



GROUNDWATER in the MURRAY MALLEE

INTRODUCTION

The Murray Mallee is an important agricultural area whose primary produce includes wheat, barley, and wool. Development of the region began in the early 1900s with the expansion of the States' railway network. With the exception of several conservation parks, the area has been mostly cleared of natural vegetation for cropping and grazing. Average annual rainfall decreases from about 450 mm in the southwest to 300 mm in the northeast. Annual rainfall is greatly exceeded by the average annual evaporation which ranges from 1700 to 2175 mm/year. Because of the low rainfall and well-drained sandy soils, there are few surface water resources and the region is dependent on groundwater for water supplies.

GEOLOGY

The Murray Mallee is underlain by sand, clay and limestone up to 300 m thick, which were deposited over the last 30 million years during the Tertiary Period. During this time, an ocean formed when Australia and Antarctica

became separated by continental drift. The sediments are flat lying and uniform in thickness like a layer cake. The area forms part of the Murray Basin which stretches from the Mount Lofty Ranges eastward to the Great Dividing Range on the eastern seaboard (Fig. 1).

HYDROGEOLOGY

The most extensively used water-bearing layer (aquifer) in the Mallee is the Murray Group limestone, known locally as the 'coral' (Fig. 2). This aquifer was first discovered in the Pinnaroo area in 1894 and the State Government tested the region by drilling extensively in the 1900s. The good quality water found at a depth of about 60 m encouraged development of the aquifer and it is now used for domestic, stock, irrigation and town water supplies.

Groundwater in this limestone aquifer originates from rainfall. Although very little, if any, rainfall soaks down to the water table in the Mallee region, most of the replenishment to the aquifer occurs in southwestern Victoria where rainfall is

