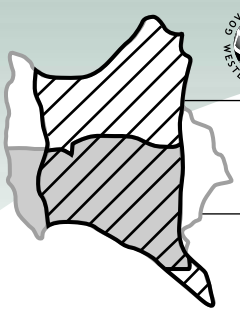

South West Yarragadee
Blackwood Groundwater Area

FactSheet 8

July 2003

Aquifer water quality and salinity

Maintaining a reliable supply of fresh water to our homes, factories and farms is essential if we are to sustain our quality of life. By 'fresh' we mean that the water supply has low levels of dissolved solids, consisting mainly of a range of salts. The Australian Drinking Water Guidelines state that 'fresh water' must have less than 500 mg/L of Total Dissolved Solids (TDS).

All living creatures have upper limits on the amount of salt they can tolerate in the water they consume to support life. The acceptable limit for human drinking water salt content is 1,500 mg/L TDS, but less than 1,000 mg/L TDS is preferred. Most domestic supplies are less than 500 mg/L TDS.

Water that is too salty cannot be used for irrigation, and industrial processes can also be affected by excessively salty water.

Current sources of fresh water

In the south western area of Western Australia, most fresh water supplies come from reservoirs on the rivers in the forested areas above the Darling Scarp and from groundwater supplies in the Perth Basin. As well as supplying the Perth metropolitan area, coastal towns, industries and irrigated agriculture, water is also distributed by pipelines to communities in the Goldfields, the Wheatbelt and the Great Southern. Within the South West, fresh groundwater from the South West Yarragadee and Leederville aquifers are important for towns and irrigated agriculture across the region.

The growing demand for fresh water supplies requires that we identify and carefully manage the available supplies. We need good information about the water quality and salinity of supplies that are capable of providing additional fresh water.

Where does the salt come from?

Salt spray is picked up from the ocean by wind action and is held in the rain cloud systems that sweep across the south west of the State. The rain that falls from these clouds contains a very small amount of salt – about 20 mg/L TDS near the coast. Incoming rainfall either runs off the surface into streams, wetlands and lakes, evaporates back into the atmosphere, or it soaks into the ground. Plants take up some of the soil water through their roots and move it to the leaves from where it is 'transpired' as water vapour into the atmosphere Only small amounts of incoming dissolved salt are taken up by most plants, and none of the salt finds its way back into the atmosphere. The salt is deposited on the earth's surface and is stored in soil profiles, or migrates into waterways and water bodies.

The major ions in the salts found in soils and water are calcium (Ca^{++}), magnesium (Mg^{++}), sodium (Na^{+}), potassium (K^{+}), chloride (Cl^{-}), sulphate ($SO4^{-}$) and bicarbonate ($HCO3^{-}$).

Salt in groundwater supplies

One other pathway is for the salt dissolved in the rainfall to enter groundwater aquifers as part of normal recharge. While only a small proportion of the rainfall may infiltrate the aquifer as recharge, most of the dissolved salt will be carried into the aquifer. In a situation without surface run-off, all of the salt in the rainfall falling on the surface will remain there. Most of the water will be returned to the atmosphere through 'evapo-transpiration', leaving a small proportion of the total water, and all of the salt to enter the aquifer as recharge. Therefore, although rainfall contains only 20 mg/L TDS, the concentration of salt in the recharge water will be higher. How much higher will depend on how much of the rainfall recharges. The smaller the recharge rate, the higher will be the salinity of the recharge water, and vice versa.

Water quality and salinity in the South West Yarragadee aquifer

The South West Yarragadee aquifer contains fresh water throughout, although there is a tendency for the salinity of the groundwater to increase marginally along the groundwater flow path from areas of recharge to areas of discharge.

The lowest salinity of 180 mg/L TDS is found in water that is nearest to the main recharge area in the Blackwood Plateau. On the Scott Coastal Plain, about 40 km south of the recharge area, the groundwater being used for irrigated agriculture is about 300 mg/L TDS. Water drawn from the aquifer for domestic supplies in Bunbury is about 350 mg/L TDS. This marginal increase in salinity is due possibly to the small leakage of slightly saltier water from the Leederville aquifer into the South West Yarragadee.

The lateral groundwater movement in the aquifer is generally very slow, about one metre per year. Groundwater circulation in the aquifer extends vertically to the bottom of the formation – 1,200 m below the surface. The shales of the Cockleshell Gully Formation, which underlie the South West Yarragadee Formation, prevent groundwater circulation at greater depths, hence the groundwater below this level is saline.

Water quality and salinity in the Leederville aquifer

The Leederville aquifer contains water of varying salinity, depending on the local nature of the geological formation. Groundwater from this aquifer is freshest (about 300 mg/L TDS) where the material in the aquifer consists of coarse sands, and the proportion of rainfall entering as recharge is the highest. In these areas, the Leederville aquifer is an important source of fresh water for communities and industries across the South West. For example, production bores into the Leederville aquifer in the Jindong area (south east of Busselton) yield water of good quality for irrigated agriculture.

The aquifer contains higher salinity groundwater (up to 2,000 mg/L TDS) in areas where it consists of clays and shales, resulting in low rates of recharge. These areas occur on the Blackwood Plateau. Some reduction of water quality close to the coast is probably caused by minor seawater intrusion or mixing.

Other issues in groundwater quality

Two other elements can affect groundwater quality. Dissolved iron (Fe^{++}) is found in all groundwater supplies, requiring treatment before it can be used for drinking water. Dissolved manganese (Mn^{++}) is a problem in some bores, and again, treatment is required for the water to be suitable for drinking.

For more information contact

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