

WetlandCare Australia's

Lake Bathurst and The Morass Wetland Management Plan



2008 Management of Lake Bathurst and The Morass Wetlands



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Report information

Prepared for: Hawkesbury Nepean Catchment Management Authority
Prepared by: WetlandCare Australia
Project Team: Michael Pattison, Brooke Turner, Cassie Burns, Surrey Jacobs, Liza Schaeper, Laura Torrible, and Amber Moon

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WetlandCare Contact: Michael Pattison,
Project Officer – Hawkesbury Nepean
(02) 4567 0251

WetlandCare Head Office: PO Box PO Box 114 Ballina NSW 2478
(02) 6681 6169

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>Introduction

This Management Plan has been developed for the Hawkesbury Nepean Catchment Management Authority (HNCMA) as part of the Wetlands Management Program. The Wetlands Management Program “aims to restore and protect wetlands on private property as well as Wetlands of National Importance in the catchment” (HNCMA, 2008). It builds on the Lake Bathurst and The Morass Background Paper and current wetland rehabilitation work undertaken by the HNCMA with local landholders to improve the condition of important wetland areas.

Wetlands are important for a variety of reasons; they provide habitat for plants and animals such as amphibians, fish, reptiles, mammals and birds, they help control flood waters, they assist in erosion control, they enhance water quality and are important culturally and for recreational activities. Wetlands also contribute to biological diversity as they are the interface between the terrestrial and aquatic environment (DLWC, 1996). To conserve and restore these values at Lake Bathurst and The Morass, management actions need to be directed towards maintaining and improving existing native vegetation and the control of introduced animal and plant species. Social values (recreation and aesthetic values) and cultural values are also important and should be conserved for future generations.

There are a number of threats facing Lake Bathurst and The Morass. The expansion of weeds including Serrated Tussock (*Nassella trichotoma*), Blackberry (*Rubus fruticosus* agg.) and Bathurst Burr (*Xanthium spinosum*) are placing increased pressure on native vegetation, becoming widespread and more difficult to manage. Rabbits (*Oryctolagus cuniculus*) are another major threat they alter the structure and composition of vegetation and contribute to land degradation (NSW SC 2002). These issues identify a need for a coordinated approach to wetland management.

Through the implementation of this project, the HNCMA and WetlandCare Australia (WCA) aim to increase awareness of important wetlands, threats and assets, and to promote sustainable wetland management on private land. Kingsford and others (2003) noted, “effective conservation of wetlands will only occur if there is integration of river management planning and wetland conservation”.

The aim of this document is to identify the risks and threats to Lake Bathurst and The Morass, provide options for managing those threats and identify management objectives for onground actions. Consultation with the local community and stakeholders has led to the compilation of threats, assets and management objectives. This Wetland Management Plan establishes clear management objectives to improve the biological and physical health of the wetland, while maintaining community and cultural significance.

Vision Statement

The vision statement below defines in broad terms a five to ten year vision for the management of Lake Bathurst and the Morass.

To maintain and rehabilitate wetland habitat in Lake Bathurst and The Morass through management of threats and protection of assets, to provide a high value wetland for sustainable use by local landholders and the community.



Figure 1: Lake Bathurst and The Morass catchment showing drainage lines.

> Site Description

Lake Bathurst and The Morass lies within the Southern Tablelands of NSW and cover an area of approximately 1350 hectares (Abell 1995). The wetlands are listed in the Directory of Important Wetlands in Australia (DIWA), as inland wetlands which are temporary freshwater lakes (>8 ha) or floodplain lakes. Lake Bathurst and The Morass meet DIWA criteria 1, 3 and 6 (and potentially 4) (COG 1995). The DIWA criteria as well as further information are described in the background paper.

Lake Bathurst and The Morass are considered important wetlands in the region they provide important habitat for waterbirds, especially during inland droughts. Due to the size of the wetland complex and the significant amount of aquatic vegetation, it also supports significant breeding events. At least 64 species of breeding birds has been recorded at the wetlands. The wetlands also support various threatened species such as the Freckled Duck (*Stictonetta naevosa*) and the Blue-billed Duck (*Oxyura australis*) (NPWS, 1998).

