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THE GOULBURN BROKEN WATER QUALITY STRATEGY 20 YEARS ON

Presenting outcomes of long term nutrient management in a large Victorian catchment

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BACKGROUND

The Goulburn Broken Water Quality Strategy (WQS) *(GBREWQC, 1997)* was originally developed in the mid 1990s. Strategy implementation was expected to occur over 20 years, finishing in 2016. Implementation has been under way since the mid 1990s. The 1996 version of the WQS was reviewed in 2002 and 2008. The original Strategy focused on reducing the risk and impacts of blue green algal blooms by reducing the inputs of nutrients, especially phosphorus, to waterways and water bodies.

Many of the actions in the WQS were incorporated in the Goulburn Broken CMA Regional River Health Strategy 2005 – 2015 (now updated as the Goulburn Broken Waterway Strategy 2014 – 2022) *(GB CMA, 2014)*.

The Goulburn Broken Catchment Management Authority (GBCMA) undertook a review to assess WQS progress. This review was undertaken with key partners as the strategy sunsetted in 2016. Catchment conditions have changed substantially since the mid 1990s and these changes suggest that modifications in the approach to water quality management may be warranted.

ABOUT THE CATCHMENT

The Goulburn Broken Catchment covers 2.4 million hectares, extending north from the Great Dividing Range, near the outskirts of Melbourne, to the River Murray on the border with New South Wales. The Catchment boasts a diversity of landscapes, including seasonally snow-covered alps, forests, granitic outcrops, gentle sloping plains, box woodlands and red gum floodplains.

Average annual rainfall varies across the Catchment, from 1600 millimetres in the high country to 400 millimetres in the north-west. The catchment's two major river basins (Goulburn and Broken Rivers) cover two per cent of the Murray-Darling Basin, or about 10.5 per cent of Victoria.

Water inflows to the catchment are 3,559 gigalitres per year, or about 11 per cent of the total annual inflows to the Murray-Darling Basin.

Approximately one third of the catchment is forested and half is used for dryland agriculture (grazing and cropping) with the balance largely used for irrigated agriculture. There are relatively small urban areas and pine plantations. Urban and peri-urban areas are growing, especially in the south of the catchment.

Natural resource-based industries underpin the catchment's economy. Livestock, dairy, fruit, vegetable, grape and other food production and processing contribute to the $15.9 billion gross regional output (2009 figures) with a gross value of agriculture production in the Catchment in 2009–10 of $1.16 billion.

THE WATER QUALITY STRATEGY 1996

In the mid 1990s the community and stakeholder driven Goulburn Broken Water Quality Working Group (WQWG) and the region's River Environment and Water Quality Committee coordinated development of a water quality management strategy focussing on the management of nutrients for the Goulburn Broken Catchment *(GBREWQC, 1997)*.

This catchment was one of three high priority catchments targeted by the Murray Darling Basin Ministerial Council's Algal Management Strategy *(MDBMC, 1994)* to develop and implement catchment management strategies addressing algal and nutrient problems. The need for water quality management strategies was driven by the occurrence of blue green algal blooms on the Darling River. In the Goulburn Broken catchment blooms of blue green algae at Lake Mokoan (now the Winton Wetlands) were widely reported.

The main target of the WQS was to reduce potential catchment phosphorus loads delivered to the River Murray by 65% by 2016 with a number of objectives and related actions identified to deliver on this target.

THE 2016 REVIEW

The WQS was prepared to cover the period 1996 to 2016. It has been regularly reviewed since 1996 and the GB CMA took the opportunity for a final review *(Feehan Consulting, 2016)* during its last year of implementation. It is highly unusual for such a strategy to be implemented over such a long time. The 2016 review looked at the program logic, nutrient sources and export, works achieved, water quality changes and sought to update thinking about implementing and improving approaches to such strategies over time to guide the direction for water quality management in the catchment into the future.

