



Plan of Management for Wollundry Lagoon

2008–2013

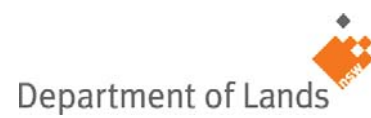


TABLE OF CONTENTS

1. INTRODUCTION	3
1.1 PURPOSE OF THE PLAN.....	3
1.2 RELEVANT LAND AND WATER AREAS.....	3
1.3 REGIONAL SETTING.....	3
1.4 HISTORY OF LAND USE.....	5
2. PLANNING CONTEXT	5
2.1 PREVIOUS PLANS.....	5
2.2 RELEVANT LEGISLATION.....	5
2.3 RELEVANT PLANNING POLICIES.....	6
2.4 COMMUNITY CONSULTATION.....	6
3. VALUES OF WOLLUNDRY LAGOON	7
3.1 RECREATION AND SOCIAL VALUES.....	7
3.2 HISTORICAL VALUES.....	7
3.3 NATURAL AND CULTURAL VALUES.....	7
3.4 WATER MANAGEMENT VALUES.....	7
4. MANAGEMENT ISSUES	8
4.1 WATER QUALITY.....	8
4.2 DECLINING NATURAL ENVIRONMENT.....	8
4.3 POOR VISUAL AMENITY.....	8
4.4 INTRODUCED BIRD POPULATION.....	8
4.5 RUBBISH.....	8
5. MANAGEMENT STRATEGIES	9
5.1 OBJECTIVES OF MANAGEMENT.....	9
5.2 MANAGEMENT POLICIES AND ACTIONS.....	9
5.2.1 <i>Improve the water quality of Wollundry Lagoon</i>	9
5.2.2 <i>Protect and rehabilitate natural values</i>	9
5.2.3 <i>Develop and promote Wollundry Lagoon as one of Wagga’s “iconic” open spaces which is used extensively for passive recreation</i>	10
5.2.4 <i>Manage Wollundry Lagoon cooperatively with the community</i>	12
6. IMPLEMENTATION PLAN	13

MAPS AND FIGURES

Map 1. Wollundry Lagoon area

Figure 1. Site plan for the duck feeding day use area

ATTACHMENTS

Wollundry Lagoon Water Quality Management Plan (Aitken Rowe Testing Laboratories Pty Ltd - December 2007)

1. Introduction

This Plan of Management has been prepared over Crown Land owned by the Department of Lands known as Wollundry Lagoon of which Wagga Wagga City Council is the Trust Manager.

1.1 Purpose of the Plan

The purpose of this plan is to provide directions to management and operational staff about how to manage the area for the next five years. The Plan will also communicate intended management to the community.

This plan is associated with the attached Wollundry Lagoon Water Quality Management Plan (Aitken Rowe 2007).

1.2 Relevant land and water areas

This Plan of Management is for Wollundry Lagoon, an area of 8.8Ha including 2.6Ha of surrounding terrestrial reserve and 6.9Ha of water. The relevant area includes the surrounding Civic Gardens, Clear Park, the Esplanade, Wollundry Avenue and several parcels of freehold land.

Part Reserve Number: 71657

Trust Manager: Wagga Wagga City Council Crown Reserves Reserve Trust

Purpose of Reserve: Public Recreation

Reserve Number: 71353

Trust Manager: Wagga Wagga City Council Crown Reserves Reserve Trust

Purpose of Reserve: Future Public Requirements, Preservation of Native Fauna and Preservation of Native Flora

1.3 Regional Setting

Wollundry Lagoon is a central civic open space in the middle of Wagga Wagga. It connects to a range of other civic spaces including The Victory Memorial Gardens, Wagga Wagga Civic Centre and the Central Business District of Wagga Wagga.

Wollundry Lagoon is a naturally occurring waterway which was previously connected to the Murrumbidgee River. Water now drains into Wollundry Lagoon from urban stormwater drains. The Lagoon is part of the Turvey Park Catchment which drains to the Murrumbidgee River.

WOLLUNDRY LAGOON - Map 1



1.4 History of land use

Wollundry Lagoon was used by Aboriginal peoples because of its abundance of food and connection to the Murrumbidgee River. It was likely to have been a significant area for Aboriginal people. The term Wollundry is based on the local Aboriginal dialect. It means “place of stones” (Civic Trust 1998).

It was one of the first recreation sites in Wagga Wagga because of its central location. Wollundry Lagoon divided the early settlement of Wagga Wagga to the north and the new settlement of Newtown to the south (Civic Trust 1998).

2. Planning context

2.1 Previous Plans

There have been a range of previous reports relevant to Wollundry Lagoon. A review of environmental factors for the enhancement of Wollundry Lagoon was completed in 1992 (Short 1992). This report recommended a range of strategies to enhance the function of the natural water features.

Based on the report by Short the Civic Trust produced a report of community issues and recommendations on Wollundry Lagoon in 1998. This plan called for a comprehensive integrated plan for the Wollundry precinct.

2.2 Relevant legislation

Legislation that is relevant to this Plan of Management includes:

- Local Government Act (1993)
- Crown Lands Act (1989)
- Rural Fires Act (1997)
- Environmental Planning and Assessment Act (1979)
- Public Works Act (1912)
- Threatened Conservation Species Act (1995)
- Native Vegetation Act (2003)
- Clean Waters Act (1970)
- Wagga Wagga Local Environmental Plan (Draft 2008)
- Environment Protection and Biodiversity Conservation Act (1999)
- State Environmental Planning policies

Crown Lands Act 1989

A large portion of the plan area is Crown Reserve. All Plans of Management for Crown Lands need to be adopted in terms of the Crown Lands Act, 1989. In this instance because the Plan is over both Crown and Council Community Lands it will need to be adopted by both the Minister for Lands and Council.

Local Government Act 1993

The Local Government Act directs that all non operational community lands require plans of management. The Act prescribes the following guidelines for the preparation of plans of management for community lands:

- (1) A Council must prepare a draft plan of management for community land.

(2) A draft plan of management may apply to one or more areas of community land, except as provided by this Division.

(3) A plan of management for community land must identify the following:

- (a) the category of the land,
- (b) the objectives and performance targets of the plan with respect to the land,
- (c) the means by which the Council proposes to achieve the plan's objectives and performance targets,
- (d) the manner in which the Council proposes to assess its performance with respect to the plan's objectives and performance targets,

and may require the prior approval of the Council to the carrying out of any specified activity on the land.

2.3 Relevant planning policies

The construction of all open space infrastructure that complies with the Wagga Wagga Development Control Plan is exempt development.

Wagga Wagga Council has developed a range of other planning initiatives which influence this Plan. These include:

- Recreation and Open Space Strategy (2005)
- Wagga Wagga Natural Resources Management Plan (1998)
- Council's Strategic Plan 2008-2018
- Wagga Wagga City Council's Annual Management Plan
- Wagga Wagga Community Social Plan 2009 – 2013 (Draft 2008)
- Wagga Wagga Development Control Plan (Draft 2008)
- Strategic Plan for Recreation in Wagga Wagga (1998)
- Wagga Wagga Bikeway Plan (1998)
- Strategic Plan for management of Public Land in the City of Wagga Wagga (1995)

There are also a number of relevant Council policies including:

Council Run Community Events
Community Services
Access and Equity
Youth
Noxious Weeds
Stormwater
Leasing and Licensing
Signs for Parks, Gardens and Public Parks
Cultural Policies
Tree Management
Risk Management
OH&S
Events Support

2.4 Community Consultation

This Plan of Management has been developed based on a community consultation process. The consultation involved interviews with key stakeholders, a public workshop and public exhibition. There were approximately 60 participants at the

community workshop held on 18 October 2007. Four community submissions were also received through the Council's website.

3. Values of Wollundry Lagoon

Wollundry Lagoon has recreational, social, historical, cultural, and natural values.

3.1 Recreation and social values

Wollundry Lagoon is a popular site in the Wagga Wagga central urban area for informal recreation. It provides people with the opportunity for fitness activities, walking, dog exercise, duck feeding and picnicking. It is also used by the model boat club, birdwatchers, artists and school groups. The Lagoon precinct also provides a setting for sections of the Wiradjuri Walking Track.

The Wollundry Lagoon also has significant social value. It provides the community with a "sense of place" which is unique to Wagga Wagga (Wagga Civic Trust 1998).

3.2 Historical values

The Wollundry Lagoon precinct is strongly connected to the history of Wagga Wagga. It was one of the first developed recreational areas in Wagga Wagga and has provided a focus for development of surrounding civic areas such as the Victory Memorial Gardens and municipal buildings. It also marked a divide between the early settlement of Wagga Wagga to the north and the development of "Newtown" to the south (Civic Trust 1998)

3.3 Natural and cultural values

Wollundry Lagoon was originally a natural feature of the Murrumbidgee River. The Lagoon has substantially changed from its natural state due to landscaping and the introduction of non natural species. The Lagoon has also been cut off from the Murrumbidgee River. Currently Wollundry Lagoon is filled by a bore near the intersection of Forsyth Street and The Esplanade. This helps to circulate water but does not stop algal blooms.

Native flora and fauna populations have declined as their habitat has deteriorated due to unsuitable stormwater quality (Short Report 1992).

Priday and Mulvaney (2005) identified some significant nature conservation values of wetland areas in Wagga such as Wollundry Lagoon. Threatened species that require wetland habitats include Brolga (*Grus rubicundis*), Blue Billed Duck (*Oxyura australis*) and Freckled Duck (*Stictonetta naevosa*).

Wollundry Lagoon has significant Aboriginal cultural values. The northern side of Wollundry Lagoon was reportedly the site of meetings, corroborees and a fighting place. Up to 1000 Wiradjuri people used the area as a meeting place as late as the 1840s. The area provided for dry camping and the Lagoon and surrounds provided a reliable food supply (Dalglish 2005).

3.4 Water management values

Wollundry Lagoon serves a number of water management functions including:

- A pollution, sediment and nutrient trap for inflows into the Murrumbidgee River

- A detention pond for city stormwater runoff
- Water storage for the Civic Centre cooling system and irrigation of city parks and gardens.

