

Menindee Lakes
Economic Benefit Assessment
Regional Development Australia
Far West NSW

Final
March, 2011

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Job ID: 15859
Job Name: Menindee Lakes Economic Benefit Assessment
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Document Name: Menindee Lakes Economic Benefit Assessment Final
Last Saved: 11/3/2011 5:40 PM

Version	Date	Reviewed PM	Approved PD
Draft v1.0	25/02/2011	AS	SS
Draft v2.0	7/03/2011	AS	SS
Final	11/03/2011	AS	SS

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Executive Summary

Menindee Lakes

The Menindee Lakes is a series of natural lakes located on the Darling River in Far West NSW, around 110 km south-east of Broken Hill and around 1,300 km west of Sydney. The wetland ecosystem comprises four major and numerous small lakes and is home to over 170 different bird species. The Menindee Lakes have a rich Indigenous history extending over 40,000 years. The traditional people of Menindee are the Barkindji people, who travelled the length of the Darling River and relied upon the river and lakes for water and food.

The construction of dams, weirs, levees, canals and regulators during the 1950s and 1960s saw the lakes become an important water source for Broken Hill as well as meeting water requirements of the lower Darling and Murray system. During the last decade, the Menindee Lakes have been very dry as a result of the prolonged drought before a significant inflow of water starting in early 2010 resulting in the lakes reaching full capacity in late 2010.

Tourism Potential

The Menindee Lakes were very dry for almost a decade, resulting in significant declines in the number of visitors. Ensuring a more stable water supply for the wetlands and receiving government support for local projects has the potential to result in the Menindee Lakes becoming one of the most important and popular tourism attractions in NSW. For example, the Kakadu National Park attracts over 200,000 visitors annually supporting the fact that wetlands are attractive tourism destinations to both domestic and international visitors.

While the Menindee Lakes is unlikely to ever rival Kakadu National Park in terms of visitation, it does boast advantages such as proximity and access to Australia's largest cities. Potential tourism opportunities associated with the Lakes include:

- Indigenous tourism;
- Ecotourism;
- Bird watching;
- Outdoor recreation;
- Accommodation; and
- Art and culture.

Anecdotal evidence from consultation with local tourism representatives indicates that visitation to the Menindee Lakes has increased significantly in the last 12 months due to the significant increase in water levels and has been estimated at approximately 20,000 in 2010. Further tourism development, investment and marketing will continue to result in increased visitation. Assuming development of the tourism sector over the next five years, it has been estimated that the Menindee Lakes has the potential to attract 20,000 day trip and 60,000 overnight visitors annually. With the Menindee Lakes having the potential to be an iconic ecological and tourism asset, these projections are believed to be conservative. However, tourism business and infrastructure investment will be required to make Menindee Lakes more attractive to potential visitors.

Economic Benefit

Wetlands are an important part of the natural environment offering a number of benefits including supporting recreation and tourism, providing wildlife habitat and performing a number of environmental functions such as nutrient retention, water purification, flood mitigation, ground water recharge and carbon storage. In many cases, it is hard to quantify the economic value of environmental assets such as wetlands and for this reason, their importance and value is often underestimated.

In order to estimate the economic value of the Menindee Lakes, a total economic value framework has been adopted similar to other studies. Based on the assessment, the current total economic value of the Menindee Lakes has been estimated at \$90.3 million per annum. The current economic value includes the direct, indirect and non use value of ecosystem goods and services provided by the lakes.

The economic value is likely to increase in the future with an increased certainty of water flows through the Menindee Lakes coupled with the possibility of being Ramsar listed. When assessing the potential growth of the tourism sector in the area, the total value could increase to over \$105 million per annum. A detailed breakdown of each of the different value components are outlined below.

Table E.1: Economic Value of Menindee Lakes

Component	Total Value (\$/year)	
	Current Value (2010)	With Tourism Development
Direct Use		
Consumptive	\$0	\$0
Non-Consumptive	\$2,352,000	\$17,540,000
Indirect Use		
Water Filtration	\$55,907,500	\$55,907,500
Flood Control	\$10,450,000	\$10,450,000
Water Storage	\$2,203,000	\$2,203,000
Habitat Provision	\$11,162,500	\$11,162,500
Carbon Sequestration	N.a	N.a
Groundwater Recharge	N.a	N.a
Sub Total	\$79,723,000	\$79,723,000
Non Use		
Existence Value	\$8,229,809	\$8,229,809
Total Economic Value	\$90,304,809	\$105,492,809

Source: AECgroup, Various sources.

Conclusions

The Menindee Lakes are an iconic ecological and cultural asset of national importance. Despite having remained virtually untouched for 50 years, the region is beginning to appreciate the significance of the wetlands as reflected through the push to gain Ramsar listing.

The Menindee Lakes are conservatively estimated to have a current total economic value of over \$90 million per annum through recreation, tourism, water filtration, flood control, water storage, habitat provision and other environmental benefits. Such significant economic benefits strongly support the need to protect the sensitive ecosystem and facilitate investment so the Menindee Lakes can achieve its full growth potential as an ecological and tourism asset for NSW and the nation as a whole.

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1. Introduction

1.1 Project Background

The Menindee Lakes is a series of natural lakes located on the Darling River in Far West NSW, around 110 km south-east of Broken Hill and around 1,300 km west of Sydney. The wetland ecosystem comprises four major and numerous small lakes and also includes a vast flood plain and rich creek system. The Menindee Lakes are home to over 170 different bird species, more than 15 fish species, and other animal life including mammals, frogs and reptiles.

Regional Development Australia Far West NSW (RDA Far West NSW) and Central Darling Shire Council are looking to achieve Ramsar listing (a global environmental treaty that requires governments to protect listed wetlands) for the Menindee Lakes. Planning by the Murray Darling Basin Authority could potentially result in the release of more water into the system, which is likely to increase the flow of water through the Menindee Lakes and reduce the long dry spells. In order to identify the social, economic and environmental benefits associated with healthy wetlands, RDA Far West NSW has engaged AECgroup to undertake an Economic Benefit Assessment of the Menindee Lakes.

1.2 Purpose of the Study

The purpose of the Menindee Lakes Economic Benefit Assessment is to identify, assess and quantify the existing and potential future socio-economic and environmental benefits (such as maintaining biodiversity, water purification, flood mitigation and groundwater recharge) associated with the protection of wetlands. The study will be used to inform various organisations, stakeholders and Government decision makers on the economic value of the Menindee Lakes so that decision makers understand the true value of a healthy wetlands system when planning for the future of the Menindee Lakes, the Murray Darling Basin and tourism in outback NSW.

