Lake Bryde Recovery Catchment

Annual Report 2003

Lake Bryde looking north

1.0 Summary

Previously resources within the project have been directed toward investigating the feasibility of groundwater pumping options to protect valley floor assets and in developing a conceptual surface water management strategy for the catchment. The surface water management strategy focused on identifying issues associated with flow impedance and continuity, and discussed management options for specific problem areas within the catchment. An environmental impact assessment to the surface water management proposal undertaken in 2002 highlighted a series of issues arising from the implementation of the surface water management proposal including disposal problems.

Significant knowledge gaps were identified by the Technical Reference Group in during 2003 and the major focus during the year has been collecting and collating bio-asset information and better understanding the hydrologic processes occurring within the catchment, whilst trialling implementation of earthworks.

Investigations included a range of hydrologic reviews, remnant vegetation inventory, assessment of vegetation health using satellite imagery, lake coring, topographical surveys, assessment of storage capacity within the catchment and green house trials to determine the salinity tolerance of *Muehlenbeckia horrida* subsp *abdita*. This information has provided a much clearer understanding of the distribution of assets within the catchment, their condition, rate of decline, and the nature of threats facing them. As a result of these investigations the project objective has been reviewed and the project is in a much better position with which to proceed into an implementation phase.

Implementation during the year has been restricted to the construction of culverts under the Pingrup – Newdegate Road and a trial of on-farm surface water management works. The trial of on-farm works highlighted a series of design and construction issues that have largely been resolved. As a result, planning of works for approx. 80% of the catchment has been undertaken and negotiations with some landholders in priority sub catchments has been undertaken. Cost sharing arrangements for surface water management works have been developed and are awaiting endorsement.

The project is now set to move into the implementation phase. As a result of a better understanding of the distribution and condition of assets, major valley floor works have progressed to the point where detailed design can begin. Depending on the nature and extent of these works, construction could occur within 24 months. On-farm surface water management works throughout catchment have been planned a paddock scale and could proceed immediately.

The major challenge for the project remains developing and implementing strategies to control groundwater rise on catchment scale, as this clearly provides a serious medium – long threat to the bio-diversity assets within the catchment.

2.0 Introduction

The 140 000 ha Lake Bryde Recovery Catchment is located on the rim of the Avon catchment system. The catchment is characterised moderate grade shedding hill slopes, delivering flows to extensive flat braided watercourses via moderately incised creek lines. Soil types vary from lateritic and duplex dominated hill slopes and shallow duplex and clayey flats. Hydrologically, the catchment is characterised by impermeable aquifers and low hydraulic gradients.

The Lake Bryde wetland complex is considered to have high natural biodiversity, however in parts it has already experienced significant degradation over the last decade or so and continues to be impacted by surrounding land use practices.

There are approx. 50 landholders in the catchment, with most farms owned by local families although there are a small number of absentee landholders. Landholders are to a large extent supportive of the project, however are keen to see implementation of works within the catchment. Lake Bryde itself provides a strong landholders focus.

The catchment contains approximately 35% native remnant vegetation, situated mainly within Lake Magenta Nature Reserve. Much of the reserve system is contained with the Lake Bryde and Lakeland Nature Reserve situated on the valley floor and the large Lake Magenta Nature Reserve located in the south-eastern part of the catchment.

Landholders within the catchment began to notice the first signs of salinity in the early 1990's, coinciding with a significant increase in salt load to Lake Bryde itself. Stress to and ultimately death of pockets of *Melalueca* shrub-land also began to occur during this period. As a result of landholder concern the catchment received Government support in the form of National Landcare Project funding, initially focussing on capacity building, education and the development of conservation farm plans. Lake Bryde then became a focus catchment sponsored by the Department of Agriculture and underwent the rapid catchment appraisal process.

Lake Bryde became a Recovery Catchment in 1999, with the objective to *"to conserve the natural diversity within the recovery catchment for the medium term"*. Recent investigations have resulted in a change to the objective, now:

> *"To slow the rate of decline of biodiversity across valley floor assemblages and to conserve specific high value biodiversity assets."*

Investigations to date have established that surface and groundwater hydrologic processes occurring within the catchment are the primary cause of degradation within the reserve system. The nature of the hydrologic processes at play are intrinsically complex, and the interaction between groundwater and surface water are still not well understood. Management strategies developed to date have been primarily focused on the management of surface water with the catchment. The challenge remains to manage groundwater processes with the catchment, particularly on the valley floor and adjacent Crown Land.

Surface water management works identified for the broader catchment have progressed to a point where implementation could proceed. Surface water management works for the valley floor require further discussion and planning before implementation can proceed. Works on the valley floor are inherently complex and the impact of works on the environment difficult to predict.

