South West Yarragadee
Blackwood Groundwater Area

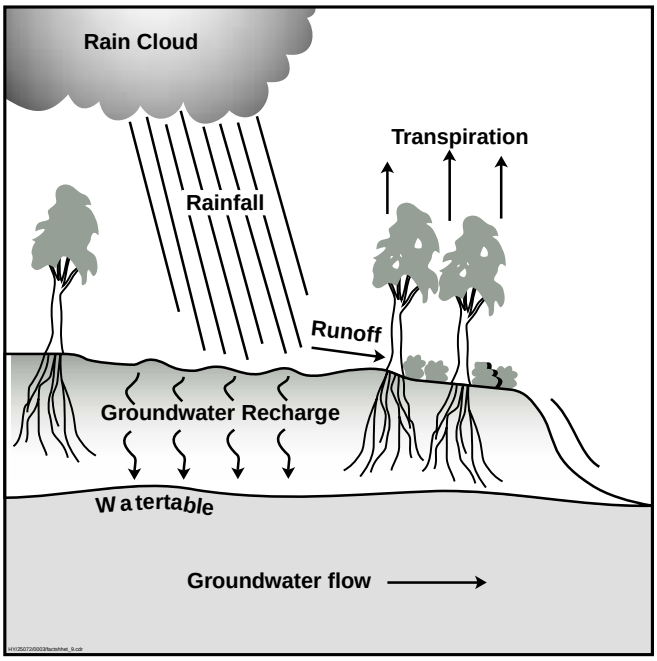
FactSheet 9

July 2003

Recharge investigations

What is 'groundwater recharge'?

Water from rainfall that infiltrates (or seeps) into the ground to become 'groundwater' is called 'recharge', and the area on the land surface where major recharge occurs is called the 'recharge area'. The amount of water that seeps into the ground varies widely from place to place according to the nature of the vegetation and soil. In porous surface material such as sand or gravel, water seeps through quickly and a lot of the rainfall becomes groundwater. On the other hand, water movement through less porous surface material such as clay is very slow so that only a very small portion of the rainfall becomes groundwater. The remainder of rainfall either runs off the land surface into streams, or evaporates from the soil surface, or is absorbed by plants through their roots and then transpired into the atmosphere through their leaves.



Diagrammatic representation of groundwater recharge

Recharge into the South West Yarragadee aquifer

Recharge into the South West Yarragadee aquifer comes from two sources.

- Areas within the State Forest, north and south of the Blackwood River, where the South West Yarragadee aquifer is exposed at the surface provide recharge from rainfall direct into the aquifer. The current estimate is that about 10 per cent of the rain falling on these areas enters the aquifer as recharge.
- Elsewhere on the Blackwood Plateau and coastal plains, recharge is indirect - by leakage from the overlying Superficial and/or Leederville aquifers, which lie over most of the South West Yarragadee. The amount of recharge entering the South West Yarragadee aquifer by this route is very hard to determine with any certainty, but is believed to be less than that occurring by direct recharge.

Recharge into the Leederville aquifer

Recharge into the Leederville aquifer occurs across its whole range, but is difficult to determine for each location. High rates of recharge occur in the more sandy areas, which are more permeable. Lower rates of recharge occur in areas where the aquifer consists of more clayey material.

How much recharge is occurring?

We need to know how much water recharges the aquifers – this will affect the volume of water that can be withdrawn ('abstracted') safely from the groundwater resources. Unfortunately, recharge can't be measured directly. Three estimation methods are being used to improve our understanding of the rate of recharge of both the Yarragadee and Leederville aquifers.

Chloride balance method

This method uses the ratio of chloride that is deposited on the surface with rainfall (and with 'dryfall', where salt

particles fall without rain), and that stored within the soil profile and groundwater. This ratio enables an estimate of the proportion of rainfall that becomes groundwater recharge. Three sites in each of the South West Yarragadee and Leederville recharge areas have been drilled to 30 m depth. The boreholes have been sampled for chloride concentrations in soil water at 2 m intervals down to the full depth. A typical figure for the South West Yarragadee sites is about 100 mg/L chloride through the profile. This compares to rainfall concentration of 10 mg/L chloride, which suggests a recharge rate of about 10 per cent of total rainfall.

Isotopic analysis

The Carbon-14 content of groundwater can tell us how 'old' the groundwater is and how long it has been since it infiltrated. Samples have been taken from past and current exploratory boreholes throughout the area and are being analysed (as at July 2003) for Carbon-14.

Numerical modelling

Two physically-based recharge models (WAVES and WEC-C) are being used to simulate the fate of the rainfall across the whole of the Blackwood Plateau, the Swan Coastal Plain and the Scott Coastal Plain. Output from these computer-based models will enable predictions of groundwater recharge across the whole region.

Recharge is influenced by:

- the amount of rainfall;
- the amount of water that leaves the site as surface run-off;
- the permeability of the soil to rainfall infiltration; and
- the amount of water lost to the atmosphere as water vapour through evaporation from the soil surface and transpiration from the leaves of the vegetation.

Data on these characteristics at the one-hectare scale for use in the model have come from the following sources:

- Soil mapping done by the Department of Agriculture for each geological unit has been used to define the soil properties and hence the potential for infiltration.
- Satellite imagery has been used to determine the land use, the type of vegetation and its density. This information is used to estimate evaporation and transpiration rates.
- Rainfall data have come from daily recordings over the period from 1980-2002. The average rainfall per year has been about 5 per cent lower over this period than in the 50 years before that time.

How are the recharge predictions being used?

Predictions of the rate of groundwater recharge from the three methods are being used as inputs in the groundwater flow modelling (described in *FactSheet 11*), which will provide information on how the aquifers respond to a range of management scenarios. This will help the management of the South West's groundwater resources.

For more information contact

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