TOOLIBIN LAKE RECOVERY TEAM

2003 ANNUAL REPORT

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for the
Toolibin Lake Recovery Team

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1. INTRODUCTION

This report summarises activities carried out under the Toolibin Lake Recovery Plan (Toolibin Lake Recovery Team, 1994) during 2003.

Toolibin Lake Recovery Plan, 1994

Toolibin Lake is a wooded, seasonal wetland situated south-east of Wickepin in the Western Australian wheatbelt. The lake is a feature of the Toolibin Lake Nature Reserve which is managed by the Department of Conservation and Land Management. Toolibin Lake is recognised as a conservation area of international significance for migatory waterbirds under the Ramsar Convention.

The Toolibin Lake Recovery Catchment Plan (Toolibin Lake Recovery Team, 1994) was prepared in response to a continued decline in vegetation health at Toolibin Lake in an increasingly saline environment. The plan was endorsed in September, 1994. The following information has been reproduced from the Recovery Plan:

Recovery Plan 5 principal goals

- to conserve Toolibin Lake and its associated wildlife as a freshwater habitat.

- to improve land use decision making and practice within the Toolibin Catchment so that land management:
  * is sustainable, productive and profitable in the long term (over 100 years);
  * reduces the current area of degraded land;
  * favours conservation of local wildlife.

- to demonstrate that, within a large catchment, it is possible to stabilise hydrological trends which if unchecked threaten land, water and biodiversity resources.

- to demonstrate to other land managers in Australia methods of protecting their biodiversity, land, and water resources.

- to develop mechanisms which lead to community ownership of Western Australia's natural resources including management problems and their solution.

Recovery Objective

The objective of the Recovery Plan is to ensure the long-term maintenance of Toolibin Lake and its environs as a healthy and resilient freshwater ecosystem suitable for the continued visitation and breeding success by the presently high numbers and species of waterbirds.

Recovery Approach

To achieve this objective it will be necessary to restore the catchment of Toolibin to a hydrological condition which conserves the Lake and its environs. Establishing sustainable, high water-use agriculture within the catchment is crucial to attain this goal.

Therefore strategies for recovery of Toolibin Lake require the integration of active management and rehabilitation of the lake, associated reserves, and nearby agricultural lands. The major cause of deterioration of the Lake is salinisation and waterlogging associated with a rising saline groundwater table. To enable the lake to survive and recover requires this process to be reversed to return the system to one that is a closer reflection of the historical hydrological regime. This can only be achieved through appropriate action at the level of the whole Toolibin Catchment.

While a solution at the catchment level is essential, emergency action, such as groundwater pumping, is required in the short term to maintain and improve Toolibin Lake until longer term strategies begin to take effect.

Recovery Strategies

While all the strategies listed are important, the first four are crucial and therefore have the highest priority. The strategies for achieving the Recovery Objective are:

- to control groundwater levels beneath Toolibin and ensure that they do not threaten the freshwater status of the Lake or its environs.

- to control surface water inflows to Toolibin and ensure that they do not threaten the freshwater status of the Lake.

- to maintain or enhance the natural vegetation in and around the Lake.

- to achieve sustainable agriculture and increased water use on agricultural lands in the catchment by:

    * developing and implementing commercial revegetation schemes based on woody, native vegetation.

    * developing and implementing revegetation which improves current agricultural production (cereal and stock). For example, by effective implementation of alley farming, shelterbelts, and rehabilitation and pastoral use of areas with surface salinity.

    * encouraging changes in farm practice which better utilise water "where it falls". This may include improving soil structure to enhance plant growth (and thus water use).

- to develop consultative mechanisms, models and decision-making systems with the community to ensure that potentially divisive land conservation issues, such as drainage and disposal of effluent from groundwater pumping, can be effectively resolved.

- to implement monitoring and research which allows the achievement of strategies to be evaluated.

Given that the Australian community contributes to the recovery of the Lake, it is recognised that the following strategies must also be pursued although they do not directly relate to the recovery objective:

- to improve knowledge of hydro)ogical, farming and natural systems so that information generated through the Toolibin Catchment can be successfully applied elsewhere.

