

Environment Protection Authority

Lake Bonney SE

**Report of the consultation and
the community's aspirational
environmental values**

Lake Bonney SE – Report of the consultation and the community’s aspirational environmental values

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Glossary

| | |
|---|---|
| aquifer | An underground porous layer of rock, gravel, sand or silt containing water |
| drain | Engineered channel used to remove water from waterlogged land to enable its use for agriculture. A significant amount of flow to Lake Bonney SE is via drains operated by the South Eastern Water Conservation and Drainage Board, a South Australian statutory authority. |
| Environment Protection Act 1993 | South Australian legislation that provides for the protection of the environment; to establish the Environment Protection Authority and define its functions and powers; and for other purposes. |
| environmental value | Any value a community agrees a body of water should be protected for and/or managed to support. This might include an ecosystem, industry, agriculture, recreation, and its spiritual and cultural uses/importance. Further information about environmental values is given in Section 4 of this document. |
| groundwater | Water in an aquifer |
| National Water Quality Management Strategy (NWQMS) | The National Water Quality Management Strategy (NWQMS) is a joint national approach to improving water quality in Australian and New Zealand waterways. The NWQMS aims to protect the nation's water resources, by improving water quality while supporting the businesses, industry, environment and communities that depend on water for their continued development. |
| spring | Groundwater that has come to the surface |
| surface water | Water in rivers, lakes, reservoirs, creeks and wetlands |
| water quality objective | Measurable targets for specific indicators that we seek to protect environmental values and indicating water quality. They include physical measures (eg turbidity), chemical measures (eg salinity) and/or biological measures (eg bacteria). They include concentrations, loads and narrative descriptions. |

Summary

The Lake Bonney SE Management Plan was developed between 1995 and 2000 to provide 'guidelines for the future management of the lake which will allow the continued recovery of the lake, protection of the natural values and the establishment of an amenity for use by the wider community' (DENR 1996). This was in recognition of the pollution effects that Lake Bonney SE has suffered since the 1950s due to discharges from a wastewater treatment plant, pulp mill and paper manufacturing industry, and catchment activities such as dairying.

In recent years it has become apparent that the water quality of the lake, while still poor, has improved. Further improvement of the water quality of the lake is now possible if sources of discharge to the lake continue to decrease in the future. In order to describe the target conditions that the lake should be managed to achieve a more formal process of identifying environmental values (EVs) was carried out. The EPA will use the information gained through this process to guide the management of discharges to the lake.

During early 2012, the community with an interest in Lake Bonney SE and its catchment were consulted about its future water quality. As part of this process, the community also offered comments about how they would like to see the lake managed into the future. This report contains a summary of the consultation undertaken and the EVs that the community aspires to. It is offered as a draft report for the comment of participants as a check-back to ensure that any miscommunication that may have occurred between participants and the project group are resolved prior to moving forward with the next phase of the work.

The EPA has attempted to reflect the bulk of the views of the community in terms of the relevant EVs for the water bodies. Each reader may have a different view of whether the community has it 'right' or 'wrong'—but this is not what is being asked. The question asked of the reader is: *Has the EPA accurately reflected the community's views in this report?*

The EVs that are agreed in this current process are aspirational—they are what the community would like to see the lake managed to meet. The next part of this process will provide a view to the community about whether these EVs are likely to be achieved and the reasoning behind different EVs that the EPA may put forward.

The steps in the process will include:

- The aspirational EVs will be reviewed against the existing water quality of the lake.
- The effort needed to improve the water quality to support each aspired EV will be described.
- Water quality guidelines and objectives for the key water quality parameters for the lake will be described.
- The existing monitoring and assessment program for the lake will be reviewed
- The appropriate management responses to continue to improve the water quality of the lake will be described. It will include information about the extent to which the aspired EVs are likely to be met in 10 and 30-year timeframes, based on the EPA's current understanding of how the lake will respond to changes in pollutant loads.
- A final report with the above information will then be circulated for future feedback by the public.

1 Why the EPA is developing community agreed environmental values for Lake Bonney SE

Since the 1950s, Lake Bonney SE has suffered from the impacts of pollution from discharges from a wastewater treatment plant, pulp mill and paper manufacturing industry, and catchment activities such as dairying and irrigated horticulture. Members of the South East community tell of how many of the activities previously undertaken at the lake including picnicking, fishing and boating ceased by the early 1980s, due to the worsening water quality of the lake. By the early 1990s, industry and government were responding to the plight of the lake and steps were taken—and continue to be advanced—to improve the water quality in the lake.

Guidance has been provided for those with responsibilities for the lake and its water quality. The Lake Bonney SE Management Plan was developed between 1995 and 2000 to provide 'guidelines for the future management of the lake which will allow the continued recovery of the lake, protection of the natural values and the establishment of an amenity for use by the wider community' (DENR 1996).

Since then, prompted by community concern, the state government and Kimberly–Clark Australia & New Zealand (KCA), the owners of the pulp and paper mill, agreed to fund a three-stage project from 2003–07 to identify the actions that needed to be implemented to improve the health of Lake Bonney SE. The EPA published a report on both the historical and current condition of the Lake (EPA 2004), and outlined a process of identifying the water quality parameters that needed to be addressed to improve the environmental conditions of the lake.

KCA have undertaken a series of process improvements at their pulp and paper mills that have collectively reduced the loads of many key pollutants that flow into Lake Bonney SE.

The EPA has been working with KCA as it reduced the load of key pollutants and has also been undertaking monitoring of the lake over this period. In recent years it has become apparent that KCA's actions have been effective and the water quality of the lake, while still poor, has improved. Further (slow) improvement of the water quality of the lake is now possible as pollutant discharge loads to the lake continue to decrease.

KCA operates under an indenture, the *Pulp and Paper Mills Agreement Act 1958* and the *Pulp and Paper Mill (Hundreds of Mayurra and Hindmarsh) Act 1964* and are not currently subject to the provisions of the *Environment Protection Act 1993* (EP Act). Prompted by the improving water quality and the need to establish the licensing requirements for KCA before their indenture ends in 2014, the EPA has initiated this project to establish community agreed environmental values (EVs) for Lake Bonney SE.

The EPA will also use the EVs to guide the management of authorisations for other discharges to the lake under the EP Act and may seek to have the EVs, agreed through the community consultation process, added to Schedule 1 of the *Environment Protection (Water Quality) Policy 2003*.

This project has been informed and guided by previous work that has been done over many years by the EPA and other stakeholders and community members. In undertaking this consultation, the project group identified and contacted as many individuals and groups as possible who have an interest in the lake and its catchment. The project group used their contacts and advice to inform others about this work. Focus group and community meetings were held. Input was also sought from the public via the EPA website, in local newspaper articles and on local radio during 2012.

While participants have been generous with their input about water quality of the lake, many have also made it clear that they have a strong interest in the broader management of the lake. The consultation process has therefore also picked up comments about the way that the lake should be managed into the future. These have been recorded in the notes of the meetings, and have been summarised in this document to enable written comment.

However, we emphasise that this project is not aimed at re-inventing the current management plan for Lake Bonney (DENR 1996). It is instead focused on establishing the desired EVs to guide the EPA in setting targets for water quality improvement for Lake Bonney SE.

The current document brings together the outcomes of all of the consultation for the project and nominates the EVs for Lake Bonney SE and its catchment that the community aspires to achieve in the future. This information is presented as a check-back to the community to consider and provide feedback, and suggest amendment as needed.

The steps in the process will include:

- The aspirational EVs will be reviewed against the existing water quality of the lake.
- The effort needed to improve the water quality to support each aspired EV will be described.
- Water quality guidelines and objectives for the key water quality parameters for the lake will be described.
- The existing monitoring and assessment program for the lake will be reviewed
- The appropriate management responses to continue to improve the water quality of the lake will be described. It will include information about the extent to which the aspired EVs are likely to be met in 10 and 30-year timeframes, based on the EPA's current understanding of how the lake will respond to changes in pollutant loads.
- A final report with the above information will then be circulated for future feedback by the public.

2 The geographical area

The intent is to establish the environmental values (EVs) for Lake Bonney SE, and the drains and creeks that lie within the lake's catchment (Figure 1). They include:

- Milnes Gap Drain that receives drainage from the town of Millicent, effluent from the Millicent Wastewater Treatment Plant, and agricultural runoff and seepage
- water from another drain that originates in Canunda Swamp to the north of the lake
- English Gap Drain that carries the effluent from the pulp and paper mills into the lake
- Stony and Benara creeks that receive shallow groundwater inflows from the surrounding grazed landscape to the east of the lake.



Figure 1 Lake Bonney SE and its drainage flow

3 Flows to the sea – Gerloff Bay

During the consultation process, it became clear that some participants were concerned about a possible discharge to the sea from Lake Bonney SE via Bucks Lake. This is not within the scope of the project and the following information is included to clarify the current position of the EPA about this matter.

The scope of the environmental values (EVs) setting process will not extend along the historical flow-path from Lake Bonney SE to Bucks Lake and further downstream to the sea. The connection with Bucks Lake has already been recreated as part of a wetland enhancement project by the Department for Environment, Water and Natural Resources (DEWNR).

The project included the installation of an earthen bank to prevent water flowing out of Bucks Lake to the sea. A site inspection carried out by the EPA in 2005 ruled out connecting the complete flow-path to the sea because Lake Bonney SE currently remains too enriched with nutrients to allow the discharge into Gerloff Bay to be reinstated. Furthermore, water movement and mixing in the bay were very limited, and there was already evidence of nutrient enrichment due to the extent of filamentous algae that was growing in the inter-tidal zone of the bay.

4 What are environmental values?

An environmental value (EV) is anything a community agrees a body of water should be protected for. This might include an ecosystem, industry, agriculture, recreation, and its spiritual and cultural uses/importance. For the purposes of this project, EVs describe what the community wants to protect, for Lake Bonney SE and its catchment. They outline the values and uses of this area that are important for healthy ecosystems and public benefit, welfare, safety and health, and that require protection from the effects of pollution and waste discharges.

The term 'environmental value' was introduced into Australia with the national water quality guidelines in 1992 and extended with the revised guidelines in 2000¹. The current Australian guidelines recognise the following environmental values that may apply to different water bodies and therefore require active protection.

4.1 Ecosystem values

Ecosystem protection (eg aquatic plants, fish and other flora and fauna, habitats) according to the following three levels of condition:

- High conservation or ecological value systems – effectively unmodified or other highly valued environments (eg national parks).
- Slight to moderately disturbed systems – ecosystems in which aquatic biological diversity may have been adversely affected by human actions (eg rural streams or marine environments with reasonably intact habitats and vegetation assemblages).
- Highly disturbed systems – measurably degraded ecosystems of lower ecological value (eg urban streams and rural streams receiving concentrated wastes) but may still provide habitat for some aquatic plants and animals.

4.2 Human use values

In the majority of cases, more than one EV will be assigned for a water body. Where two or more EVs are defined, then the most conservative guideline or approach should be used to help achieve the desired state for a water body.

The following human use values have been included as EVs:

- primary industries (eg irrigation, stock watering and aquaculture)
- recreation and aesthetics (eg swimming, boating, passive recreation)
- drinking water
- industrial water (no water quality guidelines are provided for this value)
- cultural and spiritual values (no water quality guidelines are provided for this value).