The Lake Bathurst and The Morass Background paper provides detailed information on the wetlands including;

- Location
- Wetlands of National Importance
- Climate
- Geomorphology and Soils
- Hydrology
- Water Quality
- Fauna
- Flora
- Land uses



Figure 2: Birds feeding on the Morass (Photograph by B.Turner, 2007)

> Management

The Lake Bathurst and The Morass Background Paper identifies a number of threats to the values of the wetlands. Consultation with the local community and stakeholders has also lead to the identification of current threats and potential management options.

There are a number of landholders and different land uses represented in the catchments of Lake Bathurst and The Morass. Land ownership includes, crown land, crown leases, private ownership (freehold)and Council managed-land. Agricultural use of the wetland includes grazing of sheep and cattle. Fences constructed within the lake attest to it drying out for substantial periods, allowing previous subdivision of the lake bed for grazing (Abell 1995).

To manage the wetland complex effectively there needs to be an integrated and consolidated approach by all landholders and stakeholders. Measures to mitigate threats and protect assets will be far more successful if all parties are committed to on-going, coordinated management strategies.

Threats to the wetland

Recognising threats facing the wetlands is an important factor in wetland management, as it helps to identify the management actions required to protect the environmental, social and cultural values of the wetland in the short and long-term.

A number of processes threatening the values of Lake Bathurst and the Morass have been identified. These include physical threats such as soil salinity, biological threats such as weed infestations, and management-related threats. Some of the major threats to the values of Lake Bathurst and The Morass include introduced plants and animals, loss of native vegetation, erosion, non-sustainable grazing and increased soil and water salinity..

Table 1 lists the specific threats to Lake Bathurst and The Morass, identifies their cause and potential impact, and describes the steps that have been taken or need to be taken to minimise their impact.

Table 1. Physical, biological and management-related threats to the values of Lake Bathurst and The Morass.

THREATS		IMPACT	RESPONSE TO REDUCE THREAT
Physical	Altered groundwater hydrology	<ul style="list-style-type: none"> ▪ Due to reduction of native vegetation, the groundwater table increases in lower areas ▪ Increased salinity levels in wetlands from groundwater discharge 	<ul style="list-style-type: none"> ▪ Revegetation with deep rooted native trees, and native grasses, where appropriate to lower the water table ▪ Install a groundwater piezometer network to increase understanding of groundwater dynamics ▪ Determine the impact of water extraction on the wetlands
	Increasing salinity (soil)	<ul style="list-style-type: none"> ▪ Reduction of native vegetation ▪ Increases soil and water run-off from bare areas ▪ Bare patches of soil erode easily ▪ Loss of productive land (less grazing potential) ▪ Scalding ▪ Dryland salinity 	<ul style="list-style-type: none"> ▪ Identify and map areas of dryland salinity, and salinity impact zones ▪ Fencing to prevent livestock access to important wetland areas ▪ Revegetation with salt tolerant species ▪ Revegetation with deep rooted native trees, and native grasses, where appropriate ▪ Erosion mitigation
	Impacts associated with climate change (temperature, evaporation and rainfall)	<ul style="list-style-type: none"> ▪ Increasing temperatures ▪ Changes in rainfall (seasonality and total rainfall) ▪ Higher evaporation rates ▪ Possible increase in bushfires ▪ Less available water ▪ Shift in native vegetation to dryland species ▪ Impact on local communities living in rural areas (CSIRO 2007) 	<ul style="list-style-type: none"> ▪ Investigate the historical, current and predicted (future) water balance for the wetlands ▪ Determine the impact of water extraction on the wetlands ▪ Investigate and predict the potential impacts of climate change in the local catchment
	Increased erosion in the catchment	<ul style="list-style-type: none"> ▪ Loss of topsoil or wetland soil ▪ Reduced soil productivity ▪ Decreased water quality (sedimentation, nutrients) (DNRWa, 2007) 	<ul style="list-style-type: none"> ▪ Identify areas of erosion within the local catchment ▪ Increase riparian buffer zones ▪ Investigate measures to mitigate erosion and sediment transport ▪ Reduce access to sites of high erosion
	Increased alkalinity (soil)	<ul style="list-style-type: none"> ▪ Reduced water infiltration capacity and increased runoff ▪ Reduced soil nutrient availability, leading to reduced native vegetation growth ▪ Reduced soil biota ▪ Increased potential for soil erosion ▪ Reduced water quality if eroded sediments are washed into waterways (DNRWb, 2007). 	<ul style="list-style-type: none"> ▪ Investigate whether alkalinity is a major issue effecting wetland soils ▪ Investigate methods to mitigate soil alkalinity (if necessary)