3.0 Project Structure

The Lake Bryde Recovery Project is run from the Katanning District Office of CALM, with the District Manager providing overall managerial responsibility for the plan.

3.1 Project Implementation Team:

Project staff includes the:

- *Recovery Catchment Officer* – responsible for contract and staff management, executive support to committees, budgeting, supervising and managing contracts, undertaking investigations and directing the implementation of the project.
- *Assistant Recovery Catchment Officer* – responsible for monitoring, managing data, supervising contracts and assisting the Recovery Catchment Officer.

A *Revegetation Officer* has been temporarily employed part time (0.7 FTE) and is responsible for managing revegetation projects within the catchment, including those on private and public land, for the development of a revegetation strategy and providing advice to landholders undertaking revegetation within the catchment.

Alan Kietzmann - *District Manager - Katanning (CALM)*
Matt Giraudo - *Recovery Catchment Officer (CALM)*
Jane Larsen - *Assistant Recovery Catchment Officer (CALM)*
Gavan Mullan – *Revegetation Officer (CALM)*

3.2 Committees and Management Groups

The overall direction of the project is managed by two committees / groups.

i) *Lake Bryde Recovery Team:* This is the community reference group for the project, providing a mechanism for the local community to have input into the direction of the project. This committee meets once – twice a year to discuss the direction and progress of the project and to provide community input into major outcomes. During 2003 there was one meeting of the Lake Bryde community, which included members of the Recovery Team, held during April. Minutes of the meeting are attached.

ii) *Technical Reference Group*: This is a group of professional staff representing the WADA, WRC, CSIRO, CALM Science and WASCU. The charter of the group is to provide technical support to the project and to underpin the development and implementation of the Recovery Plan. Meetings occur as required, and during 2003 were held in May and December, minutes are attached.

4.0 Major Project Focus

A strategic surface water management plan developed by the Engineering Water Management Group of the Department of Agriculture proposing the construction of an artificial waterway though the reserve system with the aim of removing impedances and providing greater continuity of flow. An independent Environment Impact Assessment of this proposal highlighted a range of risks to the natural environment, particularly in the lower catchment as a result of disposal of flows. The Environmental Impact Assessment also highlighted significant knowledge gaps within the project, and recommended that the proposed works not proceed.

A series of meetings in late 2002 were unsuccessful in resolving outstanding issues associated with the surface water management proposal. The first few months of 2003 were spent attempting to bring together information, ideas and stakeholders in an endeavour to resolve some of the outstanding issues associated with the project. As a result of this process it became evident that the range of stakeholders within the project did not have common aims and objectives, and that significant knowledge gaps were impeding the progress of the project.

The April and May meetings of the Community and Technical Reference Groups, indicated a degree of frustration from both landholders and professional staff as to the lack of progress and in particular, implementation of the project.

The Community (Recovery Team) indicated that they were keen to proceed with works and that removal of flow impediments, highlighting construction of floodways on road crossings, upgrading the inlet to Lake Bryde and the construction of small scale shallow drain linking Ryan Road with the Lakeland reserve as priorities.

The Technical Reference Group highlighted significant knowledge gaps as a major contributor to the lack of progress and requested the following investigations:

- The development of a surface water model for the catchment
- A hydrogeological review of the catchment
- Collection and collation of bio-asset information for the catchment.

As a result, the major focus during 2003 was on reviewing, collecting and collating information and developing models as required by the Technical Reference Group. It was considered that without concise robust information outlining the status of the assets and the nature and severity of threat, progress toward the development and implementation of project works could not proceed.

Catchment Sign – Designed by Newdegate Primary School (Yr 6-7)

5.0 Status of the TEC

Three populations of the threatened ecological community of *Muelenbeckia horrida* subsp *abdita* and *Tecticornia verrucosa* existed within the Recovery Catchment. One of these populations, located in two lakes in the northern part of the Lakeland Nature Reserve is dead. No surviving plants remain and no soil borne seed remains. Furthermore the salinity of the Lakes is significantly greater than the threshold for the community.

The second population, located in Lake Bryde, is considered to be under acute pressure from increasing salinity of the lakebed, and is unlikely to survive beyond a few years. This population is restricted to the fresher outer rim of the Lake and is showing considerable signs of stress. Plant death, no recruitment and a high percentage of unviable seed set combine to indicate the population has a limited future in this location.

