

# Friends of Mound Springs

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## DATES OF INTEREST:

- **Next FOMS Field Trip 23-30 June 2008 Details TBA**
- **Water Down Under Conference 2008, Adelaide SA 14-17 April**
- **Taste of the Outback, Pt Augusta SA 18-27 April**
- **Marla Bronco Branding, SA 20-22 April**
- **Oodnadatta Races & Gymkana SA 5-6 May**
- **Alice Springs Bangtail Muster NT 5 May**
- **Friends of Parks AGM, Farrell Flat Mid North SA 5 May**
- **Great Australian Cattle Drive 21 May-10 June**
- **SAAL NRM Board meeting SA 3-4 June**
- **Glendambo 4x4 Challenge, SA 7-9 June**

Contributions to the Newsletter may be emailed to the Publicity Officer (details on last page)

## President's Message

With cooler conditions and even some welcome showers, at least in more southern climes, FOMS is waking from its summer dormancy. The first meeting for 2008 has been held recently and our Secretary, Simon Lewis, has reported on it elsewhere in this Newsletter. Also in this Newsletter is advice of our forthcoming field trip. Planned for late June, it will mix visits to interesting springs with some on-ground works, including plant surveys with Travis Gotch at Strangways and vehicle control measures at the Peake.

Membership continues to grow steadily and now stands at 34, with six of these members being from interstate. Our email circulation list is larger again than this, and at the most recent general meeting it was agreed that we would continue to communicate with all interested persons on our list, whether they are paid-up members of FOMS or not. We encourage membership, of course, and there will be a number of FOMS activities open only to paid-up members, including the annual field trip(s), but we also believe that providing a communication forum for the widest possible audience is important. There is no equivalent of FOMS interstate and we see it increasingly taking on a national role in disseminating information and acting as a focus for a wide range of individuals and organisations with an interest in the springs of the Great Artesian Basin.

In this context, it was helpful to have a full page feature article on FOMS in the March 2008 issue of the national *Australian Landcare* magazine, even if the photograph accompanying it was definitely not taken in the mound springs country. The same issue also features a two page spread on the work of our Vice President, Travis Gotch, and in this case the photographs were relevant to the story! Happily, the appearance of this article has coincided with the news that Travis has been offered a position of Chief Investigator with the National Water Initiative (NWI) Great Artesian Basin (GAB) project. Our congratulations to you Travis, it is well-merited recognition of your GAB expertise.

On other fronts, two research papers of considerable interest and importance to mound springs workers have been published recently. One by Rick Davies and a number of colleagues finally resolves the confused taxonomic status of the *Eriocaulon carsonii* F. Muell. species complex, icon plants endemic to the mound springs of central and north eastern Australia. The abstract for this important paper is reproduced elsewhere in this Newsletter, as is the abstract for the second paper, by JR Prescott and MA (Rien) Habermehl on luminescence dating of mound spring deposits in the Far North of South Australia. A number of FOMS members will know of Rien and his status as a foremost authority on the hydrogeology of the GAB. He maintains close links with FOMS and is hoping to join us on one of our future field trips.

Also of interest is the recently released *South Australian Arid Lands Draft Biodiversity Strategy*. The Strategy has been prepared to provide a vision for biodiversity conservation and to provide guidance for funding priorities within the South Australian Arid Lands. Mound springs are covered within the Stony Plains section of the Strategy and attention is given to the significance of the springs, the major vegetation communities associated with them, conservation priorities and practical ways that land managers can help with their conservation. Comments are now being invited on the Draft, copies of which can be downloaded via a link from the SA Arid Lands NRM website [www.saalnrm.gov.au](http://www.saalnrm.gov.au). Comments will be accepted up to 30 June 2008 and it is likely that FOMS will prepare a submission.

Finally, there is an attractive and interesting exhibition, *Tracks in the Sand*, on display at the South Australian Museum until 20 April 2008. Put together by the Marree Arabunna people and visiting artists, mound springs have provided much of the inspiration for the exhibition's appealing mix of painting, photography, sculpture and installations.

Another active year begins and I look forward to joining a number of you on the forthcoming field trip, as well as keeping in touch via our Newsletter, which Anne Pye continues to so ably produce.

