



Mildura Rural City Council



Lake Hawthorn Management Plan

Draft Plan - 15th October 2015



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Executive Summary

Lake Hawthorn is a natural ephemeral (meaning that it dries out for short or long periods of time) lake located on the River Murray floodplain between Merbein and Mildura.

The lake has been managed as an irrigation drainage basin since 1968. It has inflows primarily including irrigation drainage from the Merbein and Mildura Irrigation Districts, and urban stormwater runoff from the expanding urban areas. The lake also provides environmental conservation, salt interception services, amenity values, and recreational activities to a range of users.

There are a number of issues relating to the operation and management of the lake that need to be resolved.

Land management at Lake Hawthorn is complex. No single entity has control of all the lake footprint and surrounds, which makes it difficult to manage risk and liability. Goulburn Murray Water (GMW) operates and maintains the two key outfall structures, however GMW has little control over the land on which the lake is situated and/ or the urban and irrigation drainage water that flows to the lake. There are overlaps and gaps in agency responsibility that create confusion as to which agency is accountable for specific issues. Bringing as many of the responsibilities as possible within one agency to secure asset management and other operational aspects such as water quality, recreation and communication would simplify this issue. Currently the primary responsibilities for Lake Hawthorn land and water issues reside with Lower Murray Water (LMW), private lessees of College Land, Mildura Rural City Council (MRCC) and GMW.

The role of Lake Hawthorn in supporting local water management has evolved in recent years with improvements in irrigation efficiencies and progressive conversion of irrigated land to urban use. GMW operates the Lake Hawthorn Drainage Scheme to dispose of the collected irrigation and stormwater drainage in a managed way. As part of the Lake Hawthorn Drainage Scheme, an outfall operational plan is followed by GMW to protect River Murray water quality. The lake now has a substantially reduced role in the management of irrigation drainage disposal, instead shifting towards being an integral part of the MRCC urban stormwater drainage strategy. Further investigations are required to determine the salt and groundwater impacts on Lake Hawthorn and impacts of different outfall options.

The environment at Lake Hawthorn has been significantly modified to provide a discharge point for irrigation and urban stormwater drainage. The connection of the lake to the River Murray has also been altered with regulated flows in the river preventing the regular flooding that provided water to Lake Hawthorn. The condition and presence of native vegetation such as black box and river red gums is poor. This has resulted from pest plant invasions, loss of indigenous trees and shrubs, increased salinisation changing the vegetation composition, and planting of non-indigenous species. Modification of the natural environment has reduced the amenity and environmental value of the landscape. Improved management of the lake would greatly improve habitat for flora and fauna, and enhance the visitor experience.

The Lake Hawthorn Management Plan includes an overall framework for the management of the lake and incorporates key actions and responsibilities to help resolve these issues.

As well as producing the Lake Hawthorn Management Plan, the overall project aims to achieve acceptance of management recommendations and responsibilities. An ongoing, comprehensive stakeholder and community consultation program has been facilitated, with a technically robust and defensible process for its implementation established. A Project Reference Group (PRG) was formed to provide advice and feedback on the consultation and development of the plan. Two formal rounds of consultation have been carried out during the development of the plan.

Ongoing consultation, education, and increased awareness will be critical to achieving goals set out in the plan. A Lake Hawthorn Implementation Group will be set up to play an important role in the agency and community engagement process during long-term management of the lake. The Implementation Group, comprising

designated agency representatives, will help prioritise actions in the plan and provide advice on implementation. The Implementation Group will also work with a Consultation Group, which will include representatives from the local community and appropriate stakeholders. The Lake Hawthorn Consultation Group will provide a channel for information exchange with the broader community and will enable the Lake Hawthorn community and various user groups to have input into the implementation of the actions identified in this plan.

It is important to note that all actions contained in this management plan are currently unfunded. An implementation plan will be developed to prioritise the actions with estimated timeframes for delivery and to seek stakeholder agency agreement.

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1. Objectives of the Plan

The Lake Hawthorn Management Plan is intended to be a key reference document for agencies and communities that interact with the lake.

The main objectives of the Lake Hawthorn Management Plan are to:

- Develop a widely-held vision for the lake;
- Recognise the diverse range of values, uses and issues associated with the lake through high-quality and meaningful stakeholder and community engagement;
- Provide a series of actions over a realistic timeframe to be implemented to improve the management of the lake;
- Identify important social, economic and environmental issues, and develop a series of actions to address these issues to be implemented;
- Manage the natural and cultural values by obtaining broad-scale agreement between agencies about principles relating to sustainable use and development of the lake and surrounding foreshore; and
- Identify options for management of salt from urban stormwater, irrigation drainage and groundwater intrusion.

As well as the production of the plan, the aim is to obtain acceptance of the management recommendations and responsibilities through a comprehensive stakeholder and community consultation program, and a technically robust and defensible process for the preparation of the plan.

2. Context

2.1 Vision for Lake Hawthorn

The following vision statement describes clear and aspirational long-term desired outcome resulting from the prioritisation and implementation of key actions outlined in this plan. The Lake Hawthorn Implementation Group and the communities using the lake will play a key role in achieving this vision.

“A well-managed, ephemeral lake connecting communities and their urban and natural environments while providing habitat and drainage services”.

2.2 Lake Hawthorn

Lake Hawthorn is situated 3 km west of Mildura City and 2 km south of the River Murray. The lake was isolated from the River Murray by a levee and has been managed as an irrigation drainage basin since 1968. The lake was originally ephemeral with periods of high salinity. It is now saline because of its use as an irrigation drainage basin, the influx of saline groundwater (as a result of the irrigation-induced groundwater mound), and infrequent flushing from River Murray flood flows.

Lake Hawthorn has a full supply level (FSL) of 35.50 mAHD, which corresponds to a volume of 4,802 ML and a surface area of 224 ha. When full the lake has a maximum depth of 2.75 meters. It has inflows primarily including irrigation drainage from the Merbein and Mildura Irrigation Districts, and urban stormwater runoff from the expanding urban areas.

The primary operational management objective for Lake Hawthorn is urban and irrigation drainage management. As both the quantity and quality of inflows is variable, the lake may be adversely impacted by poor water quality, blue green algae, odours, and dust mobilisation during drier phases.

In addition to its role in receiving and storing irrigation drainage and stormwater, the lake and surrounding public land also provides environmental values, salt interception services, amenity values, and recreational activities to a range of users.

2.3 Scope of the Plan

Whilst acknowledging the status of drainage inflows from nearby irrigation and urban development, the scope of the plan is limited to the lake, the immediate foreshore and the outlet channel from the lake to the River Murray. The plan includes current and future operational and maintenance programs of agencies that have legislative responsibilities with regard to land and water management at Lake Hawthorn.