4. Management Issues

The following management issues have been identified after review of the site and discussions with council staff, user groups and the general community. These issues are addressed in the management strategies (Section 5).

4.1 Water quality

A major concern for Wollundry Lagoon is the declining water quality which is causing regular algal blooms. The issues of water quality are documented in the attached water quality report (Aitken Rowe 2007). In summary there are increasing incidences of algal blooms in Wollundry Lagoon caused by increasing nutrient levels.

The water quality has major impacts on the recreational and natural values of Wollundry Lagoon.

4.2 Declining natural environment

The natural values of the Reserve are declining. There are few observations of native fish and turtle species. Introduced bird and fish species such as Carp are now abundant.

Weeds species are common around Wollundry Lagoon including Palms (*Phoenix canariensis*), Willows (*Salix sp.*), Privet (*Ligustrum sp.*), White Cedar (*Melia azederach*), Vinca (*Vinca sp.*), Black Locust (*Robinia pseudoacacia*) and sacred bamboo (*Nandina domestica*). A willow eradication program is currently in place.

4.3 Poor visual amenity

The area around Wollundry Lagoon has a range of settings and facilities. Some of the settings such as the duck feeding area on The Esplanade and Clear Park are degraded providing a poor visual amenity. Recreation facilities such as picnic tables are also old and poorly maintained. There is also no consistency in infrastructure and limited signage and interpretation of the values of the Lagoon.

4.4 Introduced bird population

There is a large population of ducks and geese that live in Wollundry Lagoon. Many of these species are introduced and cause adverse impacts on the surrounding vegetation and water quality of the Lagoon.

However, the bird population has provided an opportunity for community interaction. In the past there has been some community reluctance to manage the introduced bird populations.

4.5 Rubbish

Large amounts of rubbish accumulate in Wollundry Lagoon. The rubbish comes from storm water drains entering into the Lagoon and direct dumping of rubbish. Rubbish is also spread through the surrounding parkland as rubbish bins regularly overflow.

There are 19 storm water pipes that enter into Wollundry Lagoon. Only one of these storm water pipes has a functioning gross pollutant trap to collect rubbish that may otherwise enter into the Lagoon.

5. Management strategies

The following management strategies have been developed from management objectives and issues. The strategies include specific actions, ongoing actions and policies.

5.1 Objectives of Management

The following specific land management objectives have been developed based on the issues and values of Wollundry Lagoon.

1. Improve the water quality of Wollundry Lagoon
2. Protect and rehabilitate natural values
3. Develop and promote Wollundry Lagoon as one of Wagga's "iconic" open spaces which is used extensively for passive recreation
4. Manage Wollundry Lagoon cooperatively with the community

5.2 Management policies and actions

5.2.1 Improve the water quality of Wollundry Lagoon

Refer to the attached Water Quality Report (Aitken & Rowe 2007).

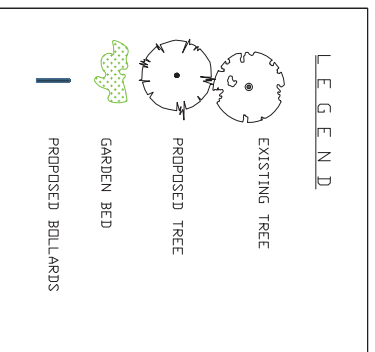
1. Install gross pollutant traps at nominated stormwater discharge sites.
2. Develop a catchment management education campaign aimed to raise awareness about the impacts of urban discharge from the Wollundry catchment into the Lagoon.
3. Install floating reed beds to aid in controlling nutrient accumulation and reduce algae.
4. Add suitable products to assist with oxygenation of the Lagoon water and further improve water quality.
5. Remove sediment that has accumulated in the western end of the Lagoon.

5.2.2 Protect and rehabilitate natural values

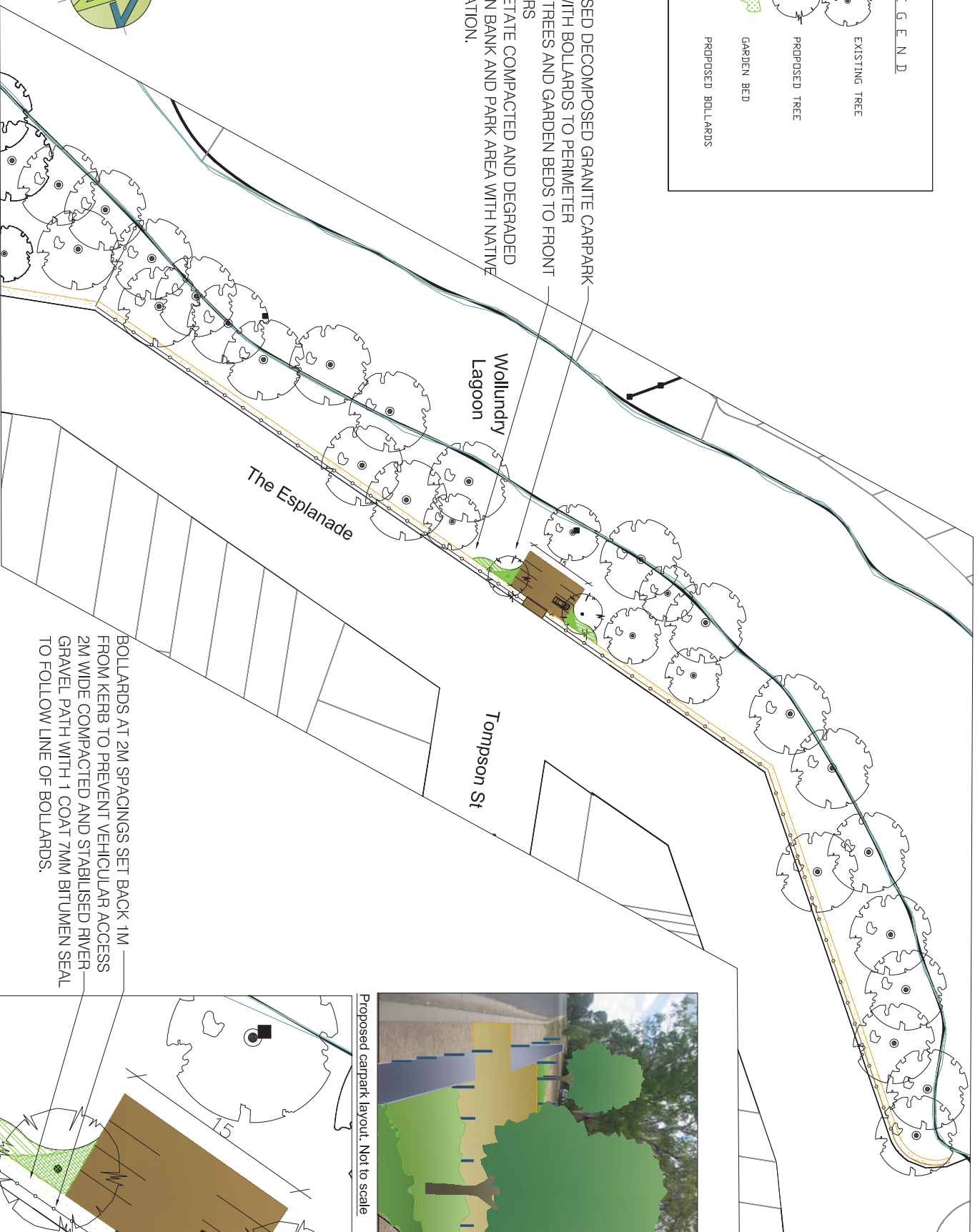
6. Remove the willows and other woody weeds (such as Privet and Black Locust) within the Lagoon environment.
7. Develop and distribute a brochure on the natural values of the Lagoon to surrounding landholders.
8. Manage the introduced duck and geese species to significantly reduce their populations.
9. Attempt to eradicate the carp population. Occasional fishing competitions may be permitted to reduce carp numbers.
10. Revegetate the Lagoon edges with locally indigenous species.

5.2.3 Promote Wollundry Lagoon as one of Wagga's "iconic" open spaces which is used extensively for passive recreation

11. Promote the circuit track around the Lagoon with interpretation signage. This walk will require safe pedestrian crossings, including possible traffic calming at road intersections.
12. Upgrade and replace all visitor infrastructure with high quality furniture.
13. The duck feeding area will be rehabilitated and developed (see concept plan Figure 1). This will include a formalised carpark area, a picnic area and rehabilitation of the surrounding environment.
14. Investigate the possibility of continuing the path around the lagoon via the construction of a board-walk in front of the privately owned section of the management area.
15. Install vehicular bollards along the Esplanade at two metre spacings set back one metre to prevent vehicular access onto grassed area assisting in the rehabilitation by minimising compaction and runoff.



PROPOSED DECOMPOSED GRANITE CARPARK AREA WITH BOLLARDS TO PERIMETER SHADE TREES AND GARDEN BEDS TO FRONT CORNERS REVEGETATE COMPACTED AND DEGRADED LAGOON BANK AND PARK AREA WITH NATIVE VEGETATION.



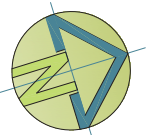
BOLLARDS AT 2M SPACINGS SET BACK 1M FROM KERB TO PREVENT VEHICULAR ACCESS 2M WIDE COMPACTED AND STABILISED RIVER GRAVEL PATH WITH 1 COAT 7MM BITUMEN SEAL TO FOLLOW LINE OF BOLLARDS.



Proposed carpark layout. Not to scale



Proposed carpark layout. Not to Scale



5.2.4 Manage Wollundry Lagoon cooperatively with the community

16. Council will facilitate a meeting with the community once this Plan of Management has been adopted. This meeting will aim to organise community involvement in the ongoing management of the Lagoon, and formalise mechanisms to ensure effective communication between Council and the community regarding management issues.

17. Funding for works will come from an annual Council allocation designated for Wollundry Lagoon.

6. Implementation Plan

The following actions will be undertaken according to their timeframe. These actions will be used as a basis for future budget consideration and provide the specific direction for operational works plans.

