

MANAGING GROUNDWATER IN THE LOWER MURRAY DARLING CLOSE TO THE STREAMS

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INTRODUCTION

This information paper is prepared to explain the status and availability of groundwater in the Lower Murray Darling River areas close to the streams. It forms part of the series of information papers published by the Department of Infrastructure, Planning and Natural Resources (DIPNR) on natural resources management.

Geography and Physical Environment:

The average rainfall and evaporation in the Lower Murray Darling area is about 250mm and 2000mm respectively. In such a dry environment, the recharge that replenishes the groundwater is very minimal, 1mm or less in a year. The salinity of the groundwater is very high, in some instances more saline than the seawater. Therefore, the fresh groundwater, if it exists, is at shallow depths near the rivers and fresh water bodies of the Lower Murray Darling area as indicated in the Fig.1 below. The extent of it varies from a few hundred metres to a couple of kilometres from the riverbank depending on the floodplains and river course over the years.

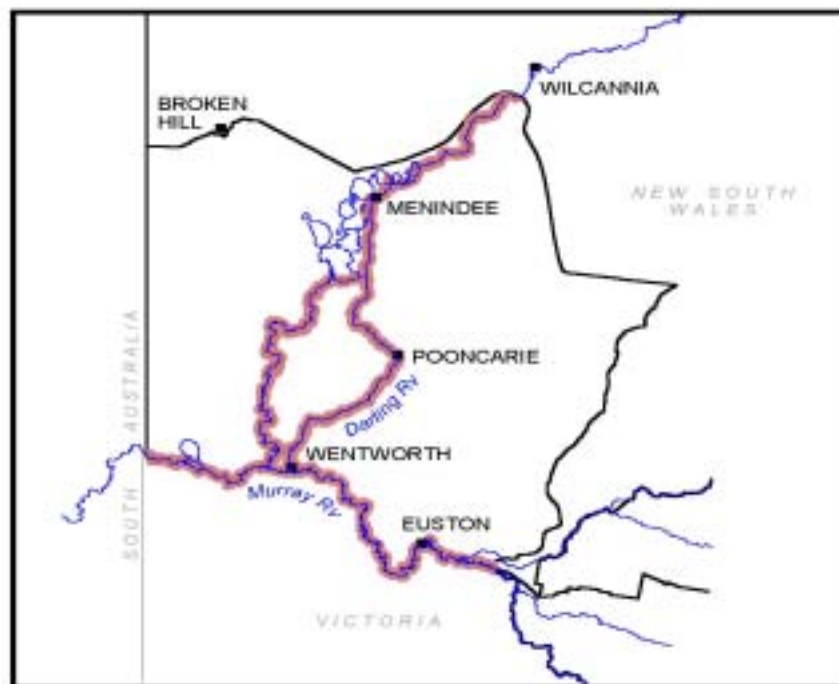


Fig. 1: Map of the Lower Murray Darling area showing the fresh groundwater lens

Groundwater Management:

Geology and Hydrogeology

Groundwater is contained in the space between soil particles (sand, silt and clay), gravels and in fractured rocks. They have been deposited in layers under processes that began millions of years ago. An aquifer is a layer or layers of sediments that contain extractable amount of groundwater. Fig.2 below shows the hydrogeology of the area near to the river.

The fresh water lens forms part of the river deposits and is referred to as the 'Channel Sand Aquifer'. This lies above the deeper layers that contain highly saline water. In some instances the deeper layers are exposed to the layer above, and may contain relatively fresh water. The depth of the layer containing the fresh water lens varies and may not be continuous. In the absence of adequate information, it has been estimated that the depth of the 'Channel Sand Aquifer' would be around 30m.