1.3 Report Structure

Chapter 1: Introduction – Overview of the project’s background and the purpose of this study to quantify the economic value of the Menindee Lakes.

Chapter 2: Menindee Lakes – Outline of the location, characteristics, history, regulation and current planning for the Menindee Lakes.

Chapter 3: Tourism Assessment – Overview of the existing tourism sector relating to the Menindee Lakes and wider Outback NSW region and potential future development.

Chapter 4: Economic Benefit Assessment – Assessment of the benefits of healthy wetlands and the economic value of the Menindee Lakes.

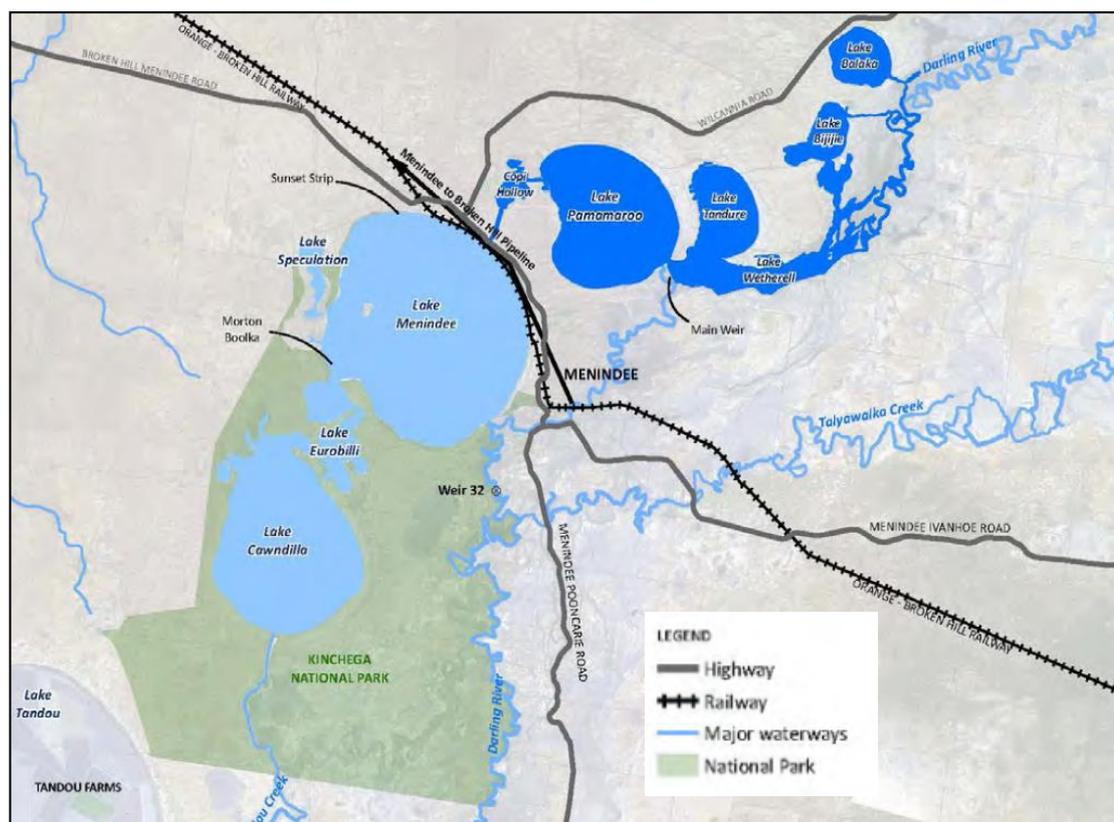
Chapter 5: Conclusion – Overview of the benefits of the Menindee Lakes and implications for planning and tourism development.

2. Menindee Lakes

2.1 Overview

Located on the Darling River in the Central Darling Shire, the Menindee Lakes comprise a series of natural lakes around 110 km south-east of Broken Hill and 1,300 km west of Sydney. The lakes were originally a series of natural depressions that filled during floods. As the flow receded, the floodwaters in the natural depressions drained back into the Darling River. The lake system underwent modification during the 1950s and 1960s with the construction of the Menindee Lakes Water Storage scheme to supply water to Broken Hill.

Figure 2.1: Menindee Lake System and Surrounds



Source: Sinclair Knight Merz (2010)

The Menindee Lakes comprise approximately over 15 lakes, with a nominal full water capacity of 1,731 gigalitres (GL), with an additional capacity of 300 GL during floods. Major lakes within the Menindee wetland ecosystem include Pamamaroo, Wetherell, Menindee and Cawndilla lakes, with over 10 small lakes including Malta, Balaska, Bijiji, Copi Hollow, Tadure, Packers, Kangaroo, Stir Tank, Emu, Spectacle, Eurobilli and Speculation.

The total surface area covered by the lakes is around 47,500 hectares with Lake Menindee the largest of the lakes measuring 16km long and 14km wide. The wetland ecosystem is home to a diverse range of flora and fauna, with over 170 different bird species including several endangered and vulnerable species. Since the water levels have been stabilised, the lakes have built up a large population of fish, with over 15 different species including European carp, murray cod, crayfish, eastern gambusia, Australian smelt, flat-headed gudgeon, hardy head, bony bream, and cat fish. The wetlands are also home to other threatened animal species including mammals, frogs and reptiles.

Located around 13km north of Menindee, the artificially constructed water body of Copi Hollow is a major tourist attraction offering a range of recreational facilities including speed boating, sailing, swimming, water skiing, caravan parks and picnic facilities. The water sports facility also hosts inland speed championships, only when water is available, attracting a large number of sporting enthusiasts.

2.2 History

The Menindee Lakes have a rich Indigenous history extending over 40,000 years. The traditional people of Menindee are the Barkindji people, who travelled the length of the Darling River and relied upon the river and lakes for water and food.

The Menindee Lakes were first discovered by Europeans in 1835 by Major Thomas Mitchell. The lakes were identified as a water supply source for Broken Hill and in 1949 work began on building dams, weirs, levees, canals and regulators to catch and retain floodwaters, with completion of major works in 1960 and final completion in 1968. The initial purpose of the scheme was to provide water to the city of Broken Hill and foster economic development in the Far West NSW region through irrigation. However, under the Murray-Darling Basin Agreement, the lakes now play a vital role in meeting water requirements of the lower Darling and Murray system. The table below outlines key characteristics of the Menindee Lakes.

