Assessing and Increasing Rockhampton’s Water Supply Security

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Abstract:
An abstract with 100-300 words

In recent years, Rockhampton Regional Council has completed an assessment of its water supply security in partnership with the Queensland Government, and has identified opportunities to increase the security of its water supply. This paper describes the recent, current and future work to assess and increase Rockhampton’s Water Supply Security with particular focus on a project opportunity to increase the Full Supply Level in the Fitzroy River Barrage and significantly increase the water supply security of the water allocations within this important storage. When completed it is expected that this project will help to ensure that Rockhampton’s water supply security continues to underpin future growth and development in our region and continue the sustainable use of the valuable water resource provided by the Fitzroy Basin.

Keywords: Water Security, Fitzroy River Barrage, RWSSA

Background
The high likelihood that annual flow events within the 142,000 km² of Fitzroy Basin catchment area achieve an average annual discharge of 5,000 – 6,000 GL is what underpins the water security of our region. Through a combination of long-serving Mayor Rex Pilbeam’s capacity to deliver and the amazing natural resource that is the Fitzroy Basin, Rockhampton is very fortunate to have an abundant and very reliable supply of water sitting behind the Fitzroy River Barrage (Barrage). The Barrage is critical infrastructure for a range of regional water users. Rockhampton Regional Council (Council) owns an allocation of 50,383 ML of high priority water that it accesses from the Barrage storage. A further 11,600 ML of medium priority water is available for a range of holders of relatively small allocations who use this water mostly for agricultural or rural purposes. The Stanwell Power Station accesses its 24,240 ML high priority allocation, held in the Eden Bann Weir, via the Barrage which acts as distribution and storage infrastructure for this water allocation. Although Council and other Barrage allocation holders typically only use just less than half of their combined annual allocations, it is important that we continue to assess and maximise our water security to ensure that the Barrage provides just as much benefit to the community in the next 50 years as it has in the last 50 years!

Assessing Rockhampton’s Water Supply Security

Fitzroy River Water (FRW) collaborated with officers from the Department of Energy and Water Supply (DEWS) to complete a Regional Water Supply Security Assessment (RWSSA) for Rockhampton Regional Council (Council). RWSSA is designed to identify opportunities to increase water supply security and takes a region-wide approach to the assessment. The assessment considered the current and future water supply security for the water allocations held by FRW, other Barrage allocation holders and other allocations. The analysis demonstrated a significant opportunity to increase the Full Supply Level in the Fitzroy River Barrage and maximise the water supply security of the water allocations within this critical storage. Key outcomes of the assessment included an update to the current water security position, an identification of opportunities to increase the Full Supply Level in the Fitzroy River Barrage and an assessment of water security for the water allocations held by FRW, other Barrage allocation holders and other allocations. The assessment also provided an estimate of the cost of increasing the Full Supply Level in the Fitzroy River Barrage and identified potential project partners. The results of the assessment will be used to inform Rockhampton’s Water Supply Security strategy and provide a framework for future water supply security assessments.
in October 2015. The RWSSA described in detail Rockhampton’s water source and supply infrastructure and its current and future water security based on projected growth in population and water demand. A copy of this assessment is available on the Department of Natural Resources and Mines and Energy (DNRME) website.

The RWSSA included detailed analysis of recent, current and future water demand for the Barrage storage to enable relationships between rainfall and water demand to be developed, and to confirm some projections for future water demand based on a range of growth scenarios. Figures 1 and 2 are taken from the RWSSA and provide examples of the information generated through the assessment.

Figure 1. Total volume of water extracted from the Fitzroy Barrage storage (2008-09 to 2013-14)

Figure 2. Rockhampton supply scheme – proposed demand projections
This work also included surveying the bathymetry of more than 40 km of the river channel upstream of the Barrage to accurately calculate the Full Supply Volume then use this volume along with other information to model our water security. A key finding of the survey work was that the Full Supply Volume of the Barrage was calculated to be 74,390 ML and lower than the previously used volume of 81,300 ML. Similarly, the commandable volume for the storage was found to be 49,821 ML almost 10,000 ML less than the previously measured commandable volume of 59,400 ML. It is not clear whether this reduced volume is due to gradual siltation or simply reflects the significantly more accurate survey methodology used in 2014 compared to the previous survey completed in 1998. It is possible that both these factors have contributed to the measured differences.

Stochastic modelling to calculate the water security of Council’s water allocation was performed using the IQQM model without the inclusion of the as yet undeveloped Rookwood Weir or the implementation of water restrictions to generate a baseline assessment of current water security. Water security modelling results in the RWSSA for the Barrage can be summarised as follows:

- At current demand (Council, Stanwell, medium priority users) without restrictions the Barrage level would be at minimum operating level and cause a supply failure on average about 1 in every 108 years.
- At full demand (i.e. full utilisation of allocations by Council, Stanwell, medium priority users) without restrictions the Barrage level would be at minimum operating level and cause a supply failure on average about 1 in every 24 years.

Figure 3 taken from the RWSSA shows the occurrences in a 10,000 year period where the Barrage storage level is beneath the minimum operating level at a selection of different demand scenarios.