- to educate the local, State, and National communities concerning the recovery outcomes so that people are better informed concerning land use and land conservation.

- to extend the information and lessons from Toolibin to other land managers.

2. RECOVERY TEAM

RECOVERY TEAM

The 2003 Recovery Team membership is as follows:

Mrs Roz Thomson (Farmer, member of the Lake Toolibin Catchment Group)
Mrs Audrey Bird (Farmer, Chair of the Lake Toolibin Catchment Group)
Mr John Blyth (Acting Manager, WATSCU)
Mr Jim Lane (Principal Research Scientist, CALM)
Mr Richard Pickett (Senior Resources Officer, Water and Rivers Commission)
Mr Paul McCluskey (A/District Manager, CALM, Chair).

TECHNICAL ADVISORY GROUP

The 2003 TAG membership is:

Mr David Bicknell (Senior Revegetation Development Officer, Agwest)
Dr Richard George (Senior Research Scientist, Agwest)
Dr Stuart Halse (Senior Principal Research Scientist, CALM)
Dr Peter Muirden (Surface Water Hydrologist, Water and Rivers Commission)
Dr Shawan Dogramaci (Hydrogeologist, Water and Rivers Commission
Mr Paul McCluskey (A/District Manager, CALM, Chair).

DEPARTMENTAL TOOLIBIN LAKE RECOVERY CATCHMENT STAFF

Julie Wyland (Toolibin Lake Recovery Catchment Officer)
Paul Joyce (Toolibin Lake Recovery Catchment Technical Officer)

3. RECOVERY PLAN STATUS AND FUNDING

PLAN STATUS

The Recovery Plan is current until September 2004.

PLAN FUNDING

Funds have been provided through the State Salinity Strategy and Environment Australia to implement works during 2003.

4. RECOVERY PLAN ACTIONS

Recovery actions undertaken in 2003 are detailed below.

GROUNDWATER PUMPING

Recovery Action 3.2

Pump Performance

Approximately 242 ML of groundwater has been extracted from beneath Toolibin Lake between the period of the 1st December 2002 to the 30th November 2003. On average, 662KL of water has been extracted daily, with an average 70% of this water produced from the electric submersible bores and 30% from the air displacement pumps.

During the same period, there were 308 lost pump days due to pump faults or breakdowns (approximately 8% of production time). The majority of these were related to either iron bacteria, power surges or power failures.

Iron Biofouling

The Pumpmate chemical dosing system was trialled on pumps 15 and 14 during 2002. Inspection of pump 15 indicated that the system was controlling buildup in both the pipework and pump. Iron bacteria control in pump 14 was less successful with bacteria buildup on the probe effecting pump performance in April 2003. It is considered possible that the origin of the buildup in pump 14 is non-organic.

The Pumpmate system was installed with confidence on the two remaining electric submersible pumps 13 and 11 in 2003. Despite the poor control in trial on pump14, the system was also installed on another Airwell pump (pump 7 which has had 5 iron bacteria related breakdowns in 18 months) in attempt to reduce the number of iron bacteria related problems on this particular pump. It is believed that iron buildup on pump 7 is of both inorganic and organic origin. The Pumpmate system will be effective in controlling the organic iron buildup.

