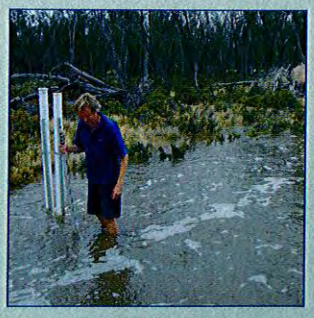
Triple test: recovering natural biodiversity at **Toolibin Lake** and **Lake Bryde**



Catchment management is a complex challenge facing land managers across southern Australia. Large-scale recovery actions at two natural diversity recovery catchments in the heart of the southern wheatbelt of Western Australia are taking a multi-pronged approach to protecting biodiversity from the threats of altered hydrology, particularly rising water tables and increasing salinity.

by Greg Durell, Natalie Nicholson and Ray McKnight

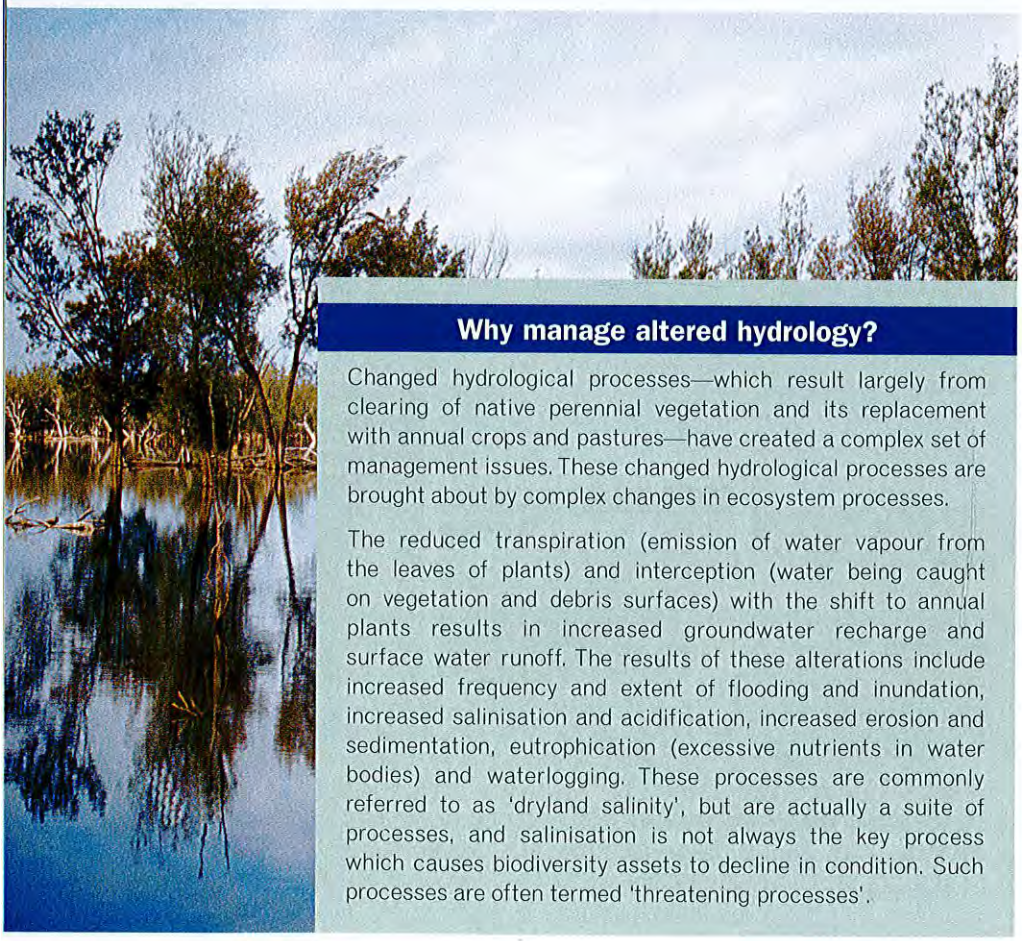
Wetland biodiversity managers in the low-to-medium rainfall zone of southern Australia face three main challenges. The first is a lack of knowledge about the complex interactions between natural biodiversity assets and the ecosystem processes, including altered hydrology, that will determine management success. The second is variability. Both the climate of these areas and their catchment landscapes are highly variable and often each situation requires site-specific research and actions. Finally, successful management in these variable areas requires a commitment, over decades, to active management.