Table 1. Management Actions

Management Action	Activity No.	Timeframe
Council will facilitate a meeting with the community once this Plan of Management has been adopted. This meeting will aim to organise community involvement in the ongoing management of the Lagoon, and formalise mechanisms to ensure effective communication between Council and the community regarding management issues	14	2010
Develop a catchment management education campaign aimed to raise awareness about the impacts of urban discharge from the Wollundry catchment into the Lagoon	2	2010
Manage the introduced duck and geese species to significantly reduce their populations	8	2009
Install gross pollutant traps at nominated stormwater discharge sites	1	2010
Install floating reed beds to aid in controlling nutrient accumulation and reduce algae	3	2010
Add suitable products to assist with oxygenation of the Lagoon water and further improve water quality	4	2010
Remove sediment that has accumulated in the western end of the Lagoon	5	2011
Develop and distribute a brochure on the natural values of the Lagoon to surrounding landholders	7	2010
The duck feeding area will be rehabilitated and developed (see concept plan Figure 1). This will include a formalised carpark area, a picnic area and rehabilitation of the surrounding environment	13	2011
Upgrade and replace all visitor infrastructure with high quality furniture	12	2010
Promote the circuit track around the Lagoon with interpretation signage. This walk will require safe pedestrian crossings, including possible traffic calming at road intersections	11	2010
Revegetate the Lagoon edges with locally indigenous species	10	2011
Install vehicular bollards along the esplanade to prevent vehicular access onto the grassed area	15	2011

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AITKEN ROWE TESTING LABORATORIES PTY LTD

WATER QUALITY MANAGEMENT PLAN

WOLLUNDRY LAGOON – WAGGA WAGGA



**S07-332
DECEMBER 2007**

TABLE OF CONTENTS

1	BACKGROUND	1
	1.1 INTRODUCTION	1
	1.2 HISTORY	2
	1.3 WETLAND ECOLOGY	2
	1.4 WOLLUNDRY LAGOON FUNCTIONS	3
2	WATER QUALITY	4
	2.1 BACTERIAL CONTENT	5
	2.2 ALGAE CONTENT	6
	2.3 NUTRIENT LEVELS	7
	2.4 SALINITY LEVELS	8
3	IDENTIFIED CAUSES LEADING TO WATER QUALITY ISSUES	9
	3.1 OVER-POPULATION FROM DUCK AND GEESE SPECIES	9
	3.2 VANDALISM AND RUBBISH DUMPING	10
	3.3 INVASIVE AND EXOTIC SPECIES	11
	3.4 SEDIMENT ACCUMULATION	11
	3.5 STORMWATER	11
	3.6 VOLUNTEER GROUPS	12
4	THE NEED FOR A WATER QUALITY MANAGEMENT PLAN	12
	4.1 OBJECTIVES OF THE MANAGEMENT PLAN	12
5	MANAGEMENT ISSUES, STRATEGIES AND ACTIONS	13
	5.1 WATER QUALITY REHABILITATION	13
	5.2 FLORA	14
	5.3 FAUNA	14
	5.4 FISHERY MANAGEMENT	15
	5.5 MONITORING	15
	5.6 ABORIGINAL CULTURAL HERITAGE	16
	5.7 NON-ABORIGINAL CULTURAL HERITAGE	16
	5.8 STORMWATER DRAINAGE	17
	5.9 ENVIRONMENTAL AND CULTURAL INTERPRETATION	17
	5.10 PROMOTION AND MARKETING	18
6	IMPLEMENTATION OF THE PLAN	18
	REFERENCES	22
	APPENDIX A – FLOATING REED BEDS	23
	APPENDIX B – AQUALEC PRODUCTS	25



TABLE OF CONTENTS (cont)

PLATES AND FIGURES

FIGURE 1: LOCATION OF WOLLUNDRY LAGOON	1
FIGURE 2: THE WOLLUNDRY LAGOON CATCHMENT	4
FIGURE 3: FAECAL COLIFORMS LEVELS IN WOLLUNDRY	5
FIGURE 4: CHLOROPHYLL-a LEVELS IN WOLLUNDRY	6
FIGURE 5: ALGAE CELL COUNT IN WOLLUNDRY 2007	7
FIGURE 6: PHOSPHORUS LEVELS IN WOLLUNDRY	7
FIGURE 7: NITROGEN LEVELS IN WOLLUNDRY	8
PLATE 1: PHOTO LOOKING EAST ALONG THE SOUTHERN BANK OF THE LAGOON DISPLAYING EXPOSED AREAS	9
PLATE 2: PHOTOGRAPH DISPLAYING THE GROSS POLLUTANT TRAPS AT THE INFLOW TO THE LAGOON	11
TABLE 1: SUMMARY OF POLLUTANTS, THEIR POSSIBLE SOURCE AND POTENTIAL IMPACT TO THE LAGOON	10
TABLE 2: ACTION TABLE	19



1.0 BACKGROUND

1.1 Introduction

Wollundry Lagoon is a natural billabong situated in what is now the Central Business District of Wagga Wagga (Figure 1). The Lagoon forms part of the Murrumbidgee River which has become isolated as the river bed has migrated across the floodplain. Billabongs provide an important static water habitat and prior to European settlement the Lagoon would have been surrounded by River Red Gum (*Eucalyptus camaldulensis*) woodland and subject to regular flooding and drying events.

The Lagoon has a surface area of 6.6 hectares although it allows adequate detention for its catchment of 539 hectares.

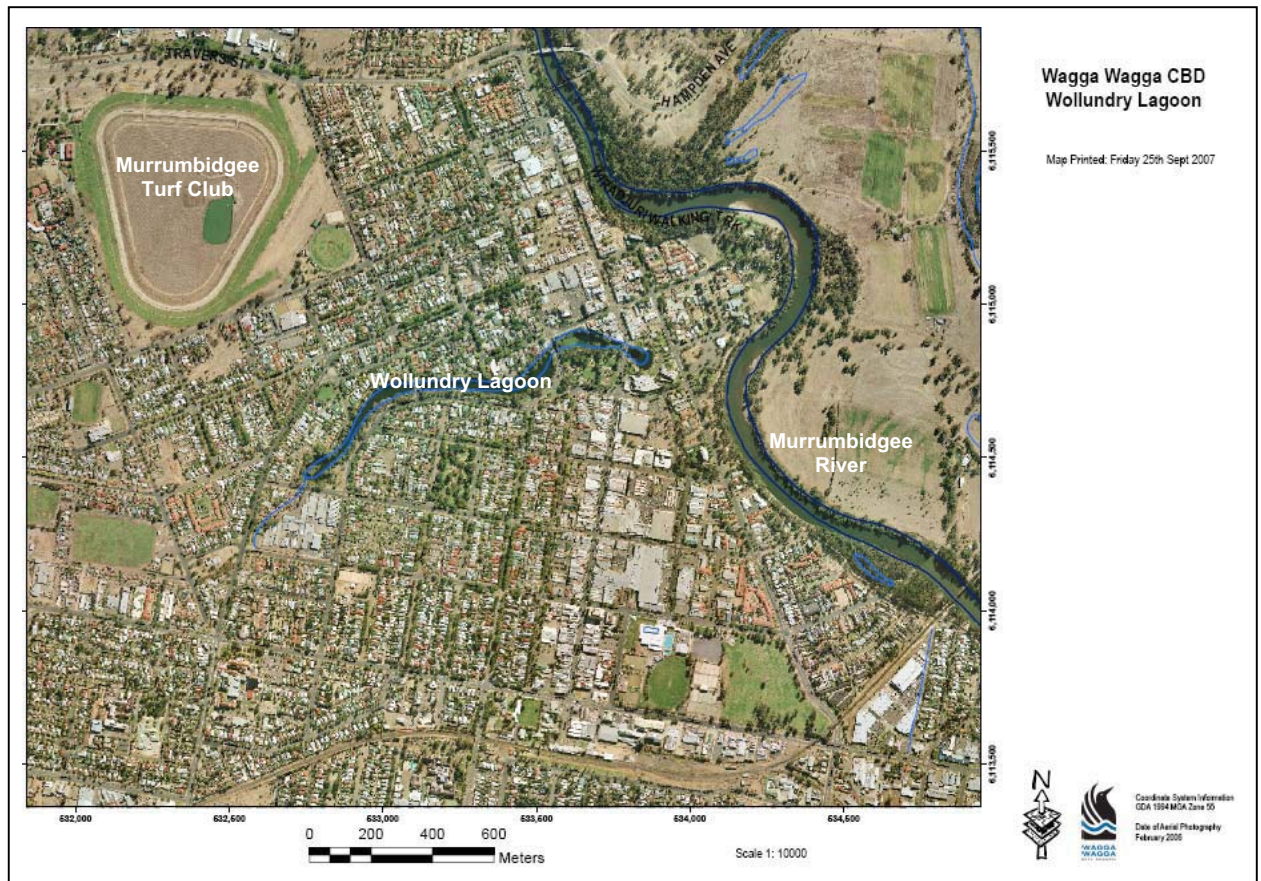


Figure 1: Location of Wollundry Lagoon in the CBD of Wagga Wagga

1.2 History

Robert Holt Best established the Wagga Wagga run in 1832. Townsend marked out the area for a town in 1849, including two streets on the northern bank of the Lagoon; Johnston Street and Freer Street. The population of Wagga Wagga has grown from approximately 700 in the 1860's to over 55 000 at present. The township grew around the Lagoon and it forms an important part of Wagga Wagga for aesthetic, recreational and engineering purposes. Fitzmaurice Street and Baylis Street form the hub of Wagga Wagga's CBD and are connected by a bridge over the eastern end of the Lagoon. It has been highly modified from its natural state with bridges, drainage connections and removal of all remnant vegetation from its banks. Parks are a predominant feature of the Lagoon along with major Civic buildings and residential dwellings to a lesser degree.