4.3 How we use environmental values to manage a water body

Once the EVs have been defined, the level of environmental quality or water quality necessary to maintain each value can be determined by setting management goals for the water body. They describe the threats to the values, the desired levels of protection and the key attributes of the environment that should be protected in the future. The setting of management goals helps to identify the key water quality indicators and guidelines that should be used in selecting water quality objectives for the water body. Under the National Water Quality Management Strategy (NWQMS), where two or more agreed EVs apply to a water body, the more conservative, or stringent, of the associated guidelines should be selected as the water quality objectives (ANZECC 2000).

¹ www.environment.gov.au/water/policy-programs/nwqms/

The intent throughout this process is to ensure the management of water bodies is carried out in a transparent manner, incorporates the best available science and focuses attention on the maintenance of publicly agreed designated uses and values.

Involving the community is fundamental to the effectiveness of the process for several reasons, including seeking a clear understanding of the community's knowledge, expectations and costs associated with managing specific water bodies; ensuring any management strategies are appropriately targeted; and gaining a shared ownership and commitment to implement the actions needed to protect or rehabilitate a water body.

The EVs that are agreed in this current part of the process are aspirational—and may differ from the final ones recommended by the EPA. This is because some of them may not be able to be achievable in practice. If the EPA believes that they cannot be achieved, this information will be made clear, along with the reason, and comment will be invited from the community.

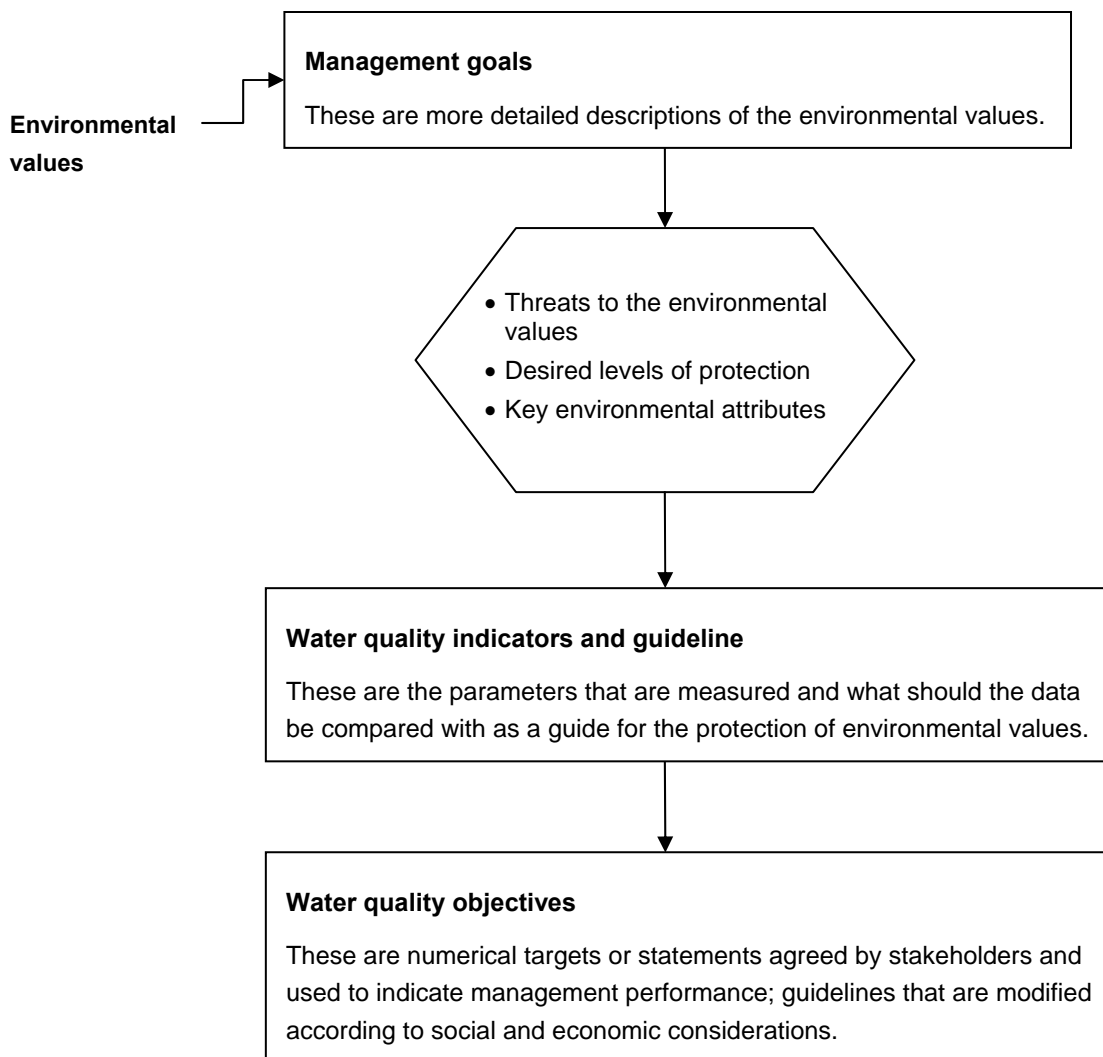


Figure 2 Process of how EVs are used to manage water bodies

5 Key community engagement activities

5.1 Meetings undertaken

A number of meetings took place with stakeholders from mid-2011 to mid-2012. These included the following:

- 1 Initial stakeholder discussions, August 2011
- 2 Stakeholder meeting Millicent, February 2012
- 3 Focus meeting with primary producers, March 2012
- 4 Community meeting Millicent, April 2012
- 5 Focus meeting with SE hunters and fishers Millicent, April 2012
- 6 Focus meeting with SE Aboriginal Reference Group (SEARG) Naracoorte, May 2012
- 7 Focus meeting with SA Recreational Fishers Adelaide, May 2012
- 8 Community meeting Mount Gambier, May 2012

Notes of the meetings held in 2012 are included in [Appendix 1](#).

5.2 Methodology

The EPA Healthy Waters Team met with a range of stakeholders, focus groups and members of the South East and Adelaide community and:

- provided information about the role of the EPA in managing water quality
- explained the actions that the EPA and other stakeholders have been undertaking to improve water quality
- informed them of the history of the water quality of the lake over the last 30 or so years, including the recent water quality status of the lake
- explained the concept of EVs and their relevance to water quality management in SA.

EPA staff then asked attendees to consider the current condition of the lake and describe the EVs they would like the lake to support in the future. Two timeframes were offered – 10 years and 30 years.

A range of materials were used for attendees to record their views including maps, lists and making notes.

Attendees were also asked to provide information about how they thought the lake should be managed. This was requested for two reasons:

- To understand the context for the EVs that they were offering
- To provide information to DEWNR about the range of issues associated with the management of the lake to assist them in any future review of the management of the lake.

Notes from each meeting were collated and provided to attendees to allow them to check and correct for errors in the documentation of the discussion, and to add points that may have occurred to them after the meeting.

Additional comments were sought and received through email and the EPA website. Information from these has been used in to compile the EVs and the comments on the future management of the lake.

6 Your feedback is required

Comment from the participants is now sought about the following two outputs of the consultation process:

- Draft environmental values (EVs) that the community aspires to
- Summarised comments about the future management of Lake Bonney SE.

In reviewing these, please remember that the EPA has attempted to reflect the bulk of the community's views and reflect this as the relevant environmental value. You may have a view of whether the community has it right or "wrong"—but this is not what is being asked. The question asked of the reader is: *Has the the EPA accurately reflected the community view in this document?*

6.1 How comments can be provided

Feedback are be provided to:

Peter Pfennig, Principal Environmental Protection Officer (Water Quality)
Environment Protection Authority
GPO Box 2607
Adelaide SA 5001
Telephone: (08) 8204 2181
Facsimile: (08) 8124 4673
Email: epainfo@epa.sa.gov.au (attention to Peter Pfennig)





6.2 Draft environmental values that the community aspires to





Note that the EVs have been divided into two tables:





- the Lake Bonney SE water body
- the catchment and drains that flow to the lake.

Where there is a different view for the next 10 to 30 years this is specifically mentioned.


Lake Bonney SE









| Symbol | Environmental value | Aspirational environmental values |
|---|---|--|
|  | Aquatic ecosystems | <p>Over the next 10 years the water quality of Lake Bonney SE should improve to the point that:</p> <ul style="list-style-type: none"> • native water plants are able to re-establish • many original fish and crustacean species are able to re-establish • salinity is consistent with historic patterns • mollusc species that are responsible for the establishment of the shell grit beaches are able to resume a high abundance • organisms in the lake are of sufficient abundance to support bird life. <p>These aspirations are consistent with the NWQMS description of ecosystem protection for a moderately disturbed system.</p> <p>There is some interest in:</p> <ul style="list-style-type: none"> • improving the lake water quality so that it is suitable for the Yarra Pigmy Perch – currently found in some of the drains to the lake • water of a quality that would allow stocking with Australian and overseas non-endemic fish species for recreational fishers. Note that re-stocking with such species is considered as impairment under NWQMS. <p>Over the next 30 years the water quality of Lake Bonney SE should improve to the point that many original fish and crustacean species are able to re-establish.</p> <p>These aspirations are also consistent with the NWQMS description of ecosystem protection for a moderately disturbed system.</p> <p>It should be noted that a small number of the community also asked for the lake to be returned to its pre-European state.</p> |
|  | Irrigating crops such as vines, lucerne, etc | <p>Over the next 10 years the water quality of Lake Bonney SE should improve to the point that levels of pollutants are low enough to supply irrigation to grow commercial crops if salinity also reduces.</p> <p>The community understands that the salinity of the lake fluctuates over time, but will generally remain too high to grow commercial crops. However, this should be the only impediment to this activity.</p> |
|  | Water for farm use such as in fruit packing or milking sheds, etc | Salinity too high, EV not supported. |
|  | Stock watering | Salinity too high, EV not supported. |




| Symbol | Environmental value | Aspirational environmental values |
|---|---|---|
|  | <p>Water for aquaculture such as barramundi or marron farming</p> | <p>Over the next 10 years the water quality of Lake Bonney SE should improve to the point that it is suitable for aquaculture:</p> <ul style="list-style-type: none"> • providing that the discharges from this will not affect lake water quality or ecosystem. <p>Over the next 30 years the water quality of Lake Bonney SE should improve to the point that:</p> <ul style="list-style-type: none"> • it is consistent with the 10-year aspiration for this EV. |
|  | <p>Human consumption of wild or stocked fish or crustaceans</p> | <p>Over the next 10 years the water quality of Lake Bonney SE should improve to the point that:</p> <ul style="list-style-type: none"> • fish, yabbies, etc from lake can be safely consumed • recreational fishing (including eating caught fish) can occur safely. |
|  | <p>Primary recreation with direct contact with water such as swimming, wading</p> | <p>Over the next 10 years the water quality of Lake Bonney SE should improve to the point that:</p> <ul style="list-style-type: none"> • primary recreation with direct contact with water such as swimming or wading is safe • boating activities where there is a high degree of contact are safe including windsurfing, stand-up paddle boards and skiing • ability to walk across Mia Mia to coast when water low is re-enabled. <p>Note that the long-term issue of turbidity is recognised, but consistent with other recreational water bodies such as Lake Albert or the River Murray the risk presented by this may be managed by means of personal floatation devices or the like.</p> <p>Over the next 30 years the water quality of Lake Bonney SE should improve to the point that:</p> <ul style="list-style-type: none"> • it is consistent with the 10-year aspiration for this EV. |
|  | <p>Secondary recreation with indirect contact with water such as boating, canoeing or sailing</p> | <p>Over the next 10 years the water quality of Lake Bonney SE should improve to the point that:</p> <ul style="list-style-type: none"> • full range of boating (gaming/fishing) is supported • recreational fishing from boats and jetties is supported. <p>Note that the long-term issue of turbidity is recognised, but consistent with other recreational water bodies such as Lake Albert or the River Murray the risk of impacting shoals, risks and other subsurface obstructions presented by this should be managed by means of marker buoys or the like.</p> <p>The community is strongly of the opinion that steps should be taken to remove the remaining logs and the structures that previously retained them. In the meantime the use of human-powered craft is supported.</p> |

