RIVER MURRAY ACT 2003
ANNUAL REPORT 2009 – 2010
SUPPORTING DOCUMENT

Prepared for the South Australian Parliament by the Minister for the River Murray

Department for Water – September 2010

Government of South Australia

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CONTRIBUTING PROGRAMS AND PROJECTS

A range of government agencies have responsibilities to contribute towards achieving the objects and objectives of the *River Murray Act 2003* (SA). Agencies were asked to nominate current programs and projects that were relevant and to describe the achieved outcomes. Projects were often collaborations with other agencies, the community or scientific groups.

Agencies nominated projects for which they were either the lead or a major partner.

Projects and programs are listed under the relevant lead agency and grouped against the four key objectives for a healthy River Murray.

- River Health;
- Environmental Flows;
- Water Quality; and
- The Human Dimension.

CONTENTS

1. SOUTH AUSTRALIAN MURRAY-DARLING BASIN NATURAL RESOURCES MANAGEMENT BOARD

In relation to the *River Murray Act 2003* (SA) (the RM Act), the South Australian Murray-Darling Basin Natural Resources Management (SA MDB NRM) Board implements a range of relevant programs and projects under the direction of its Regional Natural Resources Management plan and associated sub-plans.

1.1. RIVER HEALTH

1.1.1. COMMUNITY WETLAND PROGRAM

Community groups and Local Action Planning Groups (LAPs) are being supported to develop and implement wetland management plans for high value wetlands within the SA MDB NRM Region.

In 2009-10, seven wetland management plans were completed and 25 community groups actively participated in wetland management. On-ground works were funded to improve wetland hydrology including water control structures, box culvert structures and carp screens. Technical advice was also provided on best management practices for wetlands. Community monitoring programs were also developed with assistance and training provided in monitoring techniques, analysis, interpretation of data, and data storage requirements.

1.1.2. COORONG, LOWER LAKES AND MURRAY MOUTH (CLLMM)

The CLLMM is one of six sites in the Murray-Darling Basin identified as a Living Murray Icon Site (Icon Site) by the Murray-Darling Basin Authority (MDBA).

A range of projects have been funded to ensure appropriate management of the region, including areas with high ecological value and areas requiring remediation due to historically low water levels in the Lower Lakes.

1.1.3. COORONG & LOWER LAKES RAMSAR ON-GROUND WORKS PROJECT

This project involves habitat protection and enhancement of the Ramsar section of the Lower Lakes. In 2009-10, the dune systems and lake surrounds were protected through fencing, re-vegetation and woody weed removal. This included: 23 hectares of weed removal; 24,600 tube-stock planted; 10.35 hectares of direct seeding; and 6.3 kilometers of fencing. Goolwa to Wellington LAP and landholders were partners in the project.

1.1.4. LOWER LAKES BIOREMEDIATION AND RE-VEGETATION PROJECT

This project involves extensive rehabilitation of sections of the Lower Lakes which are now no longer naturally inundated. Works for 2009-10 included constructing fences to exclude stock from the lake bed, pest plant and animal surveys and revegetation programs.

1.1.5. CLLMM ICON SITE CONDITION MONITORING PROGRAM

The Living Murray monitoring program, undertaken in collaboration with SARDI, tracks progress against a series of 17 ecological targets. Monitoring undertaken includes aquatic vegetation, threatened fish, water-bird and invertebrate monitoring. The monitoring informs on-ground management including the provision of environmental flows and installation of infrastructure such as culverts. All information is collated into an annual report on the condition of the Icon Site for the MDBA.

1.1.6. LOWER LAKES VEGETATION CONDITION MONITORING

The first year of a Lower Lakes vegetation condition monitoring program was completed in collaboration with SARDI. The monitoring will evaluate the target *maintain aquatic and floodplain vegetation (Lower Lakes)* established in the Environmental Management Plan.

Initial results show that the target has not yet been met for understorey vegetation. However, a key species *Melaleuca halmaturorum,* has not declined in area and has shown capacity to recruit indicating that its populations are probably self sustaining.

1.1.7. SEED BANK ASSESSMENT OF DUNN'S AND SHADOW'S LAGOONS

In collaboration with SARDI, Dunn's and Shadow's Lagoon had their submergent seed banks assessed to determine if there was in situ potential for regeneration of aquatic plant communities and the specific response to salinity. These lagoons have been dry due to low lake levels but are recognised for their conservation value.

Results suggest both wetlands have the capacity to recover under hydrological restoration because they both have a submergent plant seed bank and the species present reproduce asexually and under favourable conditions can rapidly expand their distribution once they reach maturity. Results also suggest that the source of the environmental water is not important because there was no significant difference between salinity treatments.

1.1.8. BARRAGE FISHWAY MONITORING PROGRAM AND CONGOLLI TRACKING

The research project, undertaken in collaboration with SARDI, examined the levels of fish passage from the lakes to the estuary. The barrages are a major barrier to fish passage and migration in the Lower Lakes and Murray Mouth region. Large adult female Congolli (*Pseudaphritis urvillii*) have been tagged and tracked as they travel in the Goolwa channel and Lake Alexandrina region. The monitoring program has led to the development of a water bid for 2010-11 for a release of water through the Goolwa barrages.

A key finding was that the number of migrating fish was significantly reduced compared to 2006-07 when freshwater was released into the Coorong.

1.1.9. LAKE ALEXANDRINA, LAKE ALBERT AND TRIBUTARIES- SOUTHERN BELL FROG CENSUS

The project involves identifying and monitoring populations of the nationally vulnerable Southern Bell Frog which have survived the drought. Nocturnal surveys were undertaken utilising call recognition, call playback and spotlighting. There was also follow up tadpole monitoring. Monitoring the populations will assist with managing them in the long term.

1.2. ENVIRONMENTAL FLOWS

WATER ALLOCATION PLANNING

The SA MDB NRM Board in accordance with the *Natural Resources Management Act 2004* (SA) (NRM Act) is responsible for developing Water Allocation Plans (WAPs) for the prescribed water resources in the Board's region in partnership with the Department of Water, Land and Biodiversity Conservation (DWLBC), now the Department for Water (DFW).

1.2.1. WATER ALLOCATION PLAN FOR THE RIVER MURRAY

A cross agency project is currently underway to develop a detailed systems understanding of the environmental watering requirements of the ecological assets of the River Murray. It will also examine the best way to provide for these requirements through the WAP.

The development of a revised WAP for the River Murray has been delayed so it can be informed by the Basin Plan and to ensure that it is consistent with the Basin Plan. The WAP will also need to be accredited by the MDBA.

1.2.2. WATER ALLOCATION PLAN FOR THE EASTERN MOUNT LOFTY RANGES

The Eastern Mount Lofty Ranges (EMLR) is a critical water catchment for the State. A draft WAP for the region was developed in 2009-10 in collaboration with DWLBC (now DFW); and is due to be released for public consultation in 2010-11.

The environmental flow requirements of the systems of concern are being determined through the use of expert panel and scientific monitoring. The plan will outline policies regarding take, use and transfer of water and other relevant management activities.

1.2.3. RESTORING ENVIRONMENTAL FLOWS AND CONNECTIVITY

A key focus has been to examine strategies for improving environmental flows under regimes of low flow. Initiatives include weir pool raising, floodplain management programs using environmental regulators and dedicated environmental watering to high priority sites. A major emphasis has also been on watering to protect threatened species and prevent the occurrence of acid sulfate soils.

1.2.4. WEIR POOL MANIPULATION PROJECT

The objectives of the weir manipulation project are to:

- Increase in-channel water level variability to improve diversity of native riparian vegetation.
- Create temporary seasonal habitats for aquatic flora/fauna, and increase aquatic productivity.
- Improve the watering regime of low level wetlands and floodplains, including nationally and internationally significant sites.
- Provide additional feeding, breeding and recruitment opportunities for flood dependent plant and animal species.

- Improve the connectivity of the river and its floodplain and wetlands and increase the transfer and cycling of energy and nutrients.

The project focused on investigations in the 2009-10 year as there were insufficient flows to facilitate weir pool manipulations.

1.2.5. VEGETATION MONITORING OF RIVER MURRAY WETLANDS DOWNSTREAM OF LOCK 1

The project involved monitoring changes in the understorey plant community in six dry wetlands located downstream of Lock 1 (Mannum Swamps, Lake Carlet, Caurnamont, Wongulla, Devon Downs and Noonawirra) and the adjacent main channel between Spring 2008 and Autumn 2009. Wetlands have been dry due to low inflows in recent years. The study also assessed the condition of *Eucalyptus camaldulensis* trees growing on the associated floodplain for the same period.

Draw down and complete drying of the wetlands surveyed has resulted in the loss of submergent and floating species from the historically inundated areas and recruitment of terrestrial species. Species that were lost from the wetlands were observed in the main channel, albeit in much lower numbers; therefore, the main channel is probably a refuge. As a result it may be an important source of plant propagules when the wetlands refill, however, it does not fulfill the ecosystem services previously supplied by the wetlands. SARDI was a partner on the project.

1.2.6. INFLUENCES OF SALINITY, WATER QUALITY AND HYDROLOGY ON EARLY LIFE STAGES OF FISHES IN THE LOWER RIVER MURRAY

In collaboration with SARDI, this project examined the influences of salinity, water quality and hydrology on the early life history of fishes in the Lower River Murray. The project comprises three key components: a literature review, which provides the most up to date and comprehensive review of salinity tolerances and water quality/habitat requirements for selected native and exotic fish species in the Murray-Darling Basin; laboratory studies; and field surveys.

1.2.7. ENVIRONMENTAL WATER REQUIREMENTS OF THE ECOLOGICAL ASSETS OF THE RIVER MURRAY IN SA

This project was completed in 2009-10 and the findings were used to develop a SA Government response to a MDBA discussion paper regarding the environmental flow requirements of the major floodplains along the River Murray in SA.