THREATS		IMPACT	RESPONSE TO REDUCE THREAT
Physical	Increased frequency and duration of drought	<ul style="list-style-type: none"> Reduce food primary productivity, potentially resulting in stock death Native vegetation loss Reduction in available water Decreased health of remnant vegetation Reduction in groundwater discharge, reducing available water for the wetland Farm dams holding back water in the catchment 	<ul style="list-style-type: none"> Planting drought tolerant species Reduce stock numbers Determine volume of water extraction and its impact on the wetlands Investigate number and impact of farm dams in catchment
	Poor water quality	<ul style="list-style-type: none"> Increase in nutrients Increase in pesticides stored in bed sediments Decrease in fauna inhabiting the wetland 	<ul style="list-style-type: none"> Establish wetland buffer/riparian zone to filter water running off from catchment into the wetland Rewet wetland soil and test for WQ parameters (e.g. salinity, nutrients)
Biological	Loss of native vegetation	<ul style="list-style-type: none"> Reduced habitat for native fauna Reduced bank and bed stabilisation Planting of introduced plants (pine wind breaks, introduced pastures) compete with natives Decreased condition existing vegetation 	<ul style="list-style-type: none"> Identify areas for regeneration Identify appropriate species list for planting Trial assisted natural regeneration, direct seeding and/or tubestock planting. Seed bank study to determine seed available in wetlands
	High abundance of Serrated Tussock (<i>Nassella trichotoma</i>),	<ul style="list-style-type: none"> Highly invasive, out competing other plants Reduces pasture growth and palatable grass for stock 	<ul style="list-style-type: none"> Long term and coordinated control between land managers Investigate appropriate control techniques Develop a trial to determine the most cost-effective control techniques for this area Manage and improve existing pastures
	High abundance of other weeds, in particular Blackberry (<i>Rubus fruticosus</i> agg.), Bathurst Burr (<i>Xanthonia spinosum</i>), St John's Wort (<i>Hypericum perforatum</i>), Broome (<i>Genista</i> sp), Hawthorn (<i>Crataegus monogyna</i>).	<ul style="list-style-type: none"> Invasive, displacing native plants Reduces pasture growth and palatable grass for stock 	<ul style="list-style-type: none"> Long term and coordinated control between land managers Identify priority weeds and map priority areas for control Investigate effective control methods Manage existing pastures to minimise weed establishment Restrict spread of introduced plants via improved stock management practices

THREATS		IMPACT	RESPONSE TO REDUCE THREAT
Biological	High abundance of native fauna (Kangaroo and Wombat)	<ul style="list-style-type: none"> ▪ Reduction in native vegetation ▪ Reduction in condition of remnant vegetation 	<ul style="list-style-type: none"> ▪ Increase habitat and corridor areas ▪ Control introduced fauna to reduce competition for resources ▪ Education of habitat requirements ▪ Improve wildlife corridors to assist migration
	High abundance of introduced fauna (hares, rabbits, deer, foxes and goats)	<ul style="list-style-type: none"> ▪ Increased erosion ▪ Reduction in native vegetation ▪ Impact on grazing potential for stock ▪ Land degradation ▪ Increased competition with native fauna ▪ Predation on native fauna 	<ul style="list-style-type: none"> ▪ Prioritise species of highest threat and map regions to focus control effort ▪ Identify method of controlling feral species ▪ Coordinated control actions between multiple landholders ▪ Ongoing pest management strategies
Management	Impacts associated with sand mining	<ul style="list-style-type: none"> ▪ Erosion ▪ Modification to soil properties (removal of sand leaves clay exposed making it harder for water to infiltrate) ▪ Exposing subsoils ▪ Changes in catchment runoff ▪ Loss of wetland buffer zone 	<ul style="list-style-type: none"> ▪ Investigate impact on ecology of Lake Bathurst ▪ Increase buffer zones (if necessary) ▪ Investigate measures to mitigate erosion and sediment transport (if necessary)
	Non-sustainable grazing	<ul style="list-style-type: none"> ▪ Trampling and compaction of wetland soils and plants ▪ Reduced vegetation biomass increases bare ground and weed invasion ▪ Stock potentially introduce new weed species from surrounding land 	<ul style="list-style-type: none"> ▪ Identify areas at high risk from grazing ▪ Fencing areas from grazing ▪ Provide alternative stock watering points ▪ Promote DPI courses on sustainable land management ▪ Identify alternative grazing techniques (e.g. rotational grazing)
	Threat to Aboriginal culture	<ul style="list-style-type: none"> ▪ Disturbance of artefacts ▪ Disturbance of a significant site 	<ul style="list-style-type: none"> ▪ Public education to minimise impact ▪ Restrict access to significant areas
	Recreation	<ul style="list-style-type: none"> ▪ Increased number of visitors and vehicle use lead to soil erosion ▪ Increased wave erosion from boating ▪ Introduce weeds / litter into area 	<ul style="list-style-type: none"> ▪ Public education to minimise impact ▪ Restrict access to significant areas
	Uncoordinated approach to management	<ul style="list-style-type: none"> ▪ Lack of consistency between public and private land management ▪ Uncoordinated approach to managing threats 	<ul style="list-style-type: none"> ▪ Identify roles and responsibilities of landholders ▪ Develop co-ordinated approach to managing threats across all land within the wetland area ▪ Develop communications strategy for clear communication between land managers