Table 2.1: Menindee Lakes Facts and Figures

Characteristic	Figure
Dam height	11.5m
Water depth	7m average
Full Supply Level	
Lake Wetherell	61.67m
Lake Pamamaroo	60.45m
Lake Menindee	59.84m
Lake Cawndilla	59.84m
Storage capacity	1,731,216ML
Surface area	47,500ha
Catchment area	273,229km ²
Spillway capacity	97,880ML/day

Source: State Water Corporation (2009)

During the last decade, the Menindee Lakes have been very dry as a result of the prolonged drought before a significant inflow of water starting in early 2010 resulting in the lakes reaching full capacity in late 2010.

2.3 Ramsar Convention

The Ramsar Convention is an international environmental treaty for the conservation and sustainable utilisation of wetlands. Developed and adopted by 160 member countries in 1971 in the town of Ramsar in Iran, 2011 marks the 40th anniversary of the Ramsar Convention.

The treaty entails commitment on the part of its member nations to support its "three pillars" outlined below:

- Ensuring the conservation and wise use of wetlands that have been designated as Wetlands of International Importance;
- Including as far as possible the wise use of all wetlands in national environmental planning; and
- Consulting with other parties about implementation of the Convention, especially in regard to transboundary wetlands, and shared water systems and species.

RDA Far West NSW and Central Darling Shire Council are currently seeking to achieve Ramsar listing for the Menindee Lakes. The Shire's quest for Ramsar listing is strongly supported by the Broken Hill City Council. Listing would recognise the international importance of the Menindee Lakes and the need for Government to protect the wetlands.

2.4 Similar Wetlands in Australia

There are thousands of wetlands located throughout Australia ranging from marine/coastal, inland and human-made wetlands. In order to provide some context for the Menindee Lakes system, the following section provides an overview of two large wetland systems in Australia:

- *Riverland*: A similar wetland to the Menindee Lakes, located approximately 300km south west.
- *Kakadu National Park*: A major tourism destination in the Northern Territory and arguably Australia's most famous wetland system.

2.4.1 Riverland

The Riverland wetlands are located in South Australia, approximately 300km south west of the Menindee Lakes. The wetlands are within the Murray-Darling Basin catchment, with major town centres of Renmark, Berri, Loxton, Waikerie and Barmera. Covering an area of 30,615 hectares, the wetlands comprise three land components (Murtho, Calperum and Chowilla), with a series of creeks, lakes, lagoons, billabongs, swamps and kales. The Riverland wetlands are Ramsar listed with nearly 90% of the site being allocated for biodiversity conservation. Abundant in wildlife, these wetlands are home to various bird and animal species including water birds, fish, reptiles and koalas.

The Riverland wetlands are similar to the Menindee Lakes in many respects and support a significant tourism industry including a variety of recreational pursuits such as fishing, bush camping, canoeing, water skiing and waterfowl hunting. There are several local tourism operators including houseboat hire, nature-based boat and vehicle tours, pastoral industry tours and on-site accommodation. A few commercial fishers also have licenses to take Bony Herring (a common native fish), European Carp (an exotic species) and other non-native species from the backwaters of the site. Along the Chowilla Anabranche there are 38 campsites and during most Easter long weekends, all these sites can be occupied with in excess of 170 visitors (Department of Environment and Heritage, 2010).

2.4.2 Kakadu National Park

The Kakadu National Park is located in the tropical north of Australia, 130 km east of Darwin and covers approximately 20,000 sq km. The National Park is one of only a few sites included in the World Heritage list for both cultural and natural values. Kakadu National Park is well known for its Aboriginal art sites providing a historical record of human interaction over tens of thousands of years.

Kakadu National Park is recognised for its international significance under the Ramsar Convention. The wetlands represents enormous biological diversity with over 500 different species of animals, more than 250 species of birds and around 10,000 species of insects. The region is well endowed with a series of rain forests such as allosyncarpia trees, savannah woodlands and monsoon forests.

There are several accommodation options in the Kakadu National Park, mostly found in the town of Jabiru. These range from the luxury Gagudju Crocodile Holiday Inn to a range of holiday parks. There are also a wide variety of designated camping sites throughout the Park. Some of the Park's campsites charge a nominal fee as these have shower and toilet facilities, others are free, however they have limited or no facilities. Indigenous tourism operations are well developed including accommodation establishments and tour operators.

There were 226,400 visitors to the Kakadu National Park in 2009, a 1.1% decrease compared to 2008. On average, an estimated 211,800 overnight visitors came to the Kakadu Arnhem region per year over the three year period (2007-2009). Visitors stayed approximately 775,000 nights equating to an average length of stay of 3.7 nights. There was an even split of interstate overnight visitors and Territorians to the region (Tourism NT, 2010).

3. Tourism Assessment

3.1 Existing Tourism Market

3.1.1 Menindee Lakes and Surrounds

3.1.1.1 Overview

The Menindee Lakes are a popular tourist destination offering a variety of recreational activities such as paddling, sailing, boating, swimming, fishing and bird watching. The lakes are considered one of the finest fishing spots in outback NSW offering around 17 species of fish including gold and silver perch, European carp, crayfish, eastern gambusia, murray cod, Australian smelt, flat-headed gudgeon, hardy head, bony bream, and cat fish. The lakes are home to approximately 170 bird species, including a wide variety of waterbirds such as pelicans, spoonbills, egrets, cormorants and swans, and are considered a 'paradise for bird watchers'.

The surrounding area includes the town of Menindee and various national parks such as Kinchega, Mungo, Gundabooka, Mutawintji and Paroo-Darling, which attract a large number of visitors to the region. The tourism market is dominated by the self drive sector with visitors driving through the region along the main highways. Grey nomads (primarily retirees over the age of 50 driving around the country with caravans or camping) are the major visitor segment; however, they spend very little at present. The peak tourist season is usually during the cooler months from March to September with Easter and school holidays during this period particular popular. The recent rain of the past year and a half and flooding in Queensland has increased the amount of water in the Menindee Lakes and subsequently renewed visits to the area.

3.1.1.2 Visitors

Limited data is available on the number of visitors to the Menindee Lakes due to the lack of entrance gates or a visitor centre at the site. The Kinchega National Park contains part of the Menindee Lakes and can be used to inform visitation to the lakes. Data from the NSW National Parkes and Wildlife Service's *Far West Region Tourism Strategy 2008-2013* estimated that the Kinchega National Park recorded visitation of 12,000 in 2007.