2.4 Land Status

Reserved Crown land is land that has been reserved for any of the variety of public purposes under the Crown Land (Reserves) Act 1978. The Act allows reserved Crown land to be managed on behalf of the Department of Environment, Land, Water and Planning (DELWP) by a Committee of Management (CoM) appointed by the Minister (VGSO, 2008). The Committee has the power to:

- Manage and develop the reserve,
- Undertake financial transactions, including borrowing money (with the Victorian Treasurer’s consent) and entering contracts,
- Enter tenure arrangements such as leasing and licensing for part or all of the reserve, subject to the Minister’s approval,

- Employ people, and
- Enforce regulations.

Unreserved Crown Land is sometimes managed by an authority that has assumed management responsibility. This is commonly known as “implied management”.

Land can be alienated from the Crown by a grant of freehold or by a lease.

At Lake Hawthorn, land immediately above the high water mark is a combination of Crown land (reserved) managed by MRCC as the CoM, and Crown land (unreserved) managed by GMW (implied).

LMW and the Minister for Education own freehold land below the high water mark of Lake Hawthorn (including the lake floor). Land held by the Minister for Education, known as College Land, is leased with lease payments going to the benefit of schools in the Mildura district. College Land covers approximately one third of the footprint of Lake Hawthorn.

2.5 Legal Status

The agencies managing Lake Hawthorn have statutory obligations imposed by a wide variety of legislation. The Lake Hawthorn Management Plan has no legal status and does not impose any new legal or statutory requirements. The plan may influence the need for agency policy changes to help meet the objectives of the plan.

3. A Plan for the Management of Lake Hawthorn

3.1 Plan Implementation

An Implementation Group of designated agency representatives is a vehicle to enhance communication, increase understanding about issues relating to the lake and, most importantly, guide the implementation of the plan.

For this plan, it was agreed by the Project Reference Group that an Implementation Group of agency representatives involved in the management of Lake Hawthorn would be established. Principles of collaboration, integrated management, and a partnership approach to funding applications and accountability for the implementation of high-priority actions are paramount to the Implementation Group.

It was also agreed that a separate Consultation Group, convened by MRCC and consisting of representatives from the local community and appropriate stakeholders, should be established. The Lake Hawthorn Consultation Group will provide a channel for information exchange with the broader community and will enable the Lake Hawthorn community and various user groups to have input into the implementation of the actions identified in this plan. The Consultation Group will also provide a mechanism for agencies and the community to assess progress against the actions.

3.1.2 Lake Hawthorn Implementation Group

The Implementation Group will:

- Assist with the implementation, monitoring and review of actions in the plan,
- Provide a forum for agency representatives to exchange ideas about the management of the lake and surrounding public land and to discuss policy and regulatory changes relevant to its management,
- Discuss infrastructure planning, communication issues and management,
- Engage with the Lake Hawthorn Consultation Group to ensure community values and resources are contributing to the management and development of Lake Hawthorn, and
- Engage with other stakeholders as appropriate.

The Implementation Group should include but not be limited to:

- An independent chairperson,
- A Mildura Rural City Council (MRCC) Manager or nominee,
- A representative from Lower Murray Water (LMW),
- A representative from Mallee CMA, and
- A representative from Sandhurst Trustees.

Issues

- Ongoing communication and cooperation between agencies, stakeholder groups and community to ensure the long-term sustainability of Lake Hawthorn

Objectives

- To establish a Lake Hawthorn Implementation Group to provide advice on the implementation of the plan
- To ensure community resources are directed to supporting the management and development of Lake Hawthorn

- To enable the vision for Lake Hawthorn to be achieved

Actions

1. Establish an inter- agency Implementation Group to guide the implementation of the plan, public communications and future development decisions
2. Explore the possibility of jointly funding a Project Manager, initially for a 12 month period, to work with the Implementation Group and drive the initial implementation and monitoring of the plan
3. Establish a Lake Hawthorn Consultation Group of relevant community stakeholders
4. Develop Terms of Reference and roles and responsibilities for the Implementation Group - terms of reference to include principles of integrated management, collaboration and a partnership approach to funding applications, and accountability for the implementation of high-priority actions
5. Develop an Implementation Plan, including evaluation criteria, prioritisation of actions (actions 6-39) and timing

3.2 Responsibilities and Management

At Lake Hawthorn, Crown land and freehold land is managed and controlled by a range of parties. No single entity has control of the lake footprint and surrounds, making it difficult to provide leadership or manage risk and liability.

Lake Hawthorn is an important local destination for passive recreational pursuits, including walking and bird watching. Improved management arrangements will greatly increase the recreational potential of the lake.

3.2.1 Management Responsibility

Management responsibility and associated issues can be described as follows.

Lower Murray Water

LMW is the landowner and manager of the largest part of the lake bed (approximately two thirds of the footprint of the lake). In addition, LMW has assumed responsibility for managing recreation access to the lake and foreshore. Precedents exist for lake closures due to public health risks. The land management and recreational access responsibilities of LMW are complicated by not having influence over college leased land tenants' management responsibilities.

Subsurface irrigation drainage schemes are designed to remove excess water from the soil profile and prevent production losses as a result of water logging and salt accumulation. LMW uses Lake Hawthorn as an outfall from its Mildura and Merbein Irrigation Districts. The area serviced by tiled drains is over 6000ha, however in 2010 less than half of this catchment was irrigated due to changing land use and urbanisation. As a result of this and greatly improved irrigation efficiencies, the estimated volumes of irrigation drainage water flowing to Lake Hawthorn have declined substantially from around 10,140 ML/yr in 1988 to around 2,640ML/yr or less. The irrigation drainage system also receives stormwater during major or extended rainfall events. High rainfall events are correlated with high flows from irrigation drains however overall, irrigation inputs are far more significant to drain flow than is rainfall.

LMW has four irrigation drainage outfalls that discharge into Lake Hawthorn. These outlets are typically a small head wall on the end of a drainage pipe and are generally located above the nominated full operational level of 34.85 mAHD. One outfall point (from the Merbein Irrigation District) discharges into Lake Hawthorn via the outlet channel.

Goulburn-Murray Water

GMW has management responsibility for operating the Lake Hawthorn Drainage Scheme. The operational aim is to minimise salt discharge to the River Murray and to maintain the upper level of water in the lake at agreed levels (via operation of the Lake Hawthorn pump station) to prevent outfall to the River Murray.

The GMW operational responsibility involves monitoring salinity and water levels, pumping collected regional irrigation drainage and, more recently, urban stormwater to the Wargan Basins, and implementing outfall to the River Murray by gravity in accordance with agreed operating protocols (Lake Hawthorn MoU, 2007).