SURFACE WATER CONTROL

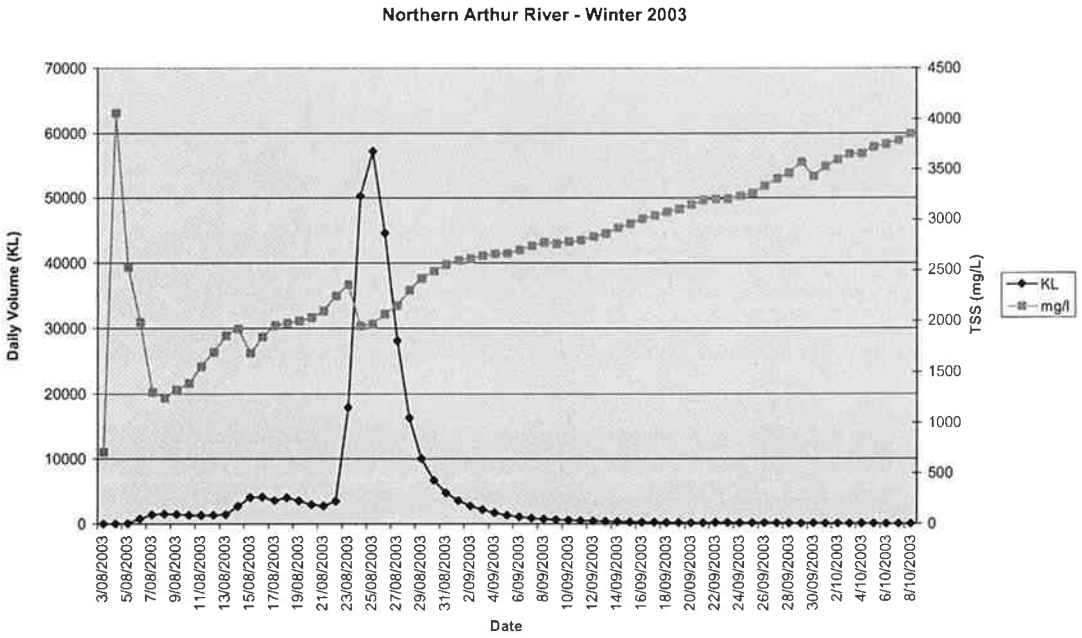
Recovery Action 3.3

Flow

Rainfall and stream flow data from the WRC gauging station 512045 indicates that total rainfall from 1st December 2002 to 10th October 2003 at Toolibin was 435mm, with 48% of this falling during the winter months of June, July and August.

The Toolibin catchment flowed during winter 2003. Flow was observed in all major drainage lines. Data from the WRC gauging station 512045 shows that 299 ML of

water with an average salinity of 2645 mg/l flowed past this point towards the separator gate during 2003. The graph below shows daily winter flows and TDS for 2003.



Lake Inlet Control and the 'Separator'
The separator gates were not closed during 2003. At no time during 2003 did the salinity of the water at the separator gate, drop below the Recovery Plan threshold of 1000mg/l. Approximately 631 tonnes of salt were bypassed around Toolibin Lake via the separator and diversion channel during 2003.

Catchment Surface Water Management Plan
The Department of Agriculture have been engaged to undertake a comprehensive surface hydrology assessment to define surface water movement across the catchment and to consolidate information generated from past surface water and groundwater investigations. This information will be used to review the performance of surface water management strategies and also recommend additional solutions to address the threats of waterlogging and salinity in the Toolibin Lake catchment.

LAKE AND RESERVE REVEGETATION

Recovery Action 3.5

Toolibin Lake and Dulbinning Nature Reserves Revegetation
Banksia prionotes seed was scattered in the ash beds of two heaps of dead vegetation that were burnt in June 2003 near the eastern track at Toolibin Lake. Another ash bed was not seeded and will be observed for natural recruitment. No germination has been observed in any of the ash beds as of December 2003.

Protection of Toolibin Lake seedlings
Several areas of *Casuarina obesa* regeneration that have been heavily grazed have been noted on the floor of Toolibin Lake. Fencing has been erected to protect two of these sites lake from further kangaroo grazing. Both of these areas are located on the southern edge of the lake.

Chadwick's Block
Progress continued on implementing the Chadwicks Block Revegetation Plan (Arboressence 2001) during 2003. Approximately 25 hectares were revegetated at Chadwick's Block during 2003. All seedlings were grown from seed that had been collected by CALM staff from the Toolibin Lake catchment.

The revegetation plots include seed orchards; single species; farm forestry plots; and areas of mixed species.

Extensive damage from kangaroo grazing has occurred at Chadwick's Block. Following a survey of the numbers kangaroos and discussions with neighbouring landholders, damage licences were sought and a cull conducted. In addition, a 1km fence has been erected to protect a single species *Casuarina obesa* plot from kangaroo grazing and tree guards are also being used to protect *C. obesa* seedlings in a 2002 mixed species plot.