Assets of the wetlands

Lake Bathurst and The Morass have been identified as a significant wetland area within the HNCMA region. The Background Paper highlighted the assets of Lake Bathurst and the Morass as being;

- Directory of Important Wetland (DIWA)
- An important bird refuge site in drought
- An important site along migratory paths for numerous JAMBA and CAMBA listed birds
- An important bird breeding site
- Habitat to several threatened flora and fauna species
- Interesting and unique geological formation
- Important indigenous site
- Used for recreation (boating, skiing, bird watching)
- Unique history involving the historical railway, boating and regattas and the nearby historic church
- Important economic value (periodic grazing, sand mining)
- Important site for tourism, public access and use
- Water source
- Significant area of freshwater wetland vegetation, particularly at The Morass
- Significant native grasslands
- Landholder co-operation, knowledge exchange and linkages present

Management Objectives

Management Objectives for Lake Bathurst and The Morass have been derived from the community and stakeholder consultation and from existing literature and expert knowledge. The management objectives for Lake Bathurst and The Morass are summarised below:

Protect and enhance native vegetation

Protect and enhance social and Aboriginal cultural values

Protect and enhance native fauna and their habitat

Support sustainable agriculture

Understand the impact of catchment processes on water quality

Control the abundance of noxious weeds and other pest plants, in particular Serrated Tussock (*Nassella trichotoma*)

Control the abundance of introduced animals, particularly rabbits (*Oryctolagus cuniculus*)

Mitigate the impacts associated with drought, reduced water flow and climate change (temperature, evaporation and rainfall)

Increase community awareness of threats and values of Lake Bathurst and The Morass

Implement a collaborative approach to wetland management

Although large areas of Lake Bathurst and The Morass are leased Crown land, these leases are effectively managed as private grazing lands. This means the vast majority of the wetlands (and catchment) are managed by private landholders and any improvement in management for biodiversity relies on their goodwill and cooperation. The management plan must therefore focus on practical, cost-effective actions that are likely to benefit both wetlands and landholders, plus any enforceable legal requirements (eg. Noxious weeds, TSC Act).

Priority management objectives are therefore aimed at the protection of native vegetation and control of noxious weeds and introduced animals. These in turn assist in the protection of native fauna and their habitat and through further consultation with local aboriginal land councils, can help protect aboriginal cultural values. To maintain and improve biodiversity, current funding needs to be targeted at these objectives to provide positive outcomes. Appendix 1 lists available control measures for noxious weeds present at Lake Bathurst and The Morass.

Developing detailed weed and vegetation maps is essential to managing noxious weeds and native vegetation and identifying target areas for actions. It is recommended that this be affected quickly and efficiently especially if Serrated Tussock continues to spread at its current rate. Further management objectives can then be evaluated and prioritised for action. Implementing a collaborative approach to management and community engagement can be achieved through continual support, encouragement and from information provided by the HNCMA Wetlands Program.

Individual property management plans will contain site-specific objectives and actions.

Table 2 lists the specific management objectives for Lake Bathurst and The Morass, and describes the targets and actions needed to address these objectives. The objectives will be reviewed and updated as necessary. Developing an ongoing monitoring program would be a useful step to provide results to inform future management.

