

# What are the ecological impacts of groundwater drawdown?

Research commissioned by the Department of the Environment and Energy provides new insights into the ecological impacts of groundwater drawdown. The findings strengthen the scientific knowledge base that informs the regulation of coal seam gas extraction and coal mining in Australia.

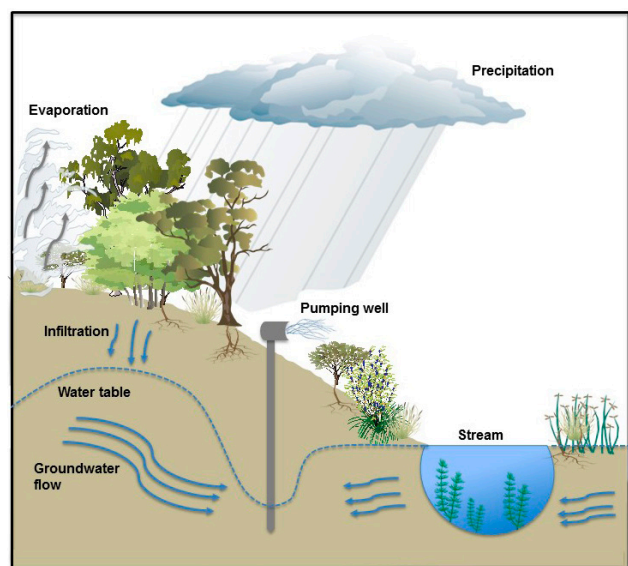
## What is groundwater drawdown?

Groundwater is a critical resource for society and the environment. Groundwater is water found underground where it saturates soil and fills spaces in rock. This water may flow underground and naturally re-surface at different locations, such as springs or streams. It may also be extracted for agriculture, industrial purposes or drinking water.

Any activity that extracts groundwater may cause groundwater drawdown, which can have important ecological consequences. Coal seam gas extraction, mining, and pumping of groundwater for irrigation are examples of such activities. In the case of coal seam gas extraction, groundwater is pumped to the surface in order to release natural gas that is trapped in an underground formation of coal.

The Department of the Environment and Energy commissioned a team of Australia's leading freshwater researchers to conduct a study investigating the role of groundwater in supporting vegetation, intermittent streams, streambed environments and Great Artesian Basin spring wetlands. This fact sheet summarises the key findings of the study. For more information, refer to the full project report.<sup>1</sup>

<sup>1</sup> Andersen M, Barron O, Bond N, Burrows R, Eberhard S, Emelyanova I, Fensham R, Froend R, Kennard M, Marsh N, Pettit N, Rossini R, Rutledge R, Valdez D & Ward D, (2016) Research to inform the assessment of ecohydrological responses to coal seam gas extraction and coal mining, Department of the Environment and Energy, Commonwealth of Australia.



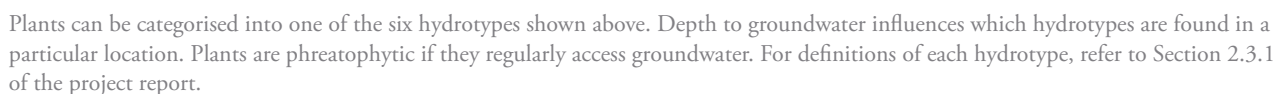
A simple example of the hydrologic cycle, where precipitation creates runoff that travels over the ground surface and replenishes surface and ground water.

The study confirmed that when plants can reach groundwater with their roots they are likely to use groundwater, especially during dry periods. Plants accessing shallow groundwater for most of the year are likely to grow faster. However, dependence on groundwater varies for different plants and different situations. Researchers developed two new tools that can be used to identify groundwater dependent vegetation:

- These tools improve our ability to predict and monitor the impacts of groundwater drawdown on vegetation.

Many streams in Australia are intermittent. Unlike perennial streams, which flow continuously, intermittent streams alternate between flowing and non-flowing periods. Intermittent streams are less well-studied than perennial streams and are sometimes wrongly assumed to be of limited ecological importance.

These findings highlight the importance of carefully assessing how groundwater drawdown may affect intermittent streams.



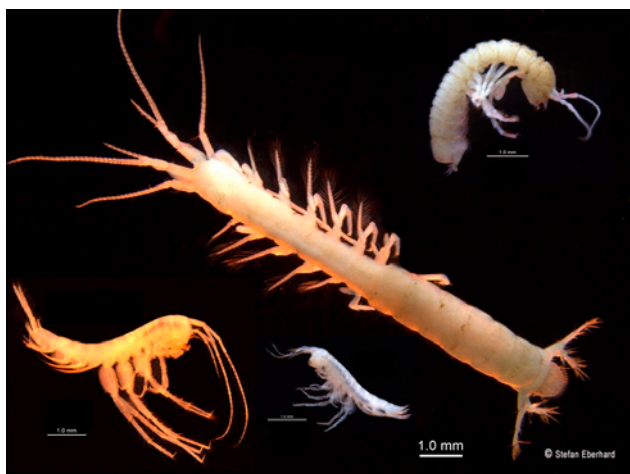
## Groundwater supports biodiversity and ecological processes under the streambed

Groundwater environments can have high biodiversity, and the ecological importance of caves and aquifers is well-known. However, the sediments underlying a streambed where groundwater and surface water mix are also important.