Wollundry Lagoon provides a number of beneficial functions including:

- The focal point of a large recreation reserve stretching through the centre of the city.
- Habitat for fauna.
- Water storage for park irrigation.
- A major detention pond for the city's stormwater drainage system.
- A pollutant trap for the catchment it serves.

The Revision of Environmental Factors (REF) completed for the Lagoon in December 1992 identified the importance of the water body following a blue green algae outbreak in January 1992. It was then that the protection the Lagoon provided to the receiving waters of the Murrumbidgee River was realised. Litter, fine sediment, nutrients, microbial contaminants, oils, pesticides and heavy metals have all been captured by the Lagoon for over 100 years.

1.3 Wetland Ecology

The Murrumbidgee River has a total catchment area of 84000km² and flows 1500km from its source in the Snowy Mountains to its confluence with the Murray River. The Murrumbidgee is a heavily regulated river with 26 dams and weirs and over 10000km of irrigation canals. The ecology of wetlands along the floodplains of most inland Australian rivers is adapted to periodic cycles of flooding and drying. Regulation has removed the majority of these flooding and drying events although such cycles are a critical driving force for the ecological productivity and diversity of these wetlands. River regulation which has basically flattened the flow regime has resulted by changing the crucial balance of these systems.

The long history of regulation along the Murrumbidgee River and relatively consistent all year round flows has created the perception that Lagoons such as Wollundry require permanent and stable water levels. However such conditions have caused serious degradation to wetlands throughout the river system.

1.4 Wollundry Lagoon Functions

Previous reports by Wagga Wagga City Council have highlighted the significance of the Lagoon both socially and environmentally.

- **Recreation**
The Lagoon and its associated parks provide areas for users to exercise, picnic and take time out as well as hosting various public functions such as fetes and celebrations. Much of the attraction of the Lagoon is the abundant flora and fauna which consist of both resident and migratory species.
- **Non-Aboriginal Heritage**
The parks surrounding the Lagoon have many items of heritage significance including the Old Council Chambers, the War Memorial monuments, the bridges at Beckwith Street and Baylis Street, the street directory at Fitzmaurice Street and several trees planted by visiting dignitaries’.
- **Aboriginal Heritage**
As part of the REF (1992) the NSW Parks and Wildlife Service advised that the likelihood of items of Aboriginal Heritage significance would be low owing to the past history of disturbance within the urban area. A current assessment however should be performed.
- **Engineering**
One of the Lagoon’s major roles is to provide detention for the Turvey Park and central Wagga Wagga stormwater drainage system. The Lagoon is 6.6 hectares in area but provides adequate detention for its catchment of 539 hectares (Figure 2). The detention allows for storage of stormwater when the river is too high for gravity drainage to the river to occur or when flows exceed the capacity of the 1050mm stormwater line connecting the Lagoon and Tony Ireland Park, located immediately prior to the outflow to the river.

Detention storage can be utilised between the minimum recreational level and the maximum safe level. Levels below minimum threaten the fauna, the operation of the heat exchange coils of the Civic Centre air conditioning system (located to the east of Baylis Street) and effect the general amenity of the area.

To assist in the management of the water level of the Lagoon a large mixed flow pump operates off the main discharge pipe opposite Tony Ireland Park. It assists in outflow during storm events and to provide sole discharge during high floods. In the past the pump could be reversed to ensure inflow for minimal recreational, irrigation and amenity levels. This method for management of the Lagoon has resulted in it’s degradation to the point where negative impacts are easily identifiable.

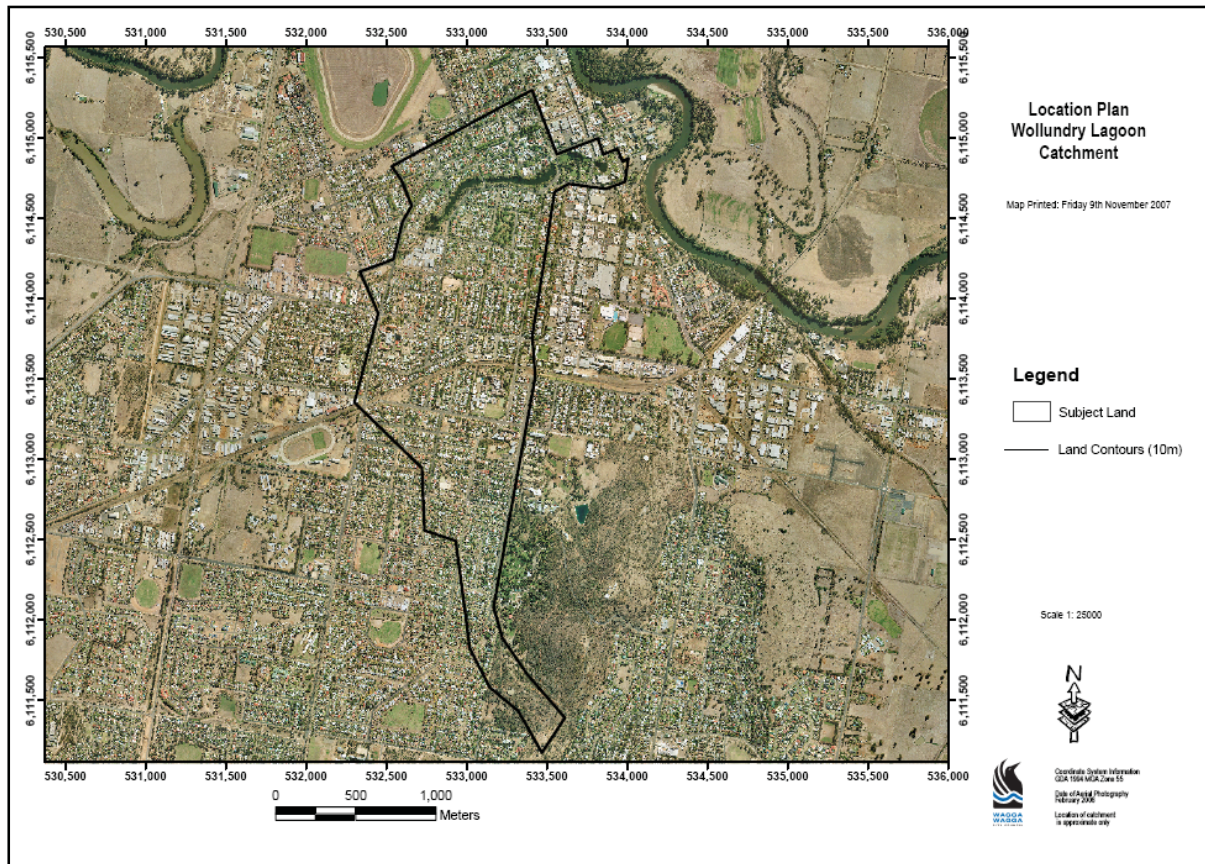


Figure 2: The Wollundry Lagoon Catchment.

2.0 WATER QUALITY

The lagoon catchment is highly urbanised and produces an urban pollutant load in the stormwater. Pollutants are transported during rainfall periods in runoff through Councils stormwater system and typically include:

- Hydrocarbon (oils/fuels) contamination from road surfaces,
- Bird and animal faeces,
- Organic matter from autumn leaf fall,
- Sediment and particulate matter,
- Nutrients from garden fertilisers
- Nutrients and pathogens from unauthorised sewer connections to stormwater,
- Dirt and detergents from the washing and cleaning of motor vehicles in residential areas,
- Dirt and detergent from carpet cleaning systems which flush to the street gutter,
- Dirt, detergent and other pollutants from the cleaning of rooves etc,
- Swimming pool backwash water illegally connected to stormwater drains,
- General litter and debris

In general the pollutant load to the lagoon ensures that water quality is poor. The past practice of pumping water from the river hampered the progression of pollutants through the lagoon to the river. Consequently Pollutants were discharged to the river as a pulse during high rainfall.

Wagga Wagga City Council has undertaken water quality analysis in the past; however the data set is highly fragmented. Following two years of regular water quality testing in 2000 the water quality for Wollundry Lagoon was considered poor. Analysis programs since this time have been erratic and on a reactive basis; following an algal bloom for example. However the data that is available are summarised in the following sections.

2.1 Bacterial Content

The limits for recreational waters in terms of faecal coliforms are 150 CFU/100mL for primary contact (swimming) and 1000 CFU/100mL for secondary contact (Fishing, Boating) as described by the ANZECC Australian Water Quality Guidelines for Fresh and Marine Waters (1992). The levels measured in Wollundry Lagoon returned an average value of 1370 CFU/100mL and a median value of 655 CFU/100mL (Figure 3). Essentially the water may not be fit for human contact. This presents serious implications for the use of this water as irrigation water. The areas irrigated with lagoon water have no restrictions over public access. Although the watering of Victory Memorial Gardens is automated the Esplanade is manual and occurs during the daytime when the parks are in use. Young children (under five years of age) who are likely to ingest both vegetation and soil/sand from irrigation areas frequent the Memorial Gardens and Collins Park.