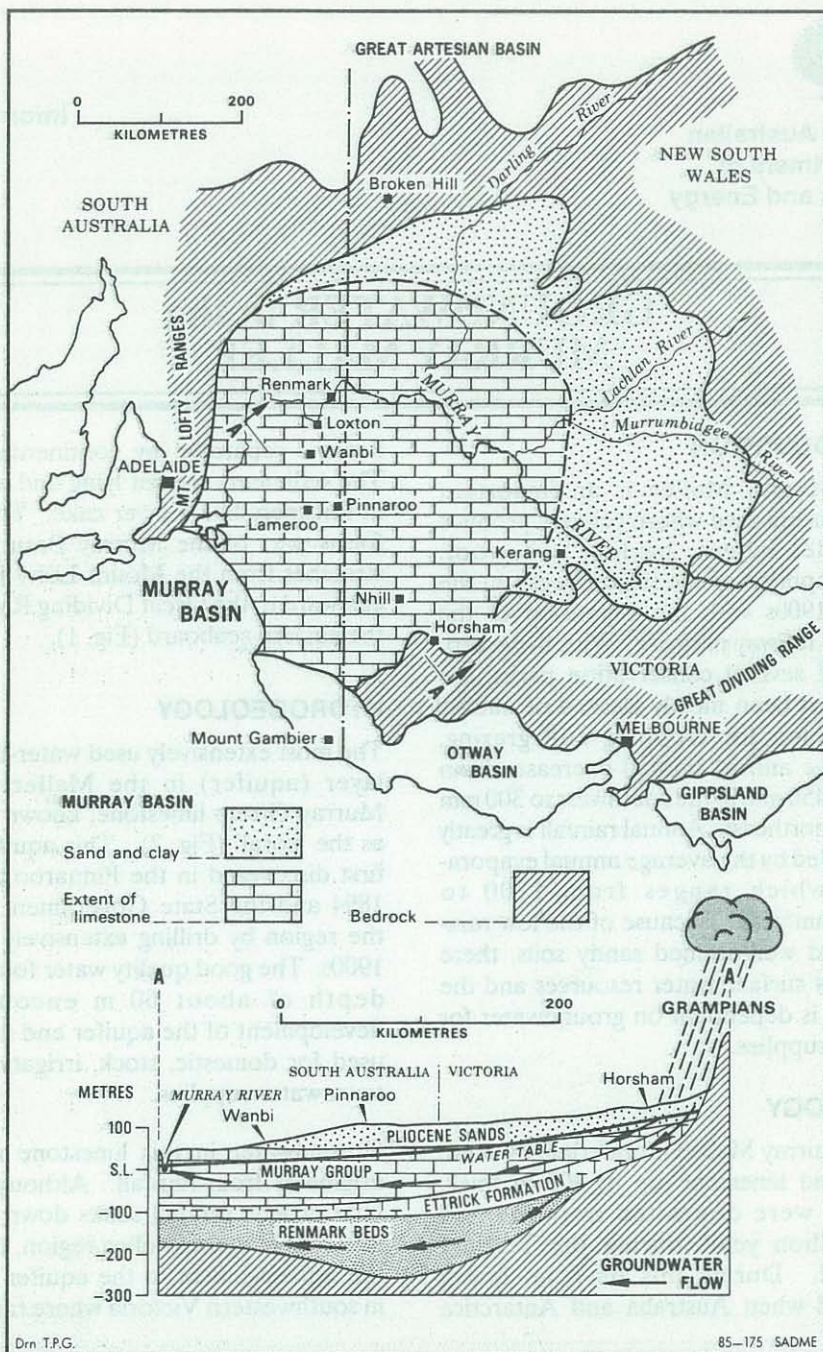


Figure 1. Generalised geological plan of the Murray Basin

much higher. From there, it flows slowly underground beneath the Mallee towards the Murray River, which acts as an effluent drain (Fig 3). The rate of movement, undisturbed by pumping, is about half a metre a year.

Figure 4 shows salinity contours of the groundwater in the limestone aquifer. Salinity increases northwesterly from about 1 000 mg/L (70 grains) at Pinnaroo, to about 12 000 mg/L (840 grains)

Loxton. This is because the slowly moving groundwater dissolves soluble salts as it passes through the aquifer, and also because of the gradual addition of minute amounts of salt carried downwards by infiltrating rainfall over thousands of years. There is a large area where the salinity is below 3 000 mg/L (210 grains) and groundwater supplies are suitable for irrigation, depending on the salt tolerance of the crop to be grown.

Groundwater salinity is generally consistent throughout the aquifer, although in the Alawoona-Peebinga area there is an improvement in quality about 30 m below the water table. The small area of unusually good quality groundwater near Kartoona occurs as a layer about 20 m thick, below which salinity rises to about 500 mg/L (105 grains).

Yields from bores in the limestone aquifer vary from 0.5 L/sec (400 gals/hr) for stock windmills, to deep irrigation bores which can pump about 60 L/sec (50 000 gals/hr).

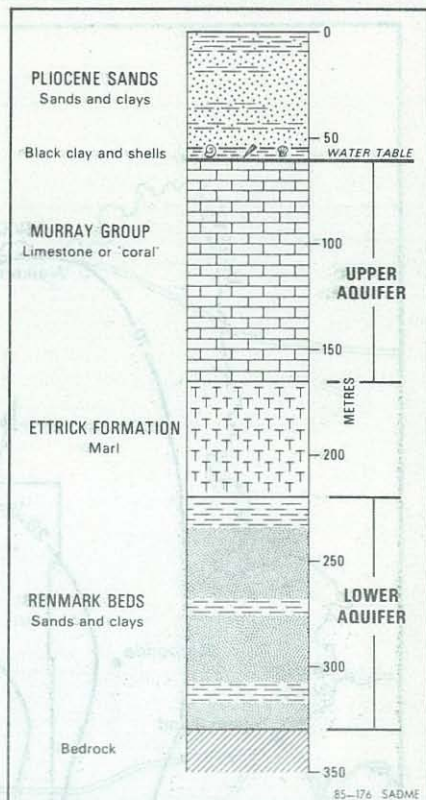


Figure 2. Typical geological section

Beneath the limestone aquifer, sands of the Renmark Beds provide a further aquifer (Figs 1 and 2). Here, groundwater is stored under pressure and, when intersected by drilling, rises to the same level as the water table in the overlying limestone aquifer. Salinity of groundwater in the pressure aquifer is similar to that in the limestone. Few bores have been drilled into the deep aquifer because of high drilling costs and the unreliability of supplies.