1.2.8. REVIEW OF MURRAY MOUTH SCHEMES

Two studies were commissioned to review the effectiveness of the Murray Mouth dredging program in relation to keeping the mouth open. The first study undertaken by Flinders University, quantified through modelling, the ecological benefit of dredging the Murray Mouth. The second study, conducted by BMT WBM Engineering and Environmental Consultants, reviewed and compared schemes and options for maintaining an open Murray

Mouth. These studies identified that dredging was still the most effective and economically efficient option.

1.2.9. ENVIRONMENTAL WATERING

Environmental water (93 GL) was secured for South Australian priority sites in 2009-10. Additional inflows into SA led to the provision of 26 GL for Lake Bonney and 418 GL for the Lower Lakes.

Environmental water was provided to a number of high priority wetland sites as directed by the South Australian River Murray Environmental Watering Framework 2008-13 including:

- Lake Albert
- 3 Lower Lakes wetlands
- 11 Chowilla wetlands
- 19 other wetlands.

Sites were selected based on the following principles and criteria:

- Sustain small, critical refuge areas for native plants and animals
- Maintain critical connectivity between sites
- Protect previous investments in environmental watering
- Avoid loss of species
- Avoid irreversible damage or catastrophic events
- Provide drought refuge.

The environmental water was targeted to sites to protect and enhance the populations of nationally significant species such as Southern Bell Frog, Murray Hardy-head, Southern Pigmy Perch, Purple-Spotted Gudgeon and an aquatic plant species *Ruppia tuberosa*. Environmental watering also contributed to the protection of the Lower Lakes from acidification.

The ecological response to the watering was significant and shows that the watering is vital for the protection, maintenance and enhancement of riverine biodiversity including:

- River Red Gum, Black Box and River Coobah at Chowilla responding to the watering with an increase in canopy growth and new saplings;
- Increased numbers of Southern Bell Frog calls and tadpoles being observed at many wetlands;
- Endangered fish populations of Murray Hardy-head protected at Boggy Creek,
- Regent Parrot habitat watered at Hogwash Bend; and
- Many pairs of Black Swans building nests at the Markaranka Wetland.

1.2.10. FLOODPLAIN MANAGEMENT

Three sites within the SA MDB NRM Region are high value floodplain sites and are the focus of floodplain rehabilitation programs- Chowilla, Pike and Katarapko Floodplains.

1.2.11. CHOWILLA FLOODPLAIN ICON SITE

Chowilla is one of six sites in the Murray-Darling Basin identified as being an Icon Site and; it is also part of the Riverland Ramsar Wetland.

An environmental watering project has been in progress on the Chowilla Floodplain since 2004. The environmental watering project has resulted in many positive outcomes for the floodplain, such as breeding events for many frog species, including the Southern Bell Frog. Thousands of water birds used wetland and floodplain sites for drought refuge, feeding and breeding. In addition, vegetation responded strongly, temporarily reversing the decline of many River Red Gums, River Coobah and Black Box trees and re-establishing flood-dependent wetland understorey species.

Significant funding has been received ($40 Million) to install and modify environmental regulators with constructions commencing in January 2010. These will improve the ecological health of up to a third of the floodplain using comparatively small volumes of environmental water. The program is funded through The Living Murray program.

1.2.12. CHOWILLA FISH ECOLOGY PROJECT

This project undertaken in collaboration with SARDI investigates the ecology of fish and fish assemblages in the Chowilla Anabranch and adjacent River Murray. In 2009-10 it involved:

1) Spawning and movement of Murray Cod;
2) Impact of altered flows on the fish movement and spawning behavior of Murray Cod and Golden Perch;
3) Condition Monitoring of 22 sites.

These studies will contribute to ongoing management, including helping to define targets within the Chowilla Asset Environmental Management Plan.

1.2.13. AN EVALUATION OF THE CHOWILLA CREEK ENVIRONMENTAL REGULATOR ON FLOODPLAIN UNDERSTOREY VEGETATION

This project undertaken in collaboration with SARDI assesses the likely vegetation response to the Chowilla environmental regulator based on long term monitoring and spatial modelling. The project found that regulated flooding will improve the condition of understorey vegetation in areas inundated by the regulator and increase the area of the littoral zone (especially at the western end of the floodplain where the regulator has the greatest effect).

1.2.14. PIKE AND KATARAPKO FLOODPLAINS

For the Pike and Katarapko floodplains, detailed monitoring and investigations have been undertaken to monitor the health of the sites and determine the appropriate management strategies required to rehabilitate and protect the floodplains. Funding submissions have also been developed for rehabilitation programs under the Commonwealth Government's Water for Future program. Community ownership for these two projects is high with local groups involved with monitoring and developing funding submissions.

1.2.15. MANAGEMENT ACTION DATABASE

A management action database is being developed to store ecological data and enable effective and transparent management and accountability of environmental water.

1.2.16. FISH HABITAT ASSESSMENT IN THE LOWER RIVER MURRAY

The project undertaken in collaboration with SARDI involved identifying priority areas in terms of fish habitat. Priority habitats were identified based on fish diversity and presence of protected or listed species under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth). The information collected has been developed into a database which can be used to view details about different locations.

The database will be useful for prioritising reaches for rehabilitation or protection. This study provides a good starting point for selecting freshwater protected areas or areas for habitat rehabilitation or revegetation.

1.2.17. INTEGRATED PEST MANAGEMENT FOR CARP IN THE MURRAY-DARLING BASIN – BRENDA PARK WETLAND

This project undertaken in collaboration with SARDI involved assessing the impact of removing Carp. This wetland has historically supported a large population of Carp – in 2002 7.2 tonnes of Carp were removed from Brenda Park during a managed drying event. Experimental plots have been constructed in 15 locations within three key habitat types within the wetland.

Fish, water quality, macro-invertebrate and aquatic vegetation sampling occurred during November 2009 and April-May 2010. Some promising preliminary results can be seen, with obvious differences in vegetation and macro-invertebrates across the fully fenced enclosure plots compared to partially fenced and unfenced control plots.

1.3. WATER QUALITY

1.3.1. LIMESTONE TOXICITY TRIALS FOR HARDY-HEADS

This project involves determining whether there are any toxic side effects to small bodied fish from limestone used for acid sulfate soil remediation. Results will determine which types of limestone and concentrations of limestone are safest when used in aquatic environments known to host small bodied fish such as the Murray Hardy-head. Hardy-head are a threatened fish species.

1.3.2. COMMUNITY LAND & WATER MANAGEMENT PLAN INITIATIVES

Land and Water Management Plans (LWMPs) are locally based plans identifying strategies to protect the key assets of the region with a major focus on managing and minimising the salinity impacts on the River Murray. The LWMPs have a high level of community ownership and community groups receive significant support from government agencies to develop and implement plans.

In 2009-10 the Bookpurnong to Lock 4 LWMP was upgraded. The upgrade provides the first evidence that improved management of the region has reduced groundwater levels and risk of salt intrusions into the River Murray. Taylorville North and Pyap to Kingston on Murray LWMPs are also in the process of being upgraded.

1.3.3. IMPROVING IRRIGATION EFFICIENCY PROJECT

In 2009-10 17 irrigation management training workshops were held with over 230 irrigators participating. Workshops aimed to provide irrigators with increased capacity to improve their irrigation management, focusing on topics such as root zone salinity management and improving the capacity to monitor and interpret soil and water data in order to better schedule irrigation events.

1.3.4. COMMONWEALTH WATER FOR THE FUTURE PROGRAM

This is a major on-farm efficiency project receiving in principle funding with $1.6 million worth of works planned. The project will result in 0.7 GL of water being saved and returned to environmental flows.

An application for upgrading both off-farm and on-farm infrastructure was also submitted during 2009-10.

Both projects involve providing significant support to irrigators to develop applications and identify potential savings. As part of the project, water use efficiency plans have also been developed. DWLBC (now DFW) has also provided technical support to the projects.

1.3.5. AUTOMATIC WEATHER MONITORING NETWORK

A regional automatic weather monitoring network was maintained and upgraded in 2009-10 in order to improve the capacity to schedule irrigations in the SA MDB NRM Region. Seven rainfall monitoring sites were upgraded to provide more regular data.

Please refer to: www.samdbnrm.sa.gov.au/Portals/7/AWMN/awsview.php

1.3.6. CLIMATE CHANGE IMPACTS ON IRRIGATION IN THE SA MDB NRM REGION

The project involves examining strategies to allow irrigators to adapt to future climate change. A series of workshops were held in the region and a report released. The report provides information on what impacts potential future climate change scenarios will have on different crop types and different locations in the SA MDB NRM Region.

1.3.7. PROJECTS TO REDUCE NUTRIENT AND SEDIMENT INPUT INTO THE RIVER MURRAY

A range of projects were developed and implemented in 2009-10 in order to reduce nutrient, sediment and pesticide loading into the River Murray. Stormwater and wastewater treatment was a key focus. The projects also improve water use efficiency and hence water security and the local amenity of the region.

A partnership was developed with nine local councils with $1.6 million in funds received for developing water related development policy, Integrated Water Resource and Water Conservation Plans.

A sustainable dryland farming program was implemented to improve soil management and reduce erosion through improved crop management practices in the River Murray catchment. Buffer zones were also created along watercourses and river frontages were fenced off to stabilize soils and reduce the incidence of erosion. Such programs were implemented in collaboration with LAPs and the Environment Protection Authority.

1.4. HUMAN DIMENSION

A number of the board's programs engage with indigenous groups.

1.4.1. ABORIGINAL PARTNERSHIPS PROJECT

Aboriginal Learning on Country Trainee Teams and Working on Country Rangers have been employed to undertake on-ground works and monitoring on the Riverland Ramsar site and the Katarapko Creek at Gerard. On-ground works include pest plant and animal control and revegetation. The project will result in the establishment of large areas of vegetation which will provide connectivity between the floodplain and Mallee habitats at Calperum station.

Support is also being provided to Aboriginal land managers along the River Murray to develop management plans and access funding to protect and restore riverine, floodplain and wetland habitats.

1.4.2. INDIGENOUS FACILITATORS

Indigenous facilitators are employed to form a link between the government and community for the River Murray Icon sites project (Chowilla, CLLMM). In 2009-10 the indigenous facilitators assisted with consultation and management of the sites. A report on the importance of native plants and animals of Chowilla to indigenous communities was written.