The third population exists at East Lake Bryde. This population is considered to be under a low immediate threat, and with the exception of the north eastern section of the lake is in good health, exhibiting good recruitment and seed set. Groundwater rise beneath the lake however appears to be causing salt accumulation within the bed of the lake, and the population is considered to be under considerable threat in the medium term.

***Muehlenbeckia horrida* ssp *abdata* Flower buds- Lake Bryde 2003**
Photo: Jane Larsen

6.0 Recovery Actions

6.1 Investigations

6.1.1 A *Hydrogeological investigations* undertaken by the Engineering Water Management Group, Department of Agriculture Western Australia was presented in draft from. The report focuses on investigations aimed at locating and quantifying palaeo-channels with the Lake Bryde valley and to undertake preliminary pump test to determine the likely success of groundwater pumping regimes. The report concluded there are no specific continuous palaeo-channels with the Lake Bryde system and that bore yields were low to very low and that groundwater pumping for the purposes of maintaining or reducing groundwater levels was unlikely to be feasible except for in very localised areas.

6.1.2 *On-farm Remnant Inventory*: An inventory of on farm remnant vegetation was undertaken to better understand the distribution of remnants within the catchment. The work was undertaken by consultants (Ecoscape) and is due to be completed in March 2004. Preliminary information from this inventory was used to develop a strategic focus to remnant vegetation fencing proposals. It is anticipated the inventory will provide the basis for developing a revegetation strategy for the catchment.

6.1.3 *EM 38 Survey*: An EM 38 survey of major lakes and transects through major watercourse environments was undertaken. Results were converted to soil salinity measures and Arcview shape-files developed describing soil salinity on the valley floor. This information has been presented at a range of meetings and field days and underpins the understanding of the extent of salinisation on the valley floor.

6.1.4 *Veg Health Assessments*. A vegetation health assessment of major watercourse environments was undertaken. A brief report is provided in the meeting notes for the Dec 2003 Technical Reference Group meeting. The results of this assessment are recorded and presented in a database and Arcview shape-files describing vegetation health within the major reserves. Veg health data was captured and correlated to EM 38 surveys, indicating a high positive correlation between vegetation health decline and salt accumulation in the upper soil profile.

6.1.5 A green house trial to determine the salinity tolerance of *Muehlenbeckia* was undertaken to add weight to the field observations collected during 2003. Problems associated with seed dormancy hampered the trial, however the outcome of the trial generally supported field observations. Field observations indicated that the population of *Muehlenbeckia* in Lake Bryde faces an overwhelming threat from increasing salinity within the bed of the lake.

6.1.6 *Lake Coring*: Coring of the beds of major lakes within the catchment was undertaken with the aim of determining the similarities between lakes and to better understand the processes driving salinisation of lake beds. This was achieved through analysis of salinity and cation distribution & composition of sediments.

6.1.7 *Assessment of Lake Bryde Road Proposal*: An alternative alignment for Lake Bryde Road was investigated, both in terms of ecological and engineering restraints. An alignment near to the break of slope appeared to satisfy both the hydrologic and environmental requirements of this sub-project. In addition, an accurate costing for moving and upgrading the road was undertaken.

6.1.8 *Yate Swamp Hydrologic Requirements*: An independent assessment of the hydrologic requirements of the Yate Swamp was commissioned. A brief report has been tabled indicating the major hydrologic issues associated with the lake and preliminary monitoring requirements established.

6.1.9 *Topographical Surveys*. Accurate (sub 25 mm) topographical survey of major lakebeds, flow paths and potential drainage alignments have been undertaken. Data is contained with Arcview shape files, and preliminary design criteria for alternative drainage options undertaken.

6.1.10 *Assessment of Storage Capacity*: An assessment of the storage capacity of all major lakes with the catchment has been undertaken and topographical survey of the purchase property (Roe 3191) indicates little opportunity for strategic storage of flows within this location.

6.1.11 *Development of Rainfall – Runoff model*: A rainfall – runoff relationship for the major South Lake Bryde Catchment was undertaken in house. This model uses discounted cumulative rainfall to predict major runoff events. The model was calibrated using monitoring data for Lake Bryde, and provides a basic understanding of the rainfall – runoff relationship of the catchment.

6.1.12 *Salt balance model – Lake Bryde*: A simple salt and water balance model was developed for Lake Bryde. The model uses monitoring data for the lake to determine the source of salt load to the lake. Outputs from the model indicate that Lake Bryde accumulates salts from both run off and from the surrounding / underlying saline aquifer.

6.2 Administration of Purchase Property (Roe: 3191)

6.2.1 ***Tenure***: This land has been vested with the Government of Western Australia for the period covered by this report, pending vesting with the Executive Director as a 5(1)h reserve. The vesting will be for purpose of conservation of flora & fauna, agriculture, trials & demonstrations, flow management, and will occur during the early part of 2004.