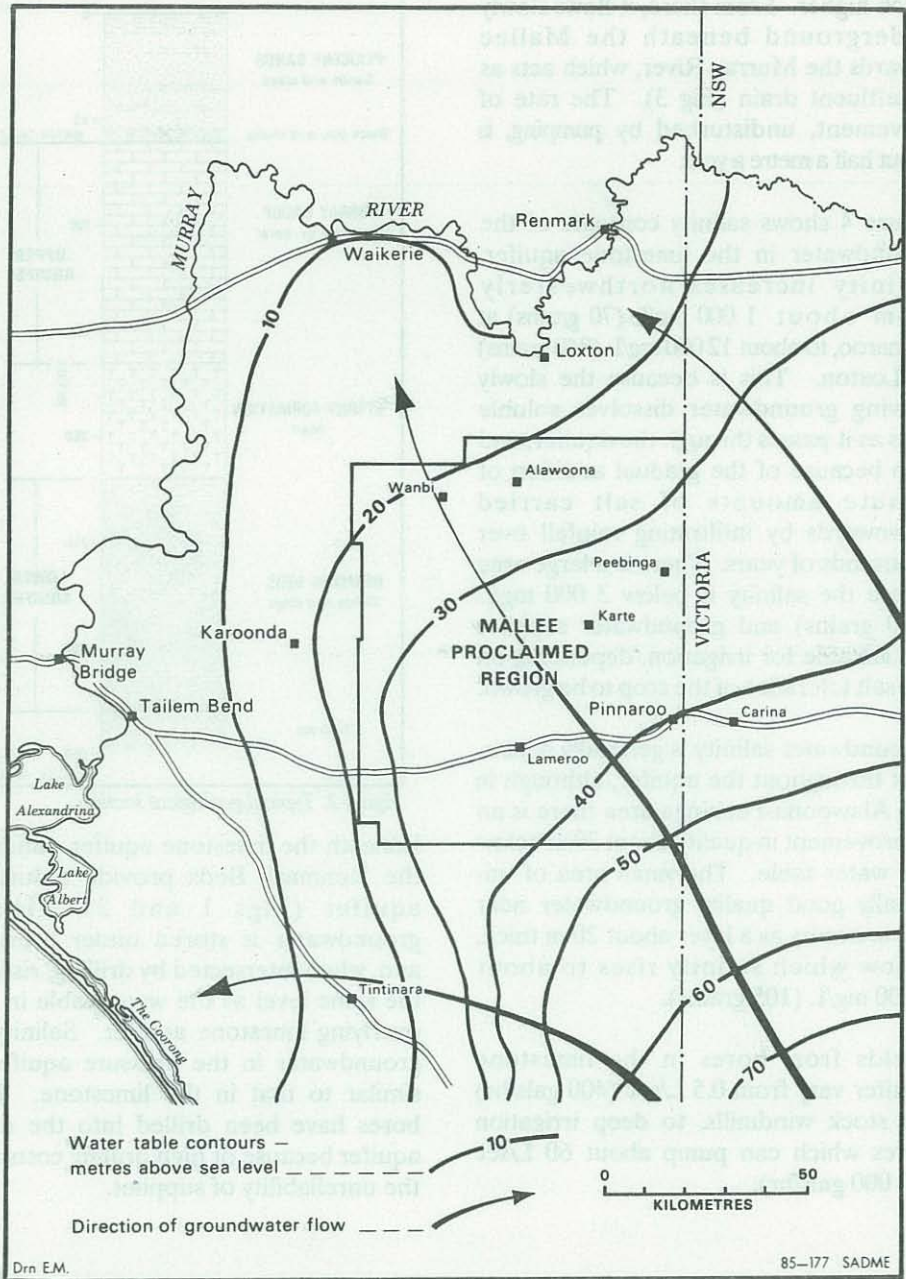