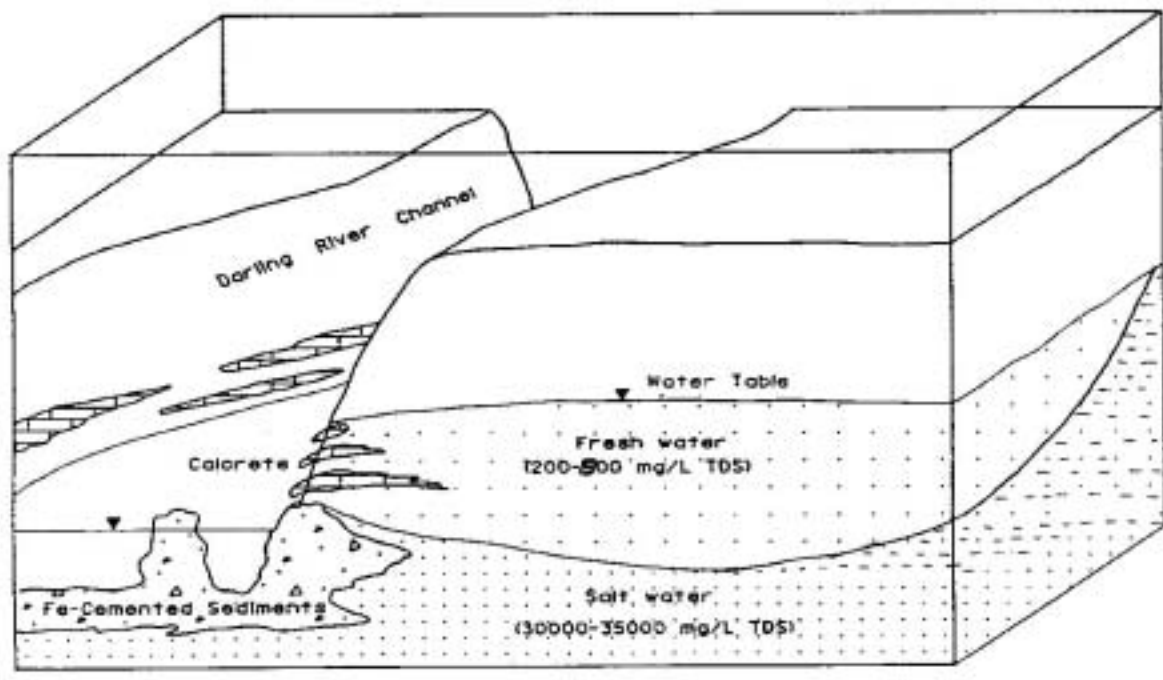


Fig. 2 Typical hydrogeology close to the river

Groundwater use, allocation and sustainable yield:

Because of high salinity levels groundwater of the Lower Murray Darling area, (discussed in the section below), has been used for stock and limited domestic purposes.

Currently, groundwater entitlement for Stock purposes is granted on the basis of maximum allowable stocking rate of a property. A fixed allocation (2-ML per annum) is granted for domestic purposes.

Groundwater extractions need to be managed within the sustainable yield of the system, so that the availability of the resource is sustained for future generations and ecological processes remain viable. The Department will soon initiate a process to define the Sustainable Yield (SY) of the 'Channel Sand Aquifer' system. The SY is defined as 'that proportion of the long-term average annual recharge that can be extracted each year without causing unacceptable impacts on the environment and or groundwater users'.

With continued drought, currently there is a high demand from existing surface water users to pump low salinity groundwater from the fresh water lens near the river. As an interim measure for granting irrigation entitlements, precautionary principle will be applied on the basis of data being collected or available at hand while allocating this water for a defined period.

Groundwater quality:

Generally, the groundwater in the Lower Murray Darling area is saline (5,000 EC to more than 50,000 EC) irrespective of depth of its occurrence with the exception of narrow lenses of alluvial aquifers along the Murray and Darling Rivers, lakes and anabranches. The depth of this fresh water lens is approximately 30m. Low salinity groundwater may still exist at depths greater than this but the extractable volume of fresh water from it may be very limited.

Connections between Groundwater and Streams:

It could be stated that groundwater and surface water are fundamentally interconnected especially close to streams.

Surface water and groundwater interactions are complex and can vary both spatially and temporally. The connectivity between surface and groundwater is influenced by factors such as geology, geomorphology, river heights and climate.

The 'Channel Sand Aquifer' system present generally along the Lower Murray-Darling rivers is considered as a connected system, but the degree of connectivity is not clearly defined. Fresh water lens or pools of low salinity water that is associated with this aquifer is a true indication of a connected system. It is also noted that the presence of fresh water lens may not be continuous.

Groundwater / surface water interaction is considered important because of the possibility of reducing surface water flows due to groundwater abstraction.

The DIPNR will be undertaking detailed investigation to quantify the degree of connectivity between these two resources especially close to streams.

It should be noted that potential groundwater inflows to streams could cause a reduction in the surface water quality due to higher salinities of groundwater. Although groundwater fluxes into the streams may be small compared to total flow, groundwater does have a profound influence on surface water quality.

In reaches where groundwater is entering the river channel, the channel is called a ‘gaining’ (effluent) stream (Figure 3). If the water is leaving the river channel, the channel is called ‘losing’ (inflow) stream. Especially in regulated river systems, the same channel may behave as an ‘effluent’ stream as well as an ‘inflow’ stream in different places along their length. This interaction is prominent along the Murray River especially in the weir pools.