| Symbol | Environmental value | Aspirational environmental values |
|---|--|--|
|  | Visual appreciation with no contact with water such as picnicking, bushwalking and sightseeing | Over the next 10 years the water quality of Lake Bonney SE should improve to the point that: <ul style="list-style-type: none"> • it is a pleasant place to be • birdwatching experience is supported • the lake is less coloured • the lake is less turbid. |
|  | Water for industrial use such as power generation, manufacturing plants | There is a divided view in the community on this. In summary: <ul style="list-style-type: none"> • the community is not keen to support further industry use of the lake given the harm that existing industry has caused • however, some support the use of the lake to allow existing local industry to continue—provided that the discharge is of a quality that allows EVs to be achieved. <p>As this EV is about the use of the lake water for industrial purposes and as each industry has its own requirements, this is not a supported EV.</p> |
|  | Cultural and spiritual values including the cultural values of traditional owners | Over the next 10 years the water quality of Lake Bonney SE should improve to the point that: <ul style="list-style-type: none"> • strong cultural values, embodied in food gathering, spending time in and adjacent to the lake, are supported. <p>Spiritual values not determined as yet.</p> |
|  | Raw drinking water supplies for human consumption | Salinity too high, EV not supported. |

Catchment and drains that flow to Lake Bonney SE

| Symbol | Environmental value | Aspirational environmental values |
|---|---------------------|---|
|  | Aquatic ecosystems | Over the next 10 years the water quality of the catchment and drains that flow to Lake Bonney SE should improve to the point that: <ul style="list-style-type: none"> • Yarra Pygmy Perch (list as vulnerable, <i>Environment Protection and Biodiversity Conservation Act 1999</i>) continues to be found in drainage system. <p>Note that fresh water from springs (Stony Creek, German Creek) has ceased flowing due to changes in water table from irrigation of agricultural areas and drought. Parts of the community asked that flows to the lake via these sources be allowed to resume.</p> <p>These aspirations are consistent with the NWQMS description of ecosystem protection for a moderately disturbed system.</p> |

| Symbol | Environmental value | Aspirational environmental values |
|---|---|--|
|  | <p>Irrigating crops such as vines, lucerne, etc</p> | <p>Over the next 10 years the water quality of the catchment and drains that flow to Lake Bonney SE should improve to the point that:</p> <ul style="list-style-type: none"> • drain water is suitable for use for irrigation. • groundwater adjacent to the lake is suitable for use for irrigation. <p>Note that irrigation from drains is not currently supported by SE Drainage Board as it diverts water needed to support ecosystem processes.</p> |
|  | <p>Water for farm use such as in fruit packing or milking sheds, etc</p> | <p>Over the next 10 years the water quality of the catchment and drains that flow to Lake Bonney SE should improve to the point that:</p> <ul style="list-style-type: none"> • water for farm use such as in fruit packing or milking sheds is possible for properties on the eastern side of lake using drain water. |
|  | <p>Stock watering</p> | <p>Over the next 10 years the water quality of the catchment and drains that flow to Lake Bonney SE should improve to the point that:</p> <ul style="list-style-type: none"> • water for stock watering is possible for properties on the eastern side of lake using non-effluent sourced drain water. |
|  | <p>Water for aquaculture such as barramundi or marron farming</p> | <p>No comment of either support or opposition from the consultation process.</p> |
|  | <p>Human consumption of wild or stocked fish or crustaceans</p> | <p>Over the next 10 years the water quality of the catchment and drains that flow to Lake Bonney SE should improve to the point that:</p> <ul style="list-style-type: none"> • food gathering (vegetation around groundwater springs on eastern side), shellfish collection and bush foods are supported. |
|  | <p>Primary recreation with direct contact with water such as swimming or snorkelling</p> | <p>Over the next 10 years the water quality of the catchment and drains that flow to Lake Bonney SE should improve to the point:</p> <ul style="list-style-type: none"> • where swimming as an existing use is supported. <p>Swimming is an existing use in some of the catchment and drains that flow to Lake Bonney SE.</p> |
|  | <p>Secondary recreation with indirect contact with water such as boating, canoeing or sailing</p> | <p>No comment of either support or opposition from the consultation process.</p> |
|  | <p>Visual appreciation with no contact with water such as picnicking, bushwalking and sightseeing</p> | <p>No comment of either support or opposition from the consultation process.</p> |

| Symbol | Environmental value | Aspirational environmental values |
|---|---|---|
|  | Water for industrial use such as power generation, manufacturing plants | No comment of either support or opposition from the consultation process |
|  | Cultural and spiritual values including the cultural values of traditional owners | <p>Over the next 10 years the water quality of the catchment and drains that flow to Lake Bonney SE should improve to the point that:</p> <ul style="list-style-type: none"> • strong cultural values, embodied in food gathering (vegetation around ground water springs on eastern side) is supported • this includes shellfish collection and bush foods along edges. <p>Spiritual values not determined as yet.</p> |
|  | Raw drinking water supplies for human consumption | No comment of either support or opposition from the consultation process. |

6.3 Summarised comments about the future management of Lake Bonney SE

6.3.1 Ownership/management

- Our (the communities) lake—encourage more access, boating, swimming—give ownership of the lake to a new generation of the community.
- Re-establish the management committee for the lake.
- Establish community ownership of the lake through the councils,
- Improve public perception by providing information,
- The ongoing management of Lake Bonney SE is and will continue to be DEWNR. PIRSA Fisheries is responsible for the organisms in the water,
- Enhanced environmental management and rehabilitation,
- (We want) local community involvement in the management of Lake Bonney SE,
- Water quality improvement,
- Manage by the community for the community,
- Clean the lake up environmentally by stopping Kimberly–Clark polluting,
- Restore the vegetation,
- The lake needs to be restored to as close as possible the state it was in before the government allowed unlimited discharge into the lake,
- (The management of the lake) has a broad spectrum of society and user groups with less industry ratio and impact,
- The former DEH proposal to discharge Lake Bonney waters via Bucks Lake into Gerloff Bay appears to be discarded, after basic studies showed that there would be little dispersion offshore, and a pristine beach would be at risk of environmental vandalism,
- Encourage community ownership by transferring some of current management responsibility from parks authority to community committee. Interested stakeholders could be allocated areas for their interest (eg shooters, boating enthusiasts, indigenous groups) and to rehabilitate an area for their purpose. Boaties could remove logs and map

reefs/shoals in a selected area to re-establish boating. Shooters could have an area where they can remove fence wire and other obstacles from submerged areas to make their activity safer. Access may be seasonal or conditional but groups would be encouraged to improve the amenity of the lake. There may be opportunities for shared activity or projects. Some areas of the lake could be set aside for passive activities or to protect wading birds.

- I appreciate we cannot turn back the clock 60 years but I hope in 60 years someone will look back and say wasn't it great that someone in 2012 bit the bullet for the future generation.

6.3.2 Community use and access to the lake

- Increased access to the lake is supported—but only with associated management to control people issues—litter, uncontrolled vehicle use, toilet facilities.
- Need to control access (eg motorbikes and 4WDs) to avoid damage to environment – lake edge and bed.
- Picnic areas established with BBQs, toilets and drinking water.
- Be able to swim in the water.
- Become tourist icon for region boating regattas, etc.
- Better access – only four points of access.
- No access from Canunda National Park currently.
- Give broader public better knowledge of where to access Lake Bonney.
- Picnic area for visual amenity.
- Used to be able to access lake's edge from Picnic Point.
- Shell grit beach.
- Toilets and change rooms.
- Improved access for hunting (95 out of the 100 people who visit the Lake are there for hunting).
- Improve infrastructure near lake – toilets, change, boat ramps.
- Build a boardwalk on the western side to allow better access (to the lake).
- More walks on western side to the south.
- Access to or reservation of certain areas for cultural activities (gathering food, canoeing).
- Have a teaching facility for Boandik culture, Indigenous history, canoe making and traditional fishing methods
- Sea to lake interaction through indigenous culture.
- Semi permanent camp site (hunt, fish, gather bush foods).
- That suitable facilities for families be provided, including some jetties.
- That an appropriate number of boat ramps, with support facilities such as carparks, toilets, rubbish deposit and removal. These ramps would generally be on the northern, highway sides.
- Improved recreation access.
- Campground/interpretative signage.
- Maintain tracks on eastern side. Provide access to western side of lake.
- Walking trails/boardwalks.
- Be able to use the lake for recreation – fishing, picnicking, boating, collecting of shell grit and recreational hunting.
- I think there is a view amongst many in the community they would like to reclaim the lake for the recreational and environmental values it once had.

- We would like to resume our previous recreational activities on Lake Bonney, including fishing, boating and swimming, without fear of health risks for our children.
- Encourage community groups to assist monitoring recovery process—Landcare and farmers along with EPA to establish fencing and promote regrowth of indigenous vegetation in a wide riparian zone on eastern border – School groups encouraged to use qualitative environmental monitoring (using invertebrate surveys popularised by Audubon Society in US) to track progress in designated areas. Local school groups would have more ownership and should be perhaps targeted to do this as part of their environmental education program.

6.3.3 Lake level and water flows

- Fresh water from springs (Stony Creek, German Creek) have ceased flowing due to changes in water table from irrigation of agricultural areas.
- More water flowing into the catchments—water input north of Lake George seems to be diverted elsewhere and going out to sea.
- Ensure environmental water allocated to Lake Bonney and Lake George.
- Get back the water diverted to the Lake Frome drain/want more water once issues with the Southern Coorong are resolved.
- Other proposals to discharge Lake Bonney water into the ocean along the Canunda coast would seem to clash with the conceptual marine parks.
- Increase flows to the lake through controls on the interception of water to the lake for irrigation purposes.
- Management expectation of a generally lower lake needs to be factored in.
- Ensure that water flowing into the lake from the Snuggery Drain and Drain 88 is fit to drink and so reduce the pollutant burden entering the lake. How? Establish natural sedge filters along the miles of drains between KCA and the Millicent sewerage plant and their entry points into the lake. These drains are effluent drains and should not be considered otherwise, even by the drainage board and they should be managed to reduce pollutant impact primarily and not as drains for agricultural purpose.
- To ensure rapid return of the 1950s pristine quality water, that consideration be given to draining the lake or as much of the lake as is possible.
- During that drained time, logs be identified and stacked to make wildlife refugia in the shallow lake, or removed.
- That appropriate fish ways (to and from the sea) with suitable monitoring equipment, be installed when the lake has drained sufficiently.
- That some ramps and facilities be constructed during that time.
- That stocking of suitable recreationally attractive fish be undertaken when filled.
- That the internationally recognised bio-manipulation technique be considered for enhancing the water quality on an ongoing basis.
- Increase water flows into the lake and if possible allow some drainage.