OBJECTIVES/GOAL

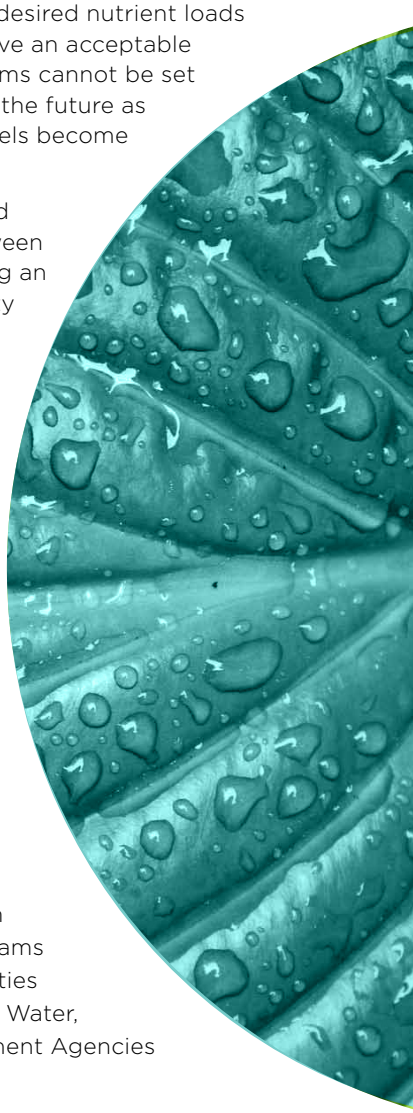
Overall the program logic of the strategy remains sound, although some updates are necessary.

The 2016 review updated the water quality goal and objectives:

Goal - Improve, or maintain, water quality to optimum levels within and downstream of the catchment for environmental, social and economic benefits.

Underlying **assumptions** have been reviewed and are now expressed as:

1. Water quality in terms of nutrients (including nitrogen) will be enhanced if phosphorus levels can be reduced and managed
2. The implementation of Best Management Practices through this strategy will lead to a reduction in nutrient levels and therefore in the risk of blue green algal blooms. Better water quality will also improve river health
3. It is appropriate to set an overall target for nutrient loads even though desired nutrient loads and concentrations to achieve an acceptable risk of blue green algal blooms cannot be set (although this may occur in the future as better information and models become available)
4. It is now formally recognised that there is a time lag between undertaking work and seeing an improvement in water quality or river health.



IMPLEMENTATION AND ENGAGEMENT

In recent years, the WQS was been considered part of the CMA's Regional Waterway Strategy *(GB CMA, 2014)*. This is appropriate given good water quality is one component of a healthy waterway and healthy waterways underpin many of the Catchment's environmental, social and economic values.

WQS implementation has occurred principally via the CMA's River and Wetland Health and Sustainable Irrigation Programs together with partnership activities undertaken by Goulburn Murray Water, Goulburn Valley Water, Government Agencies and Local Government.

A substantial program of works has been implemented. In dryland areas 818 km of stream buffers have been established; in irrigation areas 3,475 water reuse systems and 34 high flow storages have been installed and a number of wastewater management facilities have been upgraded.

Over time, several models for stakeholder engagement have been implemented, but none has been entirely satisfactory. Engagement is relatively simple during the strategy preparation phase, when there is high interest and focus, but it becomes difficult to maintain interest over a long implementation period. Interest, particularly from the public, tends to have short term focus around particular events, for example blue green algae or hypoxic blackwater.

Currently water quality coordination across the catchment is achieved through the Goulburn Broken Water Quality Coordination Group (by GB CMA), comprising representatives of appropriate agencies and municipalities. The Coordination Group has been involved in the Strategy Review.

In the Goulburn Broken catchment water quality contingencies (for example, responding to drought or the effects of wildfire) are managed in a partnership approach. This approach was endorsed in the Victorian Waterway Management Strategy *(DEPI, 2013)*.

ENVIRONMENT CHANGES

Over the 20-year period of WQS implementation numerous changes have affected nutrient delivery to waterways, including:

- Drier climate
- Wastewater treatment plants discharging to land rather than to stream
- Very large reduction in irrigation water availability and subsequent focus on water use efficiency
- Steady increase in urbanised area, and a likely very large increase in urban area in the south due to Melbourne expansion
- 20 years of catchment and waterway management activities (for example 818 km of streamside has been fenced)
- Knowledge, education and best practice development and adoption.

NUTRIENT EXPORT

The original Water Quality Strategy was based on a small water quality data set spanning two to three years. We now have access to 25 years of relevant data. Analysis of the quantum and timing of nutrient loads (Figure 1) in catchment streams indicates:

- Nutrient loads were very high in the early 1990s (due to wet climate and associated high stream discharges)
- There were very low nutrient loads during the Millennium drought of the mid 2000s
- High nutrient loads are associated with high flow events
- Loads can be highly variable from year to year and within years (i.e. they are event driven)
- The catchment goal of a 65% reduction in TP (Total phosphorus) export from the catchment is close to being realised, although this is probably in part due to low loads associated with low flows as much as nutrient management work within the catchment
- It is probably more realistic to expect water quality improvements, and for management to have an impact, in times of "low" flow than in times of "high" flow or during storm events.