**Colin Harris, President, Friends of Mound Springs**



# Report of FOMS Meeting

**A draft recovery plan for the GAB has been released under the EPBCA for public comment to be made before 30 April 2008.**

Further information is available at <http://www.environment.vgov.au/biodiversity/threatened/publications/gab.html>

Fourteen Friends gathered for a FOMS meeting in the Coorong Board Room at the DEH, Offices, Keswick, Adelaide SA on Thursday 27 March 2008. President Colin Harris particularly welcomed new members Hadyn Hanna and Claire Bockner and visitor Elijah Bravington. Special thanks also to Patron Barbara Hardy, who continues to ply the group with some fine family wine.

Vice President Travis Gotch joined the group by telephone and provided an update on his activities. The recent Great Artesian Basin project, funded through the National Water Initiative (NWI), is now complete and Travis has been offered a Chief Investigator position with the NWI – which should be formalised shortly, paving the way for a four year, \$2million program building upon the completed NWI project. Travis also reported on recent successful work to control donkeys, camels and feral horses near Tarlton and Primrose Springs.

Lynn Brake provided comments on the big picture, emanating from his role on the GAB Coordinating Committee. The Australian Government's new "Caring for Country" program will be the focus for major funding initiatives, including programs and work carried out previously under National Heritage Trust projects. The GABCC has met with Federal Water Minister Penny Wong who appears to be supportive of the Committee's role and objectives. Lynn also noted that the GABCC is preparing a research prospectus and has prepared a fact sheet and DVD re the Basin (details available on [www.gabcc.org.au](http://www.gabcc.org.au)).

Robyn Ashworth gave a fascinating presentation regarding the Outback Heritage of the Far North, concentrating on the features associated with exploration and settlement after 1836. Robyn noted the linear focus of much of the State Heritage Branch's work, concentrating on the Oodnadatta, Birdsville and Strzelecki Tracks. Robyn, with input from Colin, described some of the early site assessments of the 1980s, the heritage surveys of the late 1990s, the conservation and interpretation works of the 1990s and the Outback Heritage Interpretation Project of 2004-05.



Source: Sue Black

## FOMS heading north in June

FOMS members are girding their loins once more for a trip to mound springs country in the week 22 to 29 June 2008. This follows the successful trip at about the same time in 2007, when members gained a good overview of many of the springs.

The June 2008 trip will include a mixture of business and pleasure. Last year at the Peake Repeater Station ruins we noted unwanted access by vehicles into sensitive areas. One of our jobs this year will be to erect a vehicle barrier to prevent or at least restrict this access. A small task awaits us at Elizabeth Springs, to clean up some rubbish – also noted last year – at an old mustering camp. At Strangways Springs, we are planning to assist Travis Gotch in a comprehensive survey of spring vents at that site. Along the way, we'll look at other springs of interest, particularly some springs that we didn't cover last year. Information about the 2008 safari has been circulated to members and planning is well under way.

## Kennicott Water Softeners



Source: John & Leigh Childs

Driving along the old Ghan train track between SA mound springs there are a couple of hulking structures alongside the road at places like Curdimurka and Beresford Sidings which have been restored by the Ghan Preservation Society. These elevated cast iron water tanks were used to water early steam locomotives. Associated with them are water softeners made by the Kennicott Water Softener Co Ltd in Wolverhampton, Staffordshire between 1922 and 1962. These water softeners used a process discovered by Kennicott in 1902 to remove dissolved limestone from hard water by exchanging bicarbonate with sodium ions. The water softener at Beresford, for example, was installed during World War 2 to treat mineralized bore water and to prevent lime and gypsum building up in steam train engines. As is the way with progress, such water softeners became redundant when the trains began to be powered by diesel engines in 1954.

# The GAB Sustainability Initiative

In 1998 the GAB Consultative Council ("GABCC") was formed. The Council developed a Strategic Management Plan ("SMP") in 2000. The SMP was devised to identify the key issues and an overlying policy framework. The vision of the SMP was to coordinate management of the Basin in a sustainable way and in particular to redress the decline in artesian pressure, and the water waste and environmental degradation caused by open bore drains. Its principles included that 'water savings made from improved management should be retained in the aquifer system where necessary to provide pressure recovery in artesian aquifers.' From a practical point of view, the key strategy dealt with rehabilitating, monitoring and maintaining bore casings, headworks and water reticulation systems. From a policy point of view, the key strategy called for groundwater management plans with clear objectives and zones to be developed using a holistic approach and backed by effective state institutional arrangements managing water access and entitlements, including State Implementation Plans. The SMP set up a 15 year framework in which to achieve specified outcomes to be reviewed at 5 year intervals. In relation to mound springs the decline in pressure over decades is very significant as it has led to the extinction of a number of springs, eg. most GAB springs in NSW no longer flow due to overextraction and loss of water pressure.