1.4.3. LOWER LAKES AND COORONG ORAL HISTORY PROJECT

The project is collecting oral histories and local natural resource management knowledge for the Coorong and Lower Lakes region in conjunction with the Goolwa to Wellington LAP. A system is being developed to allow easy storage and access of information including locating information spatially via GIS.

1.4.4. LOCAL ACTION PLANNING

LAPs (11 Groups) continued to engage extensively with the community across the region to gain active community participation in local NRM programs.

Such groups engaged their members in 2009-10 in a number of programs including wetland management, pest plant and weed control, biodiversity, climate change, and irrigation efficiency.

1.4.5. NATURAL RESOURCE MANAGEMENT SCHOOLS EDUCATION

Schools have been actively engaged in learning about River Murray issues and participating in community monitoring programs such as Waterwatch. The Natural Resource

Management Education project has also facilitated Upper and Lower Murray River Youth Councils to actively engage youth in the management of the River.

The Weed Warriors program has been run with schools and has involved the release of biological control agents to combat Weeds of National Significance in the River Murray corridor.

1.4.6. DROUGHT RESPONSE

The community have been actively involved in the monitoring of 29 managed wetlands which were closed in previous years in order to save water. The six permanent wetlands which have been temporarily disconnected (including Lake Bonney) were also closely monitored.

2. DEPARTMENT OF ENVIRONMENT AND HERITAGE

The Department of Environment and Heritage (DEH) (now the Department for Environment and Natural Resouces (DENR)) has responsibilities in relation to the *River Murray Act 2003* (SA) (the RM Act) to manage extensive areas of land as directed by the *National Parks and Wildlife Act 1972* (SA) and *Crown Land Management Act 2009* (SA). The department is also required to manage native vegetation through the *Native Vegetation Act 1991* (SA). It also protects natural heritage through the *Heritage Places Act 1993* (SA).

2.1. RIVER HEALTH

2.1.1. CONSERVATION PARK MANAGEMENT PLANS

A number of conservation park management plans have been implemented within the South Australian Murray-Darling Basin. Major programs implemented included weed and pest control, revegetation and visitor management programs.

New management plans are also in preparation for other reserves within the region, including Billiatt Conservation Park; Billiatt Wilderness Protection Area; Karte Conservation Park; Peebinga Conservation Park; Danggali Conservation Park; Danggali Wilderness Protection Area; Chowilla Regional Reserve; and Chowilla Game Reserve.

2.1.2. EMERGENCY INTERVENTIONS IN LOWER LAKES TO ADDRESS ACIDIFICATION

Emergency interventions have been implemented in the Lower Lakes in order to protect the remaining ecological character of the site. This has included aerial seeding and planting of lake beds exposed by falling water levels. This will generate vegetation cover which will reduce wind erosion, incorporate organic carbon into the soil and counter acidification.

Ultra fine limestone was placed across the mouth of Currency Creek and at locations in the lower Finniss River to neutralise acidifying water bodies.

As part of the Goolwa Channel Water Level Management Project, temporary regulators were constructed across the Goolwa Channel near Clayton and lower Currency Creek, and 27 GL of water was pumped from Lake Alexandrina into the Goolwa Channel. In addition, approximately 90 GL of water was pumped into Lake Albert from Lake Alexandrina via the Narrung Bund. These actions have prevented further acidic materials from forming and provided an additional source of alkalinity to buffer acidic inputs to the water body.

2.1.3. KATARAPKO ECKERT CREEKS DEMONSTRATION REACH FOR NATIVE FISH (KATFISH REACH)

Katarapko is a ‘demonstration reach’ where integrated actions are being taken to improve river health and native fish populations across a significant area. The project involves a number of floodplain, waterway and wetland hydrological, fish passage and habitat management options.

In 2009-10 in collaboration with SARDI and the community, programs were established for monitoring the impact of specific flow interventions on fish populations. The monitoring involves 24 locations across the anabranch system over two years with the first survey having been undertaken this year.

2.1.4. COORONG, LOWER LAKES AND MURRAY MOUTH (CLLMM) LIVING MURRAY ICON SITE

Extensive research was carried out during the year to investigate ways to address the hyper saline condition of the south lagoon of the Coorong. One option being considered is pumping hyper saline water from the lagoon out to sea, combined with improvements to the drainage of surface water from the Upper South East back into the lagoon, emulating pre-European conditions.

2.1.5. AQUATIC AND LITTORAL VEGETATION MONITORING OF GOOLWA CHANNEL

This project aims to assess the impact of the Goolwa Channel Water Level Management Project on the aquatic and littoral plant communities of the Goolwa weir pool.

The results showed that higher water levels have resulted in a change from terrestrial species to aquatic species in the Goolwa Channel and continued low water levels in Lake Alexandrina have resulted in colonisation by terrestrial species of the exposed lakebed. Furthermore, results from this study and the seed bank assessment show that the system is resilient and the aquatic plant community has the capacity to recover when historical water levels are reinstated.

2.1.6. AQUATIC AND LITTORAL VEGETATION OF THE MURRAY RIVER DOWNSTREAM OF LOCK 1, THE LOWER LAKES, MURRAY ESTUARY AND COORONG. A LITERATURE REVIEW

The purpose of this literature review, undertaken in collaboration with SARDI, is to identify specific drivers of the system, key knowledge gaps, the potential recovery of the system when freshwater flows return and to contribute towards acid sulfate soil remediation.

The literature found that despite being highly modified the River Murray region is important because it is an aquatic system in an otherwise dry environment and contributes to regional and state biodiversity because a completely different suite of species is often present compared to the adjacent highland.

The River Murray downstream of Lock 1, Lower Lakes, Murray Estuary and Coorong has undergone further changes in recent years due to the combination of drought and water abstraction with changes to more salt tolerant fringing species and loss of submergent species and amphibious species

Nevertheless, the system has showed that it is resilient and currently has capacity for recovery. Water level rises as part of Goolwa Channel Water Level Management Project have resulted in recolonisation of submergents and growth of fringing species in Goolwa Channel. How long the system can remain resilient is unknown.

2.1.7. PERPETUAL LEASE ACCELERATED FREEHOLDING PROJECT

The project seeks to return (where possible) high conservation value wetland areas to the Crown to improve land management of these areas including removal of grazing. A total of 103 new fixed waterfront boundaries with a width of 50 metres or greater have now been established under this project with 17 left to be finalised over the coming 12 months.

2.1.8. RIVERLAND RAMSAR SITE MANAGEMENT PLAN

The Commonwealth Department of Environment, Water, Heritage and the Arts has accepted the Riverland Ramsar Wetland Ecological Character Description after being reviewed by the Ramsar Wetland Expert Panel. The descriptor outlines the ecological condition of the site at the time of listing (1987) and any changes since then.

2.1.9. THREATENED RIVER MURRAY FAUNA RECOVERY PROGRAM

The Threatened River Murray Fauna Recovery Program is in its fifth year and includes preparing and implementing four recovery plans for priority species including the nationally listed Regent Parrot and Southern Bell Frog, and the regionally significant Carpet Python and Bush Stone-curlew.

The main focus during 2009-10 has been on-ground management for the Regent Parrot. The DEH Murraylands threatened species team has partnered with local action planning groups to restore Regent Parrot foraging and nesting habitat, targeting the largest known colony in SA at Hogwash Bend and also colonies at Swan Reach.

A long-term monitoring program has been established for the Bush Stone-curlew. The community continues to assist with the recovery of River Murray threatened fauna by reporting sightings of the Carpet Python and Regent Parrot.

2.1.10. DROUGHT ACTION PLAN FOR THREATENED NATIVE FRESHWATER FISH IN THE SA MURRAY-DARLING BASIN & CRITICAL HABITAT AND REFUGE FOR NATIVE FRESHWATER FISH

The River Murray below Lock 1 and the Eastern Mount Lofty Ranges contains the highest diversity of river/wetland fishes in the Murray-Darling Basin. Included in the region are five fish species that are found nowhere else in the Basin, and four species protected under State (*Fisheries Management Act 2007*) or Federal (*Environment Protection and Biodiversity Conservation Act 1999*) legislation.

Ongoing drought conditions and lowered lake levels threaten these fishes, with a possibility of local extinction, without intervention. A project was implemented in collaboration with PIRSA to collect fish species, undertake captive breeding and rehabilitate priority fish sites with revegetation and fencing.

Populations collected for captive breeding included Yarra Pygmy Perch (*Nannoperca obscura*), Southern Purple-potted Gudgeon (*Mongurnda adspersa*) and Murray Hardy-head (*Craterocephalus fluviatilis*).

2.2. WATER QUALITY

A key overarching component of the implementation of the CLLMM Long-Term Plan is ecological investigations and ongoing monitoring. A whole-of-site Ecological Monitoring Framework and Ecological Monitoring Plan are currently both under development.

2.3. HUMAN DIMENSION

2.3.1. FRIENDS OF RIVERLAND PARKS

The Friends of Riverland Parks with support from DEH undertook a range of on-ground monitoring and rehabilitation programs, including surveys of Regent Parrots, Bush-stone Curlews, Pythons, Possums, Kangaroos and Rabbits. The group also undertook feral animal baiting and re-vegetation programs in the Murray River National Park.

2.3.2. UPGRADE OF RIVER BOAT TRAIL

An upgrade of the River Boat Trail was completed along the River Murray from the Murray Mouth to the SA Border. This interpretation project includes 18 new signs at various points along the river as well as a new web-based product linked to the Discover Murray website.

2.3.3. COORONG COAST VULNERABILITY ASSESSMENT

The project involved assessing the vulnerability of the Coorong ocean coast to sea level rise. Three sea level scenarios were used. The project profiled the dunes and offshore area at 10 km intervals from the Murray Mouth to The Granites. This data was then used by Sydney University to calculate future erosion of the Coorong coast for each of the scenarios.

2.3.4. HERITAGE DIRECTIONS FUNDING

DEH (now DENR) has provided funding to the Alexandrina Council in 2009-10 as a contribution towards the Council's Local Heritage Incentive Scheme.