6.3.4 Boating

- Logs need to be removed from the lake.
- Log removal—logs only need to be removed to the edge for burning, rotting etc—involve Forestry SA, state government to assist in dredging, drag lake with nets, bounty system for logs, use sonar detecting equipment.
- That boating access for all types of craft is permitted: power (petrol), electric motors, human-powered craft such as kayaks, float tubes, canoes, etc.
- That the DPTI ban on boating be lifted immediately for boat speed less than four knots, and subsequently increased when all logs and sundry securing structure/s have been suitably placed to create wildlife refugia, or removed.

- The removal of logs from Lake Bonney SE.
- Become tourist icon for region boating regattas, etc.
- As a person who sailed regularly on the Lake until the logs, salvaged after the 1983 fires, broke away from their impoundment put an end to the lake as a sailing venue and all other recreational uses. I state, at this time, the lake is not safe for any recreation sport..

6.3.5 Wildlife

- Sanctuary areas needed, revegetation. Lake Bonney is an acknowledged drought refuge for waterfowl. It is also internationally important for several species of migratory waders.
- Build permanent birdhides for bird watching.
- Introduce/reintroduce native fish species (redfin, yellow belly).

6.3.6 Fishing

- Introduce a fish restocking program.
- That recreational fishing by wading, from the shore and from watercraft around the whole lake occurs.
- Fish that are recreationally attractive to recreational fishers be included in the fishing resource options, including indigenous that are not native to the area, and exotic fish from the salmonid family be encouraged.
- That natural access through the provision of fish ways be provided/maintained for anadromous and diadromous fish, including monitoring cameras for fish counting, etc.
- That all types of recreational fishing bait, lure and fly fishing be permitted, with no allowance for nets.
- That no commercial fishing be permitted in the lake.
- That foot/vehicle access be permitted around the complete lake for recreational fishing access.

6.3.7 Commercial use

- Lake Bonney SE, being 25 km by four km, and around two metres deep, is the largest body of freshwater in SA, with significant tourism potential.
- Establish aquaculture industry using lake water.
- Goal should be to have minimal perhaps no discharge.
- Dairy farms (ongoing).
- No cows on the lake edge.
- Area reclaimed from farming.
- No commercialisation.
- Do not use the lake or its water for irrigation crops such as vines, lucerne, etc.
- Water for farm use such as in fruit packing or milking sheds, etc.
- Stock watering.
- Water for industrial use such as power generation, manufacturing plants.
- Farming is not a problem to the lake and no extra controls needed, though this needs to be confirmed through monitoring of dairies and feeds to lake.
- EPA should consider conditions for next KCA licence. They have enjoyed a licence to pollute for years, now they should be made responsible for any mess from the end of the indenture, given the government is responsible for the current mess.

7 References

ANZECC 2000, *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*, Australian and New Zealand Environment and Conservation Council and the Agriculture and the Resource Management Council of Australia and New Zealand, Canberra.

DENR 1996, *Lake Bonney Management Plan 1996–2000*, Prepared by the Lake Bonney Management Committee, November 1996, Department for Environment and Natural Resources, Adelaide.

EPA 2004, *Lake Bonney South East, South Australia Past, Present and Possible Future*, Environment Protection Authority, Adelaide.

Appendix 1 Notes of the meetings held with stakeholders

1 Stakeholder meeting Millicent, February 2012

Active Water Quality Manager Stakeholder meeting re Lake Bonney SE

Environmental Values setting project

17 February 2012

10:00–12:30

Wattle Range Council Chambers, Millicent

Objectives

- Outline management history of Lake Bonney and the scope of this project.
- Identify technical capabilities of users (ie what water quality improvement activities are within present capability?)
- To explore the short to medium term environmental values (EVs) that can be set for Lake Bonney? And consider implications and issues involved in achieving these EVs.
- Establish approach for the next phases of the project.

Brief history of Lake Bonney SE water quality

- Existing Management Plan that was developed for the lake has been actioned by many of the stakeholders, resulting in improved water quality of discharges. This in turn has started to be reflected in lake water quality.
- Water quality was very poor when the plan was developed in the mid-nineties, but signs of improvement are now evident. A note of caution: with improving water quality, there may be episodes of algal blooms as nutrients located on the lake floor receive increased light due to reduced turbidity. It is important that if/when blooms occur, these are seen in context as part of a lake recovery, rather than a sign that efforts to date are a waste of time. Key messages should be developed for these situations.
- Attendees had a long experience of the history of the water quality of Lake Bonney.
- Diatom analysis of lake sediments show the lake was a relatively freshwater environment long before artificial drainage into lake commenced in 1865.

What at present can be done for water quality in Lake Bonney?

Kimberly-Clark–Australia (KCA)

Through recent asset closures and improvements in water usage KCA's discharge to the lake is now only 20% of what it was in 1996, and the quality has improved significantly over time. The closure of the Tantanoola Pulp Mill has all but eliminated the nutrient load to the Lake from the Mill. KCA aim is to further reduce discharges to the Lake.

The aspirational goal would be to have the discharge reduce to a negligible amount.



SA Water











Currently have agreements for the reuse of some of their effluent.

Issues









- Will the reduced discharge from KCA further change the ecosystem of the Lake?
- People do not know the Lake water quality is now safe for swimming, fishing and shooting.
- Obstructions such as, logs, star pickets and shoals need to be identified and water visibility/clarity needs to improve if the Lake is going to be used for boating.
- There is very little access to the lake for recreational activities and infrastructure (toilets, sealed roads, picnic grounds) would need to be put in place for further recreational use in the Lake.
- Lake has become a habitat for birds for resident, migratory and nomadic species. Should the part of the Lake be protected for this purpose?
- Some community members from the Bucks Lake area south of the Lake are still concerned about possible chemical contamination (dioxins) that may come from the Lake were water allowed to leave for the ocean.
- The nutrient contribution from farming activities in the northeast area of the Lake is not known.
- Groundwater interactions with the Lake are poorly understood however the site is has been classified as having a 'very high likelihood' of groundwater dependency based on recent studies. The importance of groundwater in supporting the sites aquatic habitat is likely to increase with the reductions of surface water inflows from KCA and SA Water operations.




Environmental values (see maps)**Lake Bonney SE**

| | | Action |
|---|--|---|
|  | Aquatic ecosystems | <p>Get information to DEWNR on EPA hydrology model for Lake Bonney.</p> <p>Get photos of birds from Ross Anderson (DEWNR).</p> <p>Get historical pictures of Lake that show improvement.</p> <p>What further improvements need to happen in the Lake for it to be ideal for Yarra Pygmy perch repopulation?</p> |
|  | Irrigating crops such as vines, lucerne, etc | <p>Possible for east side of Lake</p> <p>Taking into account:</p> <ul style="list-style-type: none"> • groundwater is very high quality and plentiful • winter rainfall is high • soil types in the area need a dry-out period before the winter rains so as not to become water logged. |

| | | Action |
|---|---|--|
|  | Water for farm use such as in fruit packing or milking sheds, etc | Possible for east side of Lake Does it already occur in the farms on the Lake floodplain? |
|  | Stock watering | Possible for east side of Lake. Does it already occur in the dairy farms on the Lake floodplain? |
|  | Water for aquaculture such as barramundi or marron farming | There would need to be a significant improvement in water quality in the Lake for it to be used for aquaculture. |
|  | Human consumption of wild or stocked fish or crustaceans | Better information provided on chemical water quality. It's OK to eat fish in the Lake. |
|  | Primary recreation with direct contact with water such as swimming or snorkelling | Better information provided on chemical water quality. OK to swim in the Lake, although it is as turbid as other waters bodies such as River Murray. |
|  | Secondary recreation with indirect contact with water such as boating, canoeing or sailing | Ask DPTI about whether they would allow any sort of boating on the Lake if the logs were removed. Improvement of access to allow bird watching, fishing and shooting |
|  | Visual appreciation with no contact with water such as picnicking, bushwalking, and sightseeing | Who owns what land to allow better access for these activities? (Private Land, Crown Land, National Park?) Who will pay for better infrastructure (Camp grounds, walking trails, more road access)? Who will maintain amenities? |
|  | Water for industrial use such as power generation, manufacturing plants | Get past, present and future discharge numbers from SA Water and KCA to show improvements. |
|  | Cultural and spiritual values including the cultural values of traditional owners | Meet with local Aboriginal group(s) and learn areas of water quality importance to them. |
|  | Raw drinking water supplies for human consumption | Future housing use bore water and needs good sewage infrastructure. |

Drainage

| | | Action |
|---|---|--|
|  | Aquatic Ecosystems | Yarra Pygmy perch (Vulnerable EPBC Act 1999) found in drainage system. Water quality in the Lake needs to improve for Yarra Pygmy perch to repopulate. |
|  | Irrigating crops such as vines, Lucerne, etc | Have been licence requests in the past to utilise stormwater for irrigation SA Water may be able to better utilise reuse in the future. Groundwater is very good and plentiful and rainfall in winter is very good. Soil types in the area need a dry out period before the winter rains so as not to become water logged |
|  | Water for farm use such as in fruit packing or milking sheds, etc | Possible for east side of Lake |
|  | Stock watering | Possible for east side of Lake |
|  | Water for aquaculture such as barramundi or marron farming | |
|  | Human consumption of wild or stocked fish or crustaceans | |
|  | Primary recreation with direct contact with water such as swimming or snorkelling | |
|  | Secondary recreation with indirect contact with water such as boating, canoeing or sailing | |
|  | Visual appreciation with no contact with water such as picnicking, bushwalking, and sightseeing | |

| | | Action |
|---|---|--|
|  | Water for industrial use such as power generation, manufacturing plants | SA Water may be able to better utilise reuse in the future. |
|  | Cultural and spiritual values including the cultural values of traditional owners | Meet with local Aboriginal group(s) and learn areas of water quality importance to them. |
|  | Raw drinking water supplies for human consumption | |

Future work

- Meet with local Aboriginal group(s) and learn areas of water quality importance to them.
- Provide information about dioxins for concerned groups.
- Provide some info about models we have and potential changes to the lake. Get information to DEWNR on EPA hydrology model for Lake Bonney.
- Get photos of birds and bird numbers from Ross Anderson (DEWNR).
- Get historical pictures of Lake that show improvement.
- Tie public Meeting to an event to get more interest/attendance.
- Don't mention EVs when advertising the meeting as many people do not understand what we are aiming at. Try 'Come and discuss the future of Lake Bonney'. Make it more compelling.

2 Focus meeting with primary producers, March 2012

Attendees: Terry Carthew

Colin Creek

Eros ?