Recovery catchments: managing altered hydrology

Altered hydrology refers to changes in the way water is stored and moves through the landscape. Broad-scale replacement of native perennial vegetation with annual crops and pastures has significantly altered hydrology in agricultural areas, with considerable impacts on natural resources.

There are various approaches to dealing with altered hydrology. These include surface water management, ground water management, the protection of remnant vegetation and revegetation. It has taken some 100 years for altered hydrology to develop to its current degraded condition in some areas; hence, it may require decades to address the issue effectively.

Western Australia is the Australian state most affected by altered hydrology. It has been estimated that about one million hectares of WA are affected by salinity and this is increasing at 14,000 hectares each year. The area with 'salinity hazard'—land at risk from salinity because groundwater is predicted to rise close to the surface—was estimated to be between 2.9 and 4.4 million hectares. While about 80 per cent of this is on cleared agricultural land, salinity also threatens important public assets such as water resources, infrastructure and biodiversity, particularly in the valley floors.



Why manage altered hydrology?

Changed hydrological processes—which result largely from clearing of native perennial vegetation and its replacement with annual crops and pastures—have created a complex set of management issues. These changed hydrological processes are brought about by complex changes in ecosystem processes.

The reduced transpiration (emission of water vapour from the leaves of plants) and interception (water being caught on vegetation and debris surfaces) with the shift to annual plants results in increased groundwater recharge and surface water runoff. The results of these alterations include increased frequency and extent of flooding and inundation, increased salinisation and acidification, increased erosion and sedimentation, eutrophication (excessive nutrients in water bodies) and waterlogging. These processes are commonly referred to as 'dryland salinity', but are actually a suite of processes, and salinisation is not always the key process which causes biodiversity assets to decline in condition. Such processes are often termed 'threatening processes'.

A threat to biodiversity

Altered hydrology is a major threat to the biodiversity of WA. Many of the State's wetlands and streams have become salty, and more continue to become so. *A Biodiversity Survey of the Western Australian Agricultural Zone* was an important project funded through the 1996 *Western Australian Salinity Action Plan* and carried out by the Department of Environment and Conservation (DEC) and its predecessors and the Western Australian Museum. This work documented biota in the inland south-west agricultural zone and the extent to which it was threatened by salinity. This survey revealed that salinity has already had a significant effect on the native plants and animals of this area, particularly those in wetlands. It estimated that 450 plant species were at risk of global extinction and 400 animal species were at risk of global or regional extinction.

The Natural Diversity Recovery Catchment (NDRC) Program also arose from the Salinity Action Plan. The program targets six key catchments to ensure that critical and regionally significant natural areas, particularly wetlands, are protected in perpetuity.

The great southern NDRCs

DEC is responsible for the recovery of biodiversity in six NDRCs in the south-west of WA. Toolibin Lake NDRC and Lake Bryde NDRC fall within DEC's Great Southern District, which forms the heart of the southern wheatbelt.

Toolibin Lake NDRC is 20 kilometres south-east of Wickepin and Lake Bryde NDRC sits 35 kilometres

Previous page
Main Yate Swamp, a small swamp in Lake Bryde Conservation Park, part of the Lake Bryde NDRC.
Photo – Natalie Nicholson/DEC
Insets (left to right) A waterway under construction at Toolibin; a waterway in use following a rainfall event in Toolibin NDRC; monitoring water flows at Toolibin.