GMW has little control over the land on which the lake is situated and/or the urban and irrigation drainage water that flows into the lake. GMW is the “implied manager” for some areas of land along the outfall channel from the lake to Ranfurly Way and owns the small parcel of land on which the Lake Hawthorn Pump Station is sited.

Assets that GMW is responsible for at Lake Hawthorn include the Lake Hawthorn pump station, the connecting regulator (Lake Ranfurly to Lake Hawthorn), the outlet channel (Lake Hawthorn to River Murray), the rising main to Wargan Basins, and other ancillary assets including gauge boards, signage and fencing.

Mildura Rural City Council

MRCC relies on Lake Hawthorn for its Mildura South stormwater drainage wetlands outfall. This provides for the continued growth of Mildura in the Mildura South and Mildura East corridors. Lake Hawthorn is currently an outfall for urban stormwater generated from a residential area of about 618 ha (this figure is under review and refers to the area MRCC has connected to the urban stormwater system along 16th St). This area could grow in the longer term, resulting in a significant stormwater discharge to Lake Hawthorn. Water quality is monitored at the wetlands. The quantity of stormwater inflows is not monitored.

MRCC is responsible for the management of some parts of the Lake Hawthorn foreshore between Lake Hawthorn and Lake Ranfurly. MRCC as Committee of Management (CoM) is responsible for parts of land along the outfall channel from the lake to the railway, from the railway to Ranfurly Way, and from Ranfurly Way to the River Murray.

MRCC has assets directly interfacing with Lake Hawthorn, including an earthen stormwater drain discharge into the lake via the unused Sixteenth Street road reserve, a piped stormwater discharge to the lake for the residential area known as Lakeside Subdivision (located between McEdwards Street and Riverside Avenue), and a timber pedestrian bridge at the northern end of the lake across the lake’s discharge channel to the River Murray. Several gravel walking/cycling paths traverse the surrounds of the lake. Paths on MRCC-managed land are maintained by MRCC (GMW, 2011).

MRCC has responsibilities for the planning, health and wellbeing of the Mildura community including the growing communities of Cabarita and the new urban areas in the Mildura South corridor.

Sandhurst Trustees

A total of six separate tenants hold leased land in close proximity to Lake Hawthorn. This land is managed by Sandhurst Trustees. The land is vested in the Minister for Education and the rent money received from the leases is distributed to 27 government and non-government schools in the area. This land is known as “college land”.

Leases are for 50 years and improvements to the land remain the property of the tenants. College land lies between Riverside Avenue and the lake. Some of these lots extend well below the full supply water level of Lake Hawthorn. A separate lot is located in Seventeenth Street. This lot does not extend to the high water mark. College leased land covers approximately one third of the footprint of Lake Hawthorn.

Department of Transport

The Department of Transport is the “implied manager” for the railway line that runs between Lake Hawthorn and Lake Ranfurly.

Transport Safety Victoria

Transport Safety Victoria (TSV) is responsible for assisting waterway managers in their duties and auditing

waterway management in Victoria.

The Marine Safety Act 2010 (Vic) (MSA) commenced on 1 July 2012. The Act introduced a number of changes for waterway managers in Victoria. Before the Act came into operation TSV was the default waterway manager for un-managed waterways in Victoria. These are State waters that do not have a waterway manager appointed to them. Under the Act there is no default waterway manager.

State-wide rules apply to all waterways in Victoria. Lake Hawthorn is an un-managed waterway, therefore state-wide rules apply which include a 5 knot speed limit within 50 m of the shore. If a waterway manager is in place, exemptions, substitutions or modifications to state-wide rules to address local issues on specific waterways are permitted.

Objectives

- To ensure that public land surrounding the storage is actively managed to provide drainage and salt interception services, protect water quality, environmental and cultural heritage assets, and to enhance the amenity and safe recreation potential of the lake

Issues

- Addressing mixed management responsibility of the lake footprint and surrounds
- The future development and use of Lake Hawthorn for drainage, recreation, habitat and amenity lacks clear ownership and direction

Actions

6. Investigate and evaluate options regarding the transfer of the lake footprint and surrounds to a single agency manager
7. Investigate transfer of management of college leased land below the high water mark and a riparian buffer for public benefit

3.3 Outfall Management From Lake Hawthorn

GMW operates and manages two groups of infrastructure relevant to Lake Hawthorn - the Mildura Merbein Salt Interception Scheme (MMSIS) and the Lake Hawthorn Drainage Scheme. Although only the Lake Hawthorn Drainage Scheme addresses water in Lake Hawthorn, it shares common infrastructure with the MMSIS, being the transfer and disposal pipeline infrastructure to Wargan Basins. The aim of the Lake Hawthorn Drainage Scheme is to dispose of the collected irrigation drainage in a managed way. This is necessary to prevent a combination of drainage water and groundwater-generated salt loads from entering the River Murray and to prevent backup in the inflow drainage pipes entering Lake Hawthorn. As part of the Lake Hawthorn Drainage Scheme, an outfall operational plan is followed by GMW to protect River Murray water quality. Gravity outfall takes place direct to the River Murray via an open, natural channel to the river.

Assets that GMW is responsible for at Lake Hawthorn include the Lake Hawthorn pump station, connecting regulator (Lake Ranfurly to Lake Hawthorn), outlet channel (Lake Hawthorn to River Murray), rising main to Wargan Basins, and other ancillary assets. Refurbishment/upgrade of infrastructure is required for ongoing operation of the Lake Hawthorn Drainage Scheme (Lake Hawthorn pump station).

3.3.1 Technical Investigations

The role of Lake Hawthorn in supporting local water management has evolved in recent years, with improvements in irrigation efficiencies and progressive conversion of irrigated land to urban use reducing inflows to Lake Hawthorn from the irrigation drainage system. The lake now has a substantially reduced role in the management of irrigation drainage disposal, instead has shifted towards being an integral part of the MRCC urban stormwater drainage system. Further technical investigations are required to determine the current and projected salt and groundwater impacts on Lake Hawthorn and impacts of different outfall options.