The Menindee Lakes had almost no water during this period so it is not likely to be a good indication of total visitation. Consultation with local tourism industry stakeholders and businesses support this view, saying that visitation increased significantly in 2010 with the significant inflow of water into the Menindee Lakes. With some commentators believing visitation has increased threefold since the heart of the drought, it has been conservatively estimated that the Menindee Lakes recorded 20,000 visitors in 2010. NSW National Parkes and Wildlife Service estimated the nearby Mungo National Park recorded 45,000 visitors in 2007 which is significantly higher than Kinchega National Park.

Visitor profiles compiled from surveys in the national parks found that approximately half of visitors are from NSW with interstate visitation made up of 69% from Victoria, 21% from South Australia and 10% from Queensland. International visitors account for approximately 4% of visitation.

According to survey data from Tourism Research Australia, there was an estimated 46,000 overnight visitors to the Central Darling Shire in the year ending September 2010. Visitors were estimated to have spent 134,000 visitor nights in the Central Darling Shire, equating to an average stay in the area of 2.99 nights. Due to the small sample size, the estimated data was based on an annual average over the past four years.

3.1.1.3 Tourism Attractions

In addition to the Menindee Lakes, additional tourism attractions in the Menindee area include:

- **Town of Menindee:** Menindee is a small township of around 600 residents located on the Darling River, around 1,100 km north-west of Sydney. It is the oldest European settlement in western NSW and the first town to be established on the

Darling River. The history of the town makes it a popular destination for visitors with several pubs and heritage walking tours.

- **National Parks:** The area surrounding the Menindee Lakes is home to a number of national parks including:
 - **Kinchega National Park:** The 44,000 hectare National Park encompasses several of the Menindee Lakes and is located to the west of Menindee. The National Park is well known for gum forests and black soil flood plains along the Darling River and is a major tourist destination with over 30 camping areas and the famous *Kinchega Woolshed*, attracting tens of thousands of tourists each year.
 - **Mungo National Park:** Covering an area of 27,800 ha, the National Park was established in 1979 and is located 100km south of Menindee. The Park is well renowned for containing over 40,000 years of Aboriginal history in the form of ancient artifacts, stone tools, fireplaces and bones. A popular tourist destination, the Park offers a range of recreational and adventurous activities including camping, bushwalking, sightseeing, scenic driving and photography, attracting over 40,000 visitors each year.

3.1.1.4 Tourism Businesses & Accommodation

The town of Menindee has a variety of tourism-related businesses and accommodation establishments including hotels, motels, caravan parks, cottages and farm stays. Some of the key accommodation establishments located in Menindee are outlined in **Table 3.1**.

Table 3.1: Tourism Accommodation and Businesses, Menindee

Accommodation and Business Establishments	Rooms/Units / Cabins/ Camping Sites
Hotels & Motels	
Albemarle Hotel	6 rooms, and a unit (that can accommodate up to 8 people)
Maidens Menindee Hotel	8 rooms
Burke & Wills Menindee Motel	15 rooms
Backpackers & Hostels	
Kinchega Shearers Quarters	6 rooms
Caravan Parks & Camping Sites	
Menindee Lakes Caravan Park	3 on-site cabins & 4 on-site caravans
Copi Hollow Caravan Park	3 on-site cabins
Nelia Gaari Station	1 house (4 bedrooms); 12 camping sites
Holiday Units	
Idle View	2 rooms
Bindara on the Darling	N/A

Source: Various sources

Tourism businesses currently located in Menindee include:

- **River Lady Tours:** A riverboat cruise company first launched on the Darling River and has been operating in the Menindee area since 2000. The boat is licensed to carry 25 passengers and currently run cruises departing from the Main Weir, Menindee including day cruises, sunset cruises and personalised tours. Commentary is given on each trip including information about the Barkindji people, birdlife, animals and fish that inhabit the wetlands area and the history of the area.
- **Coach Tours:** There are several companies that operate coach tours from Broken Hill to the Menindee Lakes. Buses range from 4-45 seats and operate several tours per week depending on demand.

3.1.2 Outback NSW Region

3.1.2.1 Overview

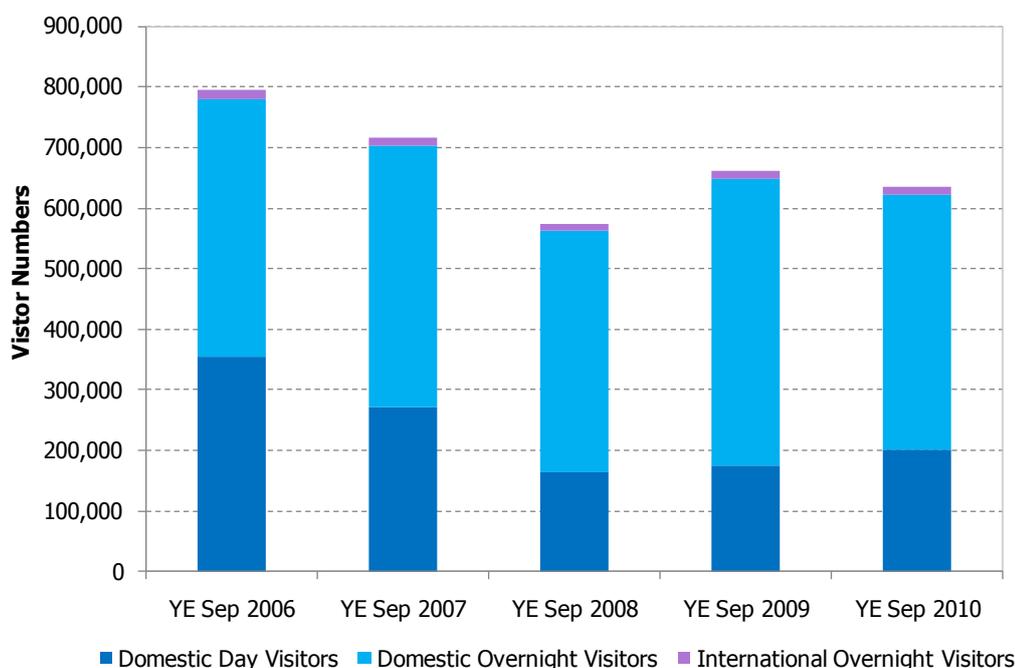
The Menindee Lakes and surrounding area forms part of the 'Outback NSW' tourism region. The region as defined by Tourism NSW is composed of nine local government areas (LGAs) with major towns comprising Broken Hill, Silverton, Lightning Ridge, White Cliffs and Wentworth. The region is renowned for its vast open spaces, breath taking landscapes and rich history.