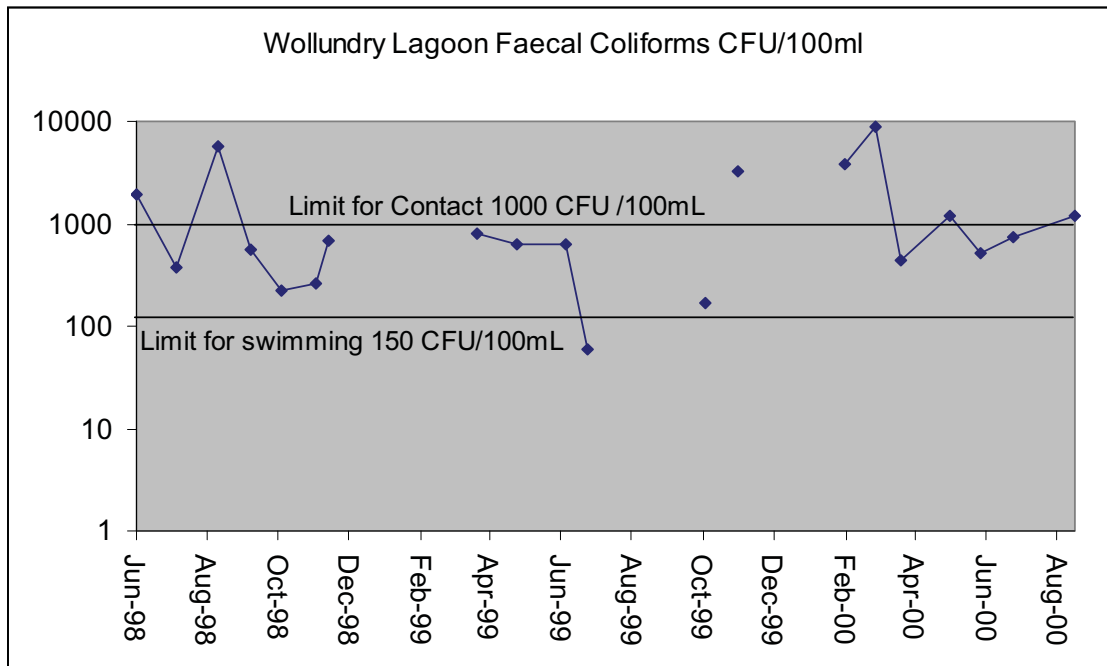


Figure 3: Faecal Coliforms levels in Wollundry Lagoon

2.2 Algae Content

Algae of many varieties are common in Wollundry Lagoon. Single cells, strings, clumps, and branched algae are most likely present. While there is a noticeable absence of blue green algae most of the colour variations of algae would indeed be present. There are a number of conditions in the lagoon, which promote algal growth. Ample nutrients and organic matter combined with a constant stormwater input brings not only nutrients but also other algae to replenish numbers and maintain diversity of algae types. Ambient temperatures through out the year also promote algal growth.

One measure for algae concentration in water is chlorophyll – a per litre. Chlorophyll – a is the green pigment in cells using a photosynthetic process to generate sugar production (plants). By measuring the amount of chlorophyll – a present one can determine an indication of the relative levels of algae over time. It's important to note that this type of comparison is very site specific, as alga type will vary markedly between sites.

The levels of chlorophyll – a in Wollundry lagoon range between 4ug/L and 32 ug/L with an average of 12 ug/L (Figure 4). The ANZECC Australian Water Quality Guidelines for Fresh and Marine Waters (1992) suggest that a range of 2 – 10ug/L is more than sufficient to create an algal bloom if other conditions are right. Given that the lagoon has an algal bloom approximately every two years it would appear that conditions are often “right”.

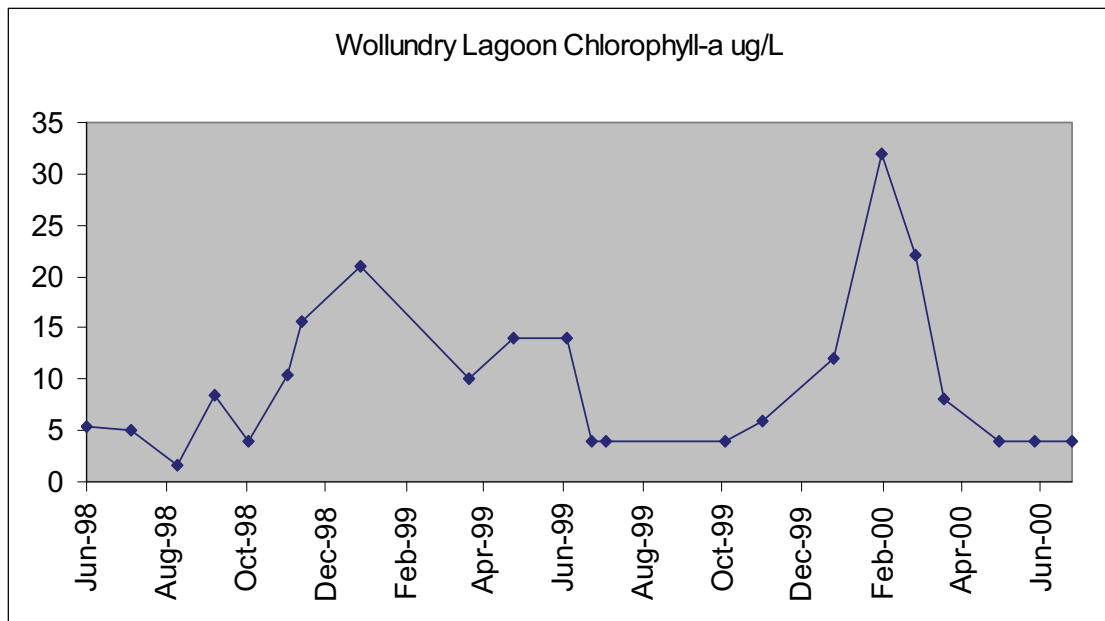


Figure 4: Chlorophyll–a Levels in Wollundry Lagoon

The latest outbreak of blue green algae occurred in January to March of 2007. The graph displayed as Figure 5 shows cells of algae ranging from medium to very high. The majority of results were well above the threshold value of 15 000 cells/mL which is considered not suitable for recreation.

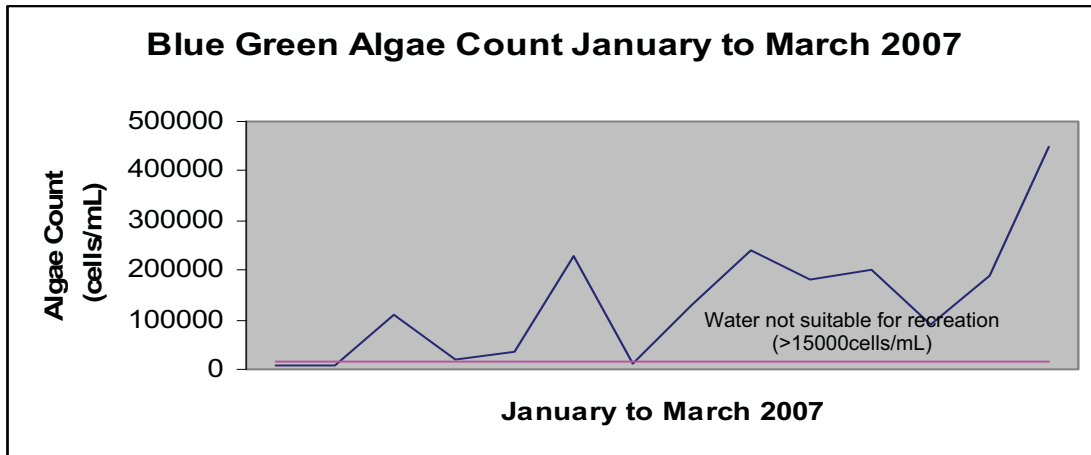


Figure 5: Algae cell count in Wollundry Lagoon 2007.

2.3 Nutrient levels

Nitrogen and phosphorus are essential nutrients in algal growth. It is well understood that their relative levels are important for the growth of algae and the type of algae that dominates in a system. There is now a strong level of awareness that blue green algae blooms can have serious repercussions for human health and faunal wellbeing. Specific types of blue green algae can cause skin irritation and/or death if ingested in sufficient quantities. Algal blooms have other less dramatic consequences such as fish kills and noxious odour production during decomposition. Algal blooms in the lagoon have produced both of the latter effects.

The levels of phosphorus (Total) in Wollundry lagoon range between 0.05 and 0.25mg/L with an average of 0.14 mg/L (Figure 5). The levels of nitrogen (TKN) in Wollundry lagoon range between 0.1 and 2 mg/L with an average of 0.96 mg/L (Figure 6).