Left background Water reflection on Toolibin Lake.
Photos – Sam MacWilliams/DEC

Above Taarblin Lake succumbed to altered hydrology particularly after a prolonged period of inundation in the 1950s and 1960s.
Photo – Jiri Lochman

south-east of Lake Grace. Both occur in broad, relatively flat valleys—Toolibin in the headwaters of the Blackwood River and Lake Bryde in the headwaters of the Avon-Swan river system. Both recovery catchments contain remnants of a once extremely rich natural landscape. They retain a significant proportion of their original values including threatened species, threatened ecological communities (TECs) and other high-value biodiversity assets.

Rich biodiversity

Lake Bryde NDRC covers an area of about 140,000 hectares and includes the Lake Bryde Conservation Park. It was formally selected as a recovery catchment in July 1999 to protect a TEC as well as threatened species and important wetland and terrestrial ecosystems.

Toolibin Lake is the largest remaining area representing a habitat of which only a handful survive today: inland, fresh water wooded wetlands. This critically endangered TEC was a relatively common lake community until the threat of too-frequent flooding and inundation and salinity began to take its toll from about the 1940s.

Both areas also provide habitat for a wide range of waterbirds. Lake Bryde has up to 23 waterbird species occurring, with up to seven species breeding. Toolibin Lake is well known for its waterbird richness, with up to 41 species of waterbirds being recorded there and as many as 24 species known to breed on the lake. The rare freckled duck (*Stictonetta naevosa*) has been recorded at Toolibin Lake, Lake Bryde, East Lake Bryde and Lake Walbyring, just south of Toolibin Lake.

Toolibin Lake is listed under the Ramsar Convention as a Wetland of International Importance and is also listed on the Register of the National Estate. Lake Bryde and East Lake Bryde are listed on the Directory of Important Wetlands at a State and Commonwealth level, hence they are considered to be of local, national and international significance.

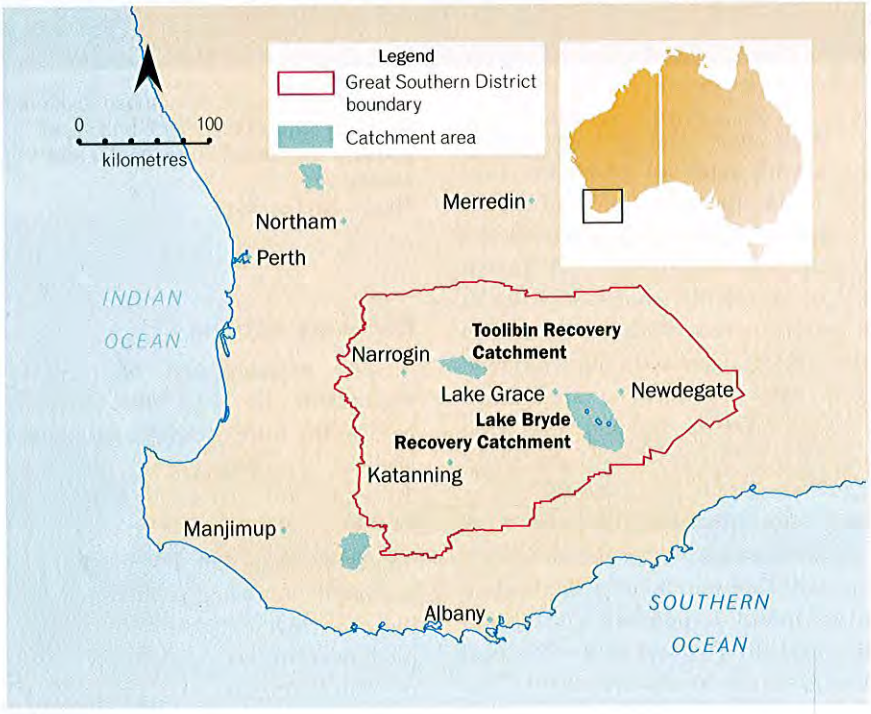
The first main phase of agricultural development at Toolibin occurred in the period 1900–10, whereas clearing at Lake Bryde began much later, during the mid-1960s. This means that while the threats are similar at the two systems, the altered hydrology at Lake Toolibin is in a later, more advanced state.