3.1.2.2 Visitors

The Outback NSW region attracted a total of 202,000 domestic day-trippers during the year ending September 2010, with 420,000 domestic and 12,300 international overnight visitors. Over the past year, the region has witnessed a decline of approximately 11.0% in the number of overnight visitors, while the number of day-trippers to the region has gone up by almost 15% since September 2009.

More than half of the domestic visitors were from NSW with the remaining 45% coming from other states. South Australia represented the largest interstate market for both visitors and nights. In relation to the international visitor market, U.S.A, New Zealand and the U.K accounted for more than two-thirds of international visitors in the region during the year ending September 2010.

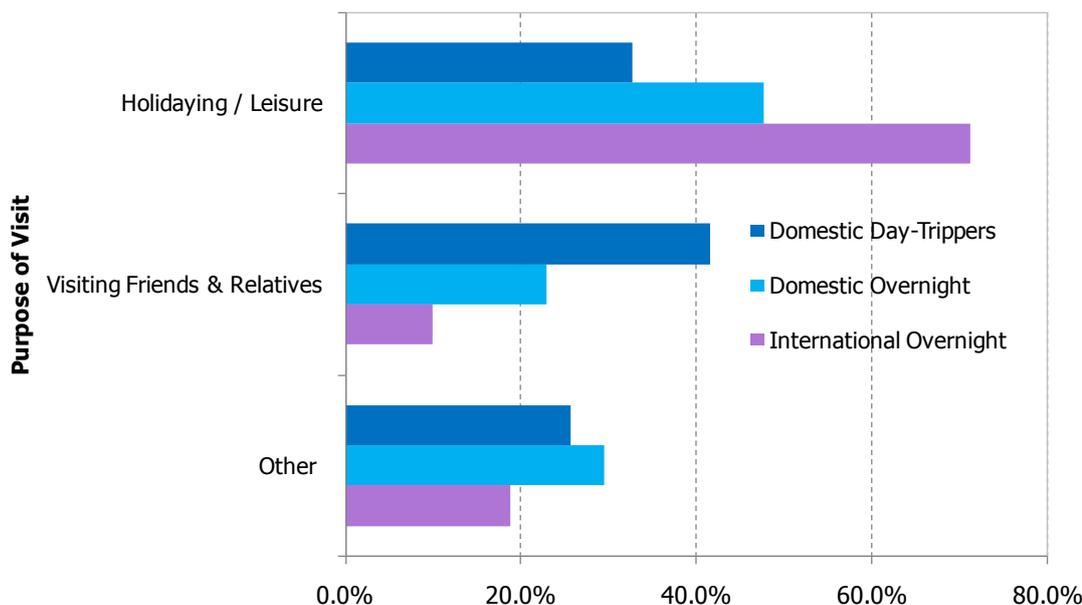
Figure 3.1: Number of Visitors - Outback NSW Region, YE September 2006-2010



Source: Tourism NSW (2010)

'Holidays/ leisure' was considered the most popular reason for visiting the region. Nearly half of the domestic overnight travellers and over 70% of international visitors came to the region to engage in leisure time activities. **Figure 3.2** provides a detailed breakup of the purpose of visits across the various visitor types.

Figure 3.2: Purpose of Visit - Outback NSW Region, YE September 2010



Note: Other category includes travel for business, employment and other reasons.
Source: Tourism NSW (2010)

The age profile of visitors to the Outback NSW region is considerably different across the various visitor types. Around half of domestic overnight visitors are above 55 years, reflecting the high number of grey nomads, while the largest day-tripper age group was between 45-54 years.

3.1.2.3 Tourism Attractions

The Outback NSW region has a number of local attractions across the towns of Menindee, Broken Hill and White Cliffs. While the local attractions found in the town of Menindee have already been discussed in the previous section, this section provides a brief overview of some of the key tourism destinations in Broken Hill and White Cliffs respectively:

- **Broken Hill:** Located over 1,100 km from Sydney, the city of Broken Hill is the largest centre in the Outback NSW region. Popularly known as 'the Silver City', Broken Hill is home to one of the world's largest known silver-lead zinc deposits. The city offers a variety of tourist attractions including reserves, symposiums, art galleries and walking tracks. Broken Hill City Council is currently attempting to invigorate tourism with the construction of a multi-million dollar world class film studio, expected to be completed in time for the filming of Mad Max 4. Some of the existing popular tourist destinations within the city of Broken Hill include:
 - The Living Desert;
 - Sculpture Symposium;
 - St. Patricks Racing Club (annual racing events attract thousands of visitors);
 - Broken Hill Regional Art Gallery; and
 - The town of Silverton.
- **White Cliffs:** The town of White Cliffs is located around 1,000 km north-west of Sydney, in the Outback NSW region. Discovered in the 1890s, the town is Australia's oldest commercial opal field. The opal mining town has a semi-desert landscape with residents living mainly underground owing to its geological characteristics. The town offers a number of tourist attractions including safari tours, day excursions, photo galleries and cafes. The town is home to Australia's largest photography gallery - the Otto Rogge Photography gallery and the Red Earth Opal Showroom and Cafe. Other

attractions in and around the city include Jock's Place (underground home, museum and mine) and the Mutawintji and Paroo-Darling National Parks.

3.1.2.4 Transport

Broken Hill and the surrounding area is known as the "Accessible Outback" due to the range of transport. The Outback NSW region is well serviced with major arterial roads including the Barrier, Cobb, Silver City and Sturt Highways. The Barrier Highway connects the Outback NSW region with Adelaide and Sydney, the Silver City and Cobb Highways link the region to Victoria, with the Sturt Highway linking it to Canberra. These roads facilitate the significant self drive tourism sector in the region.

Many people travel to the region by train with a Country Link train service connecting the region to Sydney and other regional towns. A weekly service operates between Sydney and Broken Hill on Mondays (stopping in Menindee) and returns to Sydney on Tuesdays. Great Southern Railways also operates a twice weekly return train journey between Sydney and Perth on the Indian Pacific, which stops at Broken Hill and Menindee if requested.

The region has well developed aviation infrastructure with a number of regional airports located in the towns of Broken Hill, Bourke, Lightning Ridge, Walgett and Wentworth. Regional Express operates multiple flights each day to Adelaide, Dubbo and Sydney from Broken Hill. Broken Hill airport recorded over 60,000 revenue passengers during 2009-10.