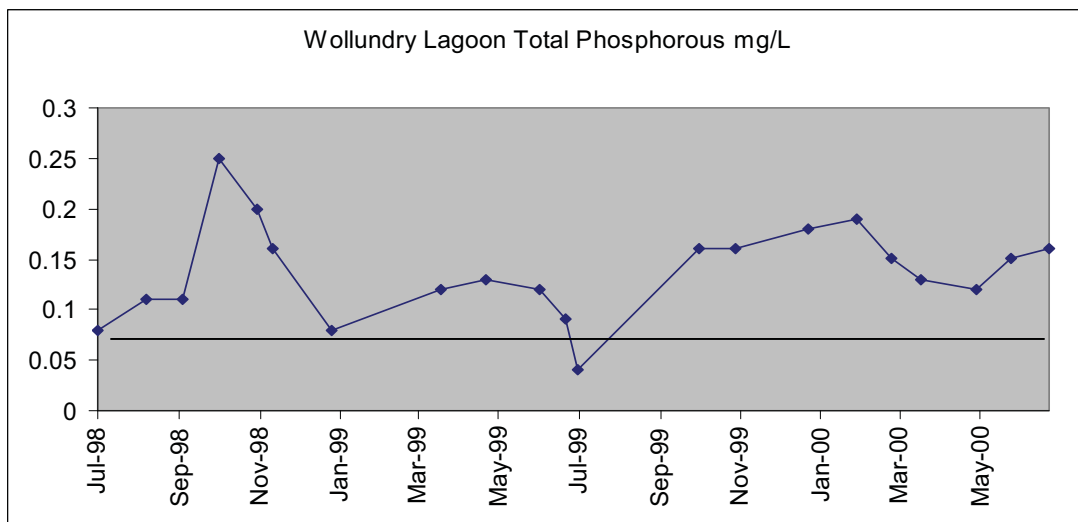


Figure 6: Phosphorus Levels in Wollundry Lagoon

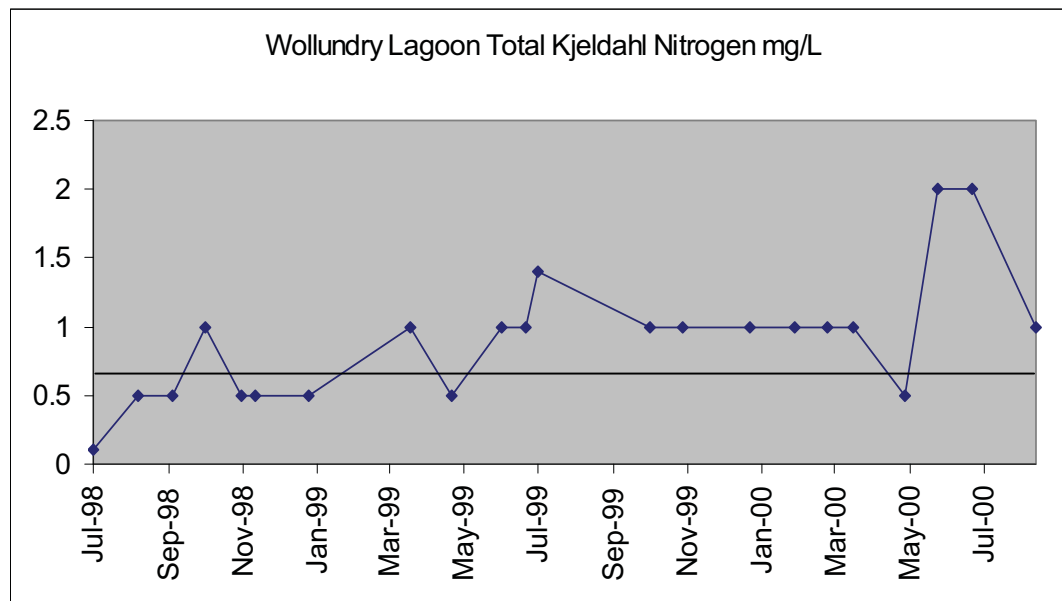


Figure 7: Total Kjeldahl Nitrogen Levels in Wollundry Lagoon

The ANZECC Australian Water Quality Guidelines for Fresh and Marine Waters (1992) suggest that a range of 0.005 to 0.05 mg/L of phosphorus and 0.1 to 0.5 mg/L of nitrogen is sufficient to support an algal bloom in fresh waters. The nutrient levels in Wollundry Lagoon are on average twice as high as the upper range suggested in the ANZECC guidelines. Consequently there is more than sufficient nutrient in the lagoon waters for an algal bloom.

Algal blooms, fish kills and noxious odours have all occurred in Wollundry Lagoon. These events have commonly taken place during summer and autumn. Complaints from residents surrounding the lagoon are common at these times of the year. Warm dry conditions provide a still environment where the algae can multiply until the bloom condition develops. Wet summers and autumns have reduced the occurrence of blooms. Presumably a substantial flushing effect from storm water removes any build up of algae in the lagoon.

2.4 Salinity Levels

Salt loads to the lagoon are minimal. The majority of areas adjacent the lagoons catchment affected by urban salinity drains to the west and consequently do not flow through Wollundry Lagoon. The low levels of salt in the lagoon are not representative of other lagoons in the area. The seasonal wetting and drying cycle which local lagoons experience, normally leads to large variations in salinity. The average electrical conductivity for the lagoon waters is 0.09 dS/m with a range of 0.06 to 0.15 dS/m. The electrical conductivity of the Murrumbidgee River at Wagga Wagga ranges between 0.1 and 0.3 dS/m, the

limit for drinking water is 0.8 dS/m. There are simply very few sources of saline water flowing to Wollundry Lagoon.

The ANZECC Australian Water Quality Guidelines for Fresh and Marine Waters (1992) suggest that water salinity should not be higher than 1.0 dS/m to protect aquatic ecosystems. Currently the lagoon salinity level is well below that threshold.

3.0 Identified Causes Leading to Water Quality Issues

Throughout the previous reports completed for Wollundry Lagoon as well as results from public workshops the following have been identified as issues leading to the reduction in water quality of the Lagoon. Table 1 provides a summary of the pollutants that are currently affecting the Lagoon.

3.1 Over-population from Duck and Geese Species

Ducks and Geese utilise the lagoon and immediate shore line. They produce a huge amount of effluent that flows directly into the lagoon causing nutrient enrichment or eutrophication. In addition the water birds have created large areas where the grass has been killed and will not grow due to compaction and foraging (see Plate 1). This leads to exposed areas that are unsightly and prone to erosion where silt, faecal matter and other contaminants are easily washed into the Lagoon following a rain event.



Plate 1: Photograph looking east along the southern bank of the Lagoon displaying the exposed areas due to water bird habitation.

Table 1: Summary of pollutants, their possible source and potential impact to the Lagoon.

Type of Pollutant	Source	Potential Impact
Gross pollutants (organic and inorganic and sediments)	Street litter, leaf litter, construction sites and erosion	Aesthetically unpleasing Chemical and biological breakdown releases pollutants Sediment smothers benthic organisms and plants reduce biodiversity
Organic Matter (DOBOD)	Vegetation and sewage	Leads to oxygen depletion, which results in the death of aquatic wildlife Efficiency of phosphorus removal is reduced
Nutrients (nitrogen and phosphorus)	Sewage, chemical, spills, erosion, fertilisers and detergents	Eutrophication and excess algal and macrophyte growth The ratio of orthophosphours to particulate P is important in design
Trace Metals (lead, cadmium, zinc, copper)	Stormwater agricultural runoff industrial and mine drainage	Food chain contamination Accumulation in sediments Important if habitat enhancement is a major objective
Faecal coliforms	Sewage, animal droppings, and septic seepage	A public health risk
Oil/grease	Road surfaces, detergents outlets and industry	Oxygen depletion Surface scums and films
Organic compounds	Pesticides	Accumulation in sediments and food chain Toxic poisoning of fish and molluscs Important for overall ecosystem and wetland health
Suspended sediments	Organic or inorganic substances, construction, land, degradation, industry	Light depiction Fish kills and destruction of invertebrate habitats Water temperature increases Smothers plants, benthic organisms

3.2 Vandalism and Rubbish Dumping

Vandalism and rubbish dumping is a huge issue for the Lagoon. Owing to its central location the Lagoon is prone to shopping trolleys, various debris, and demolition of park furniture and deliberate burning of trees in particular palms. Apart from the obvious reduction in aesthetic quality of the Lagoon repairing and cleanup after acts of vandalism can be costly and restrict funding that could be used for other more important issues.

3.3 Invasive and Exotic Species

Invasive fauna species such as European Carp reduce further the water quality of the Lagoon by stirring sediment that leads to decline in native species. The exotic flora species are problematic due to the huge additional organic matter into the Lagoon from deciduous species.

3.4 Sediment Accumulation

Sediment accumulation is particularly problematic in the western end of the Lagoon immediately downstream of the inlet point of the main stormwater canal.

3.5 Stormwater

The use of the Lagoon as a major stormwater detention basin provides an avenue for various contaminants to enter. Rubbish, fuel and oils from road surfaces and sharps are all causing a reduction in Lagoon water quality. Gross pollutant traps have been installed at both the entry (see Plate 2) and exit point of the Lagoon. These form an adequate trap for larger debris but are incapable of capturing items such as needles. This in addition to at least 20 smaller stormwater drains and countless residential outlets without traps increase dramatically the additional load on the Lagoon.



Plate 2: Photograph displaying the gross stormwater pollution traps at the inflow to the Lagoon from the western end.

3.6 Volunteer Groups

Volunteer groups such as Friends of the Lagoon and Landcare provide fantastic services for features such as the Wollundry Lagoon. In the past however the capabilities of such organisations have been poorly managed and disjointed. This has led to limited success from a free service.

4.0 THE NEED FOR A WATER QUALITY MANAGEMENT PLAN

No integrated management plan of the Lagoon has been undertaken to date. This has resulted in *ad hoc* management decisions in the past, which have not fully considered the implications for, and the long term protection of the diverse features of the Lagoon. In addition several activities have been allowed to occur which have severely altered the natural environment. Given its documented significance to Wagga Wagga the Lagoon requires a more integrated and long term approach to its water quality and subsequent retention as an integral part of Wagga Wagga's natural and built environment.

This plan has been developed to provide management goals and actions to ensure the protection of the water quality and subsequent protection of the area. It aims to achieve long term rehabilitation and conservation of the Lagoon and its catchment.

4.1 Objectives of the Management Plan

The key aim of the management plan is the improvement of the water quality of the Lagoon through conservation and rehabilitation of the Lagoon and its surrounds. This will be achieved through the following principles:

Management Principles

- Rehabilitation and conservation of the natural vegetation and habitats of the area
- Rehabilitation of the wetland environment
- Recognition and protection of Aboriginal and non-Aboriginal cultural heritage sites and values
- An appropriate level of access to, and interpretation of, the Lagoon's natural and cultural features
- Implementation of sustainable water supply usage arrangements.

The plan aims to integrate the management of key issues for the area and outline the actions required to ensure the integrity of the ecological and cultural values are maintained in the long term. The specific objectives are as follows:

Management Objectives

- Increased information about and understanding of the ecological and cultural features and values of the Lagoon and its surrounds
- Removal of exotic flora species and revegetation with native endemic species.

- Establishment of protection and preventative methods to promote water quality rehabilitation
- Conservation and protection of Aboriginal and non-Aboriginal cultural heritage associated with the wetland.
- Encouragement and facilitation of ecological and cultural interpretation
- Promotion of greater public awareness of the features and values of the Lagoon
- Assessment of the effectiveness of management changes and actions.

5.0 MANAGEMENT ISSUES, STRATEGIES AND ACTIONS

5.1 Water Quality Rehabilitation

The natural hydrology of the Lagoon has been altered by regulation of the Murrumbidgee River. Under natural hydrologic conditions the Lagoon would have been filled by seasonal floodwaters and once each flood receded the residual pool(s) in the Lagoon would gradually evaporate.

Given the location of the Lagoon and its status as both an aesthetic and required body of water for the city of Wagga Wagga it is considered impossible to re-establish the Lagoon to its natural hydrologic state. Therefore engineering measures to rehabilitate the water quality will be required.

Objective

Rehabilitate the water quality of the Lagoon.

