FITZROY RIVER WATER – RESOURCE OPERATIONS PLAN & CYANO BACTERIA MANAGEMENT

Paper Presented by:

Joshua McKenzie

Authors:

Joshua McKenzie, *Strategic Engineering Manager*,
Michael Dalton, *Treatment Superintendent,*
Mark Percy, *Scientific Officer*,

Fitzroy River Water

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RESOURCE OPERATIONS PLAN & CYANO BACTERIA MANAGEMENT

Joshua McKenzie, *Strategic Engineering Manager*, Fitzroy River Water
Michael Dalton, *Treatment Superintendent*, Fitzroy River Water
Mark Percy, *Scientific Officer*, Fitzroy River Water

ABSTRACT

This paper describes the operational and monitoring requirements for Rockhampton City Council (Fitzroy River Water) as Resource Operations Licence holder for the Fitzroy Barrage Water Supply Scheme and their subsequent implementation during the 2004/2005 water year.

KEY WORDS

Water Resource Plans, Resource Operations Plan, Resource Operations License Holder, Cyano Bacteria

1.0 INTRODUCTION

Rockhampton City Council (RCC) has been providing treated water to the residents of Rockhampton and surrounding districts since 1926, with the construction of the Fitzroy Barrage in 1970 further enhancing the Councils position in regard to regional water supply issues.

Prior to the Water Act 2000 coming into force Fitzroy River Water (FRW), as a commercialised Business Unit of RCC, had limited responsibility for the management of the Barrage storage but with the introduction of the Fitzroy Basin Resource Operations Plan in 2004, these roles were significantly increased.

2.0 WATER RESOURCE MANAGEMENT IN QUEENSLAND

In the past 10-15 years, as the vulnerability of our water resources becomes more and more apparent, there have been some very significant changes made to the way water in Australia is managed.

The significance of these changes can be seen across the entire spectrum from national policy initiatives right through to the operational paradigms under which storages and river flows are now operated on a day to day basis.

Although some time in the making, this structured reform process has essentially evolved from the *Water Resource Policy*, which was endorsed by the Council of Australian Governments (COAG) (DNRM, 1999) in 1994. The Water Resource Policy was primarily a response to the serious degradation that was occurring to the nation's water resources and the realisation that, among other things, the highest and best value use was needed to be made of an increasingly scarce and essential resource

In Queensland these changes have been facilitated by the introduction of the Water Act 2000, which required Water Resource Plans (WRP) to be developed.

The WRPs set out certain objectives that will ensure the long-term sustainable use of our waterways and satisfy environmental, social and economic considerations. The Resource Operations Plan (ROP) is the supporting tool used to achieve the objectives set out in the WRP's and this document is where the implementation and operational requirements are addressed. For FRW the specific ROP is the Fitzroy Basin Resource Operations Plan, which came into effect in January 2004.

3.0 FITZROY RIVER WATER RESPONSIBILITIES

Under the Water Act 2000, RCC have been granted a Resource Operations License to operate and manage the Fitzroy Barrage Water Supply Scheme.

The Barrage Water Supply Scheme has an area of influence from the Barrage (59.6km AMTD), to the upstream limit of the Barrage Pondage (115.0km AMTD). As a condition of this licence there are a number of monitoring, operational and reporting requirements that need to be addressed.

The storage has a nominal capacity of 80,000ML and supplies around 200 medium priority allocation holders (irrigators) with annual allocations of 12,345 ML/a as well storing RCCs 50,000 ML high priotity quota.

Working in conjunction with Eden Bann weir, approx 143 km AMTD, the barrage also supplies the Stanwell Power Station with an annual 24,000ML allocation to service the coal powered generators.

This paper describes the key monitoring and operational requirements for Fitzroy River Water as Resource Operations Licence holder for the Fitzroy Barrage Water Supply Scheme, which came into effect in July 2004 with the introduction of the Fitzroy Basin ROP.

4.0 OPERATIONAL REQUIREMENTS

As the barrage is essentially a barrier to separate the fresh and saltwater sections of the river, prior to the approval of the ROP, the Fitzroy Barrage was essentially operated to maintain water level at a predetermined height and allow releases or restrict flows as required. While the key intention of the ROP is also to satisfy these requirements there is added recognition of environmental flow requirements, which need to be met.

4.1 Releases from storages

The ROP specifies certain operating requirements for the Barrage storage that need to be considered when determining what releases need to be made and when they are required.

These release rules as specified in the ROP are summarised in Table 1. The rules were developed using complex hydrological models and taking into account ecosystem function and the need to ensure adequate supply reliability for the customers served by the system.