Stakeholders and other potential partners that may be consulted with for future management of Lake Bathurst and The Morass include:

- Hawkesbury Nepean Catchment Management Authority (HNCMA)
- Goulburn Mulwaree Council
- Crown land managers (e.g. Department of Lands (DoL))
- Landholders
- Pejar Aboriginal Land Council
- Department of Primary Industries (DPI)
- Department of Environment and Climate Change (DECC), incl. NPWS
- Department of Water and Energy
- CRC – weeds
- Botanical Gardens
- Local bird watching and environmental groups in particular Canberra Ornithologists Group
- LandCare
- Friends of Grasslands
- WetlandCare Australia
- Local schools
- Universities and research institutions

Table 2: Management Objectives, Targets, Actions and Resources (* = Priority).

Management Objectives	Targets	Actions
*Protect and enhance native vegetation	<ul style="list-style-type: none"> ▪ No further reduction of native vegetation cover or condition ▪ Reduce weed cover in the wetland and surrounding catchment ▪ Increase existing wetland, riparian and catchment vegetation ▪ Provide suitable conditions for native vegetation growth ▪ Protect threatened species 	<ul style="list-style-type: none"> ▪ Develop detailed weed and vegetation maps (High priority) ▪ Identify appropriate cost effective control techniques for priority weeds ▪ Coordinated multi-landholder trials of different methods of weed control ▪ Identify areas for enhancement or protection ▪ Identify conditions to encourage native vegetation growth ▪ Fencing and planting in identified areas
*Protect and enhance social and Aboriginal cultural values	<ul style="list-style-type: none"> ▪ Maintain sites of aboriginal significance ▪ Maintain recreation use ▪ Maintain community access ▪ Identify and implement sustainable land use 	<ul style="list-style-type: none"> ▪ Identify and protect significant areas ▪ Identify recreation use and options for maintaining and minimising its affects ▪ Ensure access remains open to the public ▪ Maintain economic viability of surrounding land ▪ Increase awareness of the values of the wetlands and the surrounding area
*Protect and enhance native fauna and their habitat	<ul style="list-style-type: none"> ▪ No further reduction of habitat ▪ Provide suitable conditions for native animals, particularly threatened species ▪ Reduce impacts on native fauna 	<ul style="list-style-type: none"> ▪ Maintain or improve habitat for native species ▪ Provide information on threatened species habitat requirements ▪ Fencing of significant areas ▪ Removal of introduced predators and feral species ▪ Provide information on legislation to landholders
*Control the abundance of noxious weeds and other pest plants, in particular Serrated Tussock (<i>Nassella trichotoma</i>)	<ul style="list-style-type: none"> ▪ Reduce the abundance and impact of priority weeds ▪ Control Serrated Tussock ▪ Develop a long term management approach to reducing weed impacts 	<ul style="list-style-type: none"> ▪ Develop detailed weed and vegetation maps (High priority) ▪ Identify appropriate control techniques for priority weeds ▪ Trial different methods of weed control ▪ Identify conditions to encourage native vegetation growth for competition ▪ Investigate seed viability ▪ Develop a long term program for control
*Control the abundance of pest animals, particularly rabbits (<i>Oryctolagus cuniculus</i>)	<ul style="list-style-type: none"> ▪ Reduce the abundance and impact of pest animals ▪ Rehabilitate areas damaged by pest animals ▪ Develop a long term management approach to reducing pest animals 	<ul style="list-style-type: none"> ▪ Identify appropriate control techniques of priority pest animals ▪ Identify areas of abundance ▪ Develop a long term program for control ▪ Develop a revegetation program for areas been damaged by pest animals