A grant of $25,000 was provided from the 2009-10 SA Heritage Fund to replace the roof of the Landseer building in Mannum.

Archaeological Permits under the *Heritage Places Act 1993* (SA) were also issued for a community archaeological project at the State heritage-listed William Randell Dry Dock at Mannum to assist in the future management of the Dry Dock.

2.3.5. INDIGENOUS ENGAGEMENT

The First Peoples of the River Murray and Mallee claimant group is finalising an Indigenous Land Use Agreement with the State Government over unallotted Crown land in the claim area. The group, together with the State Government and Berri-Barmera Council, is developing a Cultural Heritage Management Plan for Lake Bonney to ensure ecologically sustainable access to the lake and foreshore.

2.3.6. KUNGUN NGARRINDJERI YUNNAN AGREEMENT

Ngarrindjeri are the traditional owners of the region encompassing the lower Murray, and CLLMM. The State and the Ngarrindjeri Regional Authority (NRA) signed off on the Kungun Ngarrindjeri Yunnan Agreement (KNYA) in June 2009. The KNYA establishes a consultation and negotiation framework to support full participation of Ngarrindjeri in the planning and future management arrangements for the region. The agreement also enables Ngarrindjeri cultural beliefs to become integral to all planning and management.

2.3.7. CLLMM NGARRINDJERI PARTNERSHIPS PROJECT

The Ngarrindjeri Partnerships project is a key component of the CLLMM Long-Term Plan as it seeks to support capacity building within the NRA to enable full and informed participation in the CLLMM Program and a range of government-led environmental management projects that occur within the region.

The Ngarrindjeri Partnerships project supports aspirations documented in the Ngarrindjeri Nation Sea Country Plan, 2006. The capacity building within the NRA will support Ngarrindjeri in developing and implementing responsive and adaptable management arrangements in the CLLMM region that are culturally appropriate.

2.3.8. MARITIME HERITAGE PROGRAM

The Maritime Heritage Program managed by DEH protects and enhances community awareness of maritime heritage, including heritage along the River Murray.

2.3.9. MENINGIE LAKEFRONT HABITAT RESTORATION

Lakefront restoration is being undertaken adjacent to the township of Meningie. This will assist management of acid sulfate soils in the area, increase habitat for local species and provide improved amenity for the local community.

3. DEPARTMENT OF WATER, LAND AND BIODIVERSITY CONSERVATION

The Department of Water, Land and Biodiversity Conservation (DWLBC) (now the Department for Water (DFW)) is the department responsible for administering the *River Murray Act 2003* (SA) (the RM Act), including coordinating across other agencies and ensuring referral and compliance mechanisms are in place. It also administers and provides a South Australian position on a range of national initiatives including the National Water Initiative and is the lead agency for South Australian input into the Basin Plan, the Murray-Darling Basin Agreement and programs being undertaken by the Murray Darling Basin Authority (MDBA). The Department was also responsible for high level administration of the *Natural Resources Management Act 2004* (SA) (the NRM Act).

In relation to the RM Act, DWLBC (now DFW) also managed and operated an asset portfolio on behalf of the South Australian government.

3.1. RIVER HEALTH

3.1.1. MURRAY FUTURES – RIVERINE RECOVERY

Murray Futures aims to achieve long-term improvements in the health of the riverine environment between Wellington and the South Australian border. The project will enable the more effective use of water and support regional communities through an investment of up to $111.1 million over eight years.

The project is also linked to the Murray Futures Long-Term Plan for the Coorong, Lower Lakes and Murray Mouth (CLLMM), extending efforts to build resilience and address river health across the whole of the River Murray system in SA.

3.1.2. LEVEE BANK CRACKING INVESTIGATION PROJECT

The Levee Bank Cracking Investigation project was undertaken due to the drying and cracking of levee banks along the River Murray caused by the current drought. The project investigated:

- Current knowledge gaps such as the total length of the levee bank system between Mannum and Wellington.
- When (at what water level) and where do the levee banks actually connect to the River Murray (elevation mAHD) to advise DWLBC (now DFW) of priority areas for further investigation.
- The possibility of cracking beneath the levee banks linking the River Murray to the adjacent floodplain.
- The amount of water the floodplain soil could take up if the water level rises in the river channel.

This information will assist in the development of a remediation plan for both SA Government owned and private levee banks. This will assist in ensuring that flooding of the adjacent floodplains is prevented which, if it occurred, would lead to a loss of primary production. It will also ensure that water remains in the River Murray channel and is used for ecological purposes.

3.1.3. RIVER MURRAY FOREST PROJECT

The project aims to plant regionally native species along the River Murray in order to improve biodiversity and achieve carbon sequestration. An expansion in 2009-10 has aligned the project with the River Murray-Coorong Naturelinks Corridor. Expansion provides opportunities for planting in higher rainfall environments, with reduced establishment risk, while addressing important ecological needs throughout the corridor.

The River Murray Forest Project completed its final public tender process in September 2009 for broad scale plantings of native trees and shrubs in the River Murray corridor. About 2,450 hectares of private land was commissioned for planting. Plantings will be staged over several years to allow for seasonal conditions and limited seed supply, with plantings from the final tender call to commence in 2010.

3.1.4. SOUTH AUSTRALIAN AQUATIC ECOSYSTEMS CLASSIFICATION

Technical support was provided to the MDBA to:

- develop a classification and regionalisation for acquatic ecosystems in the Murray-Darling Basin; and
- assess whether the MDBA's current register of key environmental assets represents the full range of aquatic habitats in the basin.

It was found that SA was well positioned in terms of aquatic ecosystem classification in the Basin. It is the only State in the Basin which has applied the same classification across both rivers and wetlands; and aggregated wetlands into management units (Floodplain Inundation Response Units).

3.1.5. SOUTH AUSTRALIAN INPUT INTO THE BASIN PLAN

The MDBA is responsible for developing the Basin Plan which is a strategic plan for the integrated and sustainable management of water resources in the Basin. Due in 2011, the plan will set new sustainable diversion limits on water extractions from surface water and groundwater sources.

In 2009-10, DWLBC (now DFW) led and coordinated State Government agency input into the development of the proposed plan. The department coordinated the formal State Government submission in response to the MDBA's issues paper: Development of Sustainable Diversion Limits for the Murray-Darling Basin. Through this advice, data and information was provided about key environmental assets, environmental water requirements, catchment risks, socio-economic issues, water quality and salinity issues, critical human water needs and state water resource plans.

The department also coordinated a cross-agency review and response on the Australian Competition and Consumer Commission's advice to the MDBA on water trading rules.

Support was provided to the Minister for the River Murray when representing SA on the Murray-Darling Basin Ministerial Council and the Basin Officials Committee, where the State was represented by the DWLBC Chief Executive.

The department is also preparing for the release of the MDBA plan for consultation including the requirement to lead an extensive review and coordinate a whole of government response.

3.2. ENVIRONMENTAL FLOWS

3.2.1. ASSESSING RISKS FOR WATER-DEPENDENT ECOSYSTEMS

The first phase of the project was completed in 2009-10 including a preliminary assessment of risks to water-dependent ecosystems including examining the impact of water resource extraction. Zones of high risk were also identified for future planning purposes. The project is state wide but includes significant studies into the River Murray.

3.2.2. MURRAY MOUTH SAND PUMPING PROJECT

The project is required to maintain the connectivity of the Coorong and the ocean. Dredging of the Murray Mouth is required to improve both the tidal flushing characteristics and the status of the mean water level, providing positive outcomes for the environmental values of the Coorong. Without the continued sand pumping operation, the Murray Mouth would close and likely result in catastrophic failure of the unique ecosystems of the Coorong. The condition of the Murray Mouth has a significant impact on environmental, economic, social and cultural values and includes a range of ecological systems covering the full spectrum of estuarine to hypersaline environments. The Murray Mouth and Coorong have national and international significance and are listed as a RAMSAR site

In 2009-10 11,771 m^3 of sand was dredged from the Murray Mouth to maintain connectivity between the ocean and the Coorong. This ensured that the Diurnal Tidal Ratios (the key performance indicator for the Murray Mouth Sand Pumping Project) were kept well above the long term average throughout 2009-10.

3.3. WATER QUALITY

3.3.1. ASSET MANAGEMENT

A number of assets are managed to contribute towards improved water quality of the river including river vessel waste disposal stations, evaporation basins and salt disposal basins.

3.3.2. RIVER VESSEL WASTE DISPOSAL TRANSFER STATIONS

River boat facilities were upgraded in 2009-10, in collaboration with the EPA, to modernise them and allow them to meet the increased usage volumes and service requirements needed for grey-water treatment systems.

Upgrades were also completed for the Murray Bridge Station and are underway for Goolwa. Significant planning has also occurred for the Walker Flat, Lock 3 and Lock 6 transfer stations.

3.3.3. GOOLWA CHANNEL WATER LEVEL MANAGEMENT PROJECT

The Project was initiated as an emergency response to the exposure of acid sulfate soils in Currency Creek, the Finniss River and the Goolwa Channel. The exposure and oxidation of acid sulfate soils can cause the pH of water to drop as low as 2 and release pollutants such as iron, aluminium, manganese, copper, lead, zinc, arsenic, cadmium and nickel. The impacts on irrigation, stock water, human health and water dependant ecosystems can be very significant.

A number of studies have been done on acid sulfate soils with the recommended management strategy being to inundate the soils with water. Due to the expansive area of the Lower Lakes, the Channel had to first be isolated before it could be managed. A regulator in the Goolwa Channel was constructed to close the channel and enable water levels to be raised. With the Goolwa Channel isolated, 26.95 GL of water was pumped from Lake Alexandrina into the new 'Goolwa pool' to raise the water to the target level of plus 0.7 mAHD.

The project has been highly successful in mitigating the effects of acid sulfate soils by maintaining water levels. The increased water levels have also allowed for a strong ecological response of aquatic vegetation, birds, fish and amphibian species such as the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) listed Southern Bell Frog.

3.3.4. NOORA EVAPORATION BASIN

Intercepted saline groundwater from the salt interception schemes is pumped and allowed to evaporate at Salt Disposal Basins.