6.2.2 ***Tenancy***: A short-term tenancy agreement for the purchase property (Roe Location 3191) was signed on March 17 2003, providing the neighbouring landholder, Mr Rosenberg, with a one-year lease over the property. This agreement allowed for grazing and cropping of approx. 290 ha of the 730 ha property, excluding areas set aside for nature conservation and revegetation.

6.2.3 ***Revegetation***: A total of 38 ha of revegetation occurred on the purchase property in 2003. This included a 12 ha pulp wood trail, investigating the water use and production issues associated with *Acacia saligna* and other prospective pulp spp. In addition 26 ha of mainly oil mallee spp. were planted adjacent to the Lakeland Nature Reserve.

6.2.4 ***Flow Management***: A discharge lake located on Roe 3191 has been earmarked for management of small flows from the 14 Mile Catchment. Upgrading of the natural flow channel leading to the lake will require a small amount of clearance of native vegetation. An independent assessment of the impact of the clearance was undertaken and approval gained from the Acting Regional Manager (Wheatbelt regional of CALM) and a letter of intent lodged with the soil commissioner. However, works have not proceeded due to issues associated with drainage design upstream.

6.3 Monitoring

6.3.1 ***Surface Water:*** Surface water monitoring program was reviewed and extended to include an additional automated rain gauge (now three in total) to provide a greater coverage of flows from sub catchments. A single flow event in 2003 resulted in the capture of some information, including a small inflow to Lake Bryde. Whilst the information proved useful, a series of flow events will be required before an accurate picture of the flow mechanics of the catchment can be developed. Monitoring of wetland water quality was undertaken during the winter of 2003. Data is contained within an Arcview shape file.

6.3.2 ***Groundwater:*** A review of the groundwater monitoring program was undertaken. A series of shallow bores were drilled to add value to the deep groundwater drilling program undertaken during 2003. These bores will provide a much clearer understanding of the interactions between shallow and deep aquifers. Previous to this year monitoring was irregular and restricted to a small number of bores constructed during 1996. A comprehensive monitoring schedule was developed including all bores within the catchment. All existing groundwater information has been collated and is now contained within a purpose-built database. All bores were levelled to AHD (+/- 25mm) during 2003.

6.3.3 ***Vegetation Health:*** Veg health monitoring using satellite based multi spectral imagery has been initiated, with images purchased for the period Dec 02 – Feb 03. Multi spectral imagery was manipulated to provide an appreciation of the health of watercourse vegetation within valley floor assemblages. The accuracy and consistency of the multi spectral imagery was assessed using veg health assessment data discussed in section 6.1.4. In addition, low resolution multi spectral imagery (SPOT platform) was used to provide an indication of the rate of decline with valley floor assemblages.

6.3.4 ***TEC:*** Permanent transects for monitoring the health of the TEC in Lake Bryde and East Lake Bryde were established and monitored during autumn and spring undertaken.

6.4 Cost sharing initiatives

6.4.1 ***Remnant fencing***. Three remnant vegetation fencing projects for an area of approx. 30 ha were agreed to during 2003. Payments of approx. $12,000 for four projects covering 56 ha were also finalised during 2003.

6.4.2 ***Revegation***: Approx. 30,000 mixed seedlings, in addition to approx. 15,000 oil mallee seedlings were planted during 2003.

6.4.3 ***Earthworks***: A small trial of earthworks designed by the Engineering and Water Management Group of the Department of Agriculture were implemented in the 14 Mile Catchment. Initially it was envisaged that works would cover approx. 40% of the catchment. However, problems associated design and construction resulted in only approx. 8 km of banks being constructed. Whilst design and construction issues have hampered this project component, these issues have been resolved to a large extent, and preliminary design of 80% of the greater Lake Bryde Recovery Catchment using conventional earthwork structures has been undertaken. Recommended costs shares for earthworks are currently awaiting approval.

6.5 Construction

6.5.1 ***Culverts under Pingrup – Newdegate Road***: Construction of culverts under the Pingrup – Newdegate Road was undertaken in June 2003. This sub project is now complete.

6.5.2 ***14 Mile Road***: Design of floodway and culverts for the crossing on 14 Mile Road have been agreed with the Shire of Lake Grace and an accurate costing provided. Works were to be undertaken in 2003, however the Shire have delayed the works until March 2004.

Culverts Under Pingrup – Newdegate Road

Photo Jane Larsen

7.0 Works Program 2004

7.1 Lakeland Reserve

7.1.1 Further discussion within the Technical Reference Group is required regarding the design criteria for the major valley floor works.

