GISERA
Gas Industry Social and Environmental Research Alliance

AUGUST 2018
WATER RESEARCH FACTSHEET

Potential water impacts of coal seam gas in the Pilliga Sandstone

Analysing potential changes in groundwater flows to the Pilliga Sandstone, a Great Artesian Basin (GAB) aquifer.

This study uses regional-scale groundwater modelling to quantify potential changes in groundwater flows to, and water balance of, the Pilliga Sandstone arising from coal seam gas production in the Narrabri region, NSW.

KEY POINTS

- The Pilliga Sandstone aquifer, a fresh water source for irrigation, stock and domestic uses, is an aquifer of the GAB. The overlying Pilliga forest is a recharge area for the aquifer.
- The study reported expected maximum annual water flow losses of 60 ML/year from the aquifer due to CSG development, based on the median result of 500 model simulations which incorporated observed data for the hydraulic characteristics of the aquitards (layers that restrict water movement) that separate coal seams from the Pilliga Sandstone.
- This predicted impact is equal to about 0.2% of the Long Term Annual Average Extraction Limit of 29.68 GL/year from the GAB groundwater source in this area, called the Southern Recharge Source.
- Water for the proposed gas project would not be taken from the GAB aquifer, but from the coal seams which are part of the Gunnedah Basin that underlie this GAB formation, which results in reduced pressure in the coal seams. The near-surface aquifer, the Namoi Alluvium, is a major water resource for agriculture in the region.

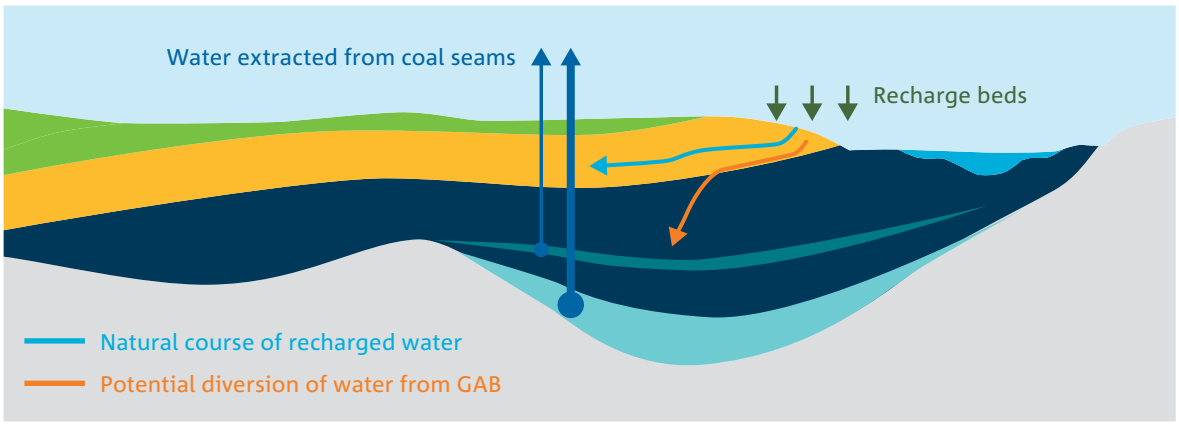
Research challenge

CSIRO researchers are working to better understand the potential water impacts on the GAB due to coal seam gas (CSG) development in NSW's Pilliga region.

This follows community concern that depressurising coal seams to extract gas may impact groundwater pressure in the Pilliga Sandstone aquifer and affect the quantity of water recharge into the GAB.

Using groundwater models, researchers have quantified the range of changes in water volume and water balance for the Pilliga Sandstone, a GAB aquifer, which could arise from depressurisation of the underlying coal seams. This approach takes into account information on the chemistry of the water and how it flows underground, our models of the groundwater system, and the uncertainties associated with our knowledge of the groundwater systems. It uses this to estimate the range of possible flow changes into and from the Pilliga Sandstone.

The study provides results for a broad generalised case of coal seam depressurisation for gas production and is an independent assessment of the possible range of potential impacts on GAB aquifer flows.



Conceptual cross section showing the geological layers and potential water movement due to CSG through the GAB aquifer. Figure for illustrative purposes only.

CSIRO | Australia Pacific LNG | QGC | origin | Santos We have the energy. | NSW Government | Australian Government Department of Industry, Innovation and Science | Supported by Government of South Australia | Queensland Government | Northern Territory Government

Research findings

Two sets of simulations run 500 times each were performed to quantify the CSG-induced flux changes. The first one used a simplified approach to characterise the groundwater system properties. The second one applied more sophisticated modelling methods to account for the spatial variability within aquifers and aquitards by using observations from core samples.