Work is currently being undertaken at the Noora Basin to ensure that when the basin is operated at maximum capacity the water will be contained within the basin boundary. Land management work is also being undertaken to ensure that the basin is managed in a sustainable manner. This includes a rabbit management program, revegetation, and removal of rubbish and pest plants.

3.3.5. DRAINAGE DISPOSAL BASINS.

In the River Murray System 17 drainage disposal basins are operated and maintained with individual asset management plans prepared for each basin.

In 2009-10 infrastructure plans were developed for the Disher Creek disposal basin in order to provide a sustainable habitat for the endangered fish species, Murray Hardy-head. Repair work also began on structures at the Loveday basin.

3.3.6. LAKE ALBERT SPOIL TREATMENT AND CHANNEL PREPARATION PROJECT

The work involved modifying the existing channel from Narrung Narrows out into Lake Alexandrina and the relocation of material previously dredged from that area back into

deeper waters within Lake Alexandrina. This was needed to mitigate acid sulfate soils and prevent a navigation hazard.

The channel was modified so that it can reliably deliver at least 1 GL per day of Lake Alexandrina water to the extraction point on the Narrung embankment, under most wind conditions, down to an average water level in Lake Alexandrina of minus 1.5 mAHD.

Participation of the Ngarrindjeri was part of the process adopted to ensure compliance with the *Aboriginal Heritage Act 1988* (SA) and Native Title legislation.

3.3.7. LAKE ALBERT WATER LEVEL MANAGEMENT PROJECT

Water level management has been identified as a key tool to prevent the drying of sulfidic soils, and hence the generation of acid sulfate soils and potential future large-scale acidification of the lake. Modeling shows that by the end of the 2009-10 summer, if Lake Albert had no additional water it would be over 90% dry with high salinity levels. Participation of the Ngarrindjeri was part of the process adopted to ensure compliance with the Aboriginal Heritage and Native Title Acts.

As Lake Albert has very high evaporation and no tributaries or other inflows (other than groundwater and rain), pumping from Lake Alexandrina was the only way to retain the Lake's water level above minus 0.5m AHD over the coming summer. In 2009-10 89.9 GL was pumped from Lake Alexandrina to Lake Albert across the Narrung Bund to maintain a water level above minus 0.5m AHD in Lake Albert.

3.3.8. SALINITY MANAGEMENT PROGRAM

An integrated salinity management program was delivered in collaboration with various state and Federal agencies including the MDBA and the SA MDB NRM Board. On ground actions include salt interception schemes, irrigation efficiency programs and monitoring and investigations.

Overall the program kept SA in a positive balance on the MDBA Basin Salinity Management Strategy (BSMS) Salinity Registers. A positive balance indicates that actions that increase river salinity have been offset by actions that reduce river salinity. However, it is widely recognised that significant work will be required in the coming period to address the management of real time salinity impacts including development of appropriate operational responses (such as additional water for dilution flows).

3.3.9. SALT INTERCEPTION SCHEMES

Infrastructure such as salt interception schemes have proven valuable in providing a reduction of saline groundwater flows into the River Murray, playing a vital role in reducing in-river salinity.

Salt interception schemes have been constructed along reaches of the River Murray in areas of high irrigation development to reduce the inflow of saline groundwater into the River Murray.

Within SA there are seven operating salt interception schemes that during 2009-10 intercepted 294,776 tonnes of salt, preventing it from entering the River Murray.

There are currently two salt interception schemes under construction within SA which are located at Murtho, and Loxton.

The Loxton salt interception scheme is expected to be commissioned in September 2010, once all construction works are completed. The Loxton scheme was designed to reduce in-river salinity by 16.5 EC at Morgan over a 30 year average.

The Murtho salt interception scheme is expected to be completed by January 2012 and has been designed to intercept a total of 99.4 tonnes of salt per day with a 20.2 EC benefit at Morgan over a 30 year average.

The Pike salt interception scheme has been conceptually designed to intercept a total of 167.6 tonnes of salt per day with a 35.4 EC benefit at Morgan over a 30 year average. Funds have been made available to commence some preliminary works.

Construction of the Waikerie salt interception scheme was commissioned in 2009-10 and the salinity credits have been accepted onto the MDBA Salinity Register.

3.3.10. SETTING STRATEGIC DIRECTIONS FOR SALINITY

Development of a new program for salinity management in SA was initiated in 2009-10.

A project was completed (Risks to Registers entries project) highlighting a number of risks to SA in terms of its credit balance on the BSMS Registers and a series of recommendations were made in relation to specific actions aimed at reducing the uncertainty in the existing salinity registers entries, including improving the robustness of the groundwater models that underpin the entries.

A 'salinity horizons' project was completed in 2009-10 which broadly quantified the long-term risk of actions not already included on the BSMS salinity registers, such as climate change, new diversion limits and environmental watering impacts. The outcomes will be used to ensure that new salinity programs being developed include investments of an appropriate scale to mitigate risks.

A review of water quality and salinity for the River Murray in SA was undertaken including investigations into potential targets for river salinity. This was provided as information of interest to MDBA in their development of the Water Quality and Salinity Management Plan within the Basin Plan.

In recognition of floodplain salinity as one of the key risks to River Murray system health, SA worked with MDBA and other Basin jurisdictions in the initiation of a project to investigate the risks (at a basin scale) of floodplain salt storages being mobilized to the river and increasing river salinity. In addition, a South Australian specific project was initiated to quantify the local risk of floodplain salinity to the River Murray and to identify specific mitigation strategies that could be driven from within the State

3.3.11. BOOKPURNONG LOCK 4 CASE STUDY

The Bookpurnong to Lock 4 Case Study approach continued in 2009-10 with the development of a district scale report on irrigation efficiency and the undertaking of a number of research and investigation projects.

Irrigators within the region continued to utilise Irrigation Research and Evaluation System (IRES) to manage their irrigation scheduling. When used in combination with soil moisture monitoring devices, IRES was found to be particularly useful for accurately forecasting future irrigation events in times of drought.

3.3.12. IRRIGATION CODE OF PRACTICE

A draft code of practice for sustainable irrigation was formulated in conjunction with Rural Solutions. The code is based around accrediting irrigators at a range of levels of practice from meeting a minimum to a high level of competency. The code was formulated by identifying the key points of risk in the irrigation enterprise in relation to creating a deep drainage event and ensuring practices are in place to minimise these risks. A training program for each level of the code has also been developed.

3.3.13. IRRIGATION RECORDS AND EVALUATION SOFTWARE

This leading technology has continued to be used throughout the SA MDB NRM region as an irrigation management tool but with a focus on maximising irrigation efficiency in collaboration with PIRSA and Rural Solutions. Currently, IRES users are found across the SA MDB NRM region including Loxton, Bookpurnong, Pike and Taylorville districts.

A major project has been run in 2009-10 to simplify the use of the software through a more user-friendly data entry screen. This will help to maintain the current use of the software and will be released to communities next year. Effort is also being directed into enabling automatic upload of metering data via telemetry.

3.3.14. PIKE RIVER CASE STUDY

A Pike River Implementation Plan has been developed in collaboration with the community and other agencies. The plan identifies a number of key priorities for the Pike system, including hydrological management and fish passage, sustainable extraction of water through the development of a sustainable diversion limit and irrigation infrastructure which allows for flexible water levels; removal of grazing and pest plant and animal control and salt interception.

The Pike River Implementation Plan Reference committee is currently seeking funding from the Murray Futures program to implement the floodplain aspects of the plan.

3.3.15. HOW EFFICIENT ARE WE- A REPORT ON THE IRRIGATION EFFICIENCY WITHIN THE MURRAY DARLING BASIN

The draft report for this project was released in March 2010. This documents major drivers of changes in water use efficiency since 1960 in the SA Murray-Darling Basin. The report recommends a process for benchmarking district irrigation efficiency and deep drainage levels.

3.3.16. SALINITY MODELLING AND INVESTIGATIONS

A range of modelling programs and investigations have been undertaken to underpin the salinity program. Modelling support for salinity management in the River Murray is

fundamental to meeting South Australian salinity management obligations within Schedule B, of the BSMS particularly in terms of meeting the requirement to report the impact of any action that will have a significant effect on salinity (refer above).

3.3.17. DEVELOPMENT OF MODFLOW GROUNDWATER MODELS

A series of MODFLOW groundwater flows have been developed to enable SA to meet its meets its obligations under Schedule B. With the completion of the Morgan to Wellington model in 2009-10, these models now cover the entire River valley in SA, from the border to Wellington.

A key component of groundwater model development is the accreditation of each model and their use in relation to each of the modelling scenarios. Accreditation involves a process of independent and peer review of each model and ensures the models are sufficiently robust to be used as the basis for BSMS Salinity Registers entries.

3.3.18. MODELLING FOR PROPOSED CHOWILLA REGULATOR

SA is working to conduct a full assessment of the salinity risk from the operation of the Chowilla environmental regulator (under construction). This will be completed in 2010-11. This will facilitate the future development of an appropriate operation strategy for the regulator to minimise salinity impacts. As a first step, in 2009-10 an independent assessment of the suitability of the existing Chowilla MODFLOW model for calculating real time salinity impacts was completed.

3.3.19. ASSESSMENT OF SUITABILITY OF SALT INTERCEPTION SCHEME WATER FOR AQUACULTURE

The project involves assessing the suitability of saline groundwater from the Woolpunda salt interception scheme for aquaculture and was undertaken in collaboration with SARDI.

The results of the research showed that Mulloway can grow in saline groundwater and that the fish produced are well accepted by consumers. It was recognised that commercial scale developments utilising salt interception scheme water water would require significant financial investment in land based infrastructure.

3.3.20. SALINITY MONITORING

Regular 'run of river' monitoring to calculate salt loads was not undertaken this year due to low flows. A new survey boat, 'MVS Rosco', was purchased this year for improving the capability to undertake salinity surveys and to monitor bank erosion, algal blooms and sample sediment.

Monitoring of groundwater trends under irrigation regions continued this year with trends compiled every five years.