Objectives

- To conduct technical investigations to determine the salt and groundwater impacts on Lake Hawthorn and impacts of different outfall options on the River Murray
- To operate Lake Hawthorn under a 'fill and spill' regime if possible

Issues

- The lake has a reduced role in the management of irrigation drainage disposal and is shifting towards being an integral part of the MRCC urban stormwater drainage system

Actions

8. Conduct detailed technical investigations to determine the salt and groundwater impacts on Lake Hawthorn if changes to the operating rules are proposed
9. Undertake a technical investigation of impacts of different outfall options
10. Conduct a risk assessment into risk of flooding and controls (stormwater inflows)
11. Pending the results of the technical investigations (Actions 8, 9 and 10), explore options for altering Lake Hawthorn outfall operations/management
12. Pending the results of the technical investigations (Actions 8, 9, 10 and 11), determine appropriate new operating rules and maximum water level, taking into account riparian vegetation, infrastructure, impacts on adjacent land, and flood risk/flows
13. If technical investigations (Actions 8, 9, 10 and 11) lead to an unchanged management regime, investigate technical and cost implications to refurbish and operate the GMW pump station and diversion assets

3.4 Alternative Water Sources

Lake Hawthorn was originally ephemeral and naturally received inflows directly from the River Murray during periods of high flow via an interconnecting channel to the north west of the lake. With European settlement, the lake was used for passive recreational purposes when the lake was full and provided habitat for a diverse array of flora and fauna. Since the lake has operated as an irrigation drainage basin, it has continued to provide recreational opportunities, aesthetic value, and important habitat for birds, fish and native vegetation.

With the rise of more efficient irrigation techniques there has been less irrigation runoff entering the lake. The lake also becomes dry during times of drought or decreased rainfall when evaporation exceeds input flows.

During the consultation that was undertaken for the development of this plan, the community expressed an interest in options to maintain higher water levels in the lake and concern about negative impacts when the lake is dry and/or water levels are very low.

3.4.1 Environmental Flows

Mallee CMA works with the community, environmental water holders and partner agencies to identify and implement environmental watering actions to improve or maintain the health of priority sites within the Victorian Mallee. This has involved the development of a regional waterway strategy, comprehensive environmental management plans and numerous investigations into improved environmental flows at key wetlands and floodplain areas. In addition, on-ground activities (such as the construction of regulators and the delivery of environmental water to priority wetlands and floodplain areas) have been implemented. The allocation of environmental water at Lake Hawthorn will be weighed against the needs of other waterways, community users, and urban water supply. The final decision rests with environmental water holders. Infrastructure capacity and the feasibility of delivering regulated flows to Lake Hawthorn also need be considered if environmental flows were to be allocated to Lake Hawthorn.

Objectives

- To maintain higher water levels and habitat in the lake by delivering environmental flows

Issues

- The relative value of environmental benefit at Lake Hawthorn compared with regional and state priorities
- Technical feasibility and costs of delivering environmental flows to Lake Hawthorn
- Evaporation of water in the lake (estimated at 2,000 mm/year)
- The lake needs wet and dry phases to be a healthy functioning wetland, from an environmental perspective

Actions

14. Investigate infrastructure capacity and/or options for delivering environmental flows to Lake Hawthorn

3.4.2 Stormwater Inflows

The stormwater catchment surrounding Lake Hawthorn includes eight sub-catchments in Mildura South and Mildura East, covering an area of approximately 6,180 ha. A significant portion is urbanised. Urbanised areas surrounding Lake Hawthorn are expected to increase in the longer term, resulting in a significant stormwater discharge to the lake.

Currently, there is a stormwater drain discharge into Lake Hawthorn via the unused Sixteenth Street road reserve. This road reserve is used to separate the drainage scheme from the college leased land. The drain is the discharge from the Mildura South linear wetland stormwater disposal network, which services the expanding Mildura South and Mildura East residential corridors. There is also a piped stormwater discharge to the lake for the residential area known as Lakeside Subdivision, located between McEdwards Street and Riverside Avenue.

MRCC should continue to maximise stormwater inflows to Lake Hawthorn as urban development progresses in the surrounding catchments.

Objectives

- To maintain higher water levels in the lake by maximising stormwater inflows

Issues

- Technical feasibility and costs of maximising stormwater inflows

- Evaporation of water in the lake (estimated at 2,000 mm/year)
- The lake is subject to wet and dry phases - it will become dry during times of low rainfall

Actions

15. Continue to maximise stormwater inflows to Lake Hawthorn where able
16. Review the Sunraysia Drainage Strategy (2002), in particular maximising current and future inflow volumes to Lake Hawthorn and maintaining a whole of catchment approach to management of drainage in the region

3.4.3 Purchased Water

Community consultations identified the purchasing of water as a solution to maintaining water in Lake Hawthorn.

The cost of purchasing water, particularly during dry periods, is considered to be impractical due to the ongoing costs of purchase and delivery, and high evaporation losses.

The capacity of Lake Hawthorn when it has a 1 m maximum depth is 1,450 ML (30%) and the surface area is 158 ha (70%). Evaporation at Lake Hawthorn is relatively high (estimated at 2,000 mm/year). If evaporation loss was not replaced from other sources such as stormwater and/or irrigation drainage, the lake at 1 m depth would become dry within one year.

Water purchased on the temporary market may cost in the order of \$1,200/ML. The annual cost of purchasing water to maintain a maximum water depth of 1 m and a surface area of 158 ha (30% capacity and 70% area) would therefore be in the order of \$1.8M (1,500ML at \$1,200/ML). If dry conditions continue, ongoing purchases would be required.

Objectives

- To maintain higher water levels to ensure amenity and recreation values are retained

Issues

- Available supply of water for purchase
- High costs of water and delivery
- Ongoing evaporation
- Groundwater and salinity impacts on the lake

Actions

- No actions are proposed to purchase water

3.4.4 Dredging of the Lake Floor

Community consultations identified the dredging of the lake floor to deepen the lake as a solution to maintaining water in Lake Hawthorn.

The floor and overflow level of Lake Hawthorn is substantially undisturbed from its historical state. Dredging the lake to deepen the lake would require permission from a wide range of agencies and the wider community to gain approval on environmental and cultural heritage matters. Funding of the design and implementation of dredging

would be unlikely to come from government funding and works would have to be conducted when the lake was dry.

While some sections of the community were in favour of dredging as a solution, other sections were sceptical or opposed to this as a solution.

Objectives

- To maintain water to ensure amenity and recreation values are retained

Issues

- Cost of environmental and cultural heritage approvals and impacts on cultural heritage sites
- Cost and amenity impacts of earth works
- Ongoing evaporation
- Groundwater and salinity impacts on the lake

Actions

- No actions are proposed to dredge the lake

3.5 Water Quality

Major point sources of nutrient pollution in Lake Hawthorn include irrigation drainage and urban stormwater. The lake is now saline because of its use as an irrigation drainage basin, the influx of saline groundwater, and infrequent flushing from River Murray flood flows. Levee banks and flow-regulating structures now separate the lake from the River Murray except at times of very high flow. As more irrigated land surrounding the catchment is urbanised, Lake Hawthorn will continue to receive increased urban stormwater run-off. Urban stormwater can contain nutrients, suspended solids and other pollutants. Septic tanks can also be a significant source of groundwater contamination that impact on water quality. The local township of Cabarita relies on septic tanks and is currently not connected to the sewerage system. It is anticipated that there will be an increase in low-density residential development in the Lake Hawthorn catchment that will be unsewered.

