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Subsurface drainage and surface water management for salinity control

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The problem

Salinity, waterlogging and soil structure decline are major threats to maintaining agricultural productivity, water resources and biodiversity in the south-west agricultural region of Western Australia. Under the current land management practices soil and land degradation caused by these issues will affect the productivity of up to 30 per cent of the agricultural area by 2050. If we are to reduce the area impacted then management action needs to be taken now.

This Farmnote provides information on engineering options for salinity control. Information on vegetation options to control salinity, such as the use of perennial pastures and revegetation, is available from the Department of Agriculture.

Water management systems

Excess water in the landscape can be managed using engineering options such as shallow or deep drains and, in some situations, groundwater pumping or relief wells. These structures are designed to control run-off, to lower groundwater tables and reduce the effects of water erosion, waterlogging, flooding, groundwater recharge, groundwater discharge, high watertables and salinity. Effective water management can reduce productivity losses caused by excess water.

A system to manage excess water can include:

- ***surface water management*** options, through the construction of broad based channels, grade banks or shallow drains;
- ***subsurface drainage or groundwater management*** options, through deep drains, relief wells, siphons or pumping.

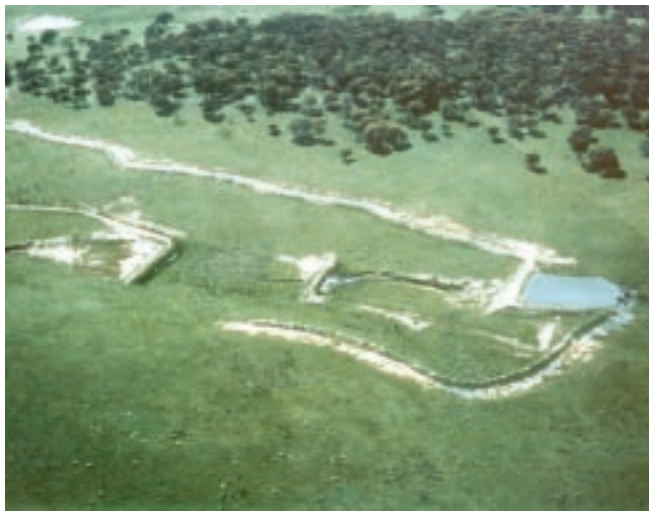
Management of excess water also includes methods for disposal of discharge, such as the development of on-farm water resources (dams, bores, water distribution systems) for fresh water, or detention storage and evaporation basins for low quality or saline water.

Water management systems are complex and need to be carefully planned and evaluated prior to construction to gauge their impact. Surface water management and subsurface drainage target quite different problems with different engineering techniques. Their impact both on- and off-site needs careful consideration, particularly in regard to neighbouring properties.

Subsurface drainage

Problems arising from groundwater recharge and high watertables can be tackled through deep drainage or pumping. Issues to consider when developing a drainage management plan include:

- the assessment of on-site characteristics (soils, geology, and gradient of slopes) to establish the potential for effective drainage. Deep drains constructed in heavy, clay soils in the lower landscape are generally not effective in lowering the watertables, while drains in coarse, sandy soils are often unstable and prone to erosion;
- determining the permeability or rate at which water will flow from the soil into a deep drain, or the rate at which it can be extracted using a pump. This will establish the area affected by the drain or pump and can be useful in estimating the amount of water likely to be discharged. For example, sandy, coarse soils have high permeability, whereas heavy, clay soils have low permeability;
- assessing the best areas for subsurface drainage. The greatest economic benefit can be achieved where high value crops are to be protected, such as the drainage system on the Swan Coastal Plain to establish the horticulture and dairy industries;



Using a combination of systems, such as drains, banks, roaded catchments and dams, is likely to produce the best results when trying to manage surface water and near surface recharge.

- that pumping requires a power source and regular maintenance;
- that benefits from relief wells or siphons tend to be site specific and confined to small areas (mainly in high relief landscapes);
- that a safe disposal point is required for the discharge from a drain or pumping system if the water is of low quality;
- that notification of intent to undertake deep drainage and pumping is required under the Soil and Land Conservation Act.

Surface water management

If constructed properly, surface water structures have certain advantages over subsurface drainage for water management:

- cost of construction is relatively low;
- surface run-off water is usually of good quality and can be stored in farm dams or directed into natural watercourses;
- groundwater recharge is reduced;
- peak stream flow in creeks is reduced, so reductions in flooding, channel erosion and sedimentation can be achieved;
- minimal maintenance is required;
- notification of surface water earthworks is not required under the Soil and Land Conservation Act, but each landholder has a Duty of Care to make sure that flows are not discharged indiscriminately on a neighbour and that stream flows are not significantly diminished.

Which option to use and where?

There is no universal solution for developing a catchment or farm water management plan that suits all the varied landscapes and soil types in the wheatbelt. The most suitable site for a specific engineering option depends on a number of factors such as where it is located in the catchment, the soil type, rainfall and the nature of the problem to be treated. Because of this, understanding the various water management problems and which option is best for each situation is important for the plan to work and to be cost effective.

A range of earthwork options is commonly used to manage or alleviate problems associated with excess water in a catchment or on the farm. Each option has a set of design criteria for location within the landscape, to reduce risk, improve planning and provide maximum economic benefit to the landholder.

Moving fresh surface water is generally less risky than draining saline groundwater. Also, draining or pumping saline water from a property may have unacceptable impacts on others in the catchment.

Before deciding which management system to adopt, the following should be considered.

Is your property in a landscape that is:

- flat, poorly drained land with low rainfall (<450 mm)? Are there areas of broad valley floors that can become waterlogged or inundated? Drainage is one option but the disposal of saline water is difficult because of the low gradients and limited safe disposal points;
- in a high relief landscape, with medium rainfall (600–450 mm) and good natural drainage? Engineering options are more flexible in this landscape with better opportunities for discharge management;
- flat with high rainfall (>600 mm) with waterlogging and inundation in mainly coastal areas? Systems in this landscape are designed more for waterlogging and inundation management rather than salinity control.

For any management system the benefits need to be at least equal to or greater than the cost of their implementation to ensure that the investment is worthwhile.

Environmental considerations

Waterways and wetlands in catchments are important for nature conservation and local ecology as well as local drainage and floodwater discharge. If additional water is discharged into them, the normal patterns of flow and the natural water balance of the existing ecosystems may be altered. All landholders have a duty of care to the land and to other landholders within their catchment.

Strategic water management

As with most decisions on the farm, the capacity to invest and the effectiveness of the treatment in which you invest, comes down to individual landholders' decisions and the site specific characteristics. By cooperating with your neighbours and working with the community or catchment group, more effective results can be achieved through co-investment. Consideration can also be given to the incorporation of modified farming systems and revegetation strategies into the catchment water management plan, as this will increase the potential for success and may off-set the investment in engineering strategies.

Given the capacity of most landholders to invest in the short to medium term, applying engineering options is considered a way of 'buying time' to establish alternative farming systems, such as lucerne or woody perennials.

Further information

Refer to Factsheet #7/2003 for a list of Department of Agriculture publications on engineering water management options and related topics, as well as contacts of officers within the Department who may be able to advise on the best approach to water management in your region.

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