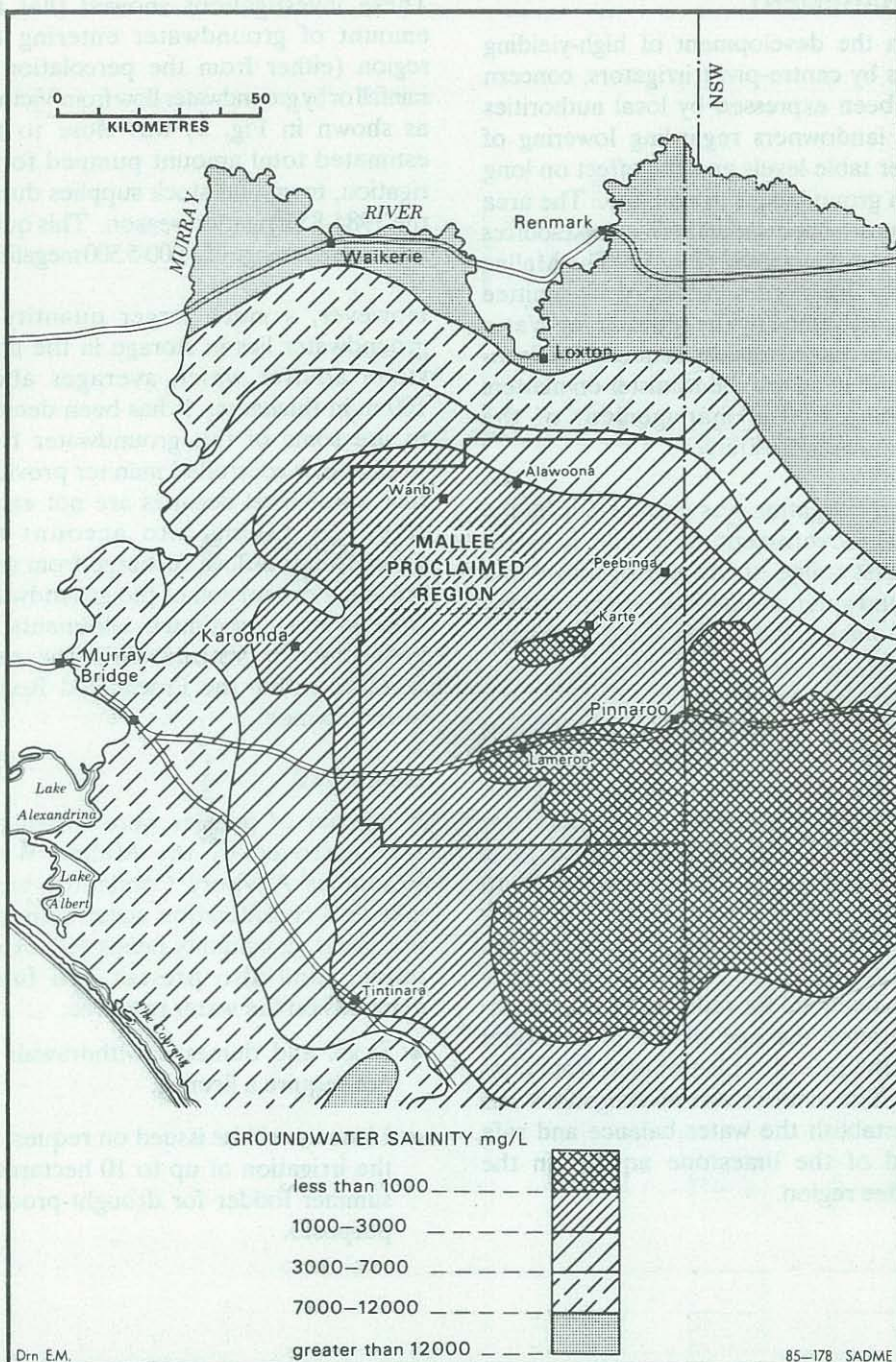