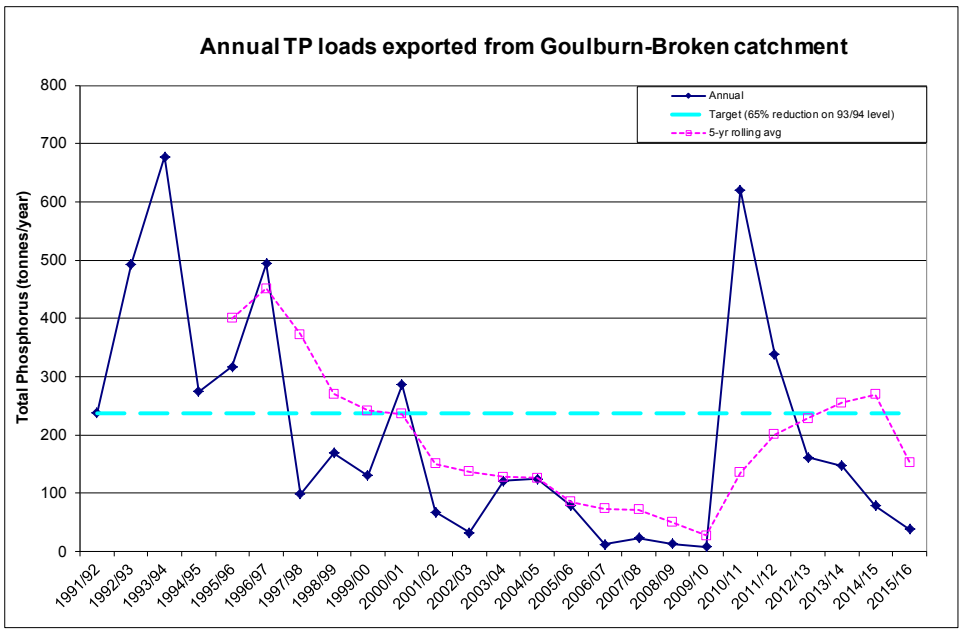


Figure 1. Total Phosphorus (tonnes) exported from Goulburn Broken catchment *(G-MW, 2016)*

The original WQS was prepared during a wet climate period. We are now in a drier climatic period. Set and forget management approaches are not appropriate, but rather resilience and adaptation pathways approaches to water quality management are now needed. These require regular review and improvement activities and, if necessary, resetting approaches, based on current knowledge, in a partnership approach.

WATER QUALITY CHANGES

Current and past estimates of nutrient loads discharged to waterways are shown in Figure 2. This shows that, since WQS implementation began:

- Wastewater treatment plants are no longer a major nutrient source in the catchment
- Irrigation drainage contribution has reduced substantially
- The ratio of irrigation drain to dryland source has changed, such that dryland is now the major nutrient source (in 1996 the ratio of irrigation to dryland was 1.5; in 2016 it is 0.5)
- Loads from intensive animal industries and urban stormwater are unlikely to have changed much over time.

(Note: The apparent increase in nutrient load from the dryland is due to improved estimates; 1996 estimates were made with two to three years of data; 2016 estimates used 25 years of data).

Assessment of water quality against objectives in the State Environment Protection Policy (Waters of Victoria) shows a slight improvement in the number of sites that do not meet water quality objectives. Total Nitrogen, Total Phosphorus and turbidity are the parameters most frequently in excess of objectives.
Decommissioning of Lake Mokoan in 2009 has caused a major improvement in water quality in the Broken River, Broken Creek and, probably, the Goulburn River at Shepparton. For example, in the Broken Creek at Katamatite, the long term 75th percentile turbidity is 145 NTU, but over the past three years it is just over 10 NTU.