7.1.2 Once the Technical Reference Group have agreed on the basic design criteria for major valley floor works, further topographical survey will be required and a design engineer engaged to provide detail design drawings for works, and to provide supervision of construction.

7.1.3 An independent environmental assessment of the design may be required prior to lodging of design with the Conservation Commission for consideration.

7.1.4 Given the lead up required and the resources available for this project component it is unlikely that major valley floor works could proceed during 2004, unless a minimalist approach is taken to waterway construction, reducing the requirements for rigorous detail design and environmental assessment.

7.2 Lake Bryde

7.2.1 Further monitoring of inflows and static water column within the lake should be undertaken in the event of an inflow.

7.2.2 EM38 survey during winter 2004 should be undertaken to quantify the increase in salt accumulation in the lakebed over the last 12 months. This will provide a clear indication of the rate of increase in salt load to the lakebed. This is critical in quantifying the rate of decline in the TEC.

7.2.3 Further discussion at the Technical Reference Group and with the Shire of Kent and with the local community regarding the cost and benefits of moving the road verse upgrading the current structure. Neither the Shire, nor the local community appear convinced of the benefits of moving the road at this point.

7.2.4 Design and construction for upgrading of culverts at the inlet to Lake Bryde could be undertaken in the short term and would provide a means of further engaging the community.

7.2.5 Negotiations with landholders in the South Lake Bryde catchment could proceed, regarding the implementation of surface water management works, as per plans produced during 2003.

7.3 East Lake Bryde (Lake Dorothy)

7.3.1 Monitoring of inflow salinity to the lake, via the salinity probe and data logger is installed in the entrance of the lake. This will provide a clearer understanding of the salinisation processes occurring within the lakebed.

7.3.2 EM38 Survey during winter 2004 needs to be undertaken to quantify the increase in salt accumulation in the lakebed over the last 12 months. This will provide a clear indication of the rate of increase in salinity within the lakebed, which will be important in quantifying the level of threat to the TEC.

7.3.3 Discussions with adjacent landholders, in particular Grant-Williams, Walsh and Burgess regarding survey and construction of surface water management structures. Examination of funding opportunities for lucerne establishment should also be undertaken as landholders in this catchment adjacent the lake have shown interest in this management option.

7.4 Yate Swamp (14 Mile Catchment)

7.4.1 Final design of flow regulation into and away from the Yate Swamp needs to be undertaken. This may require further discussion with the Technical Reference Group, and in particularly the management of flows into and around the disposal lake. Design of flow to and / or bypassing the disposal lake needs to be undertaken in conjunction with drainage design for the Lakeland Reserve.

7.4.2 Completion of works on Frank Oliver's property should be undertaken. The Engineering Water Management group of the Department of Agriculture initiated Works on this property, however the design offered by this group was not acceptable to the landholder. Fred Armstrong undertook a second design in association with Mr Oliver and an agreed design has been completed. Survey and construction of works on this property should be a priority, both in terms of its proximity to the Yate Swamp, and in managing the relationship with the major project partner, the local community.

7.4.3 Broad based banks designed by the Engineering Water Management Group have been trialled on Ian Kent's property. After cropping and harvesting the banks the landholder has requested they be removed, as he believes they cannot be cropped and harvested successfully.

7.4.4 EM38 Survey during winter 2004 needs to undertaken of the Yate Swamp to quantify the increase in salt accumulation in the lakebed over the last 12 months.

7.4.5 Further negotiations with other landholders in the catchment (particularly Richardson, Kent and Rosenberg) regarding the opportunities for implementing surface water management works needs to undertaken, with the survey and construction of works to proceed where possible.

7.5 Monitoring

7.5.1 ***Monitoring Review***: A review of hydrologic monitoring programs will be undertaken by the CALM Hydrologist during the first quarter of 2004. This review will consider monitoring of the groundwater network and surface water monitoring requirements.

7.5.2 ***EM 38***: EM 38 Monitoring of major lakes should be undertaken as indicated in the above section.

7.5.3 ***High resolution satellite multi-spectral imagery*** for the reserve system should be captured during the summer – autumn of 2004 -2005. This imagery will provide a qualitative assessment of changes to vegetation health when compared to the existing coverage captured during Summer - Autumn 2002 - 2003. Archive imagery for the 2003-2004 may be purchased if and when it becomes available.

7.5.4 ***TEC***: Continuation of monitoring program established for the TEC will provide a basis for quantifying the change in vegetation health, and provide a rigorous basis for comparing the health of the two remaining populations.

Report prepared by:

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