Strategies

1. Installation of remediation devices
2. Removal of sediment accumulation at western end of Lagoon
3. Allow flushing events to occur regularly

Actions

1. Installation of floating reed beds to aid in controlling nutrient accumulation and reduce algae. Floating reed beds remove suspended solids, nutrients, phytoplankton and reduce biological oxygen demand (see Appendix A).
2. Installation of aeration products to assist in oxidation of the Lagoon and further improve water quality. Such products precipitate pollutants so that they accumulate at the surface for ease of removal (see Appendix B).
3. Remove sediment that has accumulated in the western end of the Lagoon as described in the Lagoons Revision of Environmental Factors completed by WWCC; primarily through damming immediately downstream of the area and pumping the water from the western end to allow for dredging and cartage of accumulated sediment off site.

5.2 Flora

The flora of the Lagoon is highly disturbed from its natural state to such a degree that there is little to no remnant vegetation remaining. The exotic deciduous species currently on-site provide huge amounts of organic matter entering the Lagoon.

Objective

Rehabilitation and conservation of the natural vegetation of the area

Strategies

1. Encourage regeneration of native floodplain species
2. Identify areas that require immediate revegetation

Actions

1. Undertake an in depth study to identify all flora species currently at the Lagoon and complete a detailed map to be used in identifying removal of exotic flora.
2. Liaise closely with government departments and community to decide the most appropriate methods.
3. Remove all exotic species that do not have cultural significance and re-vegetate with native preferably endemic species. This will need to be a staged process to ensure minimal bank exposure susceptible to erosion at any given time.
4. Protect re-vegetated areas with temporary fencing.
5. Revegetate majority of the shore line heavily with sedges and grasses leaving pathways. This will aim to promote areas where ducks and geese can forage and nest reducing their large scale impact. The heavily planted shore will also provide filtration of overland flows prior to it entering the main water body of the lagoon.

5.3 Fauna

Although the water quality of the Lagoon has deteriorated the potential for provision of habitat for native fauna species is considered high. Although there is no evidence of an in depth current study into the occurrence of fauna, general observations have found that the Lagoon is utilised by an abundance of fauna species, particularly waterbirds.

Objective

To gain a greater understanding of native fauna that do and could potentially use the Lagoon and surrounds and gain an understanding of the habitat requirements to promote further habitation.

Strategies

1. Identify native fauna that do and could potentially inhabit the Lagoon and surrounds.

2. Increase recognition and public appreciation of native fauna occurring in the lagoon.

Actions

1. Establish frequent (seasonally) fauna monitoring for the Lagoon.
2. Research historical data for fauna of the area.
3. Commence a detailed fauna inventory.

5.4 Fishery Management

Due to the lack of detailed historical data for aquatic fauna of the Lagoon it is difficult to ascertain the extent of decline of these species. However anecdotal evidence suggests that populations of invasive exotic fish species such as carp are increasing to the detriment of natives. Control measures maybe possible to remove the invasive species and re-stock with natives however advice from the NSW Department of Fisheries should be sought as a priority.

Objective

Recovery of native fish populations within the Lagoon

Strategies

1. Improve native fish habitat within the Lagoon
2. Determine the most appropriate control measures for species such as carp.

Actions

1. Maintain adequate large woody debris (snags) within the Lagoon.
2. Investigate options and feasibility of re-snagging sections of the Lagoon.
3. Investigate appropriate control options to remove and subsequently prevent re-colonisation by carp.

5.5 Monitoring

Any management changes must incorporate adequate monitoring to allow their success (or lack there of) to be assessed and reviewed. This will provide essential information for future management of the Lagoon and potentially allow for information sharing for similar Lagoons along the Murrumbidgee River. Regular monitoring should commence immediately to enable adequate baseline conditions to be recorded.

Objective

Assessment of the effects of management changes on the Lagoon and immediate environment.

Strategies

1. Develop an effective monitoring program to assess any changes in the environmental condition of the Lagoon and to provide information for future management options.

Actions

1. Establishment of photo points at selected sites across the foreshore of the Lagoon to assess the rate and success of re-vegetation activities.
2. Maintain photo-points at selected sites across the foreshore of the Lagoon to assess the rate and success of re-vegetation.
3. Baseline assessment of water quality.
4. Monthly monitoring of water quality.

5.6 Aboriginal Cultural Heritage

The Wollundry Lagoon and Wagga Wagga area are significant to the Aboriginal community because of the Wiradjuri People who are considered one of the largest Aboriginal tribes of NSW. Identification and appropriate management of the Aboriginal heritage is integral to the management of the area.

Objective

Protection and recording of culturally significant sites and provide greater community understanding of the significance of the heritage sites in the Lagoon area.

Strategies

1. Protection of significant Aboriginal heritage sites.

Actions

1. Research previous studies performed for the Wollundry Lagoon
2. Identify all Aboriginal cultural heritage sites of significance.
3. Survey and mark sites of Aboriginal cultural heritage significance.

5.7 Non-Aboriginal Cultural Heritage

At the time of writing a draft management plan addressing the Non-Aboriginal Cultural Heritage items of the Victory Memorial Gardens has been complete. This has not been available for completion of this report. Significant sites identified include the Old Council Chambers, bridges, War memorial and a number of trees planted by visiting dignitaries. Identification and appropriate management of the non-Aboriginal heritage is integral to the management of the area and for this reason the completion of the management plan should be seen as a priority.

Objective

Protection and recording of non-Aboriginal culturally significant sites and provide greater community understanding of the significance of the heritage sites in the Lagoon area.

Strategies

1. Protection of significant non-Aboriginal heritage sites.

Actions

1. Research previous studies performed for the Wollundry Lagoon
2. Identify all non-Aboriginal cultural heritage sites of significance.
3. Survey and mark sites of Aboriginal cultural heritage significance.

5.8 Stormwater Drainage

The Lagoon receives stormwater from its catchment of approximately 539 hectares predominately to the south. The catchment is highly urbanised consisting of roads, residential areas and light commercial/industrial properties. This load is considered a major contributor to contamination entering the Lagoon.

Objective

Control of stormwater drainage to the Lagoon to reduce contaminant loads to the Lagoon.

Strategies

1. Minimise impacts of stormwater discharge to the Lagoon.

Actions

1. Install gross pollutant traps at outflow points of medium drains.
2. Develop and undertake promotion and education program into the importance of reducing the contaminant load from stormwater entering the Lagoon.

5.9 Environmental and Cultural Interpretation

Interpretation and education facilities are required to improve public awareness of the environmental and cultural significance of the Lagoon and surrounds. In particular these facilities should focus on the wetland ecology and the Aboriginal and non-Aboriginal heritage of the area. Such interpretation facilities will highlight all the features of significance including Aboriginal heritage, historic heritage and wetland and floodplain ecology.

Objective

Interpretation facilities at the Lagoon and surrounds explaining the ecology and Aboriginal and non-Aboriginal significance of the area.

Strategies

1. Identify appropriate levels, intensity and locations of further interpretation facilities.
2. Develop appropriate interpretation facilities.

Actions

1. Prepare and install interpretation boards at significant locations including the entry/exit points of the Lagoon foreshore.
2. Develop a self guided tour booklet outlining the cultural and ecological features of the area.

5.10 Promotion and Marketing

Promotion and marketing of the Lagoon and surrounds are needed for two reasons. In the short term efforts should be directed to raising local appreciation for the current status of water quality of the Lagoon and the immediate need for rehabilitation efforts. Over the longer term promotion should focus on raising the profile of the area as a regional attraction.

Objective

Greater understanding of the role the Lagoon plays and the immediate need for rehabilitation and preventative measures to ensure improvement in water quality. Promotion of the area as a regional feature of ecological and cultural significance.

Strategies

1. Develop a public identity for the Lagoon.
2. Promote the Lagoon as part of a city and regional circuit of ecological and cultural tourism features including the Murrumbidgee River.

Actions

1. Investigate all items of cultural significance.
2. Prepare media releases to publicise work being done at the Lagoon and its surrounds.
3. Develop information brochures outlining the features of the area.
4. Liase with local and regional tourist organisations.

6.0 IMPLEMENTATION OF THE PLAN

Implementation of the management plan will be based on the objectives as outlined in Section 5. The plan is by no means permanent and should employ a series of checks and balances to ensure accurate and timely response to the success of any action.

New actions and their respective approximate costs are listed in Table 2. Actions cover the following main categories.

- Technical investigations will provide additional information about the Lagoon environment and the threats and challenges it faces.
- Monitoring to provide information on changes occurring in and around the Lagoon as a result of existing processes and future management actions.
- Management planning and actions will provide the co-ordination, effectiveness and efficiency of management arrangements.
- On-ground works will bring into effect the management strategies outline in Section 5.

Table 2: Action Table

Issue	Actions	Timing	Comments	Estimated Cost (\$)
5.1 Water Quality Rehabilitation	Installation floating reed beds	Immediate and staged over 3 years	A total of 1000m ² has been recommended however this could be reduced based on performance (Based on 300m ² supplied with plants)	\$47 250/year (\$141 750 total)
	Installation of Aeration products	Immediate	Aeration products are available for purchase or hire.	Allow \$20 000 Not available at time of writing
	Research viability of regular flushing events	Immediate	Liaise with government departments including NSW Department Water and Energy	\$0
	Removal of sediment from western end of Lagoon	Short term	Allow dredge for 2 weeks (\$250/hr and \$3000 establishment) Remove and dispose of 2000m ³ silt at \$25/m ³	\$53 000
			Total Water Quality Rehabilitation	\$214 750 (over 3 years)
5.2 Flora	Map flora of the area	Immediate		Allow \$5000
	Remove exotics and re-vegetate with natives	Staged over 5 years	Based on a crew of 4 with back hoe and truck and including matting, fertiliser and seedlings at \$3 each	Allow \$125 000
			Total Flora	\$130 000 over 5 years
5.3 Fauna	Undertake fauna monitoring	Ongoing	Based on \$500 per monitoring event – 4 per year	\$2000/year
	Research historical data	Immediate		\$0
	Commence detailed fauna inventory	Ongoing	\$1000 per year	\$1000/year
			Total Fauna	\$15 000 (over 5 years)
5.4 Fishery Management	Investigate re-snagging the Lagoon	Immediate		Allow \$1 000
	Investigate options to remove carp	Immediate		Allow \$1 000
			Total fishery management	\$2 000

Table 2: Action Table (cont.)