3.2 Future Tourism Potential

The Menindee Lakes reached full capacity in 2010 for the first time since September 2001. Anecdotal evidence from consultation with local tourism representatives indicates that visitation has increased significantly in the last 12 months due to the significant increase in water levels despite flooding closing several key access roads and national parks in the area. Some commentators believe visitation has increased threefold since the heart of the drought.

The limited water supply in the Menindee Lakes over the last decade has not provided the security and certainty required to facilitate significant tourism investment. An increased certainty of water flows through the Menindee Lakes coupled with the possibility of obtaining Ramsar listing for the wetlands will create considerable tourism opportunities within the Menindee Lakes and surrounding area.

The Menindee Lakes are an iconic ecological asset of national significance and significant government support could see it become the premier tourism attraction in Outback NSW. The Kakadu National Park attracts over 200,000 visitors annually supporting the fact that wetlands are attractive tourism destinations. While the Menindee Lakes is unlikely to ever rival Kakadu National Park in terms of visitation and scale of biodiversity, it does boast advantages such as proximity and good access to Australia's largest cities.

Potential tourism opportunities associated with the Lakes include:

- **Indigenous Tourism:** Appropriate marketing of the rich cultural and Aboriginal history of the Menindee Lakes and surrounding areas will create an opportunity to attract visitors interested in Aboriginal culture and colonial heritage. Ramsar listing would enable the Lakes to be marketed as a site of international significance, potentially attracting visitors interested in the cultural and natural heritage of the Lakes. Government support could assist local indigenous people develop tourism businesses. Indigenous tourism businesses have been successful in the Kakadu National Park and similar accommodation and tour operations could be developed around the Menindee Lakes. Facilitation of new businesses that can employ Indigenous people will also have a direct positive social impacts including reduction in the high rates of Indigenous unemployment in the region and corresponding reduction in welfare payments, plus increased optimism and hope for the younger generations in the region.

- **Ecotourism:** There is considerable potential for development of ecotourism within the Menindee Lakes. Ecotourism is a form of tourism based upon natural resource attractions and carried out in a manner consistent with the protection of these attractions. Ecotourism is a fast growing sector with people looking for holidays where they can escape from major cities to pristine natural locations. There is potential for the development in the region of ecotourism accommodation establishments which are environmentally friendly and have limited impacts on the environment such as sustainable cabins of luxury safari camps. There are also opportunities to expand the number of tours highlighting the natural beauty of the region including hiking tours, 4WD tours, kayaking tours and scenic flights.
- **Bird watching:** The Menindee Lakes is home to over 170 bird species and has the potential to attract bird watching tourists and ornithologists to the region. The Murray-Darling Region has been recognised internationally as an Endemic Bird Area due to the concentration of bird species that can only be found in certain areas. Bird watching tourists tend to be from older age groups, couples or empty nesters and are often described as falling within the socially aware visitor segment. They are relatively affluent and prepared to spend to see species in which they are interested. There is the potential to market the Menindee Lakes as an emerging bird watching destination and develop tours and bird lodges. The region would also have the potential to attract ornithologists looking to study the wide range of birds at the Lakes.
- **Outdoor Recreation:** A secure water supply within the Lakes will create possibilities for expanding the range of water sports and activities such as paddling, sailing, boating, swimming and fishing throughout the year, attracting increased number of visitors. There are also opportunities to expand land based recreational activities such as hiking, camping, quad-biking and cycling. This will in turn further create growth opportunities for a variety of tourism businesses including, tour operators, hiring services and hospitality operators.
- **Accommodation:** A rise in visitor numbers to the Lakes is likely to create an increased demand for tourist accommodation around the Lakes, creating potential opportunities for accommodation providers including motel, holiday parks and camping sites. As mentioned above, accommodation establishments could include environmentally sustainable cabins or tents.
- **Art and Culture:** Outback NSW is regarded as a premier destination for art and culture with a large number of art and photographic galleries located throughout the region. Menindee has the potential to leverage this reputation with the development of tourism products such as photography tours, indigenous arts and crafts, art gallery and cultural/environmental interpretation centre.

Anecdotal evidence from consultation with local tourism representatives indicates that visitation to the Menindee Lakes has increased significantly in the last 12 months due to the significant increase in water levels. Further tourism development, investment and marketing will continue to result in increased visitation. Assuming tourism development over the next five years, it has been estimated that the Menindee Lakes has the potential to attract 20,000 day trip and 60,000 overnight visitors annually. With the existing average stay of 2.99 nights in the Central Darling Shire, it has been conservatively estimated that overnight visitors to the Menindee Lakes will stay an average of two nights.

When compared with existing visitation to the Outback NSW Region, projected visitation to the Menindee Lakes represents less than 10% of day trips and visitor nights spent in the wider region. With the Menindee Lakes having the potential to be an iconic ecological asset, these projections are believed to be conservative. However, tourism business and infrastructure investment will be required to make Menindee Lakes more attractive to potential visitors. Additional investments can be readily marketed by local Council and the RDA Far West.

4. Economic Benefit Assessment

4.1 Benefits of Wetlands

Wetlands are areas of land where the soil is saturated with moisture either permanently or seasonally. They include a variety of water bodies such as swamps, marshes, billabongs, lakes, lagoons, mudflats, mangroves, coral reefs, bogs, fens and peatlands. Wetlands are considered as an important part of the natural environment offering a number of benefits including:

- **Wildlife Habitat:** The wetlands across the globe play a significant role in maintaining biodiversity by offering vital habitats to a wide variety of flora and fauna including fish, birds, mammals, reptiles and insects. Many of these species only live in wetlands and are endangered due to the destruction of wetlands.
- **Environmental Benefits:** Wetlands perform a number of environmental functions, including nutrient retention, water purification, flood mitigation, ground water recharge and carbon storage. In many cases, these environmental services provided by wetlands replace the need for additional 'manmade' infrastructure such as water treatment and filtration plants which can cost millions of dollars to construct and operate. In these cases, wetlands provide value by avoiding costs that would otherwise be needed.
- **Cultural & Geological Heritage:** The Australian wetlands are well known for their natural and cultural significance, providing a rich record of Aboriginal history including fossil sites, art, and tools.
- **Ecotourism:** Wetlands have in recent years become popular ecotourism destinations, offering a range of environmentally sustainable recreational activities including bird watching, canoeing, kayaking and fishing.