First year weed control was carried out on plots planted in 2002. Spring weed control was also necessary for plots planted in 2003.

CATCHMENT REVEGETATION

Recovery Action 3.6
Biodiversity Revegetation Programme
Thirty five hectares of privately owned, agricultural land was revegetated with approximately 48 500 seedlings through cost sharing arrangements with the Department. Approximately 30% of these seedlings were used to infill 2002 planting sites. Eight landholders participated in the revegetation programme during 2003.

Approximately 160 Ha of remnant vegetation was arranged to be fencing through cost sharing arrangements with the Department in 2003. Four landholders are participating and two of the remanants will be covenanted.

Revegetation can play an important role in conserving the biodiversity of the catchment. However, the scale of the current revegetation programme very much restricts its impact on the hydrology of the Toolibin Lake catchment.

Oil Mallees
The Department considered that the 2003 growing season offered an excellent opportunity to substantially increase revegetatation in the Toolibin Lake catchment and offered a once off, increased subsidy rate of $0.60 per oil mallee seedling to landholders. The increased subsidy rate was conditional to a minimum order of 25 000 seedlings; agreement to specified planting standards; and proposed sites also had to fall in a designated target zone.

A total of 338 000 oil mallees were planted by 11 landholders through the subsidy scheme. A further 61 000 oil mallee seedlings have been planted in the catchment with private industry funding. The oil mallees have been planted in alley formation over approximately 1000ha of agricultural land.

Review of Catchment Revegetation Work
The Department of Conservation and Land Management and the Lake Toolibin Catchment Group worked together to record all revegetation works that have been

carried out in the Toolibin Lake catchment. Approximately ninety percent of the catchment landholders were interviewed. Revegetated areas and areas of remnant vegetation were mapped with the assistance of landholders. Information about these areas was then recorded in a database.

The objective of the project was to quantify past revegetation and remnant protection activities in the Toolibin Catchment. Preliminary results suggest that approximately 6% (3200 Ha) of the Toolibin Lake catchment has been revegetated with either commercial (including pines, oil mallees and tagaste) or biodiversity species and over 600ha of remnant vegetation on private land has been protected by fencing.

AGRONOMIC MANIPULATION

Recovery Action 3.7

These works are primarily under the jurisdiction of the Lake Toolibin Catchment Group (LTCG). The LTCG offers a subsidy to its members for the use of high water use pastures. The Department has no documentation of these activities.

DECISION SUPPORT SYSTEM

Recovery Action 3.8

Revegetation Database

A database to assist with the establishment and administration of Recovery Catchment revegetation schemes is in the final stages of production. It is anticipated that the database will also provide a skeleton structure for recording other recovery activities such as earthworks.

MONITORING AND REPORTING

Recovery Action 3.9

Groundwater Bore Monitoring

Department staff continue to conduct comprehensive groundwater monitoring of around 250 bores across the Toolibin catchment. All data has been entered into the COMBORES database.

Data from the Toolibin Lake bores was analysed using the HARTT software package. This software package allows the effects of treatments (such as pumping) on groundwater levels to be separated from the effects of seasonality.

The results from this analysis (Wyland, 2004) show that there has been groundwater drawdown in many of the bores across Toolibin Lake since the commencement of the pumping programme. The HARTT analysis suggests that groundwater pumping has significantly ($P < 0.05$) contributed to this drawdown in the many of the bores.

The relationship between groundwater pumping and drawdown is most apparent in the deeper bores. However, a number of the shallower bores, particularly on the western side of the lake, also demonstrate a signicant relationship between groundwater pumping and drawdown.

Lakebed Salinity

A ground electromagnetic survey was conducted across the floor of Toolibin Lake in November 2003 (Partridge 2003). The main objectives of the project were to determine conductivity of the upper and lower root zones; establish a spatial

correlation between soil conductivity and pumping; and map temporal changes in conductivity since 1998.