Issue	Actions	Timing	Comments	Estimated Cost (\$)
5.5 Monitoring	Establish and maintain photo-points	Immediate and ongoing	Enable assessment of rehabilitation techniques	\$1 000/year
	Monthly water sampling, freight and handling	Ongoing	Allow 1 hour & \$70/hr and \$50 freight and handling	\$1 440/year (\$120/week)
	Water Analysis	Ongoing	Analysis – pH, Nitrogen, Phosphorus, BOD, Suspended Solids, Faecal Coliforms, EC (3 samples per week)	\$9 000/year (\$250/sample)
			Total Water Monitoring	\$57 200 (over 5 years)
5.6 Aboriginal Cultural Heritage	Research previous studies completed	Immediate	An in depth assessment maybe required	Allow \$1000
	Identify all sites of Aboriginal cultural significance	Short term	An in depth assessment maybe required	Allow \$1 000
	Survey and mark all sites of significance	Short term	Based on 10 hours at \$120/hr	Allow \$1 200
			Total Aboriginal cultural heritage	\$3 200
5.7 Non-Aboriginal Cultural Heritage	Research previous studies completed	Immediate	An in depth assessment maybe required	Allow \$1000
	Identify all sites of Aboriginal cultural significance	Short term	An in depth assessment maybe required	Allow \$1 000
	Survey and mark all sites of significance	Short term	Based on 10 hours at \$120/hr	Allow \$1 200
			Total non-Aboriginal cultural heritage	\$3 200
5.8 Stormwater drainage	Install gross pollutant traps at outflow points on medium drains	Immediate staged over 5 years	Based on \$5 000/trap for 20 drains (4 drains per year)	\$20 000/yr (\$100 000 total)
			Total stormwater drainage	\$100 000 (over 5 years)
5.9 Environmental and Cultural Interpretation	Prepare and install interpretation boards	Following from 5.6 and 5.7		Allow \$5 000
	Develop self guided tour book			Allow \$3 000
			Total Environmental and Cultural Interpretation	\$8 000

Table 2: Action Table (cont.)

Issue	Actions	Timing	Comments	Estimated Cost (\$)
5.9 Environmental and Cultural Interpretation	Prepare and install interpretation boards	Following from 5.6 and 5.7		Allow \$5 000
	Develop self guided tour book			Allow \$3 000
			Total Environmental and Cultural Interpretation	\$8 000
5.10 Promotion and Marketing	Prepare media releases	Ongoing	Media releases to publicise works being done	\$0
	Develop information brochures	Short term		Allow \$5 000
	Liaise with local and regional organisations	Ongoing	Develop an integrated promotional package highlighting the city of Wagga Wagga and the region	\$0
			Total Promotion and Marketing	\$5 000
			Grand Total	\$546 350 (over 5 years)

REFERENCES

Wagga Wagga City Council (1992). *Wollundry Lagoon Enhancement Project - Revision of Environmental Factors*. Wagga Wagga City Council, City Engineers Department.

Wagga Wagga City Council (2000). *Wollundry Lagoon Water Level and Quality*. Wagga Wagga City Council, Department of Community Services

Appendix A
Photograph of Floating Reed Beds being installed

Photograph of floating reed beds being installed.



Appendix B
Brochure and technical specifications for aeration products

CLEAN NON-CHEMICAL ENVIRONMENTAL TECHNOLOGIES for the TREATMENT of WATER and WASTEWATER

AquaLec electro oxidation, electro coagulation, electro flotation technology is the new silver bullet for treatment of ground and surface water and polluted waste water.

A product of many years development and re engineering, AquaLec has proven beneficial in treating waste water in industries including fresh fruit processing and canneries, wine making, poultry production, dairies and dairy production, sewage and effluent treatment, mining and others. AquaLec provides water available for re-use either returning it to the production process or down stream process or disposal. AquaLec improves bore water quality for stock, irrigation and rural use and provides outback communities with clean water from rivers & dams.

The AquaLec process is very energy efficient with an average energy cost of 0.115KwHr/KL. The energy efficiency is a result of years of development and engineering that will place the electrochemical treatment of water at the front line of water treatment. AquaLec has been scientifically supported by organisations such as the American Chemical Society and expert academics in Australia.

AquaLec reduces total dissolved salts, reduces total suspended solids, reduces biological and chemical oxygen demand, reduces or eliminates bacteria, virus, algae, increases dissolved oxygen in the aqueous solution, conditions carbonate forming cations/anions to a state where they form a soft floc capable of settlement or mechanical removal. The floc carries through the hydraulic system without carbonate formation, redissolving carbonates to improve hydraulic flow, clear discharge outlets and associated equipment.

AquaLec design utilises several configurations and anode material dependent upon the aqueous solution to be treated. As an example, when used as a non chemical pre-treatment for RO systems, the anodes are designed not to produce a level of free chlorine that is detrimental to the RO membrane. RO recovery is improved significantly with water pre treated by AquaLec.

The AquaLec process results in a flow of electrons through oxidation and reduction reactions and generates neutral or charged inorganic or organic particles that change the structure of the liquid being treated and enable secondary and/or tertiary treatment processes to be sustainable without chemicals and without the increase in salinity that chemicals generate.

AquaLec generates large volumes of microscopic gas bubbles of oxygen and hydrogen that rise slowly to the surface of the liquid. The precipitated pollutants are caught by these bubbles and raised to the surface creating an aerated sludge that is carried forward by the hydraulic flow for removal. This process is a more efficient process than DAF, which relies on



chemicals to achieve performance requirements. The generation of oxygen and organic destruction results in significant reduction in BOD and COD.

AquaLec continues to break new ground with a recent trial for a mining operation revealing that Radium-226 in the bore water had been reduced by 61% following treatment by AquaLec Plant.

AquaLec is a fully modular treatment system with rural series units available to treat volumes from 2Kl to 30Kl per hour and industrial units from 50Kl to several Megalitres.



AquaLec Electro Oxidation Water Conditioner

Advanced Water Treatment for the Rural Community (Rural Domestic and Agriculture)

The problem

Rural Australia relies on rainwater for drinking. Dams, rivers and bores are used for irrigation and stock. In most regions ground and surface waters are hard, often containing algae, colloidal clay fines and bacteria. This hard water has a high mineral content and usually consists of calcium and magnesium metal ions (salts) in the form of dissolved bicarbonates. Over time, these dissolved bicarbonates reach saturation resulting in the formation of carbonates - lime scale - deposits onto surfaces causing blockages, with havens for bacteria and algae to hide and multiply.

Iron bacteria is frequently found in bore water making it unsuitable for consumption by livestock. The AquaLec Water Conditioner can remove iron bacteria in the Bore. This is achieved by returning a small percentage of the treated water via a trickle valve, back into the Bore”.

The AquaLec solution

AquaLec’s advanced Electro Oxidation water conditioning technology redissolves carbonates back to a bicarbonate form and prevents carbonate reformation. Consequently, carbonates already formed on surfaces are gradually dissolved to clear blocked pipes. The AquaLec process also removes the need for chemical additives, creates no pollution and has a low energy requirement. Designed for a maximum current density with low electrical power requirement, the AquaLec Reactor Cell contains anode and cathode pairs made from titanium substrate with an electro-catalytic coating.

Ion exchange occurs within the Cell with the transfer of electrons to positively charged ions thereby changing their molecular structure. Calcium and magnesium ions, being positively charged, are exchanged into negatively charged ions of calcium or magnesium bicarbonates or hydroxyls. These ions remain in a soluble state and will not precipitate into a carbonate. In this soluble state they form a floc that is filterable or will settle out of the water.

AquaLec Water Conditioning

Having conditioned hard water to soft water with reduced surface tension, the softened water supplies good quality water to:

The Home – Bathrooms, laundry, kitchen, for toilet flushing and on the garden.

Drip Irrigation Systems – Pumps, pipes and fittings de calcified. Blockages banished completely

Stock – Healthier, thrive on better quality water.

Performance Specification AL-series

Model	Pump L/min	Head Pressure psi	Recirculation Rate L/Hr	Reactors	Filters Stage 1	Stage 2	Dimensions mm	Weight Kg
AL12	45	26	2700	1			1000 x 550	50
AL22	60	24	3600	2			1000 x 750	75
AL32	82	19	4920	3			1000 x 950	100
AL12F		NA	5,000	1	1	1	1100 x 1100	80
			Max. daily volume					

Performance Specification AL-NP series

Model	Flow rate/vessel	Service pressure/vessel	Maximum pressure/vessel
AL12NP	45 l/min	60 psi	145 psi
AL22NP	60 l/min	60 psi	145 psi
AL32NP	82 l/min	60 psi	145 psi

Material Specification

AquaLec Reactor:

Power Supply	240vac 50 Hz single phase - DC output
Control	Programmable Logic Controller [Factory set functions]
Reactor Housing	HDPE
Anodes	Dimensionally Stable Anodes [DSA] - self cleaning
Anode Connectors	Titanium/Stainless Steel – Nylon Insulators

Recirculation Pump:

DAB 0.37Kw Ductile Iron Heavy-Duty Centrifugal Irrigation Pump fitted with pressure gauge and pressure adjustment valve

Base:

Folded aluminium checker plate with welded tube lifting handles

Electrical Connections:

All external wiring is vermin protected with uPVC conduit & fittings

Filter Stage 1:

51cm housing fitted with cleanable 51cm x 12cm x one micron cartridge

Filter Stage 2:

51cm housing fitted with disposable activated carbon cartridge element

Pipe & Fittings:

Blueline PN12.5 pressure pipe & fittings 25mm [1"] & 32mm [1.25"]

Manufactured & Serviced by:
Aquatic Mechanical Services Pty. Ltd.
ABN 24 082 553 400

Distributed by:

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