In many cases, it is hard to quantify the economic value of environmental assets such as wetlands and for this reason, their importance and value is often underestimated. In recent years, more studies have been undertaken looking to quantify the various benefits of wetlands in monetary terms.

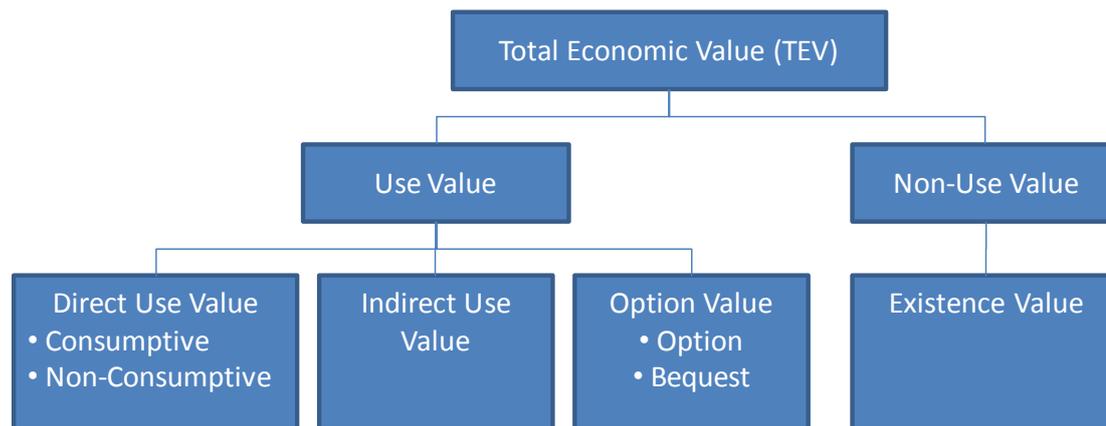
4.2 Total Economic Value Framework

The approach used for this study has been developed based on the framework outlined in the study *Assessing the Economic Value of Ecosystem Conservation* (Pagiola, 2004) and adapted in *Wetlands: underpinning a robust rural economy A briefing paper on the economic benefits of Australian wetlands Hattah Lakes case study* (ACF, 2010), a study of the Hattah Lakes in Victoria.

To estimate the economic values of a wetland ecosystem the concept of Total Economic Value (TEV) has been adopted. TEV is a common approach used for assessing the total range of economic values attributable to an environmental asset, such as a wetlands system, and includes the following categories:

- **Direct Use Value:** Comprises 'consumptive uses' that are goods used directly by human beings (such as the extraction of timber, hunting, fishing etc) and 'non-consumptive uses' that are benefits that don't require the harvesting of products (such as recreation and tourism). These values can generally be associated with monetary values through market prices.
- **Indirect Use Value:** This is the value of the ecosystem services where benefits are felt outside the ecosystem. In the case of wetlands this includes water filtration, flood protection, water storage, groundwater recharge, nutrient discharge, carbon storage and animal habitat.
- **Option Value:** This is the value placed on conserving an environmental asset for future use, either by having the option to use it at a later time by ourselves (option) or by future generations (bequest).
- **Existence Value:** This is the satisfaction people gain by simply knowing a natural asset exists, even if they never plan to use it themselves.

Figure 4.1: Total Economic Value Framework



Source: Pagiola (2004)

As previously discussed, the approach adopted in the Hattah Lakes study has been used as a template for the study of the Menindee Lakes. The assessment of the tourism sector has been based on tourism statistics and informed by consultation with tourism industry stakeholders.

The indirect use and environmental benefits for the Menindee Lakes have been calculated by applying benefits identified in other peer reviewed studies of wetland ecosystem service values in Australia and internationally to the Menindee Lakes. In all cases, the more conservative figures have been used and in some cases no value has been estimated due to limited data and significant uncertainty. Where possible, data has been used from studies that have looked at Australian wetlands though in some case Australian studies have not been available and international studies have been used.

4.3 Total Economic Value for Menindee Lakes

4.3.1 Direct Use

The direct use value refers to the value of ecosystem goods and services that are directly used by human beings. Direct use values are usually enjoyed by local residents or visitors to the ecosystem and can be divided into consumptive and non-consumptive uses.

4.3.1.1 Consumptive

Consumptive uses encompass the value of the extraction of goods from the wetlands such as timber, hunting, fishing and medicinal products. There is very limited extraction from the Menindee Lakes with recreational fishing the only sector. Recreational fishing is relatively small and there is no reliable statistics on the quantity of fish taken from the lakes. Therefore, no consumptive value has been applied to the Menindee Lakes.

4.3.1.2 Non-Consumptive

Non-consumptive uses generally comprise recreational and cultural activities that do not require harvesting/extraction of products. Examples include bird watching, swimming, boating, canoeing and kayaking. The non-consumptive value of the Menindee Lakes includes expenditure in the local area by visitors to the Menindee Lakes. Expenditure includes a range of items such as accommodation, transport, fuel, organised tours, recreation activities, meals, drinks and souvenirs.

In order to calculate the non-consumptive value of the Menindee Lakes, average daily expenditure estimates have been applied to estimated visitation. In the absence of specific visitor expenditure data available for the Menindee Lakes area, data from the *National Visitor Survey* has been used. According to the survey, domestic overnight visitors to the Outback NSW Region spent an average of \$129 per night in the year ending September 2010. Average daily expenditure by day trip visitors is not available for the Outback NSW region due to the sample size being too small. Data for the wider

regional NSW region found that the average day trip visitor spent \$103 per day in the year ending September 2010. Consultation with local tourism representatives indicates that current average expenditure is likely lower than the averages outlined below due to the demographic of visitors and available commercial attractions in and around Menindee. Therefore, expenditure in Menindee has been conservatively estimated at 60% of regional averages, equating to \$61.80 for day trip visitors and \$77.40 for overnight visitors.

It is estimated that the Menindee Lakes attracted 8,000 day trip visitors and 12,000 overnight visitors in 2010, equating to 24,000 visitor nights. When average expenditure estimates are applied, the total non-consumptive value of the Menindee Lakes is estimated to be \$2.35 million.

As outlined earlier, the development of the tourism industry in the Menindee Lakes could result in approximately 20,000 day trip visitors and 120,000 visitor nights annually. It is very likely that the development of the tourism sector would result in the attraction of a more affluent visitor demographic and greater expenditure in the area as a result of more visitor attractions and hospitality services. It has been assumed that average expenditure would increase to be in line with regional averages. When average expenditure estimates are applied to potential visitation, the total non-consumptive value of the Menindee Lakes is estimated to have a potential value to the economy of \$17.54 million.