At the time the SMP was released, the Great Artesian Basin Sustainability Initiative ("GABSI") was also announced with a 5 year joint funding package of \$100 million aimed at accelerating the bore rehabilitation program and replacing open bore drains with pipes. The results have been to improve community awareness of the GAB, convince land managers of the need for bore rehabilitation, and to rehabilitate almost a third of the flowing bores. A three year review of GABSI in 2003 found that 12% of eligible bores had been capped and 15% of bore drains replaced with a water saving of 41,546 ML/y. However, it noted that little data was available on actual measured pressure recovery and that there had only been moderate to minor spring recovery in SA.

The Federal Government committed a further \$42.7 million to fund the second 5 year GABSI from 2004-2009. By 2005 there were concerns that GABSI was running behind schedule and faced cost blow outs, and that it still needed to cap more than 950 higher flowing bores if it was to succeed. Pastoral landholders, who are required to pay 20% of bore and 40% of piping costs, were (and are) facing long delays in availability of drillers and financial strain from the effect of successive droughts in meeting their share of the rehabilitation works. Furthermore the recovery in pressure had destabilised bores that weren't initially included in the program's calculations and could be causing leakage between aquifers, possibly causing contamination.

In early 2007 the Howard government committed to a third phase of GABSI from 2010. In 2008 a mid-term review of the second phase of the GABSI scheme is due to be released shortly. Findings apparently include that steady progress has been made by the scheme in all the relevant states and that there has been pressure recovery in northwest NSW as well as QLD, ostensibly as a result of the scheme (time lag factors in pressure recovery in some areas notwithstanding).

Debate about the nature of the third phase continues. While some of the issues such as drilling rig shortages and financial problems with participation (now caused by floods as well as droughts) continue, other nuances of the third phase are currently being considered. In particular an expansion of eligibility criteria to include currently ineligible low flowing bores which will be affected by pressure recovery are being encouraged. Also being considered is a change from an emphasis in the scheme on encouraging landholder participation to providing more disincentives to landholders to not be involved with the capping and pressure recovery scheme. This is a push for more community participation in the actual direction of the scheme and in the allocation of priorities for funding - with the expectation that this would result in better integration with other natural resource management programs such as Landcare and Bushcare, and may also serve to provide social as well as financial disincentives to landholders who to date have not expressed interest in bore rehabilitation and the piping of open drains.



Installation Art Work at Cooper Pedy in 2002 by Matej Andraž Vogrincič

Source: <http://slonew.sta.si/index.php?s=1&id=z>

## Abstracts from forthcoming papers relating to the mound springs

### Luminescence dating of spring mound deposits in the southwestern Great Artesian Basin, northern South Australia

JR Prescott & MA Habermehl *Australian Journal of Earth Sciences* (2008) 55, (167-81)

**Abstract** Artesian spring mound deposits in the southwestern part of the Great Artesian Basin arise from groundwater discharge from flowing springs in the southern and western margins which reaches the surface through faults and weaknesses in thin confining beds overlying the Mesozoic artesian aquifers. Carbonate in solution in the artesian groundwater is deposited by many springs as tufa, building 'spring mounds'. Active flowing and dry inactive spring mounds occur in a variety of sizes and shapes. The ages of a representative selection of spring mound deposits have been found by luminescence dating of quartz sand grains that have been incorporated in the mound deposits. The spring deposits of the active flowing, Big Bubbler, Blanche Cup and Beresford Spring have ages of  $15.1 \pm 2.2$ ,  $10.9 \pm 1.5$  and  $13.9 \pm 1.0$  ka, respectively. Spring complexes with both active flowing and dry extinct mounds, Strangways and Beresford Springs, have ages of  $60 \pm 8$  and  $219 \pm 35$  ka, respectively. Spring deposits of springs which ceased flowing and are overlying pedestals of Cretaceous Bulldog Shale and of substantial height (up to >45 m above the surrounding plain) of Beresford Hill and Kewson Hill gave ages of  $128 \pm 33$  ka and  $400 \pm 100$  ka, respectively. Elizabeth Springs is a large spring mound, and parts contain active flowing springs; a sample from a dry inactive part gave an age of  $740 \pm 120$  ka. The analyses for radioactive content, necessary for the estimation of dose rates for luminescence dating, were unusual because the uranium radioactive decay chain is in disequilibrium, with the parent uranium patently unable to support the lower part of the chain. We interpret this as being due to radium being carried up with the spring water from the confined Mesozoic aquifer, which overlies Proterozoic basement rocks. Calculations of dose rates take account of detailed measurements on individual nuclides and differ from site to site.