Shiloh Gerrity

Stephen Packer

Peter Pfennig

General comments about the Lake

Concern about the low water level:

- A lack of rain in the last few years, along with more irrigation using groundwater has reduced the flow of water into the lake (WAP?).
- The previously maintained moisture level in soils has now drawn down.
- Full lake helps soils and pastures of those adjacent to it.
- The lake level is starting to drop naturally.

Environmental values

Visual amenity only now that much of the lake is now fenced off:

- Lake could be used for managed grazing and providing stock water (stock and domestic).
- Bore water is now not saline?
- Lake water more fresh – better quality.
- Not the water of choice unless there is increased rainfall.

Unlikely to draw on water for stock and domestic uses.

Lake Bonney SE is valuable as an ecosystem and has a cultural value.

Use of the lake needs to be controlled to maintain and improve the lake.

If increased access is granted, people will introduce their own pressures.

Four wheel driving, boating, camping need to be managed .

With change in climate – warmer weather, hot winds and more evaporation and less winter rainfall, lake is likely to remain lower for most of the time.

KCA used to draw on spring (artesian?) water, now draws on bore water (sub-artesian?) (a sign of lowering water tables).

Summary of EVs comments (PP)

Ecosystem value

Visual amenity

Stock and domestic not likely

Cultural value – European and non-European inferred

Primary and secondary recreation

Management

No inputs to the lake from farming – ie no control needed?

Need to remove logs and allow increased use of Lake Bonney SE, more values?

Our (the communities) lake – encourage more access, boating, swimming – give ownership of the lake to a new generation of the community.

Colin Whitehead – a local source of historical information about the lake.

Summary of Management Comments (PP)

Increase flows to the lake through controls on the interception of water to the lake for irrigation purposes.

Management expectation of a generally lower lake needs to be factored in.

Increased access to the lake is supported – but only with associated management to control people issues – litter, uncontrolled vehicle use, toilet facilities.

Farming is not a problem to the lake and no extra controls needed, though this needs to be confirmed through monitoring of dairies and feeds to lake.

Logs need to be removed from the lake.

Our (the communities) lake – encourage more access, boating, swimming – give ownership of the lake to a new generation of the community.

3 Community meeting Millicent, March 2012



Setting Environmental Values for Lake Bonney SE and its Catchments

Public consultation 21 March 2012

A public meeting was held on 21 March at Millicent to engage the community and garner representative priorities in relation to environmental values for Lake Bonney and its catchments with a focus on a 10-30 advance timeframe.

A total of 25 community members attended and nominated their principal individual areas of interest spanning Recreational, Environmental and Industry issues.

Peter Pfennig, Principal Environment Protection Officer (Water Quality) first provided some scientific context and answered a number of questions from the floor in order to provide a foundation for informed debate. The group then divided into three subgroups - Industry (3 members); Recreation (8 members) and Environment (14 members). Each subgroup was provided with maps, tags and a pro forma reporting instrument for collecting and feeding back to the whole group the results of their deliberations.

Following 40 minutes of discussion each group reported back to the plenary session and comments and questions from the floor were sought and are recorded here.

Major recurring themes:

- Removal of logs.
- Improve road access(both sides) and customise recreational areas for purpose eg motorcycles, 4x4s and other non water contact activities.
- Reintroduction of native plants and improve water quality to eg encourage flora and fauna.
- Improve turbidity for environmental and recreational purposes.
- More detailed and publicly available scientific data.

For the next 5–10 years the groups identified the following environmental values:

Aquatic ecosystems:

Recreation

- Reintroduce native species.
- Improve water quality to allow fish species to re-establish.
- Reintroduce relevant plant species to encourage plant growth.

Environment

- Check levels of effluent from drains.
- Reduce *E coli* levels.
- Back to historical salinity levels.
- Improve water quality to allow populations of flora and fauna to flourish.
- No flow through Gerloff Bay.

Agreement that Gerloff Bay was the historical flow path to the sea. Some contention over whether it should be re-established

EPA: At this time the nutrient levels in the Lake are too high for release of water to Gerloff Bay.

- Logs need removing (liability).
- Allow lake to return to natural level and state.
- Water levels affect water quality.
- Aim for secondary contact water quality similar to Lake Alexandrina.
- Sanctuary areas needed.
- Maintain flows into lake – retain hydrology.
- Revegetation buffer around the northern side of the lake where dairy farmers impact the lake.
- Revegetation projects Implemented and support for community and landholders.
- Restoration of shell grit beaches.

Industry

- Healthier populations of fish and bird species.
- Healthier aquatic plant populations.
- Better water quality.
- Restoration of shell grit beaches (dependent on water level).
- Reduction of nutrients is necessary.
- Better community understanding of the present water quality inflow, outflow nutrients. Nutrient sinks (take up), components, resources etc with reference to historical and future trends.

From the floor

Other lakes in this region have natural inflows from surrounding farmland yet these lakes stay habitable when Lake Bonney does not

KCA should be made to contribute to the clean up as they made the mess – it was pointed out they have contributed above statutory requirements and this point was the subject of some debate.

Q. How do we increase the rate of nutrient use in the lake to speed up recovery above natural attrition?

Irrigating crops

Industry

Not until after 2014 when KCA stop putting liquid into lake—perhaps after this date flush lake into the ocean one more time

N Grey: KCA discharge will continue. After indenture KCA will apply to EPA for a licence to discharge

Water for Aquaculture

Industry

Yes but discharge needs control.

Water for industrial use such as power generation, manufacturing plants

Industry

- Yes – licensed discharge for local industry.
- Discharge must not compromise environmental values.

Human consumption of wild or stocked fish or crustaceans

Recreation

- Be able to consume fish, yabbies, etc from lake.
- Introduce quality testing.

Industry

- Recreational fishing should be encouraged.
- Logs must be removed to facilitate this.

Primary recreation with direct contact with water such as swimming or snorkelling

Recreation

Remove logs to allow water skiing, etc.

Industry

Would be good but unlikely that turbidity would allow this.

Secondary recreation with indirect contact with water such as boating, canoeing or sailing

Recreation

- Lake opened for boating – logs removed.
- Better road access to more sections of the lake on both sides.
- Creation of camping and picnic areas.
- Put in boat ramps, jetties and pontoons.
- Better involvement with Parks and Wildlife Dept with community.
- Bird watching hides.

Environment

- Better access to the lake – managed.
- Removal of fences.

Industry

- Must remove logs or control speed.

Visual appreciation with no contact with water such as picnicking, bushwalking and sightseeing

Recreation

- Bird watching areas.
- Interpretive signage along walking tracks, parking areas, etc.

- 4-wheel drive tracks.
- Motor bike only access tracks.
- Picnic areas.
- Club house as meeting place for various users.
- Better access/ use to lake from cook-out station, integrate.

Environment

- Wildlife refuge.
- Boating, hunting, fishing, swimming, windsurfing, water-skiing.

Industry

- Needs better road access.
- Q. Will the drain dug between the southern end of the lake and the northern end at the Mia Mia crossing, when the Lake was drained to the sea be filled to allow people to walk across the shallows at the Mia Mia crossing?

From the floor

Need to control access (eg motorbikes and 4 WDs) to avoid damage to environment – lake edge and bed.

For the next 10–30 years the group identified the following environmental values:

Aquatic ecosystems

Environment

- Sanctuary areas needed revegetation. Lake Bonney is an acknowledged drought refuge for waterfowl. It is also internationally important for several species of migratory wader.

Recreation

- Introduce a fish restocking program.

Raw drinking water supplies for human consumption

Recreation

- Picnic areas established with BBQs, toilets and drinking water.

Water for Aquaculture

Recreation

- Establish aquaculture industry using lake water.

Water for industrial use such as power generation, manufacturing plants

Industry

- Goal should be to have minimal perhaps no discharge.

Primary recreation with direct contact with water such as swimming or snorkelling

Recreation

- Be able to swim in the water.

Industry

- Questionable that turbidity due to 'natural' and industrial sources would reduce turbidity to an acceptable level.

Secondary recreation with indirect contact with water such as boating, canoeing or sailing

Recreation

- Become tourist icon for region—boating regattas, etc.
- Log removal – logs only need to be removed to the edge for burning, rotting, etc—involve Forestry SA, State govt etc to assist—dredging, drag lake with nets etc bounty system for logs use sonar detecting equipment.

**JC Munro, Senior Consultant
Oz Train Pty Ltd
23 March 2012**

4 Focus meeting with SE Hunters and Fishers Millicent, April 2012

Setting Environmental Values for Lake Bonney and its catchments

Monday 30 April 2012

Fishing/Shooting/Boating Meeting

Attendees: Shiloh Gerrity (EPA), Peter Pfennig (EPA)

Next 5 to 10 years

Use of lake for sailing, boating, hunting, windsurfing, sail boarding, yachting, skiing.

Better access – only four points of access.

No access from Canunda National Park.

Give broader public better knowledge of where to access Lake Bonney.

Picnic area for visual amenity.

Used to be able to access Lake's edge from Picnic Point:

- shell grit beach
- toilets and change rooms
- the lake was a better colour in the past, particularly northern end.

Build permanent bird hides for bird watching.

Dairy Farms (ongoing):

- no cows on the Lake edge
- determine nutrient input in order to reduce it
- does company ownership change inputs.

Improved access for hunting (95 out of the 100 people who visit the lake are there for hunting).

More water flowing into the catchments – water input north of Lake George seems to be diverted elsewhere and going out to sea.

Improve infrastructure near lake – toilets, change, boat ramps.

Fresh water from springs (Stony Creek, German Creek) have ceased flowing due to changes in water table from irrigation of agricultural areas.

Get back the water diverted to the Lake Frome drain/want more water once issues with the Southern Coorong are resolved.

Re-establish the management committee for the lake.

Establish community ownership of the lake through the councils.

Build a boardwalk on the western side to allow better access.

More walks on western side to the south.

Long term (30 years)

Two Lake Bonneys in South Australia. Want them both to be the same/both to have equal opportunities/status

Introduce/reintroduce native fish species (redfin, yellow belly).

Improve public perception by providing information.

Ensure environmental water allocated to Lake Bonney and Lake George.

Action

Go have a look at the drains near Keith – Petherick Road, Keith–Cantara Road.

5 Focus meeting with SE Aboriginal Reference Group (SEARG) Naracoorte, May 2012

Setting environmental values for Lake Bonney and its catchments

Tuesday 1 May 2012

South Eastern Aboriginal Focus Group (SEAFG) Meeting

Next 5 to 10 years

Access to or reservation of certain areas for cultural activities (gathering food, canoeing).

Have a teaching facility:

- Boandik culture
- Indigenous history
- canoe making
- traditional fishing methods.

Sea to lake interaction through indigenous culture.

Semi-permanent camp site (hunt, fish, gather bush foods).

Want water quality such that it is safe to fish, gather bush foods, that the Lake is a good place to be (visual amenity).

Paired projects

Project to establish cultural indicators for water quality to prioritise areas for on ground works (Cultural Water)—this project could be paired with the EV setting project.

Opportunity for traditional landholders to reclaim waterways/bodies.

Project to publish traditional cultural stories/histories—pair with a place story on the EPA website.

Long term – next 30 years

Have Lake Bonney and its catchments restored to, as close as possible, its original state.

ACTION

Add access points to map.

Get access so that the SEAFG members can have a look at the Lake and surrounds to better ascertain future uses.