4.3.2 Indirect Use

'Indirect use' value is derived from ecosystem services that benefit the overall environment. Examples include natural water filtration, flood mitigation, water storage, habitat provision, carbon and groundwater recharge. Each of these environmental benefits have been calculated by applying per hectare estimates to the 47,500ha area of the Menindee Lakes and are discussed below.

4.3.2.1 Water Filtration

Wetlands act as natural waste water purification systems, ensuring downstream rivers and oceans remain clean. The water purification process involves retention, removal and transformation of excessive nutrients and sediment. *The Economic Cost of Wetland Destruction*, study undertaken in 2008, looked to estimate the value of wetlands in terms of water filtration. The methodology adopted in this study looks at estimating the cost of constructing and operating water filtration plants to replace the function performed by the destruction of wetlands. The study found that the value of temporal wetlands (wetlands that are not continuously connected to the river) vary depending on the number of months connected to the river and filtration efficiency. It has conservatively been estimated that the Menindee Lakes have a filtration efficiency of 50% and are connected to the Darling River for two months of the year. The study found that temporal wetlands meeting these characteristics are worth \$1,177/ha annually. Based on these findings, the estimated value of water filtration of the Menindee Lakes, is assumed to be \$55.91 million per annum.

4.3.2.2 Flood Control

Wetlands play a vital role in flood mitigation by acting as 'giant sponges' absorbing flood waters, thereby minimising downstream damage. The Menindee Lakes are filled by runoff from the Darling River during periods of high flow. The table below outlines the extent of recent floods in the area.

Table 4.1: Flooding on Darling River

Year	Max height at Bourke (m)	Total volume at Bourke (GL)	Max height at Wilcannia (m)	Total flows at Wilcannia (excludes Talyawalka)	Max height Weir 32 (m)
1988	12.57	3,500	10.19	2,600	5.10
1996	12.39	2,500	9.85	2,400	5.18
1997	13.78	9,700	10.83	4,200	7.45
2001	12.28	3,300	9.75	2,250	6.21
2010	10.78	2,370	9.43	2,400	5.44
2011	12.56	6,000*	10.5*	3,500*	7.14*

Note: * Predicted values
Source: State Water (2010)

There has been very little analysis of the economic value of wetlands in relation to flood control. *The Economic Value of Wetland Services: a Meta-Analysis* was a study undertaken in the United States and was based on a peer review of 39 other studies. The study found that the flood mitigation value of wetlands is between \$220-\$4,300/ha. Due to the low frequency of flooding events in the Murray–Darling Basin, the low estimate has been used for the Menindee Lakes. The estimated flood control value associated with the Menindee Lakes is estimated to total \$10.45 million.

4.3.2.3 Water Storage

Wetlands have an important role in water storage, thereby regulating water flows during both extremely wet and drier times. By balancing out the river flow, the wetlands reduce the need for building additional dams, weirs and regulators along the Darling River. Based on the previously mentioned study, *The Economic Value of Wetland Services: a Meta-Analysis*, the annual value associated with water storage services is conservatively estimated to be \$14.8/ha. Based on the size of the Menindee Lakes, environmental water storage benefits can be conservatively valued at \$0.70 million.

In addition to the environmental water storage benefits, the Menindee Lakes is also a crucial component of water storage and supply to Broken Hill and the surrounding area. The Menindee Lakes were developed to secure water supply to Broken Hill with a pipeline constructed to transport water to the town. Broken Hill has two reservoirs including Stephens Creek and Umberumberka with capacity of 20,000 ML and 7,800 ML respectively. When required, water is transported from the Menindee Lakes to Broken Hill. The Menindee Lakes are vital to Broken Hill's water security and the town would have run out of water several times during recent droughts if it wasn't for the pipeline and water storage in the Menindee Lakes. The next resort was transporting in water to Broken Hill by rail which would cost millions of dollars a month and only supply the most important living requirements.

Geoscience Australia have spent approximately \$20 million researching whether groundwater aquifers could be developed to improve Broken Hill's water security and reduce the town's reliance on the Menindee Lakes. It is difficult to estimate the cost of developing groundwater aquifers near Broken Hill though it is likely to be tens of millions of dollars. The annual operating and maintenance costs would likely be several million dollars. As a conservative estimate, an annual value of \$1.50 million has been allocated to the Menindee Lakes in relation to water storage for Broken Hill.

When the environmental storage benefits and value of water storage to Broken Hill are added together, the Menindee Lakes have an estimated water storage value of \$2.20 million.

4.3.2.4 Habitat Provision

Wetlands act as natural habitats for wildlife including birds and animals. They further provide a range of ecosystem services such as insect predation and pollination services. Based on the previously mentioned study, *The Economic Value of Wetland Services: a Meta-Analysis*, the low scenario annual value associated with animal habitat provision is estimated to be \$235/ha. Assuming this conservative estimate for the Menindee Lakes, the total value from habitat provision is \$11.16 million.

4.3.2.5 Carbon Sequestration

Wetlands assist the environment in removing carbon from the atmosphere by storing carbon in the soils beneath them and in the vegetation. Several studies have been conducted analysing the carbon sequestration abilities of wetlands though there is very limited data on economic values. Due to limited data, no estimate has been developed for the carbon sequestration benefit of the Menindee Lakes.

4.3.2.6 Groundwater Recharge

Another important attribute of wetlands is the ability to recharge the groundwater table. Groundwater has been identified as a potential solution to Broken Hill's water security issues. The Department of Sustainability, Environment, Water, Population and Communities commissioned Geoscience Australia to undertake a study of known groundwater resources and aquifer storage options within 150km of Broken Hill. Based on positive findings from this study, the Department commissioned further work by Geoscience Australia to help identify realistic groundwater options to secure Broken Hill's water supply. Early findings from the second phase of work have determined that the use of sustainable groundwater resources and an aquifer storage system is practicable, and a more detailed on ground geological and engineering assessment is being undertaken to fully test this new approach. At this stage, it is too early to determine the value of these aquifers and the contribution of the Menindee Lakes. As with carbon sequestration, the value of this service is difficult to quantify with any accuracy as it differs from wetland to wetland. Therefore, no value has been estimated for the Menindee Lakes.

4.3.3 Non-Use

'Non use' or existence value refers to people's satisfaction associated with the knowledge that a natural asset exists. In accordance with a study conducted for the Commonwealth Government's *Australian Natural Resources Atlas* in 2000, an Australian household