**KEY WORDS:** artesian springs, Great Artesian Basin, luminescence dating, mound springs, spring mound deposits, spring tufa deposits.

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Publisher: Taylor & Francis, <http://www.informaworld.com/smpp/title~content=t716100753>

### Resolution of the taxonomy of *Eriocaulon* (Eriocaulaceae) taxa endemic to Australian mound springs, using morphometrics and AFLP markers

RJP Davies, AI Craigie, DA Mackay, MA Whalen, JPE Cheong & GJ Leach

*Australian Systematic Botany* (2007) 20, 428-47

**Abstract** The *Eriocaulon carsonii* F.Muell. species complex consists of rare perennial mat-forming forbs endemic to mound springs of central and north-eastern Australia. Even though the complex occurs across a range of more than 1500 km, the springs on which it occurs are naturally rare and highly disjunct, with groupings of springs ('super-groups') 200-500 km apart. The present paper investigated the taxonomy of the complex by analysing morphometric characters and amplified fragment length polymorphism (AFLP) genetic markers. Morphological measurements were made of 126 samples collected from 23 spring-subpopulations representing 15 spring-groups spread across all nine super-groups on which the complex occurs. Ordination and univariate analysis of data relating to 30 morphological characters revealed five morphologically distinct groups. These groupings were supported by an analysis of 613 AFLP loci markers derived from a subset of samples from all of the same springs. Ordination analysis of the genetic data matrix revealed that the morphological groups were also genetically distinct. It is proposed that the complex consists of five distinct taxa. Two new subspecies (*E. carsonii* F.Muell. subsp. *euloense* R.J.Davies and *E. carsonii* F.Muell. subsp. *orientale* R.J.Davies) are described, along with two new species (*E. aloefolium* R.J.Davies and *E. giganticum* R.J.Davies). All taxa are nationally endangered or critically endangered according to IUCN criteria, except for *E. carsonii* subsp. *orientale* which is vulnerable.



Source: [http://www.epa.qld.gov.au/nature\\_conservation/wildlife/threatened\\_plants\\_and\\_animals/endangered/endangered\\_plants/emeriocaulon\\_carsonii/em/](http://www.epa.qld.gov.au/nature_conservation/wildlife/threatened_plants_and_animals/endangered/endangered_plants/emeriocaulon_carsonii/em/)

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## Evolutionary time capsules in the desert.

The ecosystems associated with the GAB mound springs are of considerable biological significance, containing numerous plant and animal species, the vast majority of which are endemic (only found in a single environment), with very restricted distributions. The best-studied fauna of the springs are the hydrobiid snails, of which 23 species are described so far. Other endemic aquatic fauna include crustaceans such as isopods, amphipods and ostracods, a number of fish and less well-known invertebrates such as flatworms and mites. Some of these critters are relatively easy to see, others less so, and they require a microscope to identify them. Many people who have visited springs such as Blanche Cup or the Bubbler will have noticed things which look somewhat like garden slaters crawling around in the outlets of these springs. These are isopods known as *Phreatomerus latipes* and are a very unusual species endemic to the Lake Eyre Springs.

However next time you visit the springs take the time to sit for a minute and see what other life they are supporting. Sometimes something that looks like sand or dirt, can actually contain a writhing mass of life. The black dots in the photo below are not grains of sand or dirt, but actually a tiny crustacean known as *Ngarawa dirge*. There are millions of them!!

Despite the listing of the springs as a “threatened ecological community”, there is relatively little known about their biology and ecology. The majority of research undertaken on the springs has focused on specific aquatic groups such as the snails. Knowledge of the aquatic fauna is particularly important due to the reduction in artesian pressure, which places these communities at direct risk of extinction. The nature of the mound springs environment means that individual springs are essentially “islands in a sea of desert”. Whilst this isolation has ensured that the mound spring animals and plants are particularly unique, it also means that spring communities are more susceptible to extinction from springs drying out or becoming uninhabitable as dispersal by plants and animals between springs is difficult.