Table 1: ***Release rules for the Fitzroy Barrage Water Supply Scheme***

Release Rule	Details
Barrage above full supply level	Once full supply level (FSL) in the Barrage is reached, with the use of a SCADA (Supervisory Control and Data Acquisition) system Barrage gates (18 gates 12m wide x 3.3m high) operate automatically to maintain this level and in effect serve to mimic inflows to the system.
Fishway management strategy	A vertical slot fish ladder has been constructed on the southern bank of the River and must be operated when the water stored in the Barrage is above 3.2m AHD.
Base flow management strategy	The ROP specifies that when: Inflows to Edan Bann Weir exceed 220ML/d but are below 350 ML/d and the barrage level is above 2.3m AHD, a base flow equivalent to the volume entering Edan Bann must pass the Barrage. Or when Inflows to Edan Bann Weir exceed 350 ML/d and the barrage level is above 2.3m AHD, a base flow of 350ML/d must pass the Barrage. The plan allows for a 48-hour delay for the commencement and cessation of any release required under the strategy.

Figure 1 presents a graphic of the various release rules that applied during the initial year of implementation of the ROP, along with the prevailing flow conditions in the storage, which was the 2004-2005 water year from July 2004 to June 2005.

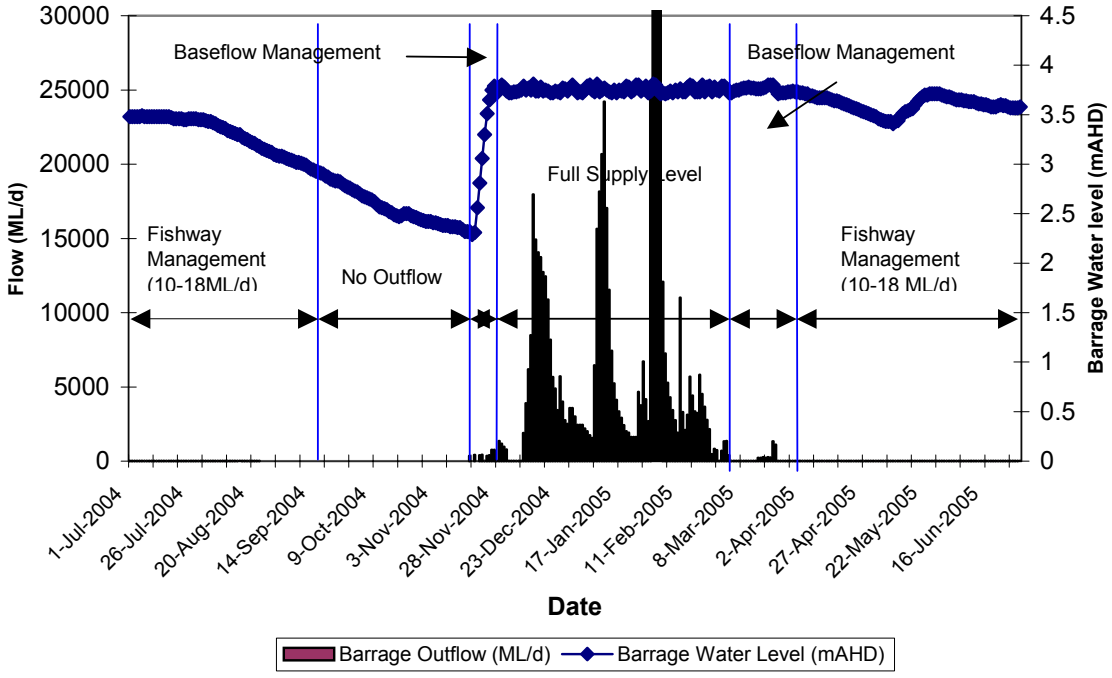

Figure 1: ***A Summary of Release Rule Implementation/Application During 2004/2005***

5.0 MONITORING REQUIREMENTS

5.1 Stream Flow and Height Data

FRW are required to record continuous time series height and flow data for four locations on the Fitzroy River. As previously there was no requirement to accurately measure the inflows and outflows of the storage these methods were required to be sourced and approved by the Queensland Department of Natural Resources and Mines. A number of existing gauging stations were utilized for stream flows but a calculated rating was required for measurement of smaller releases especially in relation to the base flow management strategy. This task was further complicated by the tidal influence downstream which can get to <200mm of full supply level.

These sites and the approved methods of measuring flows/heights are listed in Table 2.

Table 2: ***Time series height and flow data requirements***

Location	Site Measured	Method
Fitzroy Barrage Inflow	"Wattle bank" gauging station (139 km AMTD)	Sun Water Online Website
Fitzroy Barrage Storage	Water level at the Barrage (59.6 km AMTD)	Storage level above sill is recorded as part of the SCADA system.
Fitzroy Barrage Outflow	Barrage gates and fish way (59.6km AMTD) "Wattlebank" gauging station	<1000 ML/d (Flows calculated from weir/orifice formulas) > 1000ML/d (use "Wattlebank" Data)
Edan Bann Storage Inflow	"Riverslea" gauging station (276 AMTD),	Height data sourced daily from a data logger at the DNRM gauging station, which is then converted to daily flows.

5.2 Water Quality

FRW are required to take monthly samples (at least 3 weeks apart) that represent the Inflow to the Barrage (Between "Wattle bank" gauging station (139 km AMTD) and the upper limit of the Barrage), Barrage Storage and Barrage Outflow, with samples taken on the same day.

