GOVERNMENT OF WESTERN AUSTRALIA

Water facts 15

WATER AND RIVERS COMMISSION JUNE 2000

Salinity

Rising salinity levels in water resources and dryland salinity are the biggest environmental problems facing Western Australia. Salinity is also affecting our natural environment, rural towns, heritage buildings and infrastructure such as roads and railways. This Water Facts sheet explains why stream salinity has increased, the impacts on our surface water resources, and what is being done to tackle the problem.

Salinisation

Most people are aware that the crusty white deposit they sometimes see on bare patches of cleared agricultural land is salt. This is a visible sign of increasing salinity in our landscape, and is sometimes called 'dryland salinity'. Less visible, but still a huge problem, are rising salinity levels in our water resources. Some lakes are naturally saline (for example, the salt lakes in the eastern Avon catchment) but where previously fresh lakes have become salty, the dead vegetation and salt encrustations indicate rising salinity levels. Increasing salt levels are being observed in many south west rivers.

Salinity in the Avon catchment.
(Photo courtesy of Avon Ascent)

Salt in the soil and groundwater

Salt is a problem when it dissolves in rising groundwater and comes to the ground surface or flows into streams. But a huge amount of salt is stored deep in our soils, and as long as it stays there, it poses no problem.

Western Australia's soils have accumulated massive amounts of salt brought in by rain from the sea over tens to hundreds of thousands of years. Salt has been deposited on south-west Western Australia at a rate of 20 to 200 kilograms per hectare per year. Depending on the location and soil type, soils now store between 300 and 10 000 tonnes of salt per hectare deep in the soil profile. In the wheatbelt, for example, the soil holds about 3000 tonnes of salt per hectare.

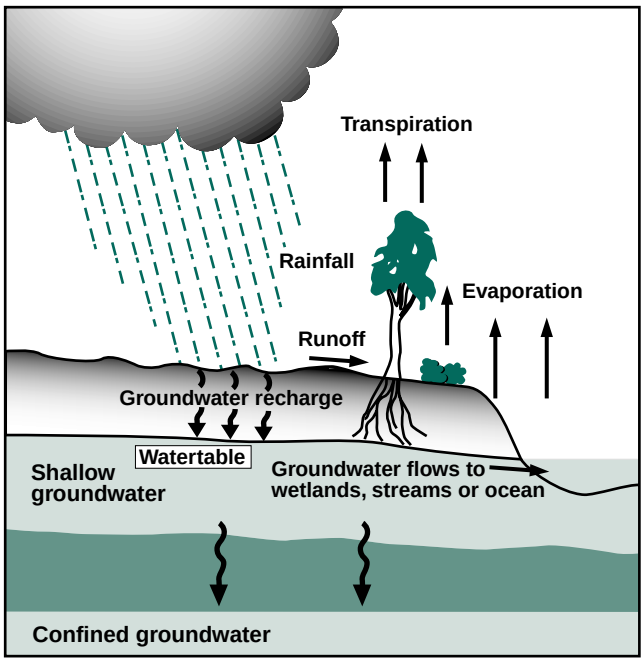
Rising watertables bring salt to the surface

Groundwater is water that occupies the pores or crevices in soil or rock.

Stream salinisation happens in two ways:

(i) When rising groundwater carries salt to the land surface where it can be washed away into streams and lakes.

Salinity problems arise when the watertable (the level at which the soil is saturated with groundwater) rises, dissolving salt stored in the soil profile as it does so, and bringing very salty water to or near the ground surface.



The water cycle.

In nature, trees play an important role as pumps. Their roots reach deep into the soil and draw water and nutrients up into the leaves. Water is being constantly released from the leaves by evaporation and transpiration. The natural vegetation in the south west is adapted to using a high proportion of the rainfall, so only a small amount recharges the groundwater. A typical large tree in a healthy jarrah forest, in a high rainfall catchment could use an average of 50 litres a day all year round.

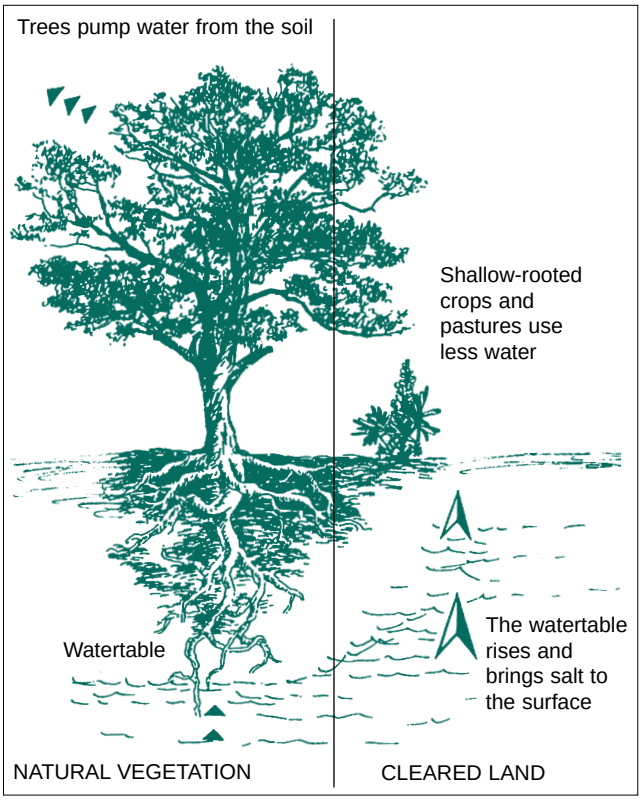
The millions of leaves in a forest or woodland also catch a lot of rain. Much of this water evaporates without ever reaching the ground.