Figure 3. Water table contours

Facing page: Figure 4. Groundwater salinity, unconfined aquifer



MANAGEMENT

With the development of high-yielding wells by centre-pivot irrigators, concern has been expressed by local authorities and landowners regarding lowering of water table levels and the effect on long term groundwater availability. The area was proclaimed under the Water Resources Act in August 1983 (Fig. 5). The Mallee Water Resources Advisory Committee was established by the Minister for Water Resources to consider requests for licences and to advise the Minister on matters relating to the management of the groundwater resource.

An investigation was carried out by the State Government to obtain a better understanding of the hydrogeology and groundwater availability so that a long term management plan could be formulated.

As part of the investigation, observation wells were selected to monitor groundwater levels throughout the Mallee and also around areas of intensive irrigation. Long term pumping tests have been carried out on selected wells to obtain information about the permeability and storage capacity of the limestone aquifer. Water samples have been analysed for radioactive isotopes to determine the age of the groundwater and the rate of replenishment from rainfall. The aim of these investigations was to establish the water balance and safe yield of the limestone aquifer in the Mallee region.

These investigations showed that the amount of groundwater entering the region (either from the percolation of rainfall or by groundwater flow from Victoria, as shown in Fig. 3) was close to the estimated total amount pumped for irrigation, town and stock supplies during the 1984-85 irrigation season. This quantity lies in the range of 5 000-5 500 megalitres.

However, a much larger quantity of groundwater lies in storage in the limestone aquifer which averages about 100 m in thickness. It has been decided to use some of this groundwater from storage in a controlled manner provided that water level declines are not excessive. By taking into account the groundwater inflow, recharge from rainfall and a proportion of the groundwater from storage, maximum allotments for groundwater withdrawals for each hundred within the Proclaimed Region were obtained.

LICENCES

A number of policies were formulated and approved by the Mallee Water Resources Advisory Committee which take into consideration water conservation goals, community needs and expectations, and also present and future demands on the water resource:

- Stock and domestic withdrawals do not require a licence.
- Licences will be issued on request for the irrigation of up to 10 hectares of summer fodder for drought-proofing purposes.

- Licences for large-scale irrigation or industrial use will be issued subject to assessment of the impact on nearby users and a review every five years. Development associated with these licences should be half completed within three years and fully developed in five years, otherwise the licensed allotment may be changed.
- Licences are issued provided that the maximum allotment for each hundred is not exceeded.

*Further information and licence application forms can be obtained from the Engineering and Water Supply Department,
P.O. Box 1715, Adelaide 5001.*

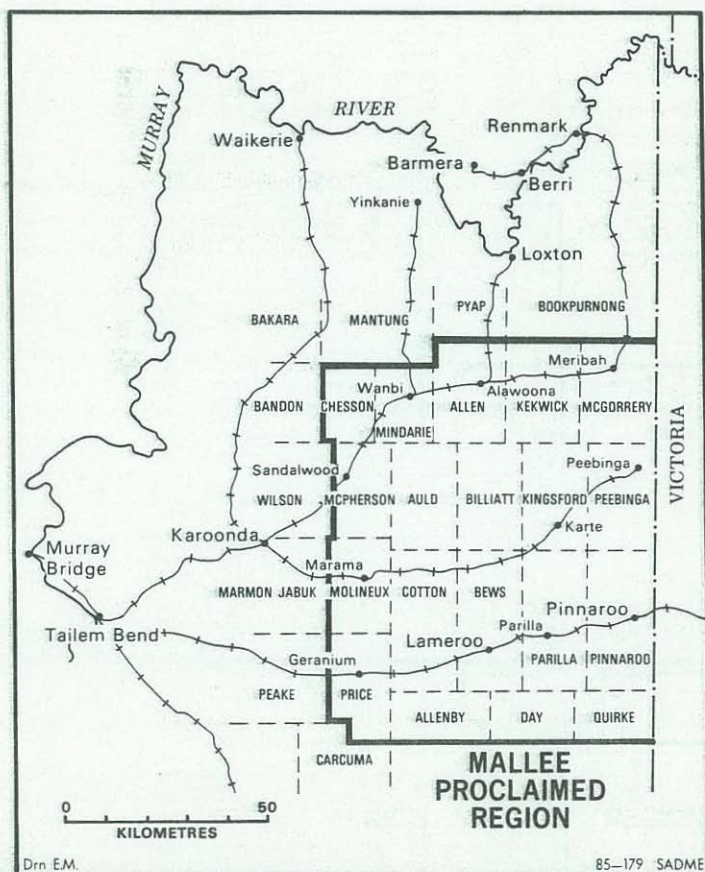


Figure 5. The Mallee Proclaimed Region