6 Focus meeting with SA Recreational Fishers Adelaide, May 2012

RECREATIONAL FISHING

ENVIRONMENTAL VALUES

LAKE BONNEY SE

DISCUSSION BETWEEN SARFAC & EPA 7 MAY 2012

- 1 Attendees: SARFAC–Kevin Dunn, Malcolm Begg, Ian Fitzgerald: EPA–Peter Pfennig, Ms Shiloh Garrity. Absent: Nik Parker BIAA, Joe Rositano DPTI.
- 2 The purpose of the meeting was to outline recreational fishers environmental values, so that the EPA may be guided in seeking appropriate water quality to meet those objectives in negotiations with the polluters, Kimberly–Clark, SA Water, dairy farmers, etc.
- 3 The ongoing management of Lake Bonney SE is and will continue to be DENR. PIRSA Fisheries is responsible for the organisms in the water.
- 4 Both parties recognise that Lake Bonney SE, being 25 km by four km, and around two metres deep, is the largest body of freshwater in SA, with significant tourism potential.

Environmental values

- 1 That recreational fishing by wading, from the shore and from watercraft around the whole lake of 25 km by four km occur.
- 2 That fish that are recreationally attractive to recreational fishers be included in the fishing resource options, including natives that are not native to the area, and exotic fish from the salmomid family be encouraged.
- 3 That natural access through the provision of fishways be provided/maintained for anadromous and diadromous fish, including monitoring cameras for fish counting, etc.
- 4 That all types of recreational fishing bait, lure and fly fishing be permitted, with no allowance for nets.
- 5 That no commercial fishing be permitted in the lake.
- 6 That foot/vehicle access be permitted around the complete lake for recreational fishing access.
- 7 That suitable facilities for families be provided, including some jetties.
- 8 That an appropriate number of boat ramps, with support facilities such as carparks, toilets, rubbish deposit and removal. These ramps would generally be on the Northern, Highway sides.
- 9 That boating access for all types of craft be permitted: power (petrol), electric motors, human powered craft such as kayaks, float tubes, canoes etc.
- 10 That the DPTI ban on boating be lifted immediately for boat speed less than four knots, and subsequently increased when all logs and sundry securing structure/s have been suitably placed to create wildlife refugia, or removed.

Supplementary

- 1 To ensure rapid return of the 1950s pristine quality water, that consideration be given to draining the lake or as much of the Lake as is possible.
- 2 During that drained time, logs be identified and stacked to make wildlife refugia in the shallow lake, or removed.

- 3 That appropriate fishways, with suitable monitoring equipment, be installed when the Lake has drained sufficiently.
- 4 That some ramps and facilities be constructed during that time.
- 5 That stocking of suitable recreationally attractive fish be undertaken when filled.
- 6 That the internationally recognised bio-manipulation technique be considered for enhancing the water quality on an ongoing basis.

Conditions

It is noted that mobile phone coverage of this area is currently limited, and that boats may need VHF.

Other government organisations

- 1 Scott Slater, Aquatic Biologist, Department for Water.
- 2 Tim Bond, Aquatic Biologist, DENR, Mt Gambier.
- 3 Jonathon McPhail, Inland Fisheries Officer, PIRSA Fisheries. It is noted that PIRSA announced in January 2012 that the draft Release of Cultured or Translocated Aquatic Organisms (Stock Enhancement) in South Australia (August 2007) is to be reviewed.

Publicity

EPA confirmed that they were 'very happy' for the widest publicity to be given to the EPA exercise to obtain the recreational fishing community's views on environmental values for Lake Bonney SE.

Timetable

- 1 The EPA objective is to finish public consultation at the end of May 2012, and that a further public meeting is to be held in Mt Gambier at the end of May 2012.
- 2 The next stage would be to publish a report on the consultation phase with draft environmental values, for further feedback, by end September 2012.
- 3 The final phase would be to include environmental values in EPA Regulations.

SARFAC

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7 Community meeting Mount Gambier, May 2012



Mt Gambier Environmental Values for Lake Bonney SE

Public Consultation Meeting

30 May 2012

Introduction

A public meeting was held at Mt Gambier on Wednesday 30 May to:

- 1 Provide community members with an introduction to the Lake Bonney SE environmental values project currently being undertaken by the Environment Protection Authority (EPA), and an overview of previous meetings with other stakeholders. Information was provided by Peter Pfennig, EPA Principal Environment Protection Officer (Water Quality).
- 2 Provide community members with an overview of the past, present and future management of Lake Bonney SE. Information was presented by Ross Anderson, Acting Regional Ecologist South East, Department of Environment and Natural Resources.
- 3 Enable the EPA to engage and consult with community members in a workshop to better understand their priorities for the water quality management and use of the lake. Meeting participants gathered in small groups to discuss and collate responses to the following questions:
 - a What is important to you about the catchment, Lake Bonney and the water quality?
 - b What would you like the catchment and Lake Bonney to be used for in the short term (5–10 years) and the long term (10–30 years)?
 - c How would you like to see Lake Bonney managed to support community use?

Each group was provided with maps, tags and a feedback sheet. They were also invited to prepare questions and nominate a spokesperson to present the questions to Peter Pfennig during a feedback session.

A total of 37 community members attended the meeting.

Following the 50-minute workshop session, each group reported back to the plenary session and questions from each of the groups were sought and are recorded here. One participant also raised matters of consideration in an email for consideration by EPA staff.

Matters considered to be of key importance to participants include:

- enhanced environmental management and rehabilitation
- improved recreation access
- local community involvement in the management of Lake Bonney SE
- the removal of logs from Lake Bonney SE
- water quality improvement.

Specific responses by the workshop groups are provided below.

Issues of community importance and timelines (responses to questions 1 and 2)

| 5–10 Years | 10–30 Years |
|---|--|
| Water quality and aquatic environment | |
| <p>Bird life. Fish. Improve aquatic ecosystem.</p> <p>Logs removed. Zero pollution from all inputs.</p> <p>Challenge the farmers to reduce discharges into the lake.</p> <p>Improvement in water quality. Water quality [suitable] for all wildlife. Water quality to be continually understood. Water suitable for livestock to drink.</p> <p>It would help to understand the impact of the dairy Perhaps auditing and compliance.</p> <p>Research facility located on lake [focusing on] water quality [and] ecosystem – aquatic.</p> | <p>Continuing water quality improvements.</p> <p>Improving the environment with flora and fauna.</p> <p>Remove the logs from the lakes.</p> <p>Water for drinking.</p> <p>Zero discharge from KCA.</p> <p>Zero discharge into the lake.</p> |
| Recreation | |
| <p>Be able to use the lake for canoeing, boating and sailing. Boating. Sailing.</p> <p>Camping on western side of the Lake.</p> <p>Hunting – duck and quail.</p> <p>Recreation fishing. Recreation of all types.</p> <p>Swimming and hunting.</p> | <p>Better access for 4-wheel drives, better trails for bikes and motorbikes.</p> <p>Boating – Is there any thought of log removal. Mapping of lake bed?</p> <p>Camping + picnic areas.</p> <p>Duck shooting – hunting.</p> <p>Fishing – get it as good as Lake George or Bool Lagoon.</p> <p>Recreational use. Rowing. Water skiing. Sailing regatta. Power boating.</p> |
| Governance | |
| <p>Access needs to be improved eg right of way.</p> <p>Lake Bonney committee run by community and government rather than government groups only. Community input.</p> <p>More viewing opportunities/locations.</p> <p>Promote historical areas.</p> <p>Promote tourism, camping, picnicking.</p> <p>Public access improvements.</p> <p>Regular meetings or communications to inform public of what's happening on the lake.</p> | <p>Better signage.</p> |

Note: multiple similar responses have been provided to ensure that the feedback from each of the workshop groups has been included.

Responses to question 3: How would you like to see Lake Bonney managed to support community use?

- Area reclaimed from farming.
- By the community for the community.
- Campground/interpretative signage.
- Clean the lake up environmentally by stopping Kimberly–Clark polluting.
- Increase water flows into the lake and if possible allow some drainage.
- Maintain tracks on eastern side. Provide access to western side of lake.
- No commercialisation.
- Restore the vegetation.
- Walking trails/boardwalks.
- Water quality – reducing and minimising pollution.
- When KCA finishes is the lake going to be cleaned up? If not why does another polluter have to remove pollutants from neighbouring land?

One group indicated that they did not wish to see the following occur:

- irrigation crops such as vines, Lucerne, etc
- water for farm use such as in fruit packing or milking sheds etc
- stock watering
- water for industrial use such as power generation, manufacturing plants.

This same group indicated that would be happy to see lake water used for the following:

- water for aquaculture such as barramundi or marron farming
- human consumption of wild or stocked fish or crustaceans
- primary recreation with direct contact with water such as swimming or snorkelling
- secondary recreation with indirect contact with water such as boating, canoeing or sailing
- visual appreciation with no contact with water such as picnicking, bushwalking and sightseeing
- cultural and spiritual values including the cultural values of traditional owners. Also historical areas from the European settlement of the area (some of it).

Additional group response

The following responses were provided by one of the workshop groups. This group did not provide direct responses to Question 3.

- The lake needs to be restored to as close as possible the state it was in before the government allowed unlimited discharge into the lake.
- Have a broad spectrum of society and user groups with less industry ratio and impact.
- Be able to use the lake for recreation – fishing, picnicking, boating, collecting of shell grit, and recreational hunting.

Responses to group questions

During the question and answer session, Peter Pfennig offered the following responses to questions.

Q. When the indenture for KCA ends, is there a plan for controlling inputs?

A. KCA will apply for a licence and the EPA will put conditions on the discharge.

Q. Will they [KCA] be responsible for the clean-up [of the lake]?

A. KCA is unlikely to have a legal requirement to clean up the lake. However, KCA has already done work/research on the state of the lake.

Q. Will the community have a strong involvement in future management of the lake (universities)?

A. Good suggestion. Goyder Institute [could be a contact].

Q. Will [the] EPA look at having KCA having [an] outlet above [the] inlet like [the] USA?

A. [The] USA legislation is very different. Not done in Australia [Australia doesn't have this legislation]. [There is currently no consideration to change the legislation to meet that of the USA].

Q. If the eastern side industry has input will the [EPA] establish preventative measures?

A. DENR is already doing work along these lines through requiring landholders to fence the western side of the lake.

Q. Will the EPA monitor KCA under licence?

A. KCA will do their own monitoring in a way EPA prescribes. [The] EPA will monitor the lake on a regular basis.

Q. How long will KCA be licensed for?

A. This varies from licence to licence. Many are licensed for around five years.

Q. What is [the] EPA doing to improve the water quality? Filtration systems?

A. [The EPA works to a waste management hierarchy. Eliminating waste within systems [is the] ideal. [The EPA] will push licences towards this where this is practical.

Q. Why do builders get fined for runoff, but KCA does not for discharge?

A. Different industries have different limitations to the way that they prevent harm. Builders are able to control the water quality of runoff from their sites through simple, well-established means. KCA is a complex operation. The two are not directly comparable.