Recovery actions

The primary aim of recovery catchments is to protect their biodiversity from threatening processes brought about by altered hydrology. To achieve this, long-term monitoring and research is required to determine optimal management strategies. Various techniques are being applied to tackle threats, including water diversion, upper catchment management, the creation of waterways and the pumping of saline groundwater.

Groundwater pumping

Several threatening processes affect Toolibin Lake's health and condition, particularly excess groundwater. A groundwater pumping program began at Toolibin Lake in earnest in 1997 when six air displacement pumps were added to a trial pump already present on the lake floor. This system pumps an average of 230,000 litres of saline groundwater a day from beneath the lake. This water is transferred by a pipeline to Taarblin



Top left The pink-eared duck feeds in the shallow waters of the catchments.
Photo – Jiri Lochman

Top Constructing a waterway in Lake Bryde NDRC.
Photo – Natalie Nicholson/DEC

Above Water inflows at Toolibin NDRC.
Photo – Lance Mudgway/DEC

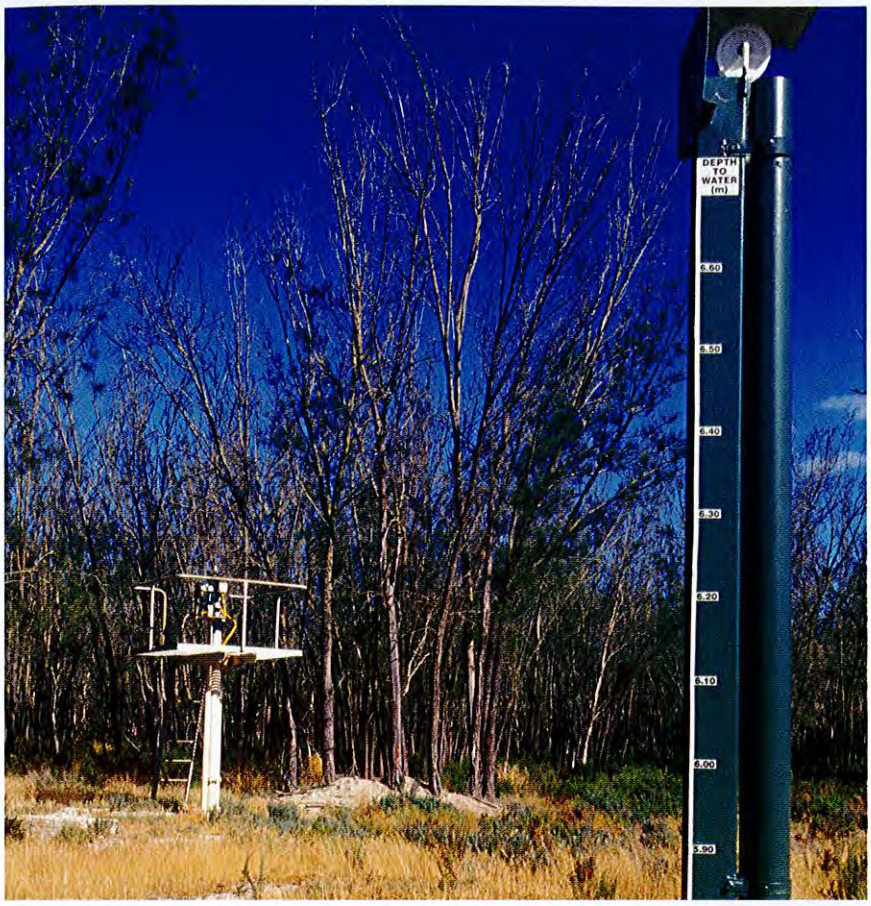
Lake, a large lake that had, unfortunately, already succumbed to salinity. One result of continued pumping is that in some areas around Toolibin Lake, vegetation is recovering.