3.5.1 Water Quality Monitoring

Monitoring is important for understanding processes that may impact on the quality of water. Water quality can be measured for its suitability for specific uses. The most common indicators used to assess water quality are pH, salinity, turbidity, suspended solids, dissolved oxygen, nutrient concentrations, and temperature. Nutrients and other factors such as temperature, sunlight intensity and flow regimes, may contribute to blue-green algal blooms. Nutrients, particularly phosphorus and nitrogen, enter waterways attached to sediments and from sewage and other industrial/commercial waste. Pesticides used in agriculture to control pest plants, fungi and animal species can be washed into lakes, rivers and tributaries. Pesticides usually have low solubility in water and can become bound to sediments.

Understanding trends in chemical and biological parameters allows water resource managers to develop strategies that can mitigate on-water/in-lake or catchment processes that may be impacting on water quality.

There has been no specific sediment or water quality testing undertaken at Lake Hawthorn.

Objectives

- Targeted and effective monitoring to improve understanding of processes affecting water quality in Lake Hawthorn

Issues

- Inflows from irrigation drainage and urban stormwater drainage impacting on water quality
- Unknown historical impacts of agricultural chemicals contained in drainage waters on lake sediments
- Impacts of septic tanks on water quality

- Currently there is no specific sediment or water quality testing undertaken at Lake Hawthorn
- Increasing low-density unsewered residential development

Actions

17. Co-ordinate an integrated water quantity and quality monitoring, evaluation and reporting strategy for Lake Hawthorn aligned with the proposed use of the lake
18. Investigate lake sediments to determine if current and historical agricultural runoff could be a hazard to public health.
19. Seek funding to implement recommendations relating to revegetation and water quality in the Regional Catchment Strategy (RCS) and the Mallee Waterway Strategy 2014-22 that relate to land use and tributaries in the catchments of Lake Hawthorn
20. The impact of unsewered development on Lake Hawthorn must be considered during development approval

3.6 Drainage Management

Sources of inflow to Lake Hawthorn include irrigation drainage (sub-surface) and urban stormwater drainage. A number of drainage catchments in the Mildura and Merbein Irrigation Districts, as well as private irrigation drainage, contribute to inflows to the lake via sub-surface drainage infrastructure. The volume and timing of drainage inflows into the lake cannot be controlled. The stormwater catchment includes eight sub-catchments in Mildura South and Mildura East, now covering an area of approximately 6,180 ha. A significant portion of this area is urbanised (see section 3.4).

3.6.1 Management Issues

The role of Lake Hawthorn in supporting local water management has evolved in recent years, with improvements in irrigation efficiencies and progressive conversion of irrigated land to urban use. The lake now has a substantially reduced role in the management of irrigation drainage disposal, instead shifting towards being an integral part of the MRCC urban stormwater drainage strategy (see section 3.3). Options to divert additional stormwater inflows to Lake Hawthorn may assist with maintaining higher water levels in the lake.

In 2009, a review of the Sunraysia Drainage Strategy identified that there is a lack of long-term security, direction, communication and integration in the management of drainage development in the region, and a lack of coordination in the design, construction and operation of drainage infrastructure for new urban developments surrounding the lake. Since 2009, MRCC, LMW, MCMA and GMW have been working in partnership on these matters.

Irrigation drainage and urban stormwater are potential point sources of pollution in Lake Hawthorn. There has been no specific sediment or water quality testing undertaken at the lake (see section 3.5).

Objectives

- Improving the management of drainage (irrigation and stormwater) at Lake Hawthorn

Issues

- The quantity of drainage (irrigation and stormwater) inflows is not monitored
- The lake has a substantially reduced role in the management of irrigation drainage disposal
- Inadequate interagency integration and communication regarding decisions on drainage impacts and other drainage related matters at Lake Hawthorn

Actions

21. Co-ordinate an integrated water quantity and quality monitoring, evaluation and reporting strategy for Lake Hawthorn aligned with the proposed use of the lake (see action 17)
22. Continue to maximise stormwater inflows to Lake Hawthorn where able (see action 15)
23. Continue to ensure a coordinated and whole-of-catchment approach to the management of drainage in the region

3.7 Cultural Heritage

State and Commonwealth legislation provides specific protection for Aboriginal and non-Aboriginal heritage. In particular, the Aboriginal Heritage Act 2006 and associated Aboriginal Heritage Regulations 2007 protect Aboriginal heritage and provide a consistent approach to managing Aboriginal cultural heritage land use and development proposals. There are also other guidelines and regulations that set standards for identification, listing and conservation of heritage places.

Further to legislative requirements, there is a moral responsibility for government agencies and individuals to preserve Australia's cultural heritage for present and future generations.

3.7.1 Aboriginal Cultural Heritage

Inland water and wetland habitats of the Lower Murray Darling are recognised as being focal points for prehistoric human occupation from the Pleistocene to the Holocene period. These environments provided an array of flora and fauna resources for Aboriginal populations and were therefore occupied frequently. As a result, archaeological sites associated with Aboriginal occupation are often found in these environments.

The traditional owners of the area are the Latji Latji people. It is understood that other Aboriginal groups from both sides of the River Murray also inhabited the area.

There have been a number of studies undertaken around Lake Ranfurly which have identified significant cultural heritage sites, including surface exposures and sub-surface deposits. Artefacts that have been identified include flake stone implements and earth features such as hearths of baked clay sediments, clay heat retainers and stone heat retainers. Freshwater shell middens, human remains/burials and faunal remnants have also been identified (GHD, 2013).

No investigations have taken place directly around Lake Hawthorn. A Cultural Heritage Management Plan (CHMP) is required if any works are undertaken at Lake Hawthorn resulting in ground disturbance.

Objective

- To protect, preserve and raise community awareness of the importance of Aboriginal cultural heritage associated with Lake Hawthorn

Issues

- Protection of culturally significant sites
- Valuing and appropriately recognising Aboriginal culture

Actions

24. Agencies to work closely with the local Aboriginal communities to identify and protect significant and sensitive cultural heritage sites during works
25. In partnership, develop a program to increase community appreciation of Aboriginal cultural heritage at Lake Hawthorn

3.8 Healthy Ecosystems

Lake Hawthorn is recognised for the maintenance and conservation of biological diversity. The lake is in close proximity to Lake Ranfurly, which is listed in “A Directory of Important Wetlands in Australia, Environment Australia, Canberra”. Historically, the lake and its connection to the River Murray provided habitat for a diverse range of native flora and fauna, including black box and river red gums, birds, reptiles and fish.