Q. What amount of pollution comes from the dairies?

A. [This was last] measured in the 1980s. [This] requires investigation.

Q. [Are] E Coli and nutrient levels increasing or decreasing?

A. They are decreasing. SA Water disinfects discharge [for reuse] so there is no E Coli.

Q. Why does the EPA not know the pollution breakdown of the lake through more regular (eg monthly) monitoring?

A. EPA has been concentrating on improvement of water quality. Intensive monitoring of a water body such as Lake Bonney SE is not justified with the EPA having other priorities for its available resources for monitoring.

Q. How will the EPA ensure that the monitoring carried out by KCA is consistent with requirements?

A. KCA are not licensed so the EPA has no direct say on how they monitor. However, once KCA are licensed there will be conditions in the licence. The licence will be managed by the South East EPA office at Mt Gambier. The EPA will also be testing the lake in the near future.

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Appendix 2 Background document about the lake and its water quality

What environmental values do we want Lake Bonney SE to support in the future?

Context for this brochure

Lake Bonney SE is located about 10 km south from Millicent in the South East of South Australia. It is the largest inland water body in the region with a length of about 23 km and volume of about 200 GL. The lake has received wastewater from pulp and paper mills for over 70 years, including the Cellulose Mill that started in 1939 and ceased operations in 1998 and a pulp and paper mill owned initially by Apcel Pty Ltd and more recently by Kimberly-Clark Australia (KCA) that started in 1958 and is still operational. Despite some initial complaints about these discharges polluting the northern part of the lake, it was not until the early 1970s that the general public considered the lake to have been badly polluted by the discharges from these mills.

This prompted the state government to carry out a series of monitoring projects and studies of the lake and eventually resulted in the state government and KCA agreeing to fund a three-stage project from 2003 to 2007 to identify the actions that need to be implemented to improve the health of Lake Bonney SE.

The findings from stage 1 of the project, which reviewed all the available information and data on water quality, hydrology, sediments and ecology of the lake, were summarised in the brochure titled *Lake Bonney South East, South Australia: Past, Present and Possible Future*². This also included a brief discussion about possibly aiming to rehabilitate the lake so that it was a healthy ecosystem that the public may be able to use for recreation and tourism.

Subsequent work carried out under stage 2 involved a series of studies and monitoring programs aimed at answering a number of critical knowledge gaps about the lake. They included a range of toxicity studies; clarifying what the lake was like before the region was settled and drained in the late 1880s; assessing the potential accumulation of chemicals in fish, sediment and water³; and studies of the processes driving the high colour and turbidity in the lake.

A detailed water model was developed using data collected from bathymetric and land-based surveys; installing a portable weather station; deploying temperature sensors in the lake; assessing groundwater inflows to the lake; and carrying out a series of water quality monitoring surveys to help calibrate the model. Finally, studies of the aquatic macro-invertebrates, fish and vegetation were carried out to gain an understanding of the current condition and any significant species that inhabit this large coastal lake.

The results from stages 1 and 2 of the project were discussed with representatives of the local community and interest groups through the Lake Bonney Community Consultation Forum and government agencies with an interest in the lake via the Lake Bonney Management Committee at meetings held during 2004 to 2006. The consistent view expressed at these meetings was that the lake should be restored to a healthy ecosystem and that other uses, such as recreational activities, should only be considered at some point in the future after the lake was in a much healthier state.

Stage 3 of the project involved identifying the management actions needed to improve the environmental conditions of the lake. The water model (comprising a hydrodynamic model and a water quality model) was used to trial a series of scenarios relating to water levels, algal production, turbidity and light penetration in the lake, based on data collected during 2005. An expert panel of scientists from CSIRO, universities, the pulp and paper mill, consultants and various government departments discussed the findings from stages 2 and 3 and helped focus attention on the need to avoid or significantly reduce the inflow of nutrients into the lake in the future.

² www.epa.sa.gov.au/xstd_files/Water/Report/lake_bonney.pdf

³ www.epa.sa.gov.au/xstd_files/Water/Information%20sheet/info_lakebonney.pdf

This brochure provides an update of the condition of the lake, a summary of the major issues facing the lake, and describes the most likely environmental values that apply to Lake Bonney SE based on all the work carried out since the 1970s. The focus of future work in the region over the next several months will be directed towards seeking the public's views on the proposed environmental values for the lake and its catchment. This will build on the previous discussions held with community representatives and aim to deliver an agreed, common vision for the management of this significant lake in South Australia.

What are environmental values?

Environmental values (EVs) describe what we want and need to protect for a specific water body such as Lake Bonney SE. They outline the values and uses of the environment that are important for healthy ecosystems and public benefit, welfare, safety and health, and that require protection from the effects of pollution and waste discharges.

The term was introduced into Australia with the national water quality guidelines in 1992 and extended with the revised guidelines in 2000⁴ but the underlying concept has been used for many years in other parts of the world, typically through designating water's according to defined beneficial uses or aquatic life uses (eg assessments based on habitat types that range from naturally occurring aquatic communities through to impaired waters that support a limited assemblage of native species; presence of recreational fish communities or desired fish habitats). All involve the classification of specific water bodies into a pass or fail type of assessment, with the results summarised into a format that can be communicated to the public.

The current Australian guidelines recognise the following environmental values that may apply to different water bodies and therefore require active protection:

Ecosystem values

- ecosystem protection (eg aquatic plants, fish and other flora and fauna, habitats) according to the following three levels of condition:
 - High conservation or ecological value systems, effectively unmodified or other highly valued environments (eg national parks).
 - Slight to moderately disturbed systems – ecosystems in which aquatic biological diversity may have been adversely affected to a relatively small but measurable degree by human actions (eg rural streams or marine environments with reasonably intact habitats and vegetation assemblages).
 - Highly disturbed systems – measurably degraded ecosystems of lower ecological value (eg urban streams and rural streams receiving concentrated wastes) but still provide habitat for some aquatic plants and animals.

Human use values

- primary industries (eg irrigation, stock watering and aquaculture)
- recreation and aesthetics (eg swimming, boating, passive recreation)
- drinking water
- industrial water (no water quality guidelines are provided for this value)
- cultural and spiritual values (no water quality guidelines are provided for this value).

In the majority of cases, more than one environmental value will be assigned for a water body. Where two or more environmental values are defined, then the most conservative guideline or approach should be used to help achieve the desired state for a water body.

⁴ www.environment.gov.au/water/policy-programs/nwqms/

Once the environmental values have been defined, the level of environmental quality or water quality necessary to maintain each value can be determined by setting management goals for the water body. They describe the threats to the values, the desired levels of protection and the key attributes of the environment that should be protected in the future. The setting of management goals helps to identify the key water quality indicators and guidelines that should be used in selecting water quality objectives for the water body.

The intent throughout this process is to ensure the management of water bodies is carried out in a transparent manner, incorporates the best available science and focuses attention on the maintenance of publicly agreed designated uses and values.

Involving the public is important for several reasons, including seeking a clear understanding of the community's knowledge, expectations and costs associated with managing specific water bodies; ensuring any management strategies are appropriately targeted; and gaining a shared ownership and commitment to implement the actions needed to protect or rehabilitate a water body.

Geographic scope

The intent is to establish the environmental values for not just Lake Bonney SE but to include the other drains and creeks that lie within the lake's catchment. They include: Milnes Gap Drain that receives drainage from the town of Millicent, effluent from the Millicent Wastewater Treatment Plant, and water from another drain that originates in Canunda Swamp; English Gap Drain that carries the effluent from the pulp and paper mills into the lake; and Stony and Benara creeks that receive shallow groundwater inflows from the surrounding grazed landscape to the east of the lake.

However, only a limited amount of data is available on the fish, macro invertebrates, plants and water quality from these drains and streams, and most of it relates to the downstream reach of each waterway.

No information is available on the possible occurrence of underground animals (called stygofauna), so setting environmental values for groundwater will not be included at this stage.

The scope of the environmental values setting process will also not extend along the historical flow-path from Lake Bonney SE to Bucks Lake and further downstream to the sea. The connection with Bucks Lake has already been recreated as part of a wetland enhancement project by the Department for Environment and Natural Resources. And previous work carried out by the Environment Protection Authority in 2005 ruled out connecting the complete flow-path to the sea because Lake Bonney SE remains too enriched with nutrients to allow the discharge into Gerloff Bay to be reinstated at this stage. Furthermore, water movement and mixing in the bay were very limited, and there was already evidence of a nutrient enrichment problem due to the extent of filamentous algae that was growing in the inter-tidal zone of the bay.

Current understanding of the condition of Lake Bonney SE

Water chemistry

The lake over the last decade has been saline (salinity ranging from 3,800–4,800 mg/L), coloured (24–64 HU) and turbid (21–150 NTU), with very high concentrations of nutrients such as nitrogen (3–10 mg/L range), phosphorus (0.05–0.36 mg/L) and organic carbon (83–166 mg/L).

Samples from the lake and four nearby wells taken in December 2005 showed that none of the metals or non-metallic inorganic parameters analysed were at concentrations of concern for the protection of moderately to highly disturbed ecosystems and the only elevated concentrations in terms of drinking water criteria were arsenic (0.016 mg/L compared to trigger value of 0.007 mg/L), fluoride (2.1 mg/L compared to the trigger of 1.5 mg/L) and sulphate (1,300 mg/L compared to 500 mg/L). These results are unremarkable for waters in the region and reflect the natural geology of the landscape rather than any contaminants contributed from human actions in the catchment. It is important to note that the

salinity of the lake is too high to use it as a water supply because 'good' tasting water typically has a salinity less than 500 mg/L and 'unacceptable' water occurs at salinities over 1,000 mg/L⁵.

Sediments and pore water (eg water in the sediments)

The sediments were typical for a coastal lake because they were mostly made up of fine sands and shell fragments. They had a high carbon content (up to 10% organic carbon) that probably contributed to the poorly oxygenated sediments throughout the lake.

A wide range of organic pollutants were analysed from sediments taken around the lake and the results did not show the presence of any chemicals at concentrations that would be of concern to either ecosystems or people.

However, analyses of pore water extracted from a series of sediment cores showed that the ammonia (4–15 mg/L) and hydrogen sulfide (1–1.4 mg/L) concentrations may be high enough to cause toxic effects to sensitive species. This is probably related to the organic matter and low oxygen levels of the sediments, issues that are commonly seen in other wetlands elsewhere in the state.

Microbial characteristics

None of the microbial data collected from the lake over the past decade indicates that there is any risk posed by human contact with the water. There is also no obvious source of microbial contamination entering the lake from any of the inflowing drains or creeks, although stock accessing the lower sections of drains to the north of the lake may pose a risk when the drains are flowing. The pulp and paper mill and Millicent Wastewater Treatment Plant discharge into drains that flow into the lake but neither are significant sources of concern for the lake. The major microbial risk for people recreating on the lake is likely to come from the faeces deposited by the large congregations of waterbirds that frequently occur near the Stony Creek outfall and the islands on the northern end of the lake.

General biology and plants in the lake

There have been several indications that the plants and animals inhabiting the lake have become more diverse and abundant during the 2000s compared with conditions in the 1980s and 1990s.

The lake has, however, remained in a consistently eutrophic state with high nutrient concentrations (particularly nitrogen and phosphorus) and large amounts of algae in the water since monitoring began in the 1970s. According to the national water quality guidelines, the trigger value for chlorophyll, the green pigments found in algae and plants, is a concentration of 5 µg/L for estuaries; above this there is a risk that adverse effects may occur. Recent measurements from the lake during the 2000s were generally in the 35–80 µg/L range and most of the data that dates back to the mid-1970s has been in the 20–30 µg/L range or higher, with only a few records less than 5 µg/L (note µg refers to one millionth of a gram).