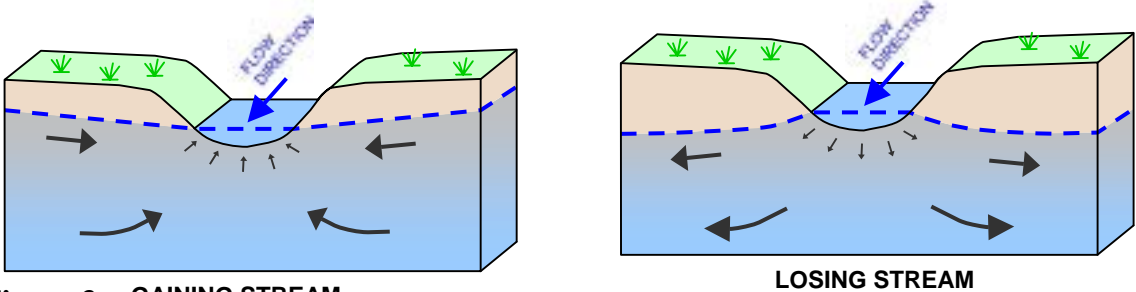


Figure 3: GAINING STREAM

LOSING STREAM

Potential Impacts of Large abstraction on resource sustainability:

As shown in Fig. 4 below, groundwater extraction from the freshwater lens could create a vacuum in the form of a cone of depression in the vicinity of the bore and slowly it will be replenished with water from the surrounding areas to allow the pumping to continue. This may result in the shifting of the saline interface closer to the pumping bores with continued pumping.

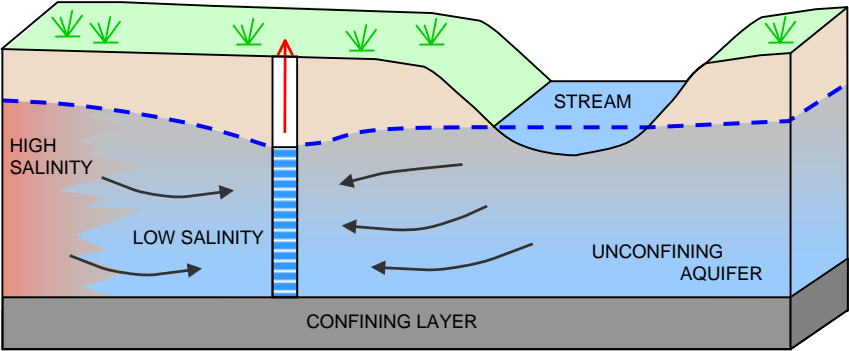


Fig 4: EFFECTS OF GROUNDWATER PUMPING ON:
 1. CONNECTION BETWEEN SURFACE AND GROUNDWATER CLOSE TO STREAMS
 2. MOVEMENT OF SALINE INTERFACE

Minimum requirements:

i) The distance requirements mentioned here have been developed and adopted to protect the resource and interest of the existing groundwater users. This includes the following:

Shallow bores (bores that are up to 30 metres deep) for Irrigation purposes

- 100m or more from the river bank or water bodies
- 200m from the property boundary
- 200 - 400m (depending on the aquifer types), from any other irrigation or stock and domestic bores
- 1000m from any town water supply bore
- 500m from a departmental monitoring bore

Deep bores (bores that are deeper than 30 metres)

All of the above conditions apply except that such bores can be constructed at a distance of 40 metres from the riverbank.

ii) Allocation for irrigation bores will be based on the enterprise and is limited to the surface water entitlement holders only. The volume of allocation will be based on;

- Enterprise
- Length of River frontage
- Area of Irrigation
- Extent of the freshwater lens
- Information collected during test pumping

iii) Test drilling is mandatory prior to constructing a production bore in the freshwater lens. The bore log and water quality test results must be sent to the Department prior to drilling a production bore.

iv) DIPNR will not allow any further groundwater extraction once the groundwater quality exceeds 3,000 EC. However, the water users should be aware that the above threshold of 3,000EC or even better quality water might not be suitable for certain agricultural enterprises. NSW Agriculture must be consulted before groundwater is used for irrigation. Once the groundwater quality reaches 1,500 EC, DIPNR must be informed of the water quality on a weekly basis.

Knowledge Gaps:

Major gaps exist in our understanding of:

- Sustainable yield, for which exploration drilling to determine the extent, continuity and geometry of the aquifer system and potential recharge are required.
- Degree of connectivity between streams and the aquifer, which is required to better understand the effect of groundwater pumping on temporal changes in both water level and quality.

FURTHER INFORMATION

Information regarding the management of groundwater closer to the streams in the Lower Murray Darling areas is available from the offices of the NSW Department of Infrastructure Planning and Natural Resources at:

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