When the trees are cleared and replaced with shallow-rooted annual crops and pastures, less water is drawn from the ground, and more water falls on the ground during rain. After clearing, the volume of water soaking into the ground may increase more than 10 times.

The result is a rise in the watertable. Watertable rises of 20 to 150 centimetres per year have been measured after clearing. The landscape fills up with water. The water also dissolves salt stored in the soil, and brings it up to the surface.

This is called dryland salinity. This salt can then be washed away by surface flows and carried into streams and lakes.

In irrigated areas, excess irrigation and leakage from irrigation channels can also contribute to the problem.



The rising watertable brings salt from deep in the soil up to the surface where it kills plants, makes water supplies salty, and raises salt levels in rivers.

(ii) When increasing groundwater flows carry larger quantities of salt directly to streams.

With rising watertables, groundwater seepage into streams increases, and greater quantities of salt are dissolved and may be discharged directly into the stream. Salt is then carried downstream to fresher parts of the river.

Both these processes account for a steady increase in salinity of most south-west rivers. For example salinity in the Warren River, whose catchment is 40% cleared, has gone from less than 300 mg/L in 1940 to about 800 mg/L in 1985. The Blackwood River, (catchment 85% cleared) has risen from about 500 mg/L in the mid-1950s to nearly 2000 mg/L in the 1980s (Pen, 1999).

Impacts of salinity

The highly saline water that comes up to the land surface kills natural vegetation and crops, and damages soil structure, buildings and roads. Water becomes unsuitable for stock and on-farm water supplies. Stream salinity starts to rise. This may start to happen years before salt on the surface is visible.

Streams and rivers that are fed by saline runoff and groundwater are gradually degraded with serious effects on the plant and animal life. Fringing vegetation is replaced by more salt-tolerant species or introduced grasses. The water is undrinkable and unusable for irrigation. The effects can extend many kilometres down stream from the source of the saline water. Rising watertables and increasing groundwater discharge may also cause inundation and waterlogging of streamlines or low lying land. This, together with the increasing salinity, has probably contributed to the stands of dead and dying trees along many inland watercourses.

The extent of the salinity problem

Western Australia is badly affected, having 70% of Australia's dryland salinity-affected land. In the south west, 18 million hectares of the 25 million hectares originally covered by native vegetation have been cleared. Of this, about 10% (1.8 million hectares) is now salt affected to some degree. Salinity has significantly affected over 80% of waterways in the south west including our divertible water resources (i.e. surface water that has potential for domestic or commercial supply).

What salinity levels are a problem?

Salinity is measured by the total soluble (or dissolved) salt (mineral constituents) in water.

One measure used is milligrams per litre (mg/L) of Total Soluble Salts (TSS) or Total Dissolved Salts (TDS). TDS and TSS are measured by different processes but for most purposes they can be read as the same thing. Another measure is conductivity, measured by an electronic probe or conductivity metre.

The impact of rising salinity depends on what the water is used for.

For water supplies, water resources are classified in the Australian Drinking Water Guidelines (1996) as:

Fresh	less than 500mg/L TDS (good quality)
Marginal	500-1500mg/L (over 1000mg/L may have excessive scaling, corrosion and unsatisfactory taste)

Other levels of salinity are:

Brackish	1500-5000mg/L
Saline	more than 5000mg/L
Hypersaline	more than 50 000mg/L

For irrigation, fresh and marginal water is suitable.

Many aquatic plants and algae are salt sensitive, and may be killed by salinities of 1000-2000 mg/L. Fresh water microbes and aquatic invertebrates can show adverse effects at salinities above 1000 mg/L. Adverse effects on fringing vegetation are often apparent at salinities greater than 2000 mg/L (Pen, 1999).

For comparison, sea water is 35 000 mg/L. (See Water Words, Water Facts 1, 1998.)

Water supplies

Water supplies are threatened, with over a third (36%) of divertible water resources brackish or saline and 16% marginally saline. Many millions of dollars have already been spent on alternative water supplies to replace storages lost to salinity, for example Harris Dam. Industry suffers because there are costs associated with using higher salinity water and mechanical equipment is likely to have a shorter life.