There appears to have been a recent shift in algal dominance from several types of green algae (eg *Crucigenia* and *Planctonema*) during the 1970s through to the 1990s, to blue-green algae or cyanobacteria (*Aphanothece*, *Planktolyngbya* and *Anabaenopsis*) during the early to mid-2000s.

It is clear that the aquatic plants growing in and around the lake have become more prolific over the past decade, which coincides with the generally clearer appearance of water in the lake. From 2004 onwards, large growths of submerged species such as the Sea Tassel (*Ruppia megacarpa*) and charophytes (*Chara* and *Nitella*) were seen throughout the shallow edges of the lake up to a depth of about 40 cm. The Sea Rush (*Juncus kraussii*) extended 100–200 metres into the lake in places and the Common Reed (*Phragmites australis*) formed extensive stands well into the water in the southwestern edge of the lake. None of the submerged plants were noted during the 1980s to 1990s and only a few were recorded during the 1970s.

⁵ www.nhmrc.gov.au/guidelines/publications/eh34

Macro-invertebrates

A total of about 60 macro-invertebrate species were recorded from the lake in 2005–08, which is comparable to the community recorded during the 1990s but more diverse than the 34 species recorded from 1987–90. The more recent samples also had 15–21 species present whereas the earlier samples generally had only 1–14 species detected at each site sampled.

The abundance data shows a marked increase from August 2005 onwards, with whole sample abundances typically 2–3 orders of magnitude higher than most of the earlier data. Earlier samples typically had only 10–100s of specimens present whereas the more recent samples usually had 1,000–10,000s of macro-invertebrates. The most commonly collected species were snails, including small unidentified hydrobiids and salt-lake *Coxiella*, species that scrape algae and detritus from the sediments and plants growing around the edges of the lake. Another detrital feeding species, an amphipod crustacean (*Austrochiltonia australis*), was also found in large numbers throughout the lake.

The increase in diversity and abundance coincides with the increased habitat complexity provided by the expanded macrophyte cover around the edges of the lake. The macro-invertebrate community still lacks any sensitive or rare species and it is unlikely that any will colonise the lake in the future unless the salinity of the lake reduces significantly to around the 1,000–2,000 mg/L, concentrations that favour the survival of freshwater species.

A few yabbies (*Cherax destructor*) were recorded throughout the lake during 2005–08 and included several small specimens, which indicates that they have been able to successfully breed in the lake. This is significant because yabbies have not previously been recorded from the lake and their apparent recent colonisation and survival provides another line of evidence that the ecological condition of the lake has improved during the 2000s compared with previous decades.

Zooplankton

A number of different zooplankton species have been recorded during recent surveys, including several copepods, ostracods and cladoceran crustaceans. The community appears to be comparable to those recorded during previous decades, and is perhaps most noted by the continued absence of several species and families (eg *Daphnia* and *Boeckella*) that are frequently recorded from inland lakes in south-eastern Australia. This may, however, simply reflect the feeding habits of the fish community in the lake because it is the larger types of zooplankton that are missing from the lake, not the smaller species.

Fish

Nine species of fish were recorded from the lake during 2005–08, comprising eight native species and the introduced Silver-phase Goldfish (*Carassius auratus*). The most abundant native species were the Common Galaxias (*Galaxias maculatus*), Small-mouthed Hardyhead (*Atherinosoma microstoma*) and Southern Pygmy Perch (*Nannoperca australis*). Smaller numbers of Lagoon and Blue-spot Gobies (*Tasmanogobius lasti* and *Pseudogobius* species), Dwarf Galaxias (*Galaxiella pusilla*), Yellow-eyed Mullet (*Aldrichetta forsteri*) and a single Yarra Pygmy Perch (*Nannoperca obscura*) were also collected. The pygmy perch and Dwarf Galaxias records are significant because they are threatened species in South Australia.

Many of the Common Galaxias collected from the lake had a range of naturally occurring growths and parasites under the skin, including: (i) nematodes that appear as red worms just under the skin; (ii) microsporidian cysts which are a type of fungi that appear as white growths on the head and body of infected fish; (iii) metacercaria which are the resting stages of a trematode (flake) parasite; and (iv) an unknown parasitic structure that was found in the nervous system of one fish. There were no indications that these parasites caused any damage to the fish and similar infections and parasites have been recorded in the same species in the Coorong/Lower Lakes, western Victorian lakes and New Zealand. None of the other fish species collected showed any signs of parasitic infections or growths.

Tortoises

Long-necked Tortoises (*Chelodina longicollis*) were commonly collected in nets deployed during the 2000s. Earlier work, however, did not record any during the 1990s and only a few observations of tortoises were made during the 1970s. The apparent increase in numbers in recent years may be due to the food supply provided by the large number of fish that inhabit the lake. It is also possible that the regionally dry conditions that prevailed during the 2000s may have resulted in tortoises moving into the lake as other nearby swamp and wetland habitats dried. Despite this, their presence supports the view that the biology and food-web dynamics of the lake have become more complex over the past decade.

Other animal groups

The lake and its surrounding margins also provide habitat for many waterbirds, mammals, frogs and reptiles. Only anecdotal information has been collected on these groups but it is clear that the lake provides a significant habitat for many species in the region.

Supporting information on the condition of the in-flowing drains and creeks

Previous work carried out in 2009 showed that the drains and creeks had been affected by the prolonged drought in the region, with all drying up for at least part of the year. The Milne Gap Drain and upstream network of drains provided habitat for a range of tolerant aquatic macro-invertebrates and the threatened Dwarf Galaxias. Another threatened fish, the Southern Pygmy Perch was also collected from further upstream in 2004 and may have persisted in the catchment, despite the drought.

The lower reaches of Stony Creek were dry in autumn but it provided habitat for many species of macro-invertebrates in spring. The creek also provides habitat for the Southern Pygmy Perch which presumably refuge in permanent pools further upstream in the upper parts of the catchment.

English Gap Drain and Benara Creek provide limited habitat for aquatic species because only a few macro invertebrates and plants have been recorded from the drain and the creek has been dry for most of the past decade.

Major problems facing the lake

The high nutrient concentrations, presence of large concentrations of blue–green algae, and the improved light climate that has occurred during the drought over the past decade, provide the potential for significant blooms of nuisance algal species to occur in the lake in the future.

If the existing dense beds of aquatic plants around the edge of the lake were to collapse for some reason then it is likely that an algal species capable of exploiting the available nutrients could, under a worse-case scenario, result in a prolonged bloom forming on the lake. If this were to occur then many of the aquatic animals that inhabit the lake would be threatened because few would be able to survive in a lake with few plants and poorly oxygenated water (occurs when large algal blooms respire at night). Similar effects have occurred in Lake George near Beachport, where major algal blooms have occurred since about 1999 and lead to regular large-scale fish kills due to the effects of low dissolved oxygen levels and clogging of gills with algae. Avoiding a similar outcome in Lake Bonney SE is obviously an important management aim for the lake.

The water model developed for the lake indicates that the inflow of nutrients from all sources in the catchment need to be significantly reduced or eliminated to minimise the risk of nuisance algal growths. While the pulp and paper mills contribute about 90% of the nutrient load to the lake, the contribution from the wastewater treatment plant and stock is also large enough to generate problems in the lake. Consequently, nutrient reduction needs to occur from all these sources to minimise the risk of nuisance algal growths in the lake in the future. This will require a long-term commitment because it is likely to take at least a few decades for the nutrients that already in the lake to gradually reduce to levels that will not be able to generate blooms of algae.

Another issue that may produce profound changes to the current condition of the lake relates to the way in which the coloured chemicals from the pulp and paper mills are being removed from the lake's water. It appears that a chemical reaction is occurring between the coloured compounds and some of the ions found in the salt in the lake to precipitate or drop them out of the water column in the northern end of the lake. This has contributed to create a much clearer lake over the past decade which has favoured the growth of aquatic plants and helps create conditions that promote algal blooms. However, it is important to note that if the lake freshens substantially it is possible that this process will no longer be as effective and could result in the colour of the lake increasing. This in turn could cause the loss of many aquatic plants around the lake and affect the many fish and invertebrates that use the lake as habitat.

The final issue to consider is the effect that climate changes will have on the future of the lake. At this stage it is obviously difficult to predict what will occur but it seems inevitable that some degree of sea-level rise will affect the lake over the next century. King tides coupled with high winds currently pushes marine water near the western margin of the lake in places on occasions, so it seems certain that at least some parts of the lake will undergo significant changes in water chemistry and aquatic life in the near future. This is beyond the scope of the current environmental values setting process to deal with but is something that will need to be discussed as part of any future reviews of the management of Lake Bonney SE.

Provisional environmental values of Lake Bonney SE

The following environmental values appear to be appropriate for the lake and its upstream catchment:

- 1 ecosystem protection for a moderately disturbed system (lake, creeks and drains)
- 2 recreational and aesthetics (lake only).

The lake in its current form appears to show elements of both a moderately and highly disturbed ecosystem, so if the community wants to see the ecological condition of the lake continue to improve and support a wide range of aquatic plants and animals then setting the slightly to moderately modified level of protection seems appropriate. The same could apply for Milne Gap Drain, and Stony and Benara creeks but the constructed English Gap Drain is likely to remain a highly disturbed system.

The lake appears to provide opportunities for a range of recreational activities including bird watching and canoeing in its current condition. It is also possible that wind surfing and boating at very low speeds could also be considered if the safety issues relating to the floating logs, rocky outcrops, strong winds and isolated location can be overcome.

There are also other recreational uses that could be considered including fishing and duck shooting, if access to the Crown Land surrounding the lake is allowed. It should, however, be noted that the only recreational fish in the lake is the Yellow-eyed Mullet which presumably entered the lake in the past through the regulated outlet channel. Previous work investigating the accumulation of chemicals in fish did not show any concerns in terms of the consumption of either mullet or Common Galaxias collected from the lake. There may be an interest in adding additional recreational species to the lake given the lack of suitable fish in its current condition but this would probably threaten the rich assemblage of native species that already inhabit the lake.

The Milnes Gap Drain receives the effluent from the Millicent Wastewater Treatment Plant and could be assigned an industrial value for part of the drainage network further downstream. However, water quality guidelines have not been defined for this environmental value so the moderately disturbed ecosystem protection value would help direct future management actions in relation to this drain. Similarly, English Gap Drain receives the wastewater from the pulp and paper mills which ultimately could be managed simply as a highly disturbed system with an expectation that it would improve into a better condition over time. Stony and Benara creeks are small agricultural creeks and managing for a moderately disturbed condition seems appropriate for these waterways.

There has been some water extracted from the lower reaches of English Gap Drain and used for irrigating crops but this practice is not widespread. However, consideration of uses by primary industries could form part of the environmental values process agreed with the public through the forthcoming consultation phase.

The final issue that should also be considered as part of this environmental values setting process is to seek ways that will allow the traditional owners of the area, the Boandik people, to participate in this process and perhaps help to identify the values that they have maintained for the lake and its surroundings.