Waterways

Major projects to manage surface water runoff are being implemented in each catchment. The main component of this is the installation of shallow waterways in the valley floors. The aim of these waterways is to relieve the immediate impacts of minor flooding on native vegetation. The waterway acts as a surface water conveyance through the valley floor to enable the typical smaller, annual water flows to pass through without causing ponding or waterlogging, preventing additional groundwater recharge and salinisation. Increasing surface flows is one of the outcomes from clearing native vegetation.

The waterways are 300 to 400 millimetres deep and up to 30 metres wide. These structures are designed to accommodate the water generated from an average runoff event (from a one-in-three-year rainfall event). In a large flood event (a one-in-25-year rainfall event), water volumes far exceed what the waterway is designed to handle and the fresh water will spill out into the surrounding vegetation as would normally occur. However, after flooding the waterway helps water levels recede more quickly, by accelerating water drainage to the disposal sites.

At Lake Bryde NDRC, 12 kilometres of a proposed 20-kilometre waterway is constructed, and design and construction of the remainder is under way. The waterways in both



Left A groundwater pump at Toolibin Lake.
Photo – Marie Lochman

Below Declared rare flora *Muehlenbeckia horrida* subsp. *abdita*.
Photo – DEC

catchments will also reduce the impacts of waterlogging on farmland and help protect the system of local roads.

Funding for the work on the two recovery catchments comes from a range of organisations including the State Government and the Australian Government's Natural Heritage Trust program through the South West Catchments Council and Wheatbelt Natural Resource Management (formerly the Avon Catchment Council). Construction work on stage four of the valley floor waterway began in 2007 and was completed in 2009. Design for construction of the final stages will occur in late 2010.

Other solutions

In addition to waterways, other surface water management techniques are required for upper catchment water management. These can include the construction of water storage dams higher in the catchment and graded contour banks to control flows from agricultural land into remnant vegetation and valley floors.

Improving the condition of existing vegetation remnants in reserves and on private property is also important, along with revegetation with perennial vegetation on both public and agricultural lands. Revegetation work usually has direct biodiversity conservation benefits and, in some cases, has potential commercial applications. For example, providing incentives for landowners to plant oil mallees will contribute to a resource base that may lead to a biofuels industry.

Working in partnership

Many operations in recovery catchments, such as waterways and revegetation, involve work on private land. Effective partnerships with land-holders are essential to achieving management success in recovery catchments. Their support, and that of a number of government agencies and other institutions, is integral to the overall success of these large-scale catchment projects.

Integrating a wide range of management actions with a variety of partners is a challenging but rewarding process. Funding for this work also presents difficulties due to the large scale of projects, long time frames and high cost of engineering and earth moving.

The future

Large-scale recovery actions are making a difference to managing the altered hydrology in recovery catchments. At Toolibin Lake and Lake Bryde, a complex set of actions are aimed at ensuring the long-term protection of the wetlands and their surrounding nature reserves. There is no quick or easy solution; managing altered hydrology will only be successful where an integrated package of recovery actions is implemented over decades.

Although the main objective of these two recovery catchments is to conserve the unique plants and animals that occur there, there are added benefits in protecting these areas. The development of new initiatives that work towards sustainable agricultural practices will also help enhance production in the catchments during the coming years. Both these projects offer a unique opportunity to develop new ideas to solve problems using a range of biological, engineering and agricultural solutions. Through the work being done at Toolibin Lake and Lake Bryde, as well as at the other four NDRCs, WA will continue to be a model for conservation and sustainable land use now and into the future.

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contents

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