3.3.21. LOWER MURRAY RECLAIMED IRRGIATION AREAS PROJECT

The Lower Murray Reclaimed Irrigation Areas program has been implemented since 2004 involving a funding commitment of $22.166 million from the Commonwealth Government.

The program was established in an effort to address ageing irrigation infrastructure in the region and deteriorating River Murray water quality levels.

The project was completed in 2009-10 including:

- Completing the mandatory on-ground works;
- Undertaking a program post implementation review;
- Extinguishing 12 Deeds of Agreement by mutual agreement between parties, and;
- The formal closure and acquittal of the Program.

3.4. HUMAN DIMENSION

3.4.1. MURRAY-DARLING BASIN WATER SHARING ARRANGEMENTS

In 2009-10 the Premier and Minister for River Murray were supported to negotiate and implement special drought water sharing arrangements under the Murray-Darling Basin Agreement.

The Department led the Government's response and input to a review of the Murray-Darling Basin agreement. The review examined options for improving the management of water resources in the Basin, in particular the operation of the River Murray System, to better meet the challenges of a drier future. The review will continue into 2010-11 but will not impact on the timing and development of the Basin Plan by the MDBA.

The Department has also been working with the MDBA and other jurisdictions to develop the new schedules under the Agreement. The schedules will give effect to SA's right to carryover and store water for critical human water needs and private carryover, and to implement a tiered system for water sharing during dry periods.

3.4.2. RIVERBANK COLLAPSE

A major program has been implemented since February 2009 to manage Riverbank Collapse in the River Murray below Lock 1. Unprecedented low river water levels below Lock 1 have created river bank collapse and slumping. The program is focusing on managing the risk and minimizing the impact on the community.

During 2009-10 Riverbank Collapse was classified as a State Hazard. DWLBC (now DFW) was identified as the Hazard leader and was responsible for coordinating a hazard management program. A River Bank Collapse Hazard Plan was also developed to identify relevant roles and responsibilities within in a framework of mitigation, prevention, preparedness, response and recovery activities.

A communications plan has been prepared to provide information to the public. This includes the establishment of a 24-hour, seven days a week, hotline number (1800 751970), for the public to report incidents, and to also receive information about Riverbank Collapse Hazard. A Safe Work Guide has also been developed and distributed to a range of stakeholders and groups.

Since February 2009, a total of 125 incidents associated with the hazard have been reported and confirmed by the Riverbank Collapse Hazard Program. This includes 35 incidents of

collapse, 55 incidents of riverbank cracking that may result in future collapse, and 35 tree related incidents that have either collapsed or may result in collapse.

The Riverbank Collapse Hazard Program is working closely with the DWLBC's (now DFW's) Development Planning Group and other agencies managing Development Approvals under the River Murray Act, considering appropriate development and also safe working procedures.

3.4.3. LOVEDAY BASIN MANAGEMENT PROJECT

The Loveday Basin Management Project was required to develop a long term management strategy to manage seasonal odour emanating from the Loveday Basin through the warmer (summer) months. Investigations have been undertaken historically to understand and identify the causes of the odour for consideration in any proposed management strategy. The unpleasant odour impacts the residents of Cobdogla which is located next to the basin and has been managed to date through inundation with River Murray water as necessary under strict conditions when detected. The township also relies on seasonal tourism and the odour is having economic impacts on visitation to the area.

3.4.4. UNBUNDLING OF WATER LICENCES.

In 2009-10 water licences for the River Murray Prescribed Watercourse were unbundled to separate the water licence into a water access entitlement, an annual water allocation and a water resource works and site use approval.

This is one of the most significant reforms to the management of SA's water resources in the past three decades. In particular, it has enabled the more efficient and effective processing of interstate and intrastate water trades. This has had several immediate benefits including significant red-tape reduction and lower costs for licence and approval holders as well as reduced processing times for DWLBC (now DFW) staff.

It will also facilitate a greater capacity to protect environmental values and reduce off-site impacts through the site use and water resource works approval mechanism.

Unbundling necessitated significant changes to the River Murray WAP. This significant reform was achieved very smoothly, with new instruments being issued to every river licensee early in the 2009-10 irrigation season. The DWLBC (now DFW) water licensing system also had to undergo significant upgrades and amendments to deal administratively with the new unbundled environment.

3.4.5. RIVER MURRAY WATER LICENSING

Extremely low inflow conditions across the basin severely impacted on the share of water resources available to South Australian users. A major priority for 2009-10 was the administration of water restrictions and water conservation programs which included increased compliance and monitoring of water use.

In support of these programs, quarterly consumption advice, drought 'Top Up' water trading and water carryover continued in 2009-10 to meet the increasing demands from managers and users of the River Murray.

3.4.6. ANGAS-BREMER/MALLEE/MARNE SAUNDERS WATER LICENSING

Other Murray-Darling Basin WAPs for the Angas-Bremer and Murray Mallee Prescribed Wells Areas continued to be implemented. The primary focus for 2009-10 was on the provision of efficient water licensing and trading approvals and administration, water use monitoring and reporting, and the provision of support to the SA MDB NRM Board in their review of these plans.

Water resources of the Marne and Saunders Rivers were prescribed on 20 March 2003 and licences were issued to existing users on 30 June 2010, following adoption of the Marne Saunders Water Allocation Plan.

3.4.7. RIVER MURRAY WATER ALLOCATIONS

Due to the exceptional drought conditions in 2009-10, negotiations were made to guarantee the delivery of water for critical human needs to SA and to provide a minimal volume of water for general allocations early in the year.

Decisions regarding available water allocations were made on a fortnightly basis based on the assessments of water availability and by applying the River Murray Drought Water Allocation Decision Making Framework. This provided as much certainty to irrigators as possible.

The framework was amended during 2009-10 to ensure the State Government could meet its commitment to securing water for critical human needs (201 GL) and for a Lower Lakes Environmental Reserve (170 GL).

This water was secured through water purchase, resource improvements and reduced pumping from the River Murray as a result of improved inflows in the Mount Lofty Ranges Watershed.

Access to floodwaters from Queensland and northern NSW also meant additional water could be allocated for irrigation and the environment late in the year. The final allocation level for irrigators was 62 percent, a significant increase on 2007-08 (32 percent) and 2008-09 (18 percent).

3.4.8. WATER CARRY-OVER FROM 2008-09 TO 2009-10

There was significant water carry-over from 2008-09 to 2009-10 including private diverter (94GL), critical human needs (201GL) and Lower Lakes Environmental Reserve carry-over (50GL).

Rather than deliver all of the water on allocation in SA in a given year, some water is stored upstream for delivery in the following year. The volume stored is based on an ongoing assessment of seasonal conditions, water-use patterns, allocation levels, water trade and the volume applied for during the carryover application process.

3.4.9. LOWER LAKES AND RIVER MURRAY MODELLING AND MONITORING

A range of modelling and monitoring programs were implemented to support the drought response and the development of recovery strategies. The information collected allowed

resource managers to provide accurate and timely scientific and technical advice to government and the wider community.

Modelling and other technical input has been provided, as required, into the development and implementation of various drought response projects and longer-term management proposals including water sharing negotiation, management of river operations and water delivery, and environmental flow requirements particularly for the Lower Lakes and development of CLLMM Long-Term Plan. Modelled information has also informed and guided negotiations on various schedules being developed under the Murray-Darling Basin Agreement and supported information provided to the MDBA to inform the development of the Basin Plan.

An additional surface water monitoring site was also installed at Woods Well to assist program delivery and management for the Coorong and Lower Lakes initiative. The additional site increases the total number of monitoring locations in the Coorong and Lower Lakes to 13.

4. PRIMARY INDUSTRIES AND RESOURCES SOUTH AUSTRALIA

In relation to the *River Murray Act 2003* (SA) (the RM Act), Primary Industries and Resources South Australia (PIRSA) through SARDI undertakes significant research regarding the ecology of the river, floodplain and wetlands. SARDI also assists the irrigation industry through research and extension including irrigation modernisation and irrigation efficiency programs. It is also responsible for fisheries management and has a major biosecurity program.

4.1. RIVER HEALTH

A major focus on research was on the Coorong and Lower Lakes region including assessing the impact of the drought.

4.1.1. FLOW AND FISH ECOLOGY IN THE COORONG

The project involves studying fish assemblages during an extended drought period and then undertaking modelling to identify the relationships between flows and fisheries production. This includes examining catch and effort data for key species, investigating their salinity tolerances during their early life history and researching into the reproductive biology of key species.

4.1.2. REMOVAL OF CARP FROM LAKE ALBERT

In response to severely reduced water levels and increasing salinity in Lake Albert, PIRSA Biosecurity initiated a trial fish-down to determine the effectiveness of this technique in reducing the biomass of common Carp (*Cyprinus carpio*) in the lake.

This action was hoped to reduce the risk of an imminent fish kill. The fish-down also presented an opportunity to gather biological information (for example, size and age structures) on the large-bodied (average adult length >150 mm) fish community of Lake Albert, including the economically important Golden Perch (*Macquaria ambigua*). Information on the fish community of Lake Albert has previously been limited to small bodied fish.

4.1.1. RIVER HEALTH RESEARCH PROGRAMS

SARDI on behalf of the South Australian Murray-Darling Basin Natural Resources Management Board and the Department for Environment and Heritage undertook a range of research programs relevant to river health including:

- Lower Lakes vegetation condition monitoring.
- Aquatic and littoral vegetation monitoring of Goolwa Channel 2009-10.
- Aquatic and Littoral Vegetation of the Murray River Downstream of Lock 1, the Lower Lakes, Murray Estuary and Coorong: A Literature Review.

- Chowilla fish ecology project.
- Chowilla floodplain vegetation condition monitoring.
- Chowilla environmental watering understorey vegetation monitoring.
- Coorong fish movement and recruitment project.
- An evaluation of the Chowilla Creek environmental regulator on floodplain understorey vegetation.
- Chowilla environmental watering understorey vegetation monitoring;
- Fish habitat assessment in the lower River Murray.

For more information refer to the relevant details in the Board and DEH (now DENR) sections.

GENERAL STUDIES

A number of general studies were undertaken to contribute to broader understanding of habitat requirements.

