



## Research Prospectus for the Great Artesian Basin

Abridged version 2009

### Purpose

The Great Artesian Basin (GAB) is the world's largest fresh water artesian aquifer system and one of Australia's most important water resources. Landholders and governments have invested many millions of dollars to rehabilitate bores, renew water delivery infrastructure and improve knowledge about the Basin and the benefits that it provides. However, our knowledge of the Basin is incomplete. The Great Artesian Basin Coordinating Committee (GABCC), a national advisory group to government on management of the GAB, is well placed to work with research and funding organisations to encourage and facilitate priority research. For more information visit: [www.gabcc.org.au](http://www.gabcc.org.au).

This Research Prospectus identifies priority GAB research and is designed to guide the preparation of new research proposals including traditional scientific research, literature reviews, case studies, statistical analysis, focus groups and other approaches. In this way researchers, industry and resource managers can collaborate in supporting GAB management.

### What is the GAB?

The GAB covers over 1,711 000 km<sup>2</sup>. It underlies around one-fifth of Australia and extends beneath arid and semi-arid regions of Queensland, New South Wales, South Australia and the Northern Territory, stretching from the Great Dividing Range to the Lake Eyre depression. It is the only source of reliable water for human activity and water-dependent ecosystems over much of this area.

Of the bores distributed across the Basin, around 5,000 are artesian, with water rising naturally above ground under hydrostatic pressure. The discovery and exploitation of these water resources has been instrumental in development of the pastoral industry and the settlement of many areas overlying the Basin. This rapid development was accompanied by a decline in artesian pressure.

### Management of the GAB

Following almost a century of efforts by landholders and governments to improve management of GAB resources, a Basin-wide Strategic Management Plan (SMP) was

completed in 2000. Governments and landholders have since worked cooperatively to invest in the best science and technology available to understand the resource and its values, rehabilitate bores, improve water delivery infrastructure and change practices to ensure that water is used judiciously. Substantial gains are now being made in eliminating waste and restoring pressure.

### Addressing Knowledge gaps

The GABCC has identified important knowledge gaps in a range of research areas and invites potential researchers/contractors to provide proposals to address priority research questions grouped under five themes. Specific questions are listed at: <http://www.gabcc.org.au/public/content/ViewCategory.aspx?id=72>.

### Theme 1. Understanding the resource

The structure and function of the GAB has been researched for more than a century. Natural discharge, and the ecology of springs and soaks, have also been investigated. Monitoring of bores has contributed to knowledge about the GAB and its management. However, the GAB is a very extensive and complex aquifer system, and knowledge gaps still limit the reliability of management and investment decisions. Additional research is required in areas listed below.

#### Water balance

Many components of the water balance in the GAB have been estimated through broadscale simplified modelling or extrapolated from point source measurements. An understanding of the characteristics of the principal aquifers and the volumes, rates and processes of water movement into and through them is necessary to predict the consequences of various management options.

## Surface/groundwater interaction

While much of the GAB is confined, in the intake areas rivers and streams run across the exposed sandstone aquifers. The National Water Initiative (NWI) and other initiatives demonstrate the increasing recognition of the connectivity between surface water and groundwater systems and the need to plan and manage accordingly.

## Springs and other groundwater dependant ecosystems

Many GAB springs are protected under federal and state legislation, in conservation areas and through water management plans. There has been research into the ecology of the springs with many endemic species, and threats to their continued existence being identified. More information is needed on their ecological significance, the processes that threaten them and how best to manage these processes.

## Indigenous values

The GAB springs have great traditional and contemporary cultural significance providing water, food and other material resources for many thousands of years. They have significant spiritual value as ceremonial sites and feature in many dreamtime stories. However, most GAB springs have not been systematically surveyed or assessed for indigenous heritage values and significance and much remains to be documented.

## Modelling and assessment tools

Appropriate assessment tools are required to improve understanding of the hydrology of the Basin, assist in the development and implementation of plans, and assess the impact of management decisions.

## Sustainability under climate change

Changes in climatic patterns have the potential to affect the water balance of the GAB. There is also the potential, if surface water and shallow groundwater systems become unreliable, for increasing pressure to be placed on access to the resource of the Basin. Investigation into the likely impacts of climate change on the GAB is required.



The Bubbler Spring (M.Butz courtesy GABCC)

## Theme 2. GAB access infrastructure

Governments and landholders have worked cooperatively to invest in the best science and technology available to rehabilitate bores, improve water delivery infrastructure and change practices to ensure that water is used judiciously. Substantial gains have and are being made in eliminating waste and restoring pressure. These investments need to be protected.

## Water bore failure

Bores have an anticipated lifetime largely determined by the method of construction, construction standards and landholder maintenance. The failure of older bores and more recently some bores constructed under GABSI is an emerging issue that jurisdictions and landholders will need to resolve. Any response requires an understanding of the likelihood of bore failure, and the associated risks to the groundwater resource. This will help to determine the extent of any future investment.

## Failure of distribution systems

While state governments have minimum construction guidelines for piping systems and use qualified engineers for system design, there have been failures in rehabilitated water distribution systems. This has implications for the future maintenance of these distribution systems and associated costs, landholder confidence, and the achievement of correct policy settings. Investigation into ways to predict, monitor and respond to distribution system failure is needed.