*Phreatomerus latipes*

A research team consisting of members of the University of Adelaide and The South Australian Museum, is currently undertaking research in the mound springs. The main goal of this research is to examine the biodiversity and evolution of the unique fauna of these springs. The primary tool for our research is molecular genetic data. By examining the genetic data of these animals, we can examine many questions, for example; How many species are there? How long have the species existed in the springs? How easily animals disperse between springs? We are also interested in studying the ecological communities within the springs, this will help us to address questions such as; Do all the springs contain a similar collection of fauna? Are there springs with ecological communities which are unique compared with other springs? By attempting to answer these questions we will gain a greater insight into the biological environment of the mound springs. This will provide a means for management bodies to incorporate significant biological information into their decision making and help facilitate the conservation of mound springs communities in the Lake Eyre region.



The very first task that we have to undertake is an assessment of the number of species supported by the mound springs and the distribution of the species. This may seem like a straightforward task, and something that should perhaps already be known for these springs; however there are a number of complicating factors. Firstly we have to define a species; which is essentially something that interbreeds successfully to produce living offspring.

**Cont/-**

In order for a species to survive it must be able to adapt to factors such as available habitat, food sources, temperature, and predation (this is known as a species niche). Because of the restricted island-like nature of the springs, the spring animals must adapt to the environment to survive as they cannot simply move to another more favourable environment. The environment of the springs is mainly governed by a very steady source of groundwater from the Great Artesian Basin. This water is quite constant in its composition and does not alter significantly over time or geographic distance and it flows into a relatively stable and essentially arid environment with very little input of surface water. Therefore despite many of the springs appearing to be quite different in appearance, the underlying environment across these springs is very similar (particularly across similar geographic regions; for example the Dalhousie springs are all quite similar). One consequence of this environmental similarity is that many of the springs appear to contain the same groups of animals. Another consequence is that animals that fill the same niche in different springs (i.e use the same habitat, eat the same food, avoid the same predators) will have evolved in a similar way to fill this niche, and can therefore have evolved to have very similar features

A good example of this in the mound springs is the amphipods. Amphipods are small, shrimp-like crustaceans, found in marine, freshwater and terrestrial environments. Within the springs, there is generally a single type of amphipod found. It is quite small, generally less than 5mm long and difficult to see with the naked eye. However, when amphipods are present they are generally present in their hundreds. Given that this amphipod is found in numerous springs, seemingly inhabiting the same environmental niche, it has been generally thought that it was a single species. However, how do we investigate this? Traditionally, we would use morphological (ie what they look like) differences and similarities to identify new species and estimate how closely related they are. If we cannot tell them apart we need to examine their genetic code and measure the differences by this means.

The use of genetic methods to do this is a relatively straightforward process. By examining the genetic code of two organisms we can determine how closely they are related. When examining more than three or more species we can use a branching diagram known as a phylogenetic tree to illustrate relationships, knowing that two species which share a common branch are more closely related to each other. The differences between species are known as mutations in the genetic code. Because these mutations occur at a steady rate we can also determine the amount of time that has passed since two species evolved. By determining the amount of genetic change we can see how many species of amphipods there are and also can trace their ancestry back and determine how long these species have existed in the mound spring environment.

So far, we have examined many of the amphipods from the Lake Eyre, Dalhousie and some of the Springsure springs in QLD. The amphipods in QLD and Dalhousie Springs are quite unrelated from each other, and from those at the Lake Eyre Springs. This is to be expected as these groups of springs are very geographically separate from each other and for them to contain a single species these amphipods would have to be able to travel over a lot of inhospitable country in order to interbreed.



Amphipod from the mound springs

The most interesting finding so far is that within the Lake Eyre Springs there are at least 10 new species of amphipod. Some of these are very similar to each other and some are incredibly different to each other (as different as humans and rats). Despite these enormous genetic differences and large increase in the number of amphipod species, these amphipods still look practically identical. Therefore, in biology they are referred to as a cryptic species complex. A cryptic species complex is a group of species which satisfy the biological definition of species, that is, they do not interbreed with each other, but they are not morphologically distinguishable.

Currently we are only in the early stages of our research and have only examined one group (the amphipods) from a relatively small (around 20) number of springs. Given that there are many other springs to examine, we expect to find many more "cryptic species" of amphipods.

We also plan to examine the genetic relationships of many of the other invertebrates within the springs and expect that they too are likely to consist of numerous cryptic species. The impact of this is that the number of different species supported by the mound springs will increase greatly, significantly increasing the importance of conserving these beautiful, unique ecosystems.

