Groundwater and drought

Groundwater monitoring

The government is monitoring water levels across much of inland NSW. If groundwater in your area is experiencing excessive water level declines, steps to manage effects on users may include restricting extraction.

Over 5,000 monitoring stations measure the quality and quantity of water across NSW. Over 1,200 of these stations continuously monitor water sources, delivering real-time data through the WaterNSW telemetry and remote data capture networks.

This data can be accessed near to real-time through the Real-time data website: https://realtimedata.waternsw.com.au/

The Real-time data website offers information and data on:

- NSW river heights
- streamflow
- dam and reservoir level and volumes
- groundwater bores
- meteorology and rainfall.

Bore owner responsibilities

Water sharing plans require that new or replacement bores to access water for basic rights (that is for stock and/or domestic supply) be constructed to sufficient depth to maintain access to the water source for the life of the bore. The onus is on the landholder to ensure they construct their bore to a depth that allows for changes in water level.

If a bore fails, the owner should check the bore integrity. A local drilling company or pump supplier may be able to assist with this. The investigation may find that the bore needs cleaning out, reconditioning, or even re-drilling if the damage is severe enough.

The investigation may find the bore integrity to be sound. In this case, it may be that the bore is not constructed to sufficient depth to allow for changes in water level. Water levels should return once the climate has improved and there has been recharge to the aquifer.

If there is an **urgent need for supply**, a deeper bore will need to be drilled. Contact WaterNSW for information on requirements for a new or replacement bore at:

www.waternsw.com.au
Phone: 1300662077
Email: Customer.Helpdesk@waternsw.com.au

Typical causes of bore failure

Bores can fail to produce water for many reasons, including:

- insufficient bore depth to allow for water level variability
- the bore has been excessively pumped
- the bore casing has become corroded, damaged or blocked
- extractions in the area have made the local water levels drop.

Some of the causes of failure are due to changes in the bore itself that can occur if:

- it has not been properly maintained
- the construction is particularly susceptible to accumulating fine sediments
- the groundwater quality lends itself to the formation of chemical or bacterial deposits (Figure 1) that can clog openings.

Slime build up inside delivery pipe.

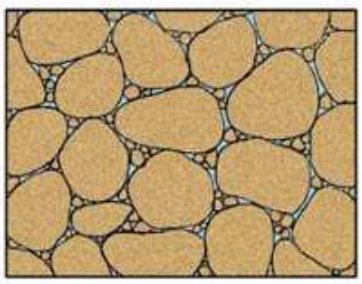
Figure 1. Iron build-up in piping

These can make water levels within the bore drop, leading to a reduction in the water supply capacity.

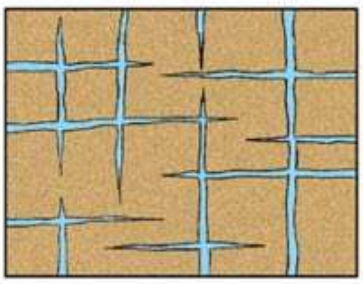
Excessive pumping from a bore can also contribute to a loss of supply. When pumping is at a faster rate than the aquifer can supply, groundwater levels in the bore rapidly reduce. Additionally, large extractions from many bores in an area can make the regional groundwater levels drop. This can make the water levels drop below the depth of the openings in the bore casing or below the pump intake. This results in a decrease in pumping yield or loss of access.

Groundwater and aquifers

Groundwater exists beneath the land surface in saturated zones known as aquifers. Contrary to popular belief, groundwater generally does not form underground rivers. It fills the pores and fractures of sand, gravel and rock, in much the same way that water fills a sponge (Figure 2).



A. Porous rock and alluvial: In porous rock or alluvial aquifers, the grains of sediment (sand, gravel and clay) store water.



B. Fractured rock: In fractured rock aquifers, the cracks in the rock store water.

Figure 2 Alluvial, porous rock compared to fractured rock

Reference: https://dpipwe.tas.gov.au/water/groundwater

An unconfined aquifer is where water can flow between the surface and the saturated zone. The top of an unconfined aquifer is the water table (Figure 3).