The study confirmed that wet streambed sediments can harbour diverse aquatic invertebrates, such as crustaceans, insects, molluscs, water mites and worms. A supply of oxygenated water is important for these fauna to survive.

The study also confirmed that wet streambed sediments are a key site for carbon and nutrient cycling. For example, microorganisms in the sediments help break down buried leaves and other organic materials, thereby releasing important nutrients into the stream's food web. Groundwater drawdown may affect the amount and type of nutrients that are released.

These findings highlight the importance of groundwater for fauna and ecological processes underlying a streambed. Insights from the study can help identify when streambed sediments are likely to harbour invertebrates and maintain important ecological processes.



These crustaceans represent some of the diverse invertebrates collected from wet streambed sediments in the Bremer River catchment in QLD and the Maules Creek catchment in NSW. Photos © Copyright by Stefan Eberhard, Subterranean Ecology Pty Ltd.

## Many Great Artesian Basin spring wetlands are at risk from groundwater drawdown and other threats

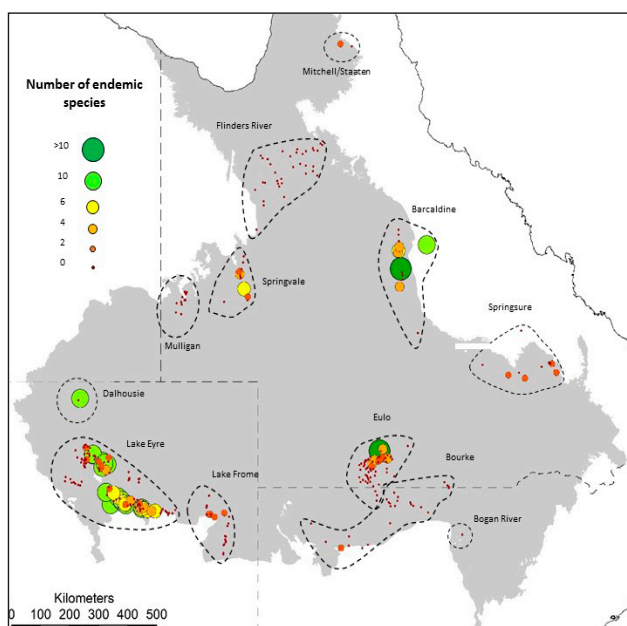
The Great Artesian Basin (GAB) is Australia's largest groundwater basin, underlying almost a quarter of the continent. Groundwater flows to the surface in the form of spring wetlands in various locations throughout the GAB. A number of these springs and some of the species that inhabit them are protected under Commonwealth and state legislation.

Due to prolonged isolation, many GAB spring wetlands contain endemic species; that is, plants and animals that occur in particular wetlands and nowhere else. To inform conservation and management of GAB spring wetlands, researchers conducted a biodiversity study and risk assessment for more than 6000 springs in 326 spring complexes throughout the GAB.

The study identified 98 endemic species, including fish, molluscs, crustaceans, and plants. The analyses showed that many of these species are extremely rare (occurring in only one spring) and are not protected within conservation reserves. Furthermore, the risk assessment found that many of the springs supporting these highly vulnerable species were at risk from threats posed by groundwater drawdown, introduced plants and animals, livestock damage, and human modifications (e.g. excavation of springs).

These findings highlight the importance of continued research and conservation efforts in relation to GAB spring wetlands and their unique biodiversity.





This figure shows the number of endemic species identified in Great Artesian Basin spring complexes. The dotted lines represent borders around clusters of spring complexes known as supergroups.



Crimson-spotted rainbowfish, *Melanotaenia duboulayi*, a common inhabitant of intermittent streams in the Bremer River study area in QLD. Photo © Copyright by Neil Armstrong.

## New knowledge to inform regulation

The study provides new tools and insights that can help inform the assessment of environmental impacts associated with proposed coal seam gas and coal mining developments in Australia. Tools developed in the study can predict and monitor impacts on vegetation. Other aspects of the study strengthen our understanding of the role of groundwater in supporting ecosystems, which in turn means a better understanding of the potential ecological impacts of groundwater drawdown.

This study is one of several studies commissioned by the Australian Government to improve understanding of the water-related impacts of coal seam gas and coal mining developments. Find out more on the Office of Water Science [website](#).

(Banner photo) Warrill Creek in the upper Bremer River catchment after a large rainfall event. Photo Copyright © by Ryan Burrows.

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