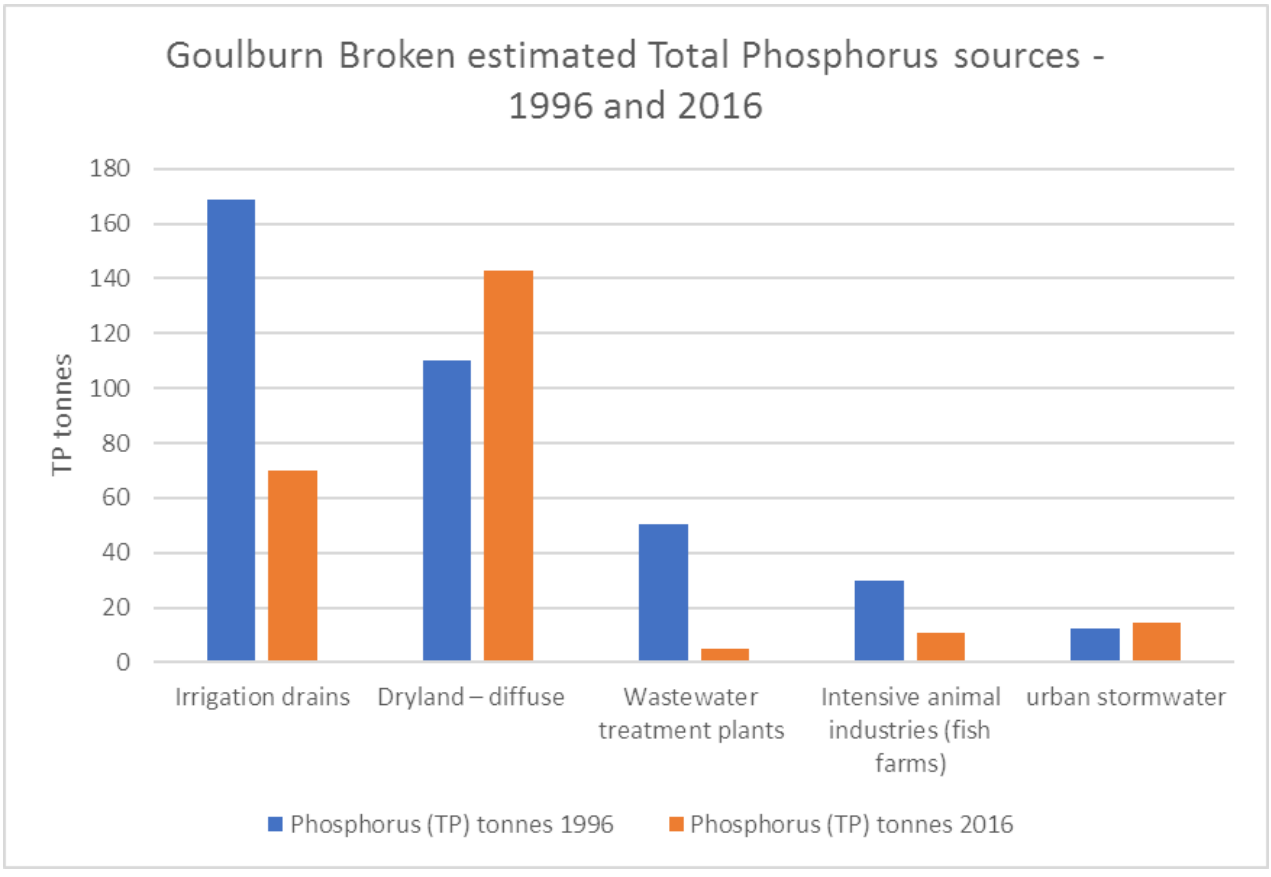


Figure 2. Estimated Total Phosphorus sources from the Goulburn Broken catchment 1996 and 2016

UPDATING APPROACHES TO WATER QUALITY MANAGEMENT

An updated approach to water quality management in the catchment through the next iteration of the WQS will now include:

- Not making things worse
- Continuing on the path of waterway improvement
- Continuing to manage obvious pollutant sources (point sources, irrigation drains)
- Focusing management action on improving base flow water quality
- Maintaining a watching brief on intensive animal industries
- Continuing to implement action to reduce nutrient outputs from irrigation drainage (especially in dry periods); identify and target high contributor drains and implement the Irrigation Drainage Memorandum of Understanding (IDMOU) *(DSE, 2010)*
- Stormwater – encourage continued development, review and implementation of municipal stormwater management plans, particularly in light of increased urban development
- Wastewater treatment plants – maintain a watching brief
- Considering other aspects of water quality, for example pathogens in drinking water supplies, and responding to water quality incidents such as hypoxia (blackwater).Implementation of risk based approaches is essential as there are many water quality issues to be considered (and not enough time or money to assess them all)
- Continue to implement adaptive management approaches by undertaking regular reviews (say at fiveyearly intervals) and focussing management attention to trends.