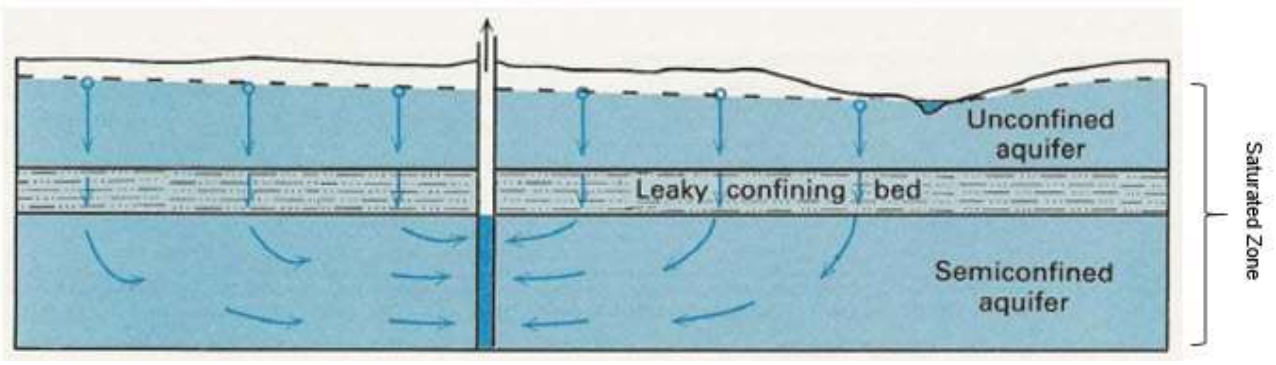


Figure 3. An unconfined aquifer

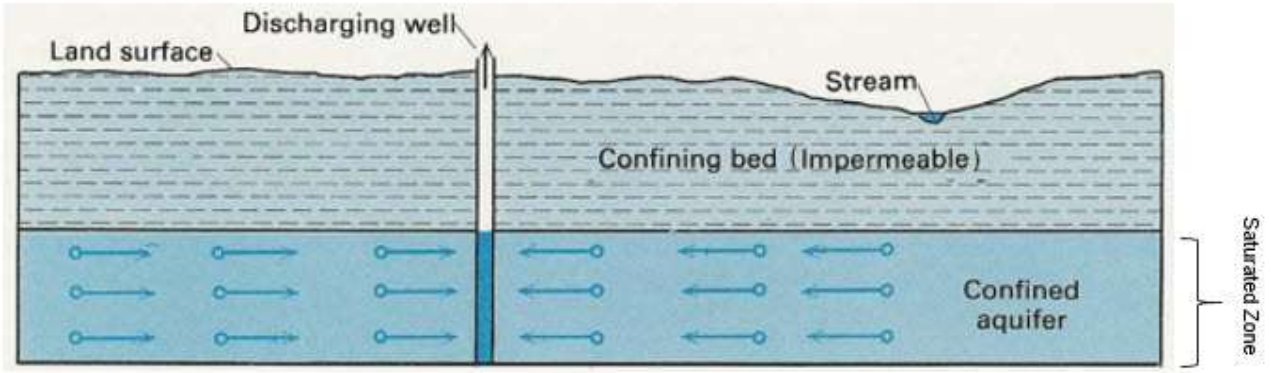


Figure 4. A confined aquifer

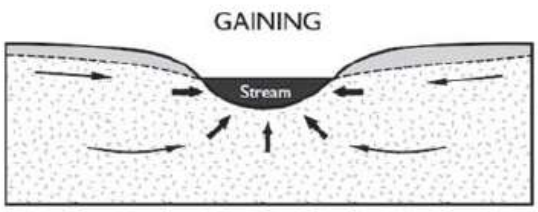
Reference: https://hydro.geo.ua.edu/GEO406_506/Lecture12.pdf

A confined aquifer has layers of impermeable material above and below the aquifer (Figure 4). These aquitards (semi-pervious) or aquicludes (completely impermeable) cause the aquifer to be under pressure so that when the aquifer is penetrated by a bore, the water will rise above the top of the aquifer.

An aquifer that is overlain or underlain by a semi-pervious layer (aquitard) through which vertical leakage takes place is called a leaky aquifer or semi-confined aquifer (Figure 3).

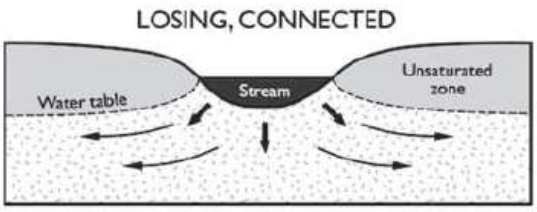
Surface water and groundwater connectivity

A.

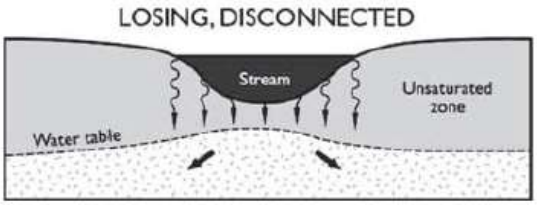


Some rivers or creeks gain water from unconfined aquifers. These are called gaining streams (Figure 5A). Others lose water to the aquifer and are called losing streams (Figure 5B and Figure 5C). These

B.



C.



unconfined aquifers are highly influenced by surface water flows.

Rivers or creeks can also shift between gaining and losing systems in separate reaches along their courses. They may also shift over time when the hydrology, underlying geology, local climate, or streamflow conditions vary.