Management Objectives	Targets	Actions
Re-establish the filled in link between the Nth Morass lake and Lake Bathurst	<ul style="list-style-type: none"> Reinstate natural flow regime 	<ul style="list-style-type: none"> Remove flow obstructions
Support sustainable agriculture	<ul style="list-style-type: none"> Determine sustainable stocking rates and suitable areas for grazing Reduce negative impacts of grazing Rehabilitate affected areas of dryland salinity 	<ul style="list-style-type: none"> Investigate appropriate areas for grazing within the wetland area and sustainable stocking rates Investigate incentive funding sources for landholders to install stock-proof fencing and alternative water sources, to improve grazing management of wetlands when flooded Identify affected areas of dryland salinity Fence off and plant salt-tolerant pasture grasses or grade the bank above the erosion areas to divert run-off and reduce erosion (CALM)
Understand the impact of catchment processes on water quality	<ul style="list-style-type: none"> Decrease the impact of groundwater discharge on wetland salinity Decrease the impact of poor quality runoff Minimise rates of erosion Decrease sedimentation 	<ul style="list-style-type: none"> Identify recharge zones in the upper catchment and plant with native vegetation Invest in programs to address major knowledge gaps Identify sedimentation sources and identify management responses
Mitigate the impacts associated with drought, reduced water flow and climate change (temperature, evaporation and rainfall)	<ul style="list-style-type: none"> Develop process for adapting to the impact of drought Investigate the impacts of climate change (temperature, evaporation and rainfall) on the catchment Investigate the current water balance for the catchment Investigate impacts on current land use practices 	<ul style="list-style-type: none"> Investigate local climate change, drought and reduce water flow impacts Community education on climate change impacts Identify local action e.g. Investigate drought tolerant species, improve water use efficiency, provide more shade for livestock and develop best practice methods for land management (CSIRO 2007)
Increase community awareness of threats and values of Lake Bathurst and The Morass	<ul style="list-style-type: none"> Implementation of the Lake Bathurst and The Morass Wetland Management Plan Increase community awareness of the wetlands 	<ul style="list-style-type: none"> Develop site action plans for surrounding landholders Identify opportunities for highlighting the threats and values facing the Lake Bathurst and The Morass
Implement a collaborative approach to wetland management	<ul style="list-style-type: none"> Clear roles and responsibilities Access funding for NRM Bi-yearly forum/communication 	<ul style="list-style-type: none"> Clearly define the roles and responsibilities of land managers Identify opportunities for funding Establish a forum for communicating between key stakeholders

Communications Strategy

Projects to enhance and protect wetlands in this area are coordinated by the HNCMA. To achieve optimal outcomes, emphasis must be shown to ensure that detailed information regarding the management of Lake Bathurst and The Morass is provided to stakeholders, community groups and landowners. To ensure that this occurs, all projects should undertake the following steps;

- Production of an initial information bulletin outlining the project and contacts
- Advertisements run in local papers
- Media releases on the current project
- Mail out to affected landholders
- Local stakeholders (including local Landcare and Councils) contacted
- Articles placed in local newsletters
- Field days and workshops to be held in regards to the project
- A poster to summarise the outcomes of the project.
- Information on the website <http://www.hn.cma.nsw.gov.au/> or www.wetlandcare.com.au

Other Funding Opportunities

The HNCMA has funding available for environmental works on private land. Funding is available for river and creek bank vegetation, native bushland and grasslands, degraded and eroded land, wetlands and saltmarsh. There are also a number of alternate sources of funding available for rehabilitation and conservation of wetlands in NSW including EnviroFund, NSW Environmental Trust and NSW Recreational Fishing Grants. WetlandCare Australia staff and HNCMA staff are experienced in seeking funding to undertake wetland conservation and have been extremely successful in obtaining outside funds to undertake such work.

If you would like to undertake some restoration work on your property or would like some advice or assistance for undertaking works or seeking funding please contact;

- **WetlandCare Australia on 6681 6169**
- **Hawkesbury Nepean CMA (Wetlands Officer) in Windsor on 4587 0050**
- **Landcare (Community Support Officer for HNCMA) in Goulburn on 4828 6747**
- **Goulburn Mulwaree Council on 4823 4444**
- **Department of Primary Industries in Goulburn on 4828 6600**
- **DECC in Wollongong on 4224 4100**
- **Crown Lands in Goulburn on 4824 3700**



Figure 4: *Wilsonia rotundifolia* (Photograph by B.Turner, 2007)



Figure 5: *Eleocharis* sp (Photograph by B.Turner, 2007)

> Regulatory Framework

All works aimed at the rehabilitation and protection of values of Lake Bathurst and The Morass should be conducted in accordance with best management practices (BMP) and appropriate legislative guidelines. Before any works are carried out, consultation with the relevant authorities will occur to ensure that all avenues are explored and ensure that best management practice is followed throughout the remediation process, and the best remediation strategies are adopted.

Local Environmental Plans (LEPs) – Consultation with Goulburn Mulwaree Council with regard to all matters considered to be of significance for environmental planning within the local government area as outlined in the locality plans will be a matter of priority.

Aboriginal and Torres Strait Islander Heritage Protection Act 1984 - An Act to preserve and protect places, areas and objects of particular significance to Aboriginals, and for related purposes.

Native Title Act 1993 - An Act about native title in relation to land or waters, and for related purposes.