Today, a number of different species of birds frequent the lake. Habitat for native fish, reptiles and other fauna is degraded and in poor condition and restoration prospects are hampered by saline, dispersive soils.

3.8.1 Flora and Fauna

Historically, Lake Hawthorn provided habitat for the rare Murray hardyhead, which is listed under the FFG and EPBC Acts. Other native species that were present included carp gudgeon, bony bream, flathead gudgeon, and golden perch. Exotic fish species included the eastern gambusia and the common carp. Yabbies and shrimp were also present. All fish, including the Murray hardyhead, had perished in the lake by 2008 due to the drying of Lake Hawthorn during the extended drought.

Over 60 species of waterbirds have been recorded at Lake Hawthorn. Large and small waders are particularly well-represented in the bird community. Birds at the site include Australian pelican, Australasian shoveler, black swan, Caspian tern, great egret, hardhead, immediate egret, little egret, Major Mitchell’s cockatoo, pied cormorant, silver gull, whistling kite, and white-bellied sea-eagle.

The condition and presence of native vegetation such as black box and river red gum communities is poor. This has resulted from significant pest plant invasions, removal of indigenous trees and shrubs, increased salinisation changing the vegetation composition, planting of non-indigenous species, and general human invasion. Some revegetation programs are showing signs of success in stabilising the riparian zones around the lake.

Vegetation around the lake includes Austral seablite, Ruby saltbush, various saltbush and bluebush, and a range of reeds, sedges and rushes. An important seagrass, *Ruppia megacarpa*, grows in the shallow waters of Lake Hawthorn and provides important habitat for fish and bird species.

Objectives

- To restore and enhance the environment at Lake Hawthorn to maintain and improve the health of aquatic and terrestrial flora and fauna

Issues

- Poor soil conditions (salinity, dispersive soils) impact on existing and planted vegetation
- The condition and presence of native vegetation is poor
- Water and salinity vary during the wetting and drying periods
- An important site for migratory birds and a drought refuge for waterbirds and waders
- The potential to return Murray hardyhead to Lake Hawthorn

Actions

26. Seek funding to develop and implement a foreshore management plan to protect riparian vegetation, prevent erosion, and encourage the establishment of foreshore vegetation within the capabilities of the site
27. In line with the national Recovery Plan for the Murray hardyhead, explore the possibility of returning it to Lake Hawthorn
28. Consider the impact of any activities or works on the health and distribution of *Ruppia megacarpa* (seagrass)
29. In line with the Loddon Mallee North Regional Growth Plan, seek funding to protect and improve the condition of environmental and cultural heritage assets, including wetlands of national and international significance

3.8.2 Pest Plants and Animals

If poorly managed, pest plants can impact on neighbouring private or public lands, decrease biodiversity, and pose a fire risk. At Lake Hawthorn, improvement to the frontage and riparian zone of the lake has been consistently raised as a management priority.

A number of pest plants occur at Lake Hawthorn. Pest plants that have been recorded include African boxthorn, boneseed, caltrop and onion weed. These pest plants are regionally controlled/restricted pest plants under the Mallee Invasive Plants and Animals Strategy (2011) or Weeds of National Significance (WONs).

Grazing and burrowing by rabbits at the lake has caused erosion problems and has reduced recruitment and survival of native plants. Foxes occur in high proportions at the lake and pose a significant threat to native wildlife.

It is apparent that agency management of these aspects has been minimal. It has also been noted that a priority operational focus is required for these areas, and that in the longer term a foreshore management plan requires development and implementation to address the issues.

Objectives

- To manage pest plants and animals on the lake bed and surrounds to improve amenity and minimise impacts on native flora and fauna and recreational activities

Issues

- Pest plants and animals can impact on adjoining properties and amenity, decrease biodiversity, and pose a fire risk
- Agency management of pest plants and animals at Lake Hawthorn has been minimal

Actions

30. Develop an integrated pest plant and animal control plan that includes Lake Hawthorn

3.9 Recreation and Tourism

Lake Hawthorn is an important local destination for passive recreational pursuits including walking and bird watching.

The Lake Primary School has been involved in developing an educational walking trail between Lake Hawthorn and the River Murray. With the support of Landcare funding, the school has worked towards establishing a trail that extends from Regina Avenue, Cabarita to the established tracks at Pump Hill, Merbein. Lake Hawthorn also supports a diverse array of birdlife. Lake Ranfurly and Lake Hawthorn are important sites for migrating waterbirds and waders or vagrant fauna moving through the area. Birdlife Mildura frequently visit Lake Ranfurly and Lake Hawthorn due to the diversity of birdlife.

Historically, the lake was a hub of activity for the local sailing club. The Lake Hawthorn Sailing Club (LHSC) was formed in the 1970s from an existing Scouts training operation at Lake Hawthorn. Club facilities are situated off Seventeenth Street and Dyar Avenue. Due to prolonged drought and other factors, sailing at Lake Hawthorn declined and in late 2013 the LHSC ceased to operate.

Lake Hawthorn has previously been used for speedboat racing and other powered boating activities, fishing, and swimming.

Lake Hawthorn will continue to be an ephemeral water body responding to the changing environment.

3.9.1 Aesthetics and Infrastructure

There are a number of factors affecting the recreation and tourism potential of Lake Hawthorn, including limited established walking trails surrounding the lake and a general lack of facilities and infrastructure to support community activity. The condition and presence of native vegetation such as black box and river red gums is poor and much of the surrounding foreshore is bare and degraded by salt (see Section 3.8). Improved management of riparian vegetation would improve habitat for flora and fauna and greatly enhance the visitor experience.

Investments in infrastructure to cater for visitors (shade, BBQ facilities, exercise stations, and toilets) were suggested during community consultations.

Objectives

- Improved aesthetics and standard of public infrastructure

Issues

- Extension of local walking trails
- Facilities and infrastructure to support and encourage community activity around the lake

- Revegetation and rehabilitation of salt-degraded land
- Changing amenity of the lake surrounds during changing seasons and drying and wetting phases

Actions

31. Investigate the possibility of a tracks and trails master plan for Lake Hawthorn linking with Mildura Tracks and Trail Strategy and the MRCC Public Open Space Strategy
32. Investigate the option to provide additional recreation (and associated infrastructure) 'spaces' at Lake Hawthorn
33. Seek funding to develop and implement a foreshore management plan to protect riparian vegetation, prevent erosion, and encourage the establishment of foreshore vegetation within the capabilities of the site (see action 26)

3.9.2 Boating

Transport Safety Victoria (TSV) is responsible for assisting waterway managers in their duties and auditing waterway management in Victoria (see section 3.2.1).