Figure 5. Gaining (A) and losing streams (B) and a losing stream that is disconnected from the water table (C)

Reference: Disconnected Surface Water and Groundwater: From Theory to Practice, Brunner et al 2009. https://core.ac.uk/download/pdf/20658253.pdf

Groundwater recharge and discharge

Water levels in an aquifer can vary due to prevailing weather conditions, longer term climate patterns and from pumping.

Recharge is the movement of water into an aquifer from rainfall or flooding through infiltration. Recharge also occurs through the seepage of water beneath rivers or creeks (losing streams).

Groundwater discharge is where groundwater leaves the aquifer. This can be naturally, for example as discharge to a river (gaining stream), or artificially, via pumping from a bore or well.

Effects of drought on water levels

Many aquifers depend on rainfall or surface water to maintain groundwater levels. Groundwater levels during non-drought conditions are more likely to sustain localised pumping effects (Figure 7).

During a drought, aquifers are not replenished as much as normal. Their only source of recharge is often losing streams while they are flowing. Reduced recharge during drought can reduce groundwater levels within the aquifer (Figure 8) and therefore in bores (Figure 9). At the same time, there may be other groundwater users in the same area needing to pump more than normal. Combined, these effects can lower water levels in bores.

Bores in unconfined aquifers are often affected more than those in confined aquifers. This is because an unconfined aquifer is usually recharged across a smaller area (such as a narrow river valley), whereas, a confined aquifer is usually recharged over a much broader area (such as a region).

Stock and domestic bores are often constructed into the shallowest available aquifer. They usually have a relatively small diameter and limited extraction capacity. This can make stock and domestic bores more susceptible to effects such as climatic fluctuations or nearby pumping.

Examples of an unconfined aquifer in non-drought and drought conditions, with and without pumping

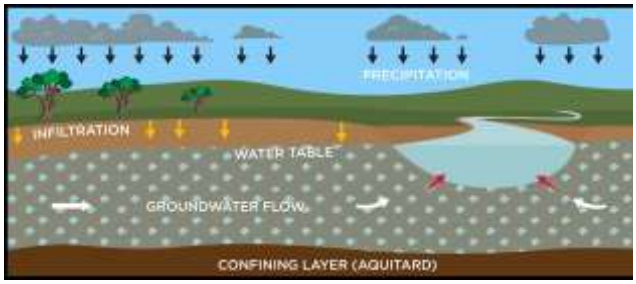


Figure 6. Non-drought conditions—no groundwater pumping

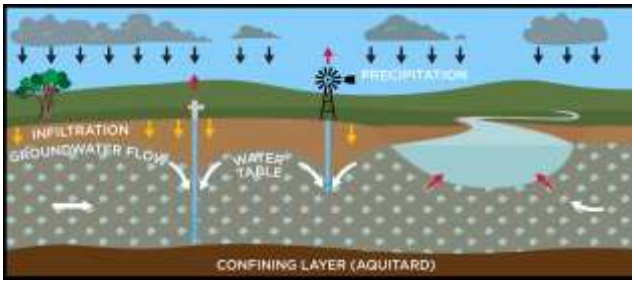


Figure 7. Non-drought conditions—bores pumping groundwater

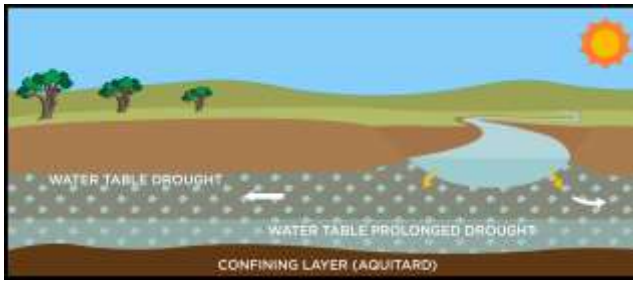


Figure 8. Drought conditions—no groundwater pumping

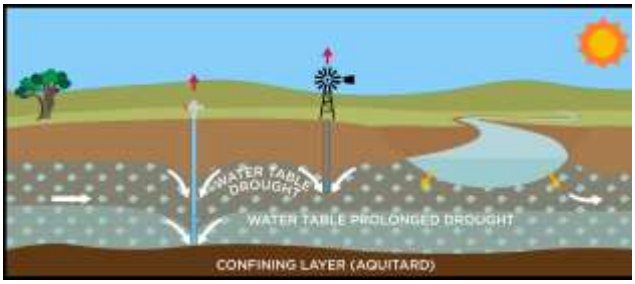


Figure 9. Drought conditions—bores pumping groundwater

More information

General information about groundwater is available on the Department of Planning, Industry and Environment website at www.industry.nsw.gov.au/water/science/groundwater/what-is-groundwater