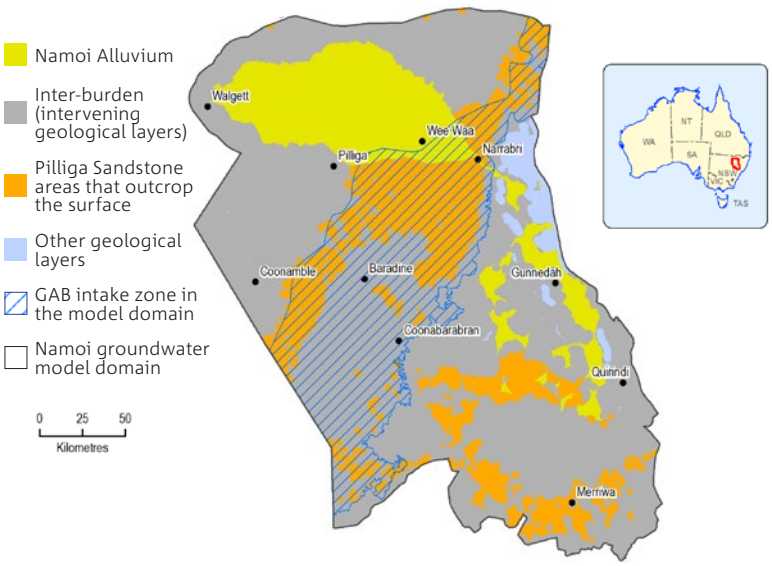
The first results, released in October 2017, found an expected maximum water loss from this GAB aquifer due to CSG development of around 85 mega litres per year, equivalent to about 0.3% of the Long Term Annual Average Extraction Limit from this aquifer, based on 500 model simulations. The maximum groundwater losses from the Pilliga Sandstone to deeper formations was predicted to vary between 0.28 to 2299 ML/year.

The second round of model simulations reported expected (median) maximum flux losses of 60 ML/year. This predicted maximum impacts between 0.01 to 267 ML/year in groundwater flow from the Pilliga Sandstone to deeper formations. The potential increase of groundwater flow from the Pilliga Sandstone to deeper formations was also accompanied by increased rate of water flow into the Pilliga Sandstone from the Namoi alluvial aquifer and surface streams overlying it. The annual maximum flow from the alluvium to the Pilliga Sandstone is expected to be 0.89 ML/year, equal to nearly 0.001 % of the average annual extractions from the alluvium.

What is the Great Artesian Basin?

The Great Artesian Basin is Australia's largest groundwater basin, containing about 65 million GL of water and underlying more than 1.7 million km^2 of eastern Australia. It consists of layers of aquifers and impermeable aquitards ranging from 65 to 250 million years old.

Water from rain and some rivers enters the groundwater along the elevated eastern margins. From these areas of recharge, groundwater flow is driven by the slope of the formations, in some places discharging back to the surface. The structure and nature of the sequence of aquifers governs groundwater flows.



The shaded area is the GAB intake zone in the groundwater model area for the region. This model was developed for the Namoi subregion as part of the Bioregional Assessments Programme.

FREQUENTLY ASKED QUESTIONS

Is the Pilliga area an important recharge zone?

Past studies identify this area as part of the intake beds of GAB in NSW. There is variability in the amount of recharge in different areas within the intake beds.

How much water is recharged annually into the GAB aquifer in this region?

The amount of groundwater recharge into the Southern Recharge Zone is quantified as 42.4 GL/y by the Water Sharing Plan. The total water recharge through the NSW GAB intake beds was quantified as 295 GL/y.

Would CSG development in this area take water from the GAB resource?

No. The water is extracted from the coal seams which are part of the Gunnedah Basin that underlies the GAB formation. Due to the resulting pressure reduction in the coal seams over a period of many years, some water may flow from the GAB into deeper formations.

Will water be lost from the Namoi Alluvium due to CSG development?

As groundwater moves from the Pilliga Sandstone to the coal measures, some water from the Namoi Alluvium may move to the Pilliga Sandstone to replace it. This is estimated to be about 0.89 ML/year or nearly 0.001 % of the average annual extractions from the alluvium.

This study only dealt with changes in the volume of water (flux), not changes to the water table. This information will be available through the Bioregional Assessments Programme, which assesses cumulative water impacts from CSG and coal mines.

Are the GAB aquifer and coal seams connected?

No. There are thick layers of rock formations between the GAB aquifer and the coal seams that generally have low permeability. However, lowered pressured in the coals seams resulting from CSG development has the potential to lead to some flow of water from the GAB, which is invested in this study.

Where do I find more information?

All reports from this project can be found at the GISERA website:

https://gisera.csiro.au/project/impacts-of-csg-depressurisation-on-the-great-artesian-basin-gab-flux/

More information about the Great Artesian Basin and coal seam gas is available at:

https://gisera.csiro.au/more-information/frequently-asked-questions/the-great-artesian-basin-and-coal-seam-gas/

FURTHER INFORMATION: 1300 363 400 | gisera@gisera.csiro.au | www.gisera.csiro.au

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