There were some difficulties obtaining sufficient soil samples to convert the apparent electrical conductivity data (ECa) data to ECe (which is representative of soil salinities), however a reasonable correlation was obtained (R^2 0.86). The ECe values show salinities in the upper soil profile range from moderate to extreme, with the majority of the lake floor highly to extremely saline (using Department of Agriculture classifications).

Visually, the data shows a spatial relationship between the lower ECe (& ECa) values and the location of the pumps, particularly on the western side of the lake. However, a statistically significant relationship between distance from pumps and ECa could not be established.

The report found that there had been a decrease in ECa across the majority of the lakebed since the 1998 survey.

Recovery Plan Review
The Toolibin Lake Recovery Catchment Plan was endorsed in September 1994 and its ten year term will expire in 2004. The Recovery Team and Technical Advisory Group recommended that the Recovery Plan is reviewed prior to the preparation of a new Recovery Plan. The review process began in November 2003.

The main objective will be to comprehensively review all major components of the recovery plan to facilitate the development of a new management plan for Toolibin Lake. The review will examine what has been achieved by the project, what still needs to be achieved and what, if anything, needs changing to meet the objectives and criteria of the Recovery Plan.

OTHER

Salt Harvesting
An investigation about the feasibility of constructing and operating a solar salt field at Toolibin Lake was completed in 2003. The report (Maunsell 2003) highlighted the significant risks for a salt harvesting venture due to the highly competitive domestic salt market. The report also found that a salt harvesting venture would only provide adequate return on investment for sales volumes more than 12 500 tonnes per year. This volume is more than double that currently produced by the groundwater pumping programme at Toolibin Lake. The report's conclusions are significant for a number of similar projects currently being investigated in Western Australia.

Aquaculture
Gavin Partridge from Challenger TAFE investigated the suitability of Toolibin Lake groundwater for culturing a number of marine and estuarine fish. The analysis included comprehensive water quality testing and screening tests involving snapper, barramundi and mulloway. Results (Partridge 2003) show that the groundwater must be treated to address an oxidative precipitate and low potassium content for successful fish growth. It is likely that the cost of this pre-treatment would be prohibitive for the establishment of a commercial fish venture at Toolibin Lake.

Interpretation & Recreation

Toolibin Lake continues to be a point of interest for a wide variety of groups. More than 300 people attended organised tours at Toolibin Lake during 2003. The Toolibin Lake Recovery Catchment Officer conducted the majority of these tours.

Approximately 400 vehicles (CALM management excluded) visited the reserve during 2003.

Web Site
Several Toolibin Lake web pages have been placed on the Departments 'Naturebase' web site. All future Toolibin Lake reports will be downloadable from these pages.

http://www.calm.wa.gov.au/projects/salinity/toolibin

Upgrade of Nepowie Diversion Drain Crossovers
Two diversion drain crossovers on the property 'Nepowie', adjacent to Toolibin Lake Reserve were upgraded. The crossovers are located on land owned by Nepowie and were upgraded to maintain winter access for Nepowie business operations.

Plant water uptake and water relations in response to rhizosphere salinity in Casuarina obesa
An honours student, Patrick Mitchell, completed his thesis on plant water uptake in response to salinity at Toolibin Lake in 2003. The results of the study confirm that *C. obesa* utilise their shallow root system to avoid salt accumulation and that the species does not routinely access groundwater moisture. The species primarily accesses surface and subsurface moisture. Summer dormancy was observed in the more saline study sites. The results of this study have important implications for management, as they suggest that leaching of surface soil salts may only need to occur in the first metre of the soil profile for a improvement in the condition of *C. obesa.*

Salinity Prize
The Toolibin Lake Recovery Catchment project was awarded the inaugural, Institute of Engineers (IAE), national Salinity Prize in 2002. Thirty thousand dollars prize money was awarded to the Recovery Team. No restrictions or guidelines were placed on the expenditure of the money by the IAE. A proposal to enhance and extend the existing Toolibin Lake recovery walk trail using the prize money was accepted by the Toolibin Lake Recovery Team during 2003.

5. REFERENCES

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