Finally, one of the more important questions that we wish to examine is ; Where did all of these unique species come from? The DNA evidence so far suggests that many of the species we have found have existed for around five to ten million years, since the geological time period known as the Miocene. Environmental conditions in inland central Australia, particularly around Lake Eyre, in the Miocene era were considerably wetter than today, with giant freshwater lakes and wetlands supporting species such as crocodiles and flamingos as well as many freshwater critters such as snails, amphipods and isopods. At the end of the Miocene period central Australia began to dry out to become the environment that we see today. Since this time the mound springs have represented the only permanent source of water within which aquatic animals and plant scould survive. Obviously they are not large enough to continually support large animals such as crocodiles and flamingos for the last 5 million years; however they could have definitely provided a refuge for the smaller fauna we find today. The geological evidence that might show that the springs have been around since wetter times has long since eroded away in the harsh desert conditions, however we may be able to use the DNA of the spring animals to enhance the scientific evidence that these springs represent living "time capsules".

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# Friends of Mound Springs

If you wish to become a member, please send \$10 together with your name, phone number, postal and email addresses to Tony Latz, Treasurer of FOMS, 10 Waratah Way, Stonyfell SA 5066. Membership runs with the financial year.

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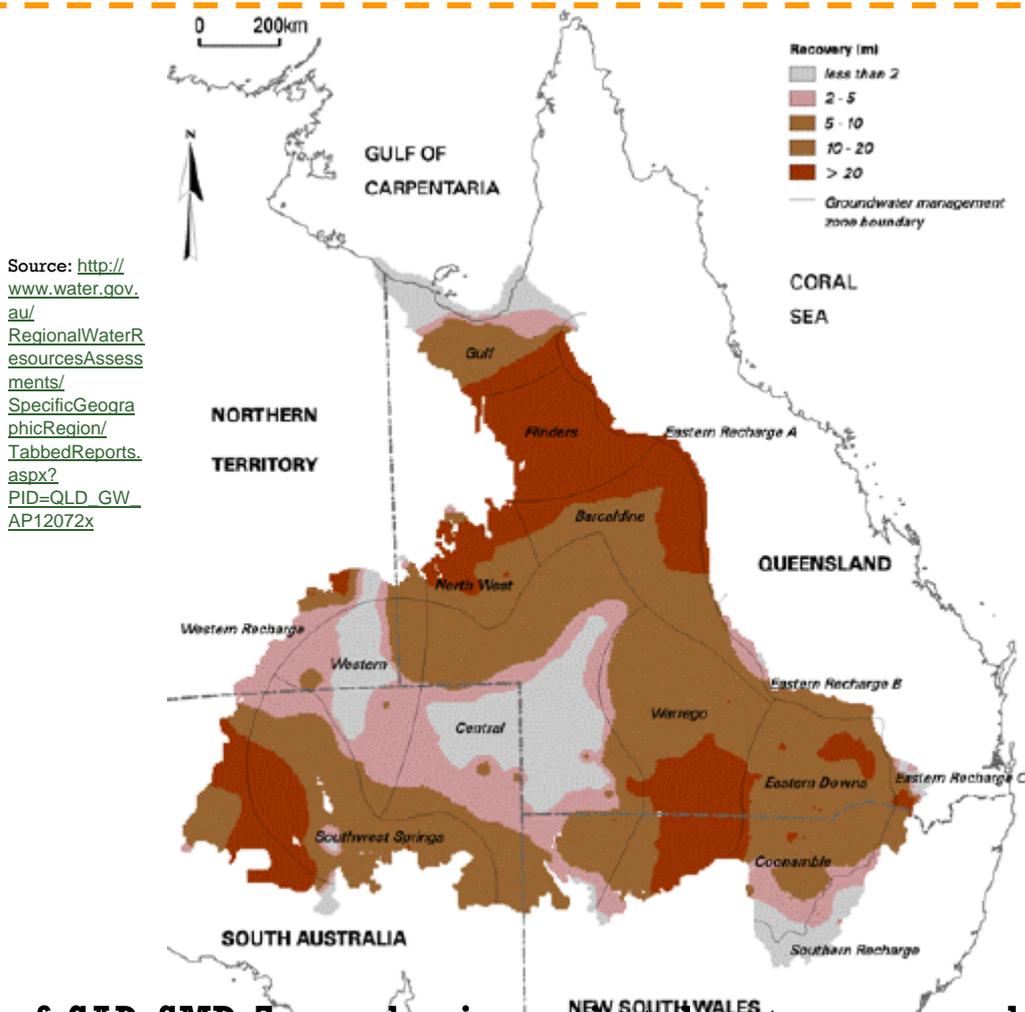
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**Map of GAB SMP Zones showing projected water recovery by 2040 if all flowing bores from the main GAB aquifer are capped and piped**