Rivers and wetlands

Most of our major rivers in the south west have high increases in salinity each year. Increasing salinity in rivers and wetlands has caused changes to the plants and wildlife. The overall impact is loss of habitat, biodiversity and recreational assets. Animals that rely on fresh water, such as frogs and water birds are particularly affected.

Frogs are the most sensitive to changes in salinity, and tadpoles can be indicators of salinity changes along streamlines. The slender tree frog is likely to become extinct in inland agricultural areas, and the long-necked turtle may also be at risk from salinisation.

Tackling salinity

Restoring the water balance

The key to controlling the salinity problem is to get the water balance back into equilibrium. That means using more water, lowering the watertable and getting the salt back down to where it is harmless. The main way to do this is to plant trees and deep-rooted perennial crops to take water from the soil.

This is a huge task. It has been estimated that $3 billion will be needed over the next 30 years to fix the problem, and over 3 million hectares of appropriate trees and shrubs will have to be planted.

The Salinity Strategy

The Western Australian Government has adopted a comprehensive Salinity Program, with an Action Plan first released in 1996 and updated with public review in 2000.

The strategy is a framework for Government, farmers and the community to work together to:

- Reduce further deterioration of agricultural land
- Recover or rehabilitate salt-affected land
- Protect natural values (biological diversity)
- Protect water resources
- Protect infrastructure
- Give land managers the capacity to address salinity issues.

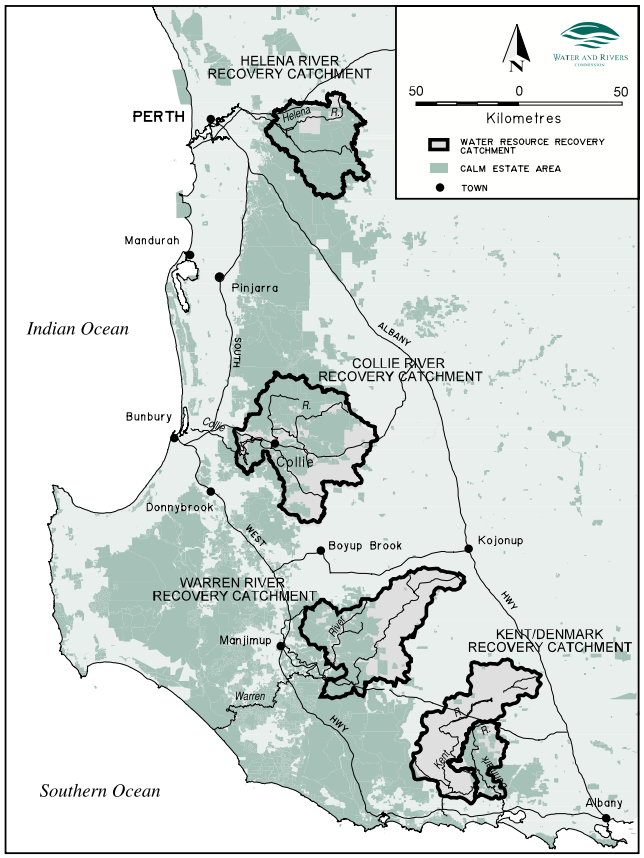
Key activities include:

- Clearing controls (and in some places clearing bans) to protect vegetation.
- Protecting remnant vegetation under the Remnant Vegetation Protection Scheme which helps to provide funding for fencing.
- Research on the nature and extent of salinity.
- Improved management of crops and pastures to use more water.
- Introduction of tree crops into farming systems.
- Revegetation of cleared land through a large-scale tree planting program.

Water resource recovery catchments

Major rivers currently supplying public water, or having the potential to be used for this purpose in the future, are affected by salinity. The Helena, Collie and Denmark rivers contribute to existing water supply reservoirs and the Kent and Warren rivers are considered to be potential future public water sources.

Concern about salinity led to statutory control of clearing in catchments of these rivers during the late 1970s. The State Salinity Strategy identifies these catchments as requiring priority management. They are termed Recovery Catchments. Recovery Teams of local community and government representatives have been formed. They are working on catchment planning based on salinity risk assessments, and using 'best practices' in land management. The aim is to achieve potable water quality in each of the Recovery Catchment rivers within 20-30 years.



Recovery catchments

Warren and Collie River Recovery Team members visit a tree trial established by CALM.

The role of the Water and Rivers Commission

The Water and Rivers Commission manages Western Australia's water resources to enable sustainable development and maintain environmental and social values.

The Commission plays an important role in the State Salinity Strategy 2000 and coordinates salinity management in Water Resource Recovery Catchments. The Commission has established Salinity Management Teams in the South West and South Coast regions. These teams are working with landowners to undertake on-the-ground work, in accordance with local Recovery Team strategies.

Further reading

Managing our Rivers — *a guide to the nature and management of streams in Western Australia,* by Dr Luke Pen. Water and Rivers Commission, 1999.

National Water Quality Management Strategy, Australian Drinking Water Guidelines. National Health and Medical Research Council and Agricultural and Resource Management Council of Australia and New Zealand, 1996.

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