4.1.2. PROTECTION OF DROUGHT REFUGIA

This project undertaken in collaboration with Murray-Darling Basin Authority (MDBA) is developing information and templates for management planning to identify and protect key refuge habitats across the MDBA. Information has been collated through workshops, questionnaires and stakeholder consultation in order to inform the development of strong refuge management plans.

4.1.3. FISH ECOLOGY AND AQUATIC HABITAT IN THE PIKE ANABRANCH SYSTEM

This study aims to assess fish populations and aquatic habitats in the Pike Anabranch system in order to develop a baseline. A total of 16 sites have been assessed for fish and habitat value. Fish species richness was found to be lower than that recorded in both the Katarapko and Chowilla Anabranch systems.

There is potential however through habitat restoration to increase the diversity of connectivity and flowing habitats. This has the potential to increase the fish species diversity and abundance within the system.

4.1.4. MONITORING OF NATIVE FISH POPULATIONS IN THE SA MURRAY DARLING BASIN

In August 2009, PIRSA Fisheries and SARDI Aquatic Sciences continued the implementation of the long-term (2009-10 to 2011/12) fishery independent monitoring program with a key focus on Murray Cod. The information will provide improved knowledge of environmental factors that influence Murray Cod population dynamics and input into MDBA population models which assist in developing fishery and/or conservation management options.

4.1.5. CARP STUDIES

A number of studies and projects to exclude or eliminate carp from systems were also undertaken. This included:

- Carp separation cages at Lock 1, where commercial license holders have removed 100 tonnes of carp since 2007;
- Carp exclusion screens at wetland inlets, resulting in two optimised mesh designs for carp exclusion screens
- Wetland carp separation cages, resulting in a conceptual design for a fully automated separation cage that meets all Australian occupational health and safety and design requirements that has now been built for use in 2010 at Lake Bonney, Barmera.

4.1.6. MURRAY COD CLOSURE 2010

The closure, which effectively prohibits the take of Murray Cod for 2010, was introduced to protect the South Australian Murray Cod populations given the continued severe drought conditions across the Murray-Darling Basin. Consistent scientific advice is that there has been little recruitment in the population since 1994. This is due to lack of flows into the River Murray. During 2010, PIRSA Fisheries will be reviewing the management arrangements for the Murray Cod.

4.2. WATER QUALITY

SARDI in its research capability undertook a number of research projects relating to understanding the impact of salinity on vegetation and fish populations including the following projects:

- Influences of salinity, water quality and hydrology on early life stages of fishes in the Lower River Murray;
- Seed bank assessment of Goolwa Channel, the lower Finniss River and lower Currency Creek;
- Seed Bank Assessment of Dunn's and Shadow's Lagoons.

For further information refer to the relevant projects in the Board and Department for Environment and Heritage sections of this document.

5. SA WATER

In relation to the RM Act, SA Water under direction of the *Waterworks Act 1932* (SA) is responsible for maintaining drinking water supplies including water sourced from the River Murray. It is also the delegated authority under the Minister for River Murray for managing a range of water infrastructure.

5.1. RIVER HEALTH

5.1.1. INCORPORATING FISH-WAYS INTO ENGINEERING STRUCTURES

Fishways have been integrated into construction plans in collaboration with SARDI for capital works at Chowilla and Locks 1 to 6. Fishways are structures that allow native fish to move through or around large engineered structures (either upstream or downstream, or from river pool to river channel and back).

Fishways are complete and fully operational at Locks 1, 3 and 6, with Lock 5 due to be completed mid July and works at Locks 2 and 4 now underway.

5.2. ENVIRONMENTAL FLOWS

A number of major projects are underway to reduce SA's reliance on the River Murray through water re-use and aquifer storage.

5.2.1. AQUIFER RECHARGE, STORAGE AND RECOVERY

The Aldinga aquifer storage and recovery project became operational in 2009-10 and has begun annual cycling of storage and recovery.

A number of other aquifer recharge, storage and recovery projects are underway across metropolitan Adelaide and the State.

5.2.2. WASTEWATER RE-USE

A major step forward in recycling treated wastewater was the completion of the Glenelg Adelaide Recycled Water Scheme. This includes irrigating the Adelaide Parklands with recycled water. Schemes are also being built in the South and North of Adelaide. These will allow recycled water for dual reticulation for watering parks and gardens and dual reticulation for toilet flushing and outside residential use.

5.3. WATER QUALITY

5.3.1. WATER QUALITY DROUGHT RESPONSE MONITORING

In order to respond to the severe drought and low flows a Drought Response Program in collaboration with the Environment Protection Authority has been implemented. This tracks the potential impacts of drought on water quality and identifies the required mitigation strategies.

The program involved more rigorous routine monitoring of amoeba, salinity, algal and nutrient levels. It also involves immediate on-the-ground assessment, tracking and early warning of potential water quality changes through focused surveys of the river.

This will allow the implementation of appropriate operational actions to address any impending water quality issues and assist in the management of those water supply systems that are likely to be affected.

5.3.2. ALGAL BLOOM DETECTION

Algal blooms can potentially occur when there are available nutrients and low flushing flows. Specific algal species can be highly toxic and in extreme cases render the water unsuitable for recreation and drinking and also be toxic to ecosystems.

High resolution digital aerial imagery was used to enable the early detection of algal blooms in the river in collaboration with the EPA. The footage is also useful in identifying illegal water discharges, illegal water harvesting and understanding the connectivity of wetlands to the river. There has also been interest from other government agencies to use this aerial footage to conduct compliance monitoring.

5.3.3. DRINKING WATER EXCLUSION ZONES

Approval for the establishment of exclusion zones around drinking water supply off-takes is currently being sought. This would restrict specific activities with the potential to threaten water quality. On the granting of approval the installation of the infrastructure and signage will be tendered and implemented.

5.3.4. SALT INTERCEPTION SCHEMES

SA Water on behalf of the Murray-Darling Basin Authority and the Minister for the River Murray is responsible for the construction, operation and maintenance of salt interception schemes within SA (See Sections 3.3.8 and 3.3.9 for more detail).

5.4. HUMAN DIMENSION

5.4.1. DROUGHT RESPONSE PLANNING

A significant drought response program has been implemented to maintain drinking water supplies given the severe drought. This includes reducing Adelaide's reliance on the River Murray.

Water has been purchased for critical human needs, there has been urban water restrictions applied and a desalinisation plant planned and under construction.

In order to ensure continued supplies to the Lower Lakes, modifications have been made to pump stations below Lock 1, sealing of the barrages has occurred to prevent ingress of seawater into Lake Alexandrina. Major pipelines for stock and domestic supplies to Meningie, Currency Creek and Langhorne Creek were also completed.

5.4.2. SCUM BOOMS

Scum booms have been installed at Renmark, Loxton, Barmera, Swan Reach and Blanchtown to prevent the accumulation of blue-green algal populations adjacent to water off-takes. A review of the condition and effectiveness of existing booms is underway as well as an investigation into whether booms can be installed at other off-take locations.

5.4.3. SCHOOL EDUCATIONAL PROGRAMS

In 2009-10 the Brainwave Learning Program for Students and Teachers was implemented, promoting education on sustainability and water in the community including the importance of the River Murray.

5.4.4. COMMUNITY EDUCATION PROGRAM

A broad-scale community education program was run including forums about specific water issues and broader water saving opportunities. This reached more than 5,500 community members in 2009. Information was also provided to the community regarding water use efficiency, works underway to address issues impacting on the River Murray and water supply through 'Water for Good' and 'WaterWise Communities' educational programs.

Educating the community about water restrictions and permanent water conservation measures were also important initiatives. Activities included a household watering calendar distributed through the Sunday Mail and a series of brochures to promote water smart gardening activities.

The promotion of waterwise behaviours through water restrictions and H_2OME Rebates communications to the community also continued in 2009-10.

6. ENVIRONMENT PROTECTION AUTHORITY

In relation to the *River Murray Act 2003* (SA) (the RM Act), the Environment Protection Authority (EPA) is responsible for maintaining the water quality of the River Murray as directed by the *Environment Protection Act 2003* (SA) and the associated Environment Protection (Water Quality) Policy 2003.

6.1. WATER QUALITY

6.1.1. REVIEW OF ENVIRONMENT PROTECTION (WATER QUALITY) POLICY 2003

A major review is underway of this policy. The review is examining how to better match the policy to achieving specific environmental values.

The review is also examining processes for dealing with both point and diffuse sources of pollution and protecting against the cumulative impacts of pollution.

6.1.2. IMPLEMENTING THE NATIONAL WATER QUALITY MANAGEMENT STRATEGY (NWQMS)

The first step in the implementation is to set environmental values for waterbodies in order to protect future values. The EPA in collaboration with the South Australian Murray-Darling Basin Natural Resources Management (SA MDB NRM) Board has undertaken a pilot process in the Bremer Barker sub-catchment. This is trialling the process, gaining feedback and streamlining the consultation process. The community involved has showed a high interest in protecting relevant river values. Preparation is also currently underway for a general round of public consultation to establish the environmental values for the region.

6.1.3. IMPROVING WATER QUALITY OF THE RIVER MURRAY

A risk assessment of River Murray water quality has helped prioritise the required actions for improving River Murray water quality. Key initiatives include audits of river boat vessels, preventing sand dumping and fencing off river frontages.

6.1.4. RANDOM AUDIT PROGRAM FOR RIVER BOAT VESSELS

An audit program of water waste discharge from river boats continued this year. To date 400 boats have been audited since the inception of the program in May 2007.

The audit addresses black-water and grey-water discharge and can result in boat facilities having to be upgraded.

The level of general awareness about the program has improved as shown by the increasing levels of compliance from boats audited. At the program's inception 90% of boats were non-compliant and this has now decreased to 70%.

6.1.5. CODE OF PRACTICE FOR VESSEL AND FACILITY MANAGEMENT (MARINE AND INLAND WATERS)

This Code of Practice was developed in 2009-10 to encourage best environmental management practices on SA's marine and inland waters for the benefit of future generations. A specific component included the introduction of new wastewater (black-water and grey-water) management requirements for all vessels operating on South Australia's inland waters. A staged implementation and consultation program has been developed for the estimated 2,000 commercial and recreational inland vessels operating on SA's inland waters.