Prior to the ROP implementation, while raw water parameters were monitored for operational control, no regular analysis of water quality was required. Due to the distances between sample sites and the accessibility of certain sampling locations this process usually requires two people for the best part of six hours.

Parameters that need to be recorded for each location include temperature (Temp), dissolved oxygen, pH, electrical conductivity (EC), Total Nitrogen (TN) and Total Phosphorus (TP) with Sulphide also needing to be monitored in the Barrage Outflow. TN, TP and sulphide are sampled and analysed at registered laboratories while the remaining parameters are gathered with a Hydrolab Minisonde sampler.

The locations of these sampling sites are listed in Table 3.

Table 3: *Water Quality Sampling Locations*

Location	Site Description	Km AMTD
Fitzroy Barrage Inflow	"Wattlebank" station.	139km AMTD
Fitzroy Barrage Storage	Immediately adjacent to GWTP intake structure	64 Km AMTD
Fitzroy Barrage outflow	Fish ladder intake or as appropriate during high flows	59.6 km AMTD

5.3 Monitoring of Bank Slump and Erosion

FRW were originally required to inspect banks in the ponded area of the Barrage storage for evidence of collapse and/or erosion to determine if any instances of instability could be attributed to the operation of the Fitzroy Barrage. At a minimum these inspections were to be carried out quarterly (July, October, January, April) and a program was developed to carry out inspection of the Barrage using a boat and documented video footage.

Subsequent changes in the ROP early in 2006 have meant these inspections are now to be carried out after rapid water level changes or large flows.

5.4 Management of Cyanobacteria in the Fitzroy River Barrage Storage

The ROP specifies in broad terms that FRW are required to monitor Cyanobacteria (Blue Green Algae) in the storage on a "regular basis". While the ROP is not overly prescriptive, monitoring of blue green algae has been standard practice for many years due to the Barrages susceptibility to blooms and the need to ensure the quality of potable water supplied. As such, with the aid of DNRM guidelines, comprehensive monitoring protocols have been established.

Blooms of Blue-Greens are driven primarily by light penetration of the water column and water temperature which is strongly influenced by seasonal variations in river turbidity which varies depending on rainfall location within the vast Fitzroy catchment.

Surveys will usually begin after mid-winter, as the storage may also be prone to blooms of green algae, predominantly Eudorina and Dinoflagellates in the colder months. Seven sites are monitored for Water Temperature, Turbidity and Secchi depth as well as general climatic conditions with the first site slightly north of the old intake at Yaamba, 40+ kilometers north-west of the present location of the Glenmore Water Treatment Plant.

These sites are reflective of the needs of the river users, including irrigators, major industrial usage, potable water and recreational pursuits.

5.5 Prevalent Species of Cyanobacteria in the Barrage Storage

Cyanobacteria species found in the storage are both colony forming and bloom forming. The colony forming species are predominantly Gleotrichia spp., Nostoc spp., and Cylindrospermum spp.

Prevalent bloom forming species are the Anabaena spp., Aphanizomenon spp., Anabaenopsis spp., Psuedanabaena spp. and Cylinderospermopsis, with major blooms of

Anabaena circinalis predominant earlier in the season.

With increasing water temperature, blooms of Cylinderospermopsis raciborskii tending to increase in the warmer months of October, November and December. Cyanobacteria blooms can be potentially hazardous to recreational users of the Fitzroy, in cases of accidental ingestion and dermal contact. Although bloom forming species which are present in the storage are known to be potential toxin producers, historically species in the Fitzroy are generally found to be non-toxic. Problems arise in potable water treatment due to tastes and odours imparted to treatable water during processing.

While algae cells can be removed as part of the overall flocculation process, tastes and odours can be removed by physical adsorption, involving dosing water with powdered activated carbon.

6.0 DISCUSSION

The introduction of the ROP in 2004, and the resulting monitoring and operational requirements, placed an additional demand on available resources at a time when regulatory monitoring from all areas is on the rise. Combined with relatively broad definitions in the ROP, which was formulated to satisfy an extremely large and diverse river system, the implementation required the development of dedicated procedures which attempted to clearly define what was required.

While there were a number of minor interpretation and communication issues the transition to the new responsibilities has been relatively smooth.

Unlike larger multi year storages, due to the nature of the Barrage pondage there is limited opportunity for the management of the storage and its operation to influence the quality of water released. As the Barrage storage is small, compared to the annual flow in the River, water essentially passes the storage as per the natural flow in the system and monitoring and operational requirements need to address this issue.

7.0 CONCLUSION

As the sustainable use of water resources gains more and more public attention the management requirements of water service providers will continue to be a dynamic issue for the short to medium term with more changes likely in the future. As with the implementation of all new systems clear communication between regulators and operators will aid the process with any outstanding issues ultimately fine tuned over time.

8.0 REFERENCES

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