Water Management Act 2000 – provides for the protection of rivers and lakeside land in NSW. Anyone who excavates or removes material from “protected land” or undertakes an action likely to interfere with the flow of “protected waters” (river or lake) must obtain a permit under Part 3A of the WM Act.

Environment Protection and Biodiversity Conservation Act 1999 – the most applicable sections of the EPBC Act in relation to the Lake Bathurst and the Morass relate to the protection of threatened species and listed migratory species.

Environmental Planning and Assessment Act, 1979 – Involves assessment of works for significant effects on the environment, and to determine if an Environmental Impact Statement (EIS) is required under 112 of the Act. Pursuant to Part 5 of the EP&A Act, The local Council is the determining authority.

Noxious Weeds Act 1993 (NWA)- Continual inspections of the wetland complex need to be conducted to ascertain the presence and extent of weeds, particularly those deemed to be noxious as declared by the relevant authorities.

Fisheries Management Act 1994 – Bank stabilisation works may require a permit if it is deemed under Section 219 that obstruction occurs across or within a river or creek. Part 7A of the Act may also be relevant as it provides for the conservation of threatened species, including protection of habitat and marine vegetation. Any works likely to impact on fish habitat or marine vegetation will not be carried out until consultation with DPI occurs and the necessary permits obtained.

Threatened Species Conservation Act 1995 - The Threatened Species Conservation Act outlines the protection of threatened species, communities and critical habitat in New South Wales. An independent Scientific Committee has been set up under the Act to determine which species, populations and ecological communities should be listed as endangered, vulnerable or extinct under the act, and also to determine key threatening processes.

Crown Lands Act 1989 – Governs management and administration of all lands owned by the Crown including the Reserves within Lake Bathurst and The Morass.

JAMBA / CAMBA – Are the agreements between the governments of Japan, China, and Australia to protect migratory birds, birds in danger of extinction, and their habitats. These birds are also protected under the EPBC Act.

> Monitoring, Evaluation and Review

Monitoring is an essential step in wetland management. Monitoring involves the collection of qualitative and quantitative data, that when analysed can be used to determine if a management action has been a success or failure. It can also be used to change or adjust a management action in response to the changes occurring in the wetland. Most monitoring techniques in wetlands look at flora, fauna, groundwater and surface water. A specific monitoring program would need to be developed in collaboration with implementing management actions. This might involve establishing photopoints when onground works occur, or establishing a piezometer network to better understand the dynamics of groundwater on the wetlands. Numerous methods of wetland monitoring are available and should involve consultation with relevant stakeholders.

As part of any successful project, evaluation and review of the objectives and actions is required. This informs the community and wetland managers of the effect that the management actions are having on the wetlands' chemical, biological and physical characteristics. It also allows for changes in the surrounding environment to be considered in management, as threats and assets will change over time.

Monitoring indicators (suggested)

- Establishing long term Photopoints
- Establishing or using existing vegetation monitoring in particular of wetland vegetation and surrounding native grasslands
- Surface water quality testing
- Establishing Groundwater monitoring bores and undertaking regular monitoring
- Continue existing bird monitoring, and
- Establishing monitoring sites at onground works sites



Figure 6: A dry Lake Bathurst (Photograph by B.Turner, 2007)

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Appendix 1.

Management Options and Techniques for Noxious Weeds: Lake Bathurst and The Morass

SERRATED TUSSOCK

(Information summarised from from CRC for Weed Management 2003, Weed Management Guide, Serrated Tussock - *Nassella trichotoma* & NSW DPI 2006 Primefacts 44, Serrated Tussock – identification and control)

Serrated tussock is a threat because:

- It crowds out useful pasture
- Lives for more than 20 years
- Indigestible to sheep and cattle
- Seed remains viable for 14 years, travels long distances on wind
- Survives better than other pasture species and survives drought better (NSW Ag.)
- Severely reduces biodiversity
- Severely reduces production (up to 95%) (CRC Weed Man.)