ASSESSMENT AGAINST TARGETS

Key targets, and target achievement, were reviewed and are summarised in table 1.

Table 1. Goulburn Broken Water Quality Strategy – assessment against targets

Target area	1996 target	2016 assessment
Overall target	Reduce potential catchment phosphorus loads by 65% by 2016. The equates to 241 tonnes (based on the estimate of TP load of 371 t TP)	Target not achieved (but close). The 5-year rolling average for TP load (269 tonnes) is still slightly above the target but this is heavily influenced by floods experienced in northern parts of the catchment in 2010/11 and 2011/12.
Irrigation Drainage Program	Reduce total P outfalling from irrigation drains by 50% (84 tonnes)	Achieved. Current five year rolling average (2014/15) is less than 80 tonnes TP.
Diffuse Dryland Sources Program	Reduce total P loads exported from the Catchment's dryland by 20% of 1993/94 estimated load (110 tonnes TP in a typical year) = 22 t	Not achieved. Load reduction in range of 2.7 to 12 tonnes TP.
Wastewater Management Facilities Program	Reduce P discharged to waterways from wastewater management facilities by 80% from the 1993/94 estimated load (of 50.5 tonnes TP) = 10 tonnes.	Exceeded. Current estimate is ~5 tonnes TP

HOTSPOT CATCHMENTS

Hotspots (i.e. catchment with a "high" nutrient export rate) can now be identified and used as the basis for priority setting; that is, all things being equal, we should focus on high exporting catchments rather than low exporting catchments (on the assumption that the effort of reducing nutrients in a low exporting catchment will result in less change than in a higher exporting catchment).

The high exporting catchments are irrigation drains, indicating management actions could be aimed at these catchments.

ARE WATER QUALITY ISSUES STILL RELEVANT?

Within the Goulburn Broken catchment blue-green algae (BGA) is probably not the front of mind issue it was in the 1990s, although the extensive BGA bloom in the Murray River in 2016/17 will ensure the issue will never go away. However, hypoxia (low water column dissolved oxygen) or blackwater now generates community concern due to impacts on aquatic biota and management of this water quality issue will be important to land and water managers. Management of pathogen sources to ensure provision of safe drinking water requires continual management.

A large number of new and emerging issues have been identified that may (or may not) require management attention in the future through implementation of the WQS. Rather than try to completely understand each and every one of these issues, the recommended approach is to adopt a watching brief and take action if necessary. Risk assessment can be used to guide priorities and assess whether action is necessary.

Similarly, it is not feasible to participate in every relevant water quality research project. It is possible to be across relevant research by review of scientific papers, conference attendance and participation in relevant networks and sharing of information with catchment partners and this approach should be supported by catchment partners.

A single-issue approach to water quality management is no longer appropriate but a broad approach introduces both complexity and a wide range of stakeholders. This is not impossible to manage but successful implementation of the WQS in the future does require long term commitment and supporting these approaches requires some dedicated resources to do the watching, risk assessment, understanding of issues, liaison and coordination.

Responding to the water quality impacts of climate change requires implementation of no regrets approaches, together with appropriate monitoring, review and improvement activities. This approach has worked for the past 20 years and should be robust enough to last another 20 years.

LEARNINGS AND CONCLUSIONS

A number of learnings can be gleaned from WQS implementation and the 2016 review:

- There is a need to understand what is going on; things don't stay the same and adaptive management, including regular review, must be applied
- Water quality has very broad scope; risk based approaches are needed to identify the more important issues
- Long term (20 years) focus on important issues is unusual, but necessary. Required action cannot be implemented overnight, and long time lags exist between doing work and seeing desired results
- Access to long term monitoring is invaluable; trends and changes may only become apparent over a long time period
- It is doubtful that blue green algal blooms are still a front of mind issue; it is very easy to grab an issue, devise a management response and move on to the next pressing issue.

THE NEXT 20 YEARS

Water quality will continue to be one of many issues to be considered when managing catchment land and water resources. Activities that focus on the things that make a difference, no regrets approaches and implementing resilience and adaptive pathways approaches should result in water quality improvements. Maintaining and extending partnerships to ensure a strong caretaker ethic for the quality of the regions water will be critical to achieving this.

THE AUTHORS

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