## Down-hole leakage

Investment in capping and piping has focused on the loss of water from artesian bores at the surface; however, in some circumstances, water (and pressure) is also being lost below ground for both artesian and sub-artesian bores. The current extent of 'down-hole' leakage in the GAB is unknown, but it may be a significant issue for pressure recovery in the GAB. The extent of down-hole leakage needs to be confirmed and technical information is needed to support policy responses.

## Sub-artesian water bores returning to artesian conditions

Capping and piping has led to measurable pressure recovery in the GAB. In marginal areas, this is resulting in some subartesian bores reflowing at the surface. Bores currently in this condition are unlikely to be operating open bore drain distribution systems and may be ineligible for rehabilitation under current programs which could be detrimental to the pressure recovery that has resulted from GABSI and its predecessors. Investigation into the potential for a return to artesian conditions and ways to monitor pressure recovery is required.

## **Theme 3. Monitoring and measurement**

### **Pressure and spring monitoring**

Jurisdictional water plans have identified a requirement for monitoring pressure and environmental flows. Although monitoring is primarily the responsibility of the jurisdictions, information collected supports both Basin-wide and local assessment needs for planning purposes. Consistency in approach and data collected is vital to a whole-of-resource assessment. Further investigation of monitoring approaches is needed, with a view to cost and the ability to accommodate the complexity of the aquifer structure of the GAB within future monitoring programs.

### **Landscape change**

Open drains have been removed from the landscape and replaced with closed piping systems through GABSI and private investment. The impacts of this change on the environment and the productivity of the land need to be measured or quantified.

### **Accounting for stock and domestic use**

Even when all uncontrolled bores are capped, stock and domestic (S&D) use will still represent the largest use of water in the GAB. Governments agree that there will not be a requirement for S&D use to be metered or to hold a volumetric entitlement. As a consequence, there is a need to identify and implement a robust methodology for measuring and accounting for stock and domestic use in the GAB.

## **Theme 4. Higher value uses**

Investment to introduce best practice water use into the pastoral industry has been considerable as this industry uses the most GAB water. New water distribution technologies have opened up opportunities for pastoralists and land managers, and led to benefits across the Basin. Investment in best practice water use for other industries within the GAB could yield further significant benefits and requires investigation.

### **Pastoral industry**

Appropriate uses of new technologies to access, control and distribute water can have important environmental benefits and improve values supported by the GAB. Additional research is required to continue the development of new technologies and find more effective applications for existing ones to improve production, reduce costs and refine management practices in the pastoral industry.

### **Petroleum industry**

The extraction of petroleum from aquifers normally results in formation water coming to the surface along with targeted petroleum products. Additional research is required to identify cost-effective ways to separate the petroleum from water either in the aquifer or at the surface without having to dispose of the water. Research into cost-effective treatment and productive use of formation water is also needed.

### **Mining industry**

The mining industry is a significant user of GAB water. Open cut mining can result in dewatering from GAB aquifers and mineral exploration often requires drilling into GAB aquifers. Additional research is required into the cost effective use of GAB water in mining, and the impacts of mining on the integrity of the GAB.

### **Tourism industry**

The GAB is important to regional tourism across the Basin. The natural discharge of water from GAB springs supports natural and cultural values that are important attractions for visitors. Additional research is required into various aspects of the tourism industry in the GAB, to support encouragement and management of tourism.

### **Community and industrial water supplies**

Research is required into the role and significance of GAB water to communities and industries and the associated water use practices. In addition to the water, temperature and pressure are valuable commodities in their own right. It is important to identify likely development scenarios and the capacity of the GAB to meet these demands.

### **Emerging industries**

The irrigation of high value crops, coal gasification, geothermal power generation, coal seam gas development and carbon geosequestration are examples of fledging industries in the GAB and additional research is required to better understand how to increase the generation of wealth supported by the GAB through improving and diversifying current businesses and developing new industries .

## **Theme 5. Valuing investment and allocation**

### **Cost/benefit - return on investment**

Water from the GAB supports natural and cultural values and human activities. Additional research is required to better value GAB resources, to develop comparative models for industries and activities supported by GAB resources, and to assess the returns on investment in water infrastructure. This will support future investment and management decisions and build on the significant existing investment.

### **Water pricing and trading**

It is foreseeable demand for GAB water will increase beyond the volume of water currently available under state water planning frameworks. Additional research is required to investigate the best way to utilise market mechanisms, including water trading to meet this demand.

### **Partnerships**

The GABCC does not undertake research directly but is well placed to

- provide leadership and focus strategic research
- broker relationships within the research community and between industry, policy and research groups
- build a knowledge base
- communicate research to a wide audience.

### **Scholarships**

The GABCC has established two PhD top-up scholarships, each valued at \$5000 per annum over three years. These top-up scholarships are intended to supplement the funding of primary scholarship holders who intend to conduct innovative research that will address priority research questions and themes identified in the Prospectus.

## **How to get involved**

The complete Research Prospectus document is available on the GABCC website at: <http://www.gabcc.org.au/tools/getFile.aspx?tbl=tblContentItem&id=191>

For further information on this Research Prospectus or to indicate your interest, please contact us at:

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