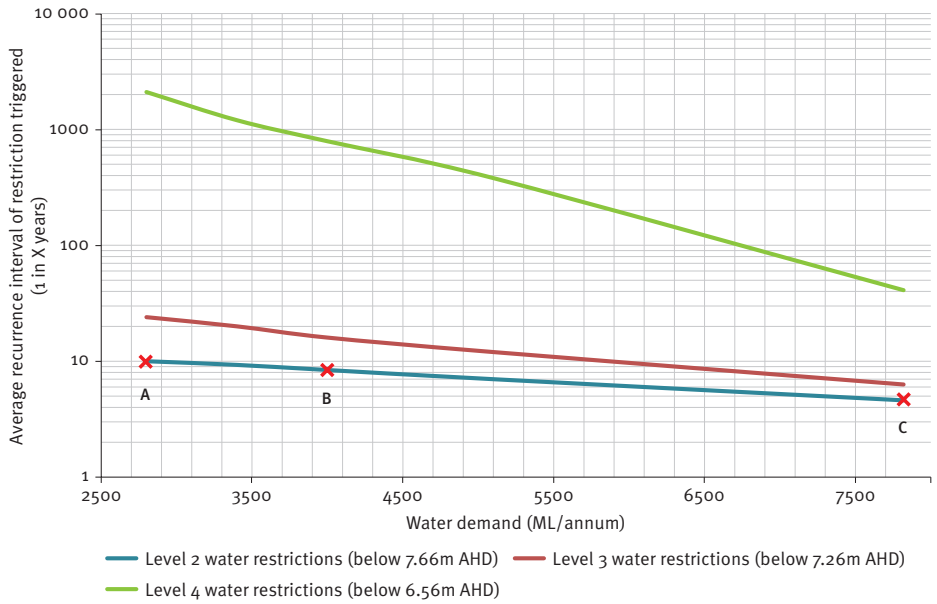

Figure 5 Frequency of water restrictions and supply shortfalls against total annual demand

Considerations such as what is an acceptable frequency of the various restrictions levels being applied, and the underlying likelihood of not being able to meet demand are critical and fundamental parts of the water supply planning currently being undertaken by WBWC and generally by councils across Queensland.

Duration and severity of water restrictions

Although the frequency of water restrictions is an important consideration, the duration and severity of each restriction period may be more important for many water users. For example, it may be more acceptable to experience water restrictions for short durations (e.g. one month) even if they occur more frequently, than to experience water restrictions for longer durations (e.g. three or six months) even if they occur far less frequently. Similarly, experiencing less severe restriction levels that occur more frequently may be more acceptable than experiencing more severe restrictions that occur less frequently.

However, with increasing water demand there is not only an increase in the likely frequency of water restrictions, but there is also an increase in both the likely duration and likely severity ('level') of those restrictions.

Figure 6 shows, for a range of water demand levels, the predicted frequency of level 2 water restrictions lasting for longer than one month, and the relative proportion of those periods that last for longer than three months and longer than six months. It can be seen from Figure 6 that, with an increasing level of water demand, there is not only an increase in the predicted number of occurrences of water restrictions being imposed, but the relative proportion of those occurrences that last for longer than three months and six months is also increased. Figure 7 shows this same effect for level 3 water restrictions.

As with the acceptable frequency of the various restriction levels being applied, the acceptable duration and severity of the restrictions being imposed are fundamental parts of water supply planning. Together, these three aspects of water restrictions (frequency, severity and duration), along with the ability to maintain a minimum supply during drought, comprise the long term reliability of the system and are referred to as the 'level of service'. The level of service for Maryborough is a matter for WBWC and Council to determine, considering factors such as water availability, customer needs, liveability and affordability.