Figure 3. Stochastic modelling simulation for a range of demands of the occurrence and duration of the Barrage storage level decreasing to beneath the minimum operating level and leading to a water supply failure.
Increasing Rockhampton’s Water Supply Security

Given that the modelled water security does not include the implementation of water restrictions to limit water use and conserve remaining supply, it can be considered that for a regional centre, at current demand, Rockhampton has a relatively secure water supply. Nonetheless, the projected future increase in water demand from the Barrage as well as increased demand due to the development of future water infrastructure in other parts of the Fitzroy Basin will result in gradual decreases to this level of water security over the coming years. In order to at least retain the current level of water security for the future, Council considered a range of options to increase its current water security.

The usual strategies such as improving demand management, reducing water distribution system losses, water-wise education and awareness programs remain a high priority for FRW. In addition to these strategies, FRW focused on options associated with maximising the use of the Barrage for improving water security. These options included potential changes to infrastructure to enable extraction of water from beneath the minimum operating level (i.e. accessing the Barrage dead storage) and also the potential raising of the Full Supply Level (FSL) of the Barrage storage by augmenting and altering the operation of the Barrage. Options associated with the Barrage storage were seen as particularly favourable options given the apparent downgrading of the Fully Supply Volume and Commandable Volume identified during the recent bathymetry survey work. As such, the Barrage Gate Raising Project opportunity has advanced over the last 1-2 years and is explained in further detail below.

Raising of the Barrage Full Supply Level

In December 2015, Council adopted recommendations to investigate options to change the Barrage structure (gates or sill) that could potentially lead to an increase in the FSL and therefore provide an increased storage volume. Close inspection of the existing Barrage gates and structure identified an opportunity to achieve a potentially cost-effective augmentation of the existing Barrage to enable the FSL to be increased from the current 3.78 m AHD to 4.28 m AHD and possibly increase the storage volume by almost 10,000 ML. Funding was subsequently allocated to this project in the 2016-17 and 2017-18 Council Budgets. Following this FRW engaged GHD to assess and confirm the feasibility of this increase to the Barrage gates and FSL.

The feasibility work was mostly completed by early 2017 and some early results communicated to the Qld Government as part of correspondence associated with the Rookwood Weir project and the potential for negative impacts of the Rookwood Weir on Rockhampton’s water supply security. The feasibility work identified the need to complete a Failure Impact Assessment (FIA) based on the current and possible future increased FSL to assess the potential for any downstream impacts that would require the Barrage to be considered as a referable dam and be regulated under the Water Supply (Safety & Reliability) Act. The FIA and remaining parts of the feasibility study were completed in the first half of 2018 with the Barrage not considered a referable dam. This finding was communicated to the Dam Safety Regulator accordingly.

Since completion of the above studies, FRW has collaborated with counterparts in DNRME and DES to complete further modelling to quantify the potential increases in water security associated with increases to the Barrage FSL under a range of demand scenarios. The historical modelling was undertaken using a simulation period from 1895 to 2015 (which includes the 1902 extreme drought year), again without the inclusion of the Rookwood Weir to test scenarios based on permutations of
different levels of demand, storage operating regimes and water restriction regimes to assess water security.

The modelling completed to date shows the significant benefit of increasing the Barrage FSL to 4.28 m AHD when combined with an appropriate restriction regime. Rockhampton’s water security at full utilisation of its allocation is effectively doubled (i.e. halving the frequency for a supply failure from a 1 in 53 year event to a 1 in 107 year event) when the Barrage commandable volume is increased by approximately 10,000 ML. The severity (duration) of this less frequent supply failure is also reduced significantly.

Current and Future Project Steps

FRW is currently continuing its engagement with GHD to complete the detailed design for the modifications to the Barrage gates and associated structure. In parallel to this work being completed, FRW is working closely with the Qld Government through an approvals process to ensure that the project complies with requirements under the Water Act (e.g. environmental flow objectives, operation of the fish passage, bank slumping, storage operating rules) as well as ensuring other approvals are obtained as required for the project to proceed to construction.

FRW is also committed to addressing any concerns or impacts that the project might have on upstream environmental values or stakeholders such as landholders and other water users who access water from the Barrage storage. Preliminary mapping work to assess any potential for inundation of areas outside of the current Barrage pondage shows that the vast majority of the increased volume will be contained within the existing river channel. Field work will be conducted to verify the findings of the preliminary inundation mapping and following this, consultation with key stakeholders for this project will commence within the coming months as the detailed design and approvals process progress to completion.

Through the completion of the project work to date, it has been identified that a very important secondary benefit of the raising of the FSL is the mitigation of risks associated with forecast future sea level rise and the potential for the estuary to overtop the existing Barrage gates or infiltrate through to the upstream freshwater when a favourable hydraulic gradient exists during storage drawdown.

Conclusion

The RWSSA was a very effective process for assessing Rockhampton’s water supply security and led to the identification of an excellent project opportunity to maximise the use of the Barrage to increase Rockhampton’s water supply security. With a total project cost estimate of less than $1 million, represents a very cost effective means to increase the Barrage FSL by almost 10,000 ML and double Rockhampton’s water supply security. At the project work continues, and approvals are obtained, the timing for the completion of construction and the commencement of any changes to the FSL will be confirmed and communicated accordingly to enable this water security increase to be realised.

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References