The Marine Safety Act 2010 (Vic) (MSA) commenced on 1 July 2012. The Act introduced a number of changes for waterway managers in Victoria. Before the Act came into operation TSV was the default waterway manager for un-managed waterways in Victoria. These are State waters that do not have a waterway manager appointed to them. Under the Act there is no default waterway manager.

State-wide rules apply to all waterways in Victoria. Lake Hawthorn is an un-managed waterway, therefore state-wide rules apply which include a 5 knot speed limit within 50 m of the shore. If a waterway manager is in place, exemptions, substitutions or modifications to state-wide rules to address local issues on specific waterways are permitted.

Waterway managers are appointed by the Minister for Ports (through Transport Safety Victoria) to regulate boating activity where the waterway would benefit from active management because of significant vessel activity and/or conflicting recreational activity. An assessment should be undertaken to determine if there is a need to establish a waterway manager for the lake.

Objectives

- To maximise opportunities that improve the management and safety of boating and on-water activities

Issues

- Boating safety
- No designated waterway manager
- Water quality impacts

Actions

34. Undertake an assessment of safe recreation possibilities and provide a recommendation on the need to establish a waterway manager for Lake Hawthorn

3.10 Health and Safety

It is assumed that if increased water levels can be maintained there will be increased recreational activity. There is no designated manager for the waterway, deep erosion gullies are evident around the lake, and residents are concerned about the impacts of odour and dust on public health.

3.10.1 Waterway Management, Erosion, Dust and Odour

An assessment and recommendation on the need to establish a waterway manager for Lake Hawthorn is required (see section 3.9). If powered boating activity takes place along with other on-water activity, hazards to users exist

along with other hazards associated with shallow water.

Erosion exists on private land with deep gullies and wash-aways most prevalent at the various drainage outfalls. These areas may pose a potential risk to the public.

Residents and the local community are also concerned about the possible impacts of odour and dust on public health, particularly when the lake is receding or dry.

Objectives

- To ensure health and safety of the public, users of the lake and surrounds, visitors and local residents

Issues

- No designated waterway manager and risks to health and safety (conflicting recreational use, submerged trees, navigation and shallow water)
- Erosion prone soil (health and safety risk associated with deep erosion gullies)
- Impacts of odour and dust on public health (during dry phase)

Actions

35. Undertake an assessment of safe recreation possibilities and provide a recommendation on the need to establish a waterway manager for Lake Hawthorn (see action 34)
36. Investigate options to stabilise erosion where it presents a risk to public safety
37. Investigate whether odour and dust are hazardous to public health

3.11 Amenity

Modification of the natural environment at Lake Hawthorn (including isolating the lake from the River Murray) to provide a discharge point for irrigation and stormwater drainage has significantly reduced the amenity and environmental value of the landscape.

The lake is subject to wet and dry phases. Residents and the local community are concerned about aesthetics and amenity at the lake, particularly when the lake is dry and/or receding.

Many communities established in close proximity to ephemeral water bodies experience the loss of amenity caused by lakes drying out during dry phases of the climate.

3.11.1 Odour, Dust and Insects

During summer when water levels recede, a strong odour can be emitted from the lake. The odour is at least partially caused by volatilisation of natural inorganic and organic sulphur compounds in the exposed sediments. The large area of fine sediment and poor vegetation cover when the lake is dry also creates a dust hazard. The local community who live near the lake are concerned about the unpleasant odour during the drying phase and the impacts of odour and dust on public health and economic development.

Drying lakes and shallow water provide habitat for breeding midges and mosquitoes that can swarm in large numbers in favourable conditions. These insects can cause an amenity hazard, particularly since they are attracted to residential areas by artificial light.

Objectives

- To improve amenity at Lake Hawthorn

Issues

- Odour during the drying phase and dust when the lake is dry impacting on local residents
- The unpredictable nature of odour events

Actions

38. Identify the cause/mechanism for odour and dust during the drying phase and relative contributions of Lake Hawthorn, East Ranfurly and West Ranfurly
39. Prepare a communications plan to advise the community of potential amenity impacts during drying phases (odour, dust, insects)

Appendices

Appendix A - Agency Roles and Responsibilities

Note: The actions listed below do not appear in any order of priority.

Action Number	Action
1.	Establish an inter- agency Implementation Group to guide the implementation of the plan, public communications and future development decisions
2.	Explore the possibility of funding a Project Manager, initially for a 12 month period, to work with the Implementation Group and drive the initial implementation and monitoring of the plan
3.	Establish a Lake Hawthorn Consultation Group of relevant community stakeholders
4.	Develop Terms of Reference and roles and responsibilities for the Implementation Group - terms of reference to include principles of integrated management, collaboration, and a partnership approach to funding applications and accountability for the implementation of high- priority actions
5.	Develop an evaluation framework to review the implementation of the plan
6.	Investigate and evaluate options regarding the transfer of the lake footprint and surrounds to a single agency manager
7.	Investigate transfer of management of college leased land below the high water mark and riparian buffer for public benefit
8.	Conduct detailed technical investigations to determine the salt and groundwater impacts on Lake Hawthorn if changes to the operating rules are proposed
9.	Undertake a technical investigation of impacts of different outfall options
10.	Conduct a risk assessment into risk of flooding and controls (stormwater inflows)
11.	Pending the results of the technical investigations (Actions 8, 9 and 10), explore options for altering Lake Hawthorn outfall operations/management
12.	Pending the results of the technical investigations (Actions 8, 9, 10 and 11), determine appropriate new operating rules and maximum water level, taking into account infrastructure, impacts on private land, and flood risk/flows
13.	If technical investigations (Actions 8, 9, 10 and 11) lead to an unchanged management regime, investigate technical and cost implications to operate and refurbish the GMW pump station and diversion assets
14.	Investigate infrastructure capacity and/or options for delivering environmental flows to Lake Hawthorn
15.	Continue to maximise stormwater inflows to Lake Hawthorn where able
16.	Review the Sunraysia Drainage Strategy (2002), in particular maximising current and future inflow volumes to Lake Hawthorn and maintaining a whole of catchment approach to management of drainage in the region
17.	Co-ordinate an integrated water quantity and quality monitoring, evaluation and reporting strategy for Lake Hawthorn aligned with the proposed use of the lake

Action Number	Action
18.	Investigate lake sediments to determine if current and historical agricultural runoff could be a hazard to public health.
19.	Seek funding to implement recommendations relating to revegetation and water quality in the Regional Catchment Strategy (RCS) and the Mallee Waterway Strategy 2014-22 that relate to land use and tributaries in the catchments to Lake Hawthorn
20.	The impact of unsewered development on Lake Hawthorn must be considered during development approval
21.	Co-ordinate an integrated water quantity and quality monitoring, evaluation and reporting strategy for Lake Hawthorn aligned with the proposed use of the lake
22.	Continue to maximise stormwater inflows to Lake Hawthorn where able
23.	Continue to ensure a coordinated and whole of catchment approach to the management of drainage in the region
24.	Agencies to work closely with the local Aboriginal communities to identify and protect significant and sensitive cultural heritage sites during works
25.	In partnership, develop a program to increase community appreciation of Aboriginal cultural heritage at Lake Hawthorn
26.	Seek funding to develop and implement a foreshore management plan to protect riparian vegetation, prevent erosion, and encourage the establishment of foreshore vegetation within the capabilities of the site
27.	In line with the national Recovery Plan for the Murray hardy head, explore the possibility of returning the Murray hardy head to Lake Hawthorn
28.	Consider the impact of any activities or works on the health and distribution of <i>Ruppia megacarpa</i> (seagrass.)
29.	In line with the Loddon Mallee North Regional Growth Plan, seek funding to protect and improve the condition of environmental and cultural heritage assets including wetlands of national and international significance
30.	Develop an integrated pest plant and animal control plan that includes Lake Hawthorn
31.	Investigate the possibility of a tracks and trail master plan for Lake Hawthorn linking in with Mildura Tracks and Trail Strategy and the Mildura Rural City Council Public Open Space Strategy
32.	Investigate the option to provide additional recreation (and associated infrastructure) 'spaces' at Lake Hawthorn
33.	Seek funding to develop and implement a foreshore management plan to protect riparian vegetation, prevent erosion, and encourage the establishment of foreshore vegetation within the capabilities of the site
34.	Undertake an assessment of safe recreation possibilities and provide a recommendation on the need to establish a waterway manager for Lake Hawthorn
35.	Undertake an assessment of safe recreation possibilities and provide a recommendation on the need to establish a waterway manager for Lake Hawthorn
36.	Investigate options to stabilise erosion where it presents a risk to public safety
37.	Investigate whether odour and dust impact are hazardous to public health
38.	Identify the cause/mechanism for odour and dust during the drying phase and relative contribution of Lake Hawthorn and East Ranfurly and West Ranfurly

Action Number	Action
39.	Prepare a communications plan to advise community of potential amenity impacts during drying phases (odour, dust and insects)

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Appendix B - Summary of Community Consultation

Preparation of Draft Plan

A Project Reference Group has been established to provide advice and feedback on various issues, including consultation activities and findings, and development of the plan.

The PRG comprises:

- Ivan McKenzie (Mildura Rural City Council)
- Belinda Fitzgerald (Mildura Rural City Council)
- Fiona Murdoch (Lower Murray Water)
- Deidre Jaensch (Mallee Catchment Management Authority)
- Paul Saunders (Goulburn Murray Water)
- John Ginnivan (Pat Feehan Consulting)

The PRG is used to test the aims and approach of each phase of consultation prior to broader community consultation. This allows for changes or refinements in the approach, based on local knowledge, before the commencement of each phase. The Project Control Group (PCG) oversees the overall delivery of the project. This group includes a senior representative from MRCC, LMW and GMW.

Consultation Round 1

Consultation Round 1 included:

- An agency focus group (12 attendees)
- 10 agency interviews (MRCC, GMW, LMW, MCMA, DEWLP, DPC, MSV, Parks Vic, Sandhurst Trustees, MDFRC)
- 4 “Have a Say” sessions involving 88 attendees
- 3 community interviews
- Online survey (70 responses)

Appendix C - Operation of the Lake

Lake Hawthorn has three functions:

- A drainage detention pondage
- An evaporative capacity
- A diversion control (for urban stormwater and tile drainage flows)

Lake Hawthorn pump station (three electrical centrifugal pumps) has a combined capacity of 54 ML/day. Usually only two pumps are operated at any given time due to the inability of the pumped outfall drain to Wargan Basins to contain flows above 40ML/day.

The pumps lift the Lake Hawthorn waters 17m (via a 600mm diameter rising main and an earthen drain) into the Wargan Disposal Basins located 17kms inland. The total pumping head is about 27m when pipe friction is considered.

The Wargan disposal basins have a capacity of 11,300 ML with a surface area of 690 Ha. The evaporation potential of Lake Hawthorn and the Wargan Basins is 10,500 ML/year. The Lake Hawthorn FSL is 35.50m AHD (corresponding storage is 4802 ML and the surface area is 224 Ha). The minimum pump drawdown level in Lake Hawthorn is 34.25m AHD (corresponding storage is 2295 ML and the surface area is 176 Ha).

A drain with a maximum capacity of 95 ML/day enables stored volumes in Lake Hawthorn to gravity outfall into the River Murray. With Lake Hawthorn at 35.32m the outfall drain flow is 95 ML/day (with a River Murray Flow of 96,000 ML/day). With Lake Hawthorn at 34.25m the outfall drain flow is 40 ML/day (with a River Murray Flow of 65,000 ML/day).

Lake Hawthorn Outfall and Diversion Operating Rules can fall into three components:

1. Lake level management via pumped diversion operation

- At 35.51 m AHD Lake Hawthorn commences spilling over the outfall regulator into the River Murray
- At 33.60m AHD - the gravity outfall ceases to flow into the River Murray
- At 34.55 m AHD - Pump 1 commences a diversion operation into Wargan Basins
- At 34.85 m AHD – Pump 2 commences an additional diversion operation into Wargan Basins
- At 34.52 m AHD – Both Pump 1 and Pump 2 cease diversion operation

2. Lake level management via gravity releases from the outfall regulator

Lake levels can also be managed with gravity releases via the outfall regulator when certain conditions are met. These conditions include:

- The River Murray flow at Mildura must exceed 15,000 ML/day
- The River Murray salinity at Merbein must be less than 420 EC
- The MDBA approves each gravity release event utilizing the outfall regulator

3. Lake Level management in emergency events

High intensity local rainfall events can generate significant urban drainage volumes that require the commencement of a gravity outfall event to the River Murray. In such instances the MDBA must be contacted in regard to outfall responses to emergency rainfall events.

Appendix D - Map of Lake Hawthorn

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Appendix E - Glossary

AAV	Aboriginal Affairs Victoria
CoM	Committee of Management
DELWP	Department of Environment Land Water and Planning
Ephemeral	A water body that dries out for short or long periods of time
GMW	Goulburn Murray Water
LMW	Lower Murray Water
MCMA	Mallee Catchment Management Authority
MRCC	Mildura Rural City Council
FFG	Flora and Fauna Guarantee Act
EPBC	Environment Protection and Biodiversity Conservation Act

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