



South West Yarragadee Blackwood Groundwater Area

FactSheet

July 2003



Geophysics investigations

What is geophysics?

Geophysics is the science of remotely mapping the variation in the physical properties of the ground beneath us. The information collected is used to determine the types of rocks below the surface, and how they are distributed.

Seven different types of geophysical investigation are being used in the South West Yarragadee – Blackwood Groundwater Area:

- Measuring variation in *gravity* over an area – provides information on the density of the material below the surface. Higher gravity means more dense material, such as hard rocks close to the surface. Lower gravity means a thick layer of less dense material, such as sands and shales over basement rocks.
- Measuring variation in *magnetic strength* over an area – provides information on the types of rocks. Bunbury Basalt is highly magnetic, whereas the sands and shales in the Yarragadee Formation are less magnetic.
- Measuring variation in the *radiation* across an area – provides information on where radioactive elements have concentrated, such as in old river beds, shale and sand deposits, and mineral sands deposits.
- Measuring how sound waves travel across an area – through '*seismic*' investigations. This provides information on how the structures are formed, and where the barriers are within a formation. These may be geological faults that can affect how water flows through an aquifer.
- Measuring *electrical conductivity* of the ground with electro-magnetic surveys – provides information on the distribution of sand (low conductivity) and clays (high conductivity).
- Measuring *electrical conductivity* and *natural gamma radiation* in a borehole – provides information on the

salinity of the groundwater. Freshwater is a poor conductor, whereas saline water is highly conductive. It also gives information on the variation in rock types. Sands have lower radiation than shales.

- Measuring *groundwater temperature* – provides information on the usefulness of the water. The cost of cooling hot water before it can be used for public water supplies or other uses can be very expensive.

Past geophysics work

Previous geophysics investigations (described in *FactSheet 2*) have given us a good working knowledge of the size and structure of the geological formations in the South West. Past work included:

- a regional gravity survey in the 1950s;
- regional airborne magnetics survey in the 1960s; and
- seismic investigations by oil companies.

Current investigations

Ground-based studies



Taking gravity measurements (courtesy Fugro)

- Additional gravity measurements across the area are helping develop a better understanding of the geological formations, and the location of faults within them.

Faults can interrupt or slow down the rate of lateral groundwater flow through the aquifer. This information will be used in the groundwater flow model (see *FactSheet 11*).

- An electro-magnetic survey is being done across the margins of the South West Yarragadee recharge area, to build a better map of the precise area where recharge occurs. This information will be used in modelling the aquifer recharge (see *FactSheet 9*).
- Boreholes are being logged for variation in natural radiation levels, which distinguishes sand from clay. Water will flow much better through sandy material, and this information will be used in the groundwater flow model (see *FactSheet 11*).
- Boreholes are being logged for electrical conductivity to measure water salinity. This will provide information on the quality of the water within the aquifers and will help to determine the suitability of water for different uses.

Airborne studies

- In December 2002, another aerial magnetic survey was commenced. The survey was more detailed than previous surveys, and has improved the mapping of the extent and thickness of the Bunbury Basalt across the South West. Knowing exactly where this layer of hard impervious rock lies over the water-holding sediments of the South West Yarragadee aquifer will help in planning further development of the aquifer's water resources.
- The same survey is also measuring radiation from the soil across the area. This information will help to map the distribution of sands and shales in the Leederville aquifer and assist in understanding the rate of 'leakage', or recharge from the Leederville aquifer into the South West Yarragadee aquifer below. The information will contribute to the recharge investigations (see *FactSheet 9*) and the groundwater flow modelling (see *FactSheet 11*).



Specially equipped aeroplane for magnetic surveys (courtesy Fugro)

For more information contact

Department of Environment
South West Region
35-39 McCombe Rd, Bunbury Western Australia 6230
Telephone (08) 9726 4111 Email: blackwoodproject@wrc.wa.gov.au
Website: www.wrc.wa.gov.au/whicher