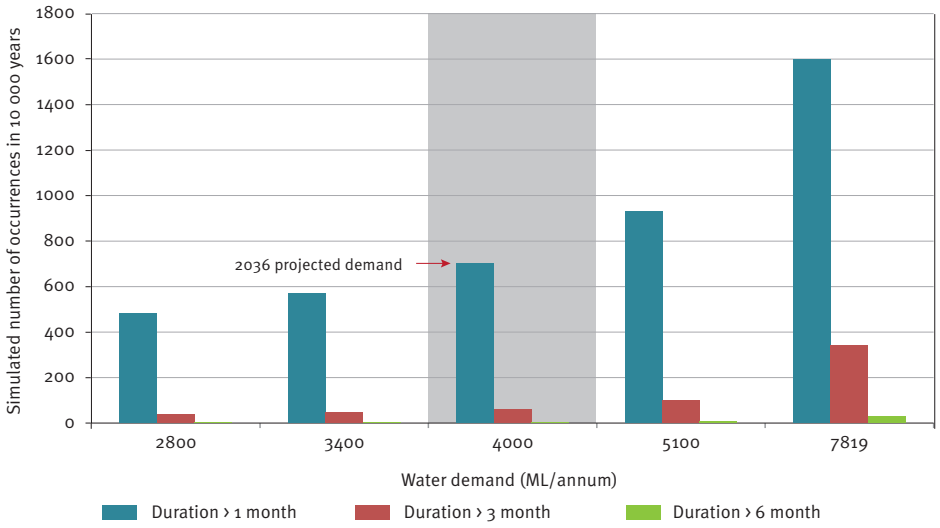

Figure 6 Number and duration of Level 2 water restriction events occurring at various annual water demands.

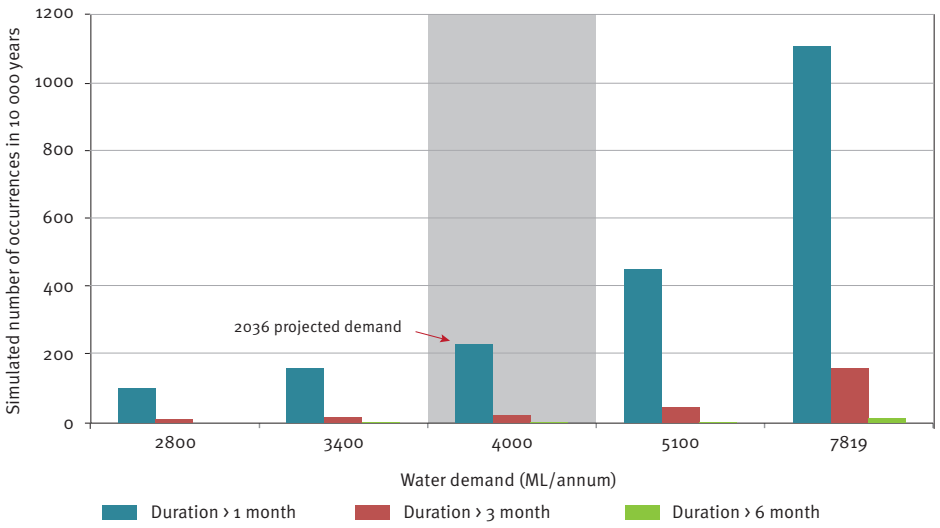

Figure 7 Number and duration of Level 3 water restriction events occurring at various annual water demands.

Moving Forward

The RWSSA represents a collaborative approach between DEWS, WBWC and Council to establish a shared understanding of the existing security of Maryborough's water supply and its capacity to support future growth.

Wide Bay Water Corporation regularly undertakes assessments of the region's water supply security and will continue to do so into the future as a function of the long term planning necessary to support the existing and future populations of Maryborough. The outcomes of these investigations are generally consistent with the findings in this RWSSA. Using the RWSSA, WBWC in conjunction with Council will continue to investigate, develop, and implement solutions to maintain water supply security on the Fraser Coast. Some of the areas of ongoing investigation may include:

- Indirect reuse of water
- Alternative raw water supply sources
- Demand management through optimisation of reticulation system and education
- Off-stream storages and flood harvesting.

The viability of any water supply options will, among other things, consider the economic, environmental, hydrologic and community outcomes, as well as statutory requirements.

Since the current water sources are sufficient for Maryborough's needs until well after 2036, these options will continue to be further assessed and included in WBWC's strategic water supply planning until such time that demand triggers the design and construction of new source options.

To obtain the best operational flexibility from existing sources in the short to medium term, WBWC is investigating the options of:

- linking the Hervey Bay and Maryborough Water Systems together to allow water to be transferred from Hervey Bay to Maryborough and vice versa
- creating a dedicated pipeline from the Mary River to the Teddington Water Treatment Plant.

Wide Bay Water Corporation is also in the process of reviewing its water restriction levels and projected reductions in water consumption as an outcome of the RWSSA. These outcomes will form the basis of drought management policies for the Fraser Coast.

For more information on the
Regional water supply security assessment
please visit www.dews.qld.gov.au

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