Control

Physical

- plough and sow with wheat / oats for a couple of years to outcompete tussock then sow back to pasture
- chipping of individual plants
- mowing / slashing of plants before seed sets to reduce seed bank and “buy time”

Chemical

Flupropanate (taskforce)

- takes several months to kill tussock so may not stop seed production if applied after August
- will kill native grasses also (questions over boom spraying)
- needs rain as is soil activated (root uptake)
- 1.5 – 2.0 L/ha for mature plants, .5 L/ha for seedlings
- Winter optimum time as ground moist, tussock easily identifiable
- Has residual effect

Glyphosate (non-selective)

- apply in spring to halt seed set, can be combined with flupropanate
- Kills everything

- Plant needs to be actively growing as it is leaf absorbed
- Best to spot spray with knapsacks or 'quickspray' units
- Use from Sept. on to stop seeding
- 100ml/100L water (450 gly)
- No residual effect

Management

- All Nassella species prohibited from entering Australia. Declared (noxious) weed in NSW so landholders are required to control it
- Pasture management where desirable species are encouraged, combined with herbicide use and mechanical control is best form of management (ie. Integrated management)
- Regular checking essential
- Serrated Tussock most vulnerable to competition when a seedling, likes full sun and bare ground, slow growing
- Generally ~18 months before it sets seed
- Desired groundcover needs to be maintained at 80% cover
- Aim for highest groundcover in autumn (>80%) to reduce available ground for germination
- Planting windbreaks to reduce windblown seed, dense native trees and shrubs are most effective
- Subdivisional fencing for rotational grazing is essential to maintain desired groundcover abundance
- Restrict grazing in summer to allow max. autumn groundcover

Options for Lake Bathurst

- Should not use Taskforce on wetland (even when dry due to residual)
- Manage surrounding land with herbicides and ploughing, possibly sow wheat / oats
- Further investigate burning option on lake bed
- Apply for funding for a quickspray unit for Landcare groups to share. (\$20 day cost to landholder for maintenance of unit) Landcare can then spotspray infestations. Successful in Monaro region
- Fence off areas with heavy infestation and spotspray (start on western and sth eastern sides to reduce windblown seed) or cultivate
- Slash lake bed to eliminate seed set and wait for rain to fill and kill remaining plants
- Plant dense native windbreaks around lake
- Revegetation with perennial pasture after cultivation or spraying
- Allowing clover dominance in the first year will smother new tussock seedlings and provide nitrogen to improved pastures

BATHURST BURR

(Information summarised from DPIW Tas 2008, Bathurst Burr (*Xanthium spinosum* L.) Control Guide)

- Declared noxious weed in NSW
- Germinates spring to early summer
- Spread entirely by seed
- Broadleaf plant, same herbicide as for thistle –glyphosate, MCPA, dicamba, bromacil and 2,4-D.
- Avoid herbicide use when bees are foraging

Control

- Strong competition, particularly from a well managed pasture containing legumes, will greatly inhibit the successful establishment of Bathurst Burr.
- An integrated approach to managing Bathurst burr should therefore be implemented which eliminates existing plants by spraying or grubbing then establishing competitive pasture to help prevent new plants from establishing.

<i>Herbicide (Active ingredient)</i>	<i>Commercial product (Content of active ingredient)</i>	<i>Rate of commercial product per litre of water</i>	<i>With- holding period</i>	<i>Comments</i>
Glyphosate	Round-Up Biactive®, Glyphosate 360® (360 g/L)	15ml	Nil	Care when used in pasture as it will kill grasses contacted by the spray.

Options for Lake Bathurst

- Integrate with thistle control programs and improved pasture techniques

BLACKBERRY

(Information summarised from CRC for Weed Management 2003, Weed Management Guide, *Rubus fruticosus aggregate*)

- Weed of National Significance (Noxious in all states)
- 14 very closely related species in Australia
- Reduces pasture production,
- Restricts access to water and land
- Provides food and shelter for pest animals such as foxes
- Management programs must be planned and sustained over a number of years to prevent the rapid return of the infestation

Control

- Herbicides effective but need continual follow-up, best when flowering or fruiting (Nov – Apr)
- Slashing can help open up dense stands for follow-up control by other methods
- Biological control greatest chance of success, using leaf rust
- Slashing in summer can enhance the effect of blackberry leaf rust because regrowth stimulated by the slashing is very susceptible to the rust fungus
- Need to identify all strains of Blackberry in the region, biological control species specific
- Maintaining good quality groundcover can help control blackberry seedlings.
- Rust alone will not eradicate blackberry but it slows its rate of spread and allows more time for control by other means

Options for Lake Bathurst

- Identify all strains of Blackberry in the area
- Summer slashing of large infestations
- Introduce appropriate rust for the species (Nov – Jan)
- Follow-up herbicide use and continual monitoring