The EPA, through the Code of Practice has also stimulated the development of world first grey-water treatment technology for river vessels and the uptake of this new technology by industry (with approximately 80 systems expected to be installed along the River Murray by the end of 2010). A significant economic opportunity for SA is expected as these innovations are adopted both locally and elsewhere for protecting our environment. The Department of Transport, Energy and Infrastructure provided advice where required on the development of the codes.

6.1.6. FENCING LOWER MURRAY AND LAKES

The Lower Murray Reclaimed Irrigation Area rehabilitation project has resulted in extensive fencing off of the margins of the Lower Murray and Lower Lakes to prevent livestock grazing on the shore-line and degradation of water quality. Property owners have signed agreements to maintain the fencing on the lake margins and the EPA is ensuring that landholders comply.

6.1.7. AUDIT COMPLIANCE AND ENFORCEMENT

The EPA has a comprehensive audit compliance and enforcement program and is also responsible for referrals under the RM Act. The EPA routinely undertakes random audits and inspections on a range of industries that have the potential to impact on water quality. Compliance is enforced through a range of instruments including letters, fines, environment protection orders, clean up orders and prosecution.

Major issues requiring enforcement in 2009-10 included sand dumping, illegal development (affecting water quality of the river), pesticide mismanagement and clean up, abandoned vessels, sewage spills and (to a lesser extent) diesel spills into the river. All of these issues were dealt with using a range of approaches, including verbal advice, letters, environment protection orders and emergency response.

6.1.8. SAND DUMPING

Sand dumping is an illegal activity which can smother ecosystems, alter the rivers natural profile, blocks pumps and channels and create navigation hazards. Due to low water levels, sand has been dumped and deposited along the River Murray and backwaters to create artificial beaches and limit erosion.

Any incidence of sand dumping has been followed up with negotiation and if required a compliance order, with approximately 150 incidents dealt with in 2009-10. A broad media

and educational awareness campaign has also been undertaken with good cooperation with the community and local councils.

Practical initiatives have also been implemented to address riverbank de-stabilisation include re-establishing natural bank profiles, stabilising banks with native flora and the use of engineered products to provide safe and stable banks.

6.1.9. DEVELOPMENT ASSESSMENT

The EPA has a responsibility to evaluate a range of proposals for development where the EPA is a referral agency. Examples of development application assessments along the River Murray in 2009-10 included applications for jetties, boat ramps, retaining walls, dwellings, land divisions, intensive animal keeping, dredging, erosion management and wastewater treatment plants.

7. DEPARTMENT OF TRADE AND ECONOMIC DEVELOPMENT

In relation to the *River Murray Act 2003* (SA) (the RM Act), the Department of Trade and Economic Development (DTED) supports economic growth and wealth creation through policy development and project initiatives. It is guided by South Australia's Strategic Plan 2007.

7.1. HUMAN DIMENSION

7.1.1. RIVERLAND FUTURES TASKFORCE

The taskforce is a dedicated program aiming to diversify existing industry and promote industry growth within the region and ensure a more sustainable approach in line with the Regional Natural Resources Management Plan.

7.1.2. THE REGIONAL PROSPECTUS PROJECT

The Riverland Futures Taskforce has coordinated the preparation of a Regional Prospectus for the Riverland, and supporting documents including an Infrastructure Audit and a Regional Investment Strategy. The focus of the project is to deliver outcomes that establish sustainable and economically productive industries, while seeking to protect and enhance the biological diversity and community social values of the area.

In addition to the support of the Riverland Futures Taskforce, DTED has provided funding and strategic input for these reports.

7.1.3. REGIONAL DEVELOPMENT AUSTRALIA MURRAYLANDS AND RIVERLAND

The State Government through DTED, in conjunction with Federal and local governments provides funding of more than $900,000 a year to the Regional Development Australia Murraylands and Riverland Inc. This funding is to support projects that address the issues, challenges and opportunities affecting, or likely to affect the region.

7.1.4. RIVERLAND SUSTAINABLE FUTURE FUND

In February 2010, the Government announced that it would establish the Riverland Sustainable Futures Fund. The Fund, which will commence in the next Financial Year, will support the Riverland to grow and diversify their economy.

Guidelines are being developed for the fund in collaboration with the Department of Primary Industries and Resources and the Riverland Futures Taskforce.

7.1.5. REGIONAL DEVELOPMENT INFRASTRUCTURE FUND

The Regional Development Infrastructure Fund supports projects in regional SA by subsidising infrastructure which leads to economic development. In 2009-10, funding of $700,000 was provided to T&R Pastoral to improve the abattoir's water use management.

7.1.6. DEVELOPMENT POLICY

DTED has been involved in the development of various policies and strategies relating to the River Murray in order to ensure an economic perspective is built into these instruments. In 2009-10 comments were provided on the three Riverland councils Better Development Plan Conversion and Alignment Development Plan Amendments, a project established from the Riverland Futures Taskforce.

7.1.7. RIVERLAND INDICATORS

DTED is working with Primary Industries and Resources South Australia to develop and prepare an improved Riverland Indicators report. The aim of this report is to provide a regular report on key indicators that show early signs of change in the Riverland economy whilst keeping longer term trends in mind.

8. DEPARTMENT OF PREMIER AND CABINET

In relation to the RM Act, the Aboriginal Heritage Branch of the Aboriginal Affairs and Reconciliation Division, in the Department of Premier and Cabinet (DPC AARD) administers the *Aboriginal Heritage Act 1988* (SA) on behalf of the Minister for Aboriginal Affairs and Reconciliation.

The *Aboriginal Heritage Act 1988* (SA) covers all areas of SA, providing blanket protection for Aboriginal remains and Aboriginal sites and objects of significance to Aboriginal archaeology, anthropology, history and tradition.

8.1. HUMAN DIMENSION

8.1.1. CONSERVATION OF ABORIGINAL SITES

DPC AARD has responded to several reports of the discovery of Aboriginal ancestral remains uncovered through erosion along the riverbank and surrounds. These sites have been recorded and management plans negotiated and enacted with local stakeholders.

8.1.2. FUNDING INTERPRETATIONS OF ABORIGINAL HERITAGE

The development of a number of pamphlets and posters by Flinders University in collaboration with the Mannum Aboriginal Community Association was funded by DPC AARD to promote and interpret Aboriginal culture. This is to compensate for many significant sites being closed to visitation due to the safety reasons related to riverbank collapse.

8.1.3. LAKE BONNEY CULTURAL HERITAGE MANAGEMENT PLAN

The draft cultural heritage management plan for Lake Bonney is nearing completion. The Plan should enable the Berri Barmera Council to better manage the cultural values of Lake Bonney in consultation with the First Peoples of the River Murray and Mallee and DPC AARD.

9. DEPARTMENT OF PLANNING AND LOCAL GOVERNMENT

In relation to the RM Act, the Department of Planning and Local Government (DPLG) is responsible for the implementation of the Development Act and the 30 Year Plan for Greater Adelaide. DPLG's work is further influenced by *Water for Good* and South Australia's Strategic Plan 2007.

9.1. RIVER HEALTH

9.1.1. OPEN SPACE PROGRAM

This involves working with interested local councils along the River Murray to increase and improve opportunities for open space. There is also an on-going grant program for conservation and/or recreation projects on public land.

9.1.2. DEVELOPMENT REFERRALS

The Development Assessment Commission (DAC) is required under the Development Act to refer various applications to the Minister for the River Murray and take into account any comments and directions of the Minister in determining these applications.

In addition where DAC is the approval authority it undertakes a compliance and enforcement function to ensure development is undertaken in accordance with approvals and to take action where development is undertaken without approval.

9.1.3. GUIDELINES FOR MARINA DEVELOPMENT ALONG THE RIVER MURRAY

A draft guideline has been developed and released for public consultation. More development is currently underway relating to the marina aspects of the guidelines, for example, site suitability criteria based on feedback from the consultation.

9.2. HUMAN DIMENSION

9.2.1. WATER SENSITIVE URBAN DESIGN

Water Sensitive Urban Design (WSUD) is an approach that supports more sustainable and water efficient urban development. It provides for the sustainable use and re-use within urban areas of water from a range of sources.

The 30 Year Plan for Greater Adelaide released this year calls for mandating of WSUD in all new developments (including residential, retail, commercial, institutional, industrial and transport developments) by 2013. This will contribute towards improved water quality outcomes and ensure the more efficient use of water. This is consistent with *Water For Good*, the Government's blue-print for water security.

A WSUD Technical Manual for Greater Adelaide has also been produced that provides guidelines for applying selected WSUD techniques suitable for local conditions.

10. SOUTH AUSTRALIAN TOURISM COMMISSION

In relation to the RM Act, the South Australian Tourism Commission (SATC) sets the strategic direction for tourism in the State via its State Tourism Plan. It works closely with key industry and government partners to strengthen the tourism industry within SA.

10.1. HUMAN DIMENSION

SATC has developed and is implementing a number of tourism plans for the River Murray region. Tourism is a key industry that can be developed around the region's natural resources.

10.1.1. RIVERLAND INTEGRATED STRATEGIC TOURISM PLAN

The plan has been developed around achieving realistic tourism for the region which is consistent with the riverland community's aspirations. It is a summary of substantial economic, market, resource, social, landscape, environmental and planning policy investigations that will provide a focus for future action.

10.1.2. MURRAYLANDS INTEGRATED STRATEGIC TOURISM PLAN.

The plan has been developed with the objective of providing the Murraylands with an innovative and strategic policy and planning framework. This will help attract and grow investment and build capacity in sustainable tourism within the region.

10.1.3. IMPACT OF THE DROUGHT ON RIVER MURRAY TOURISM

This project measures the current and future economic impact of the drought on River Murray Tourism. This includes how community perceptions of what the drought means to tourism opportunities can impact on tourism numbers. This is a tri-state initiative between Tourism NSW, Victoria and Tourism Research Australia. The report outcomes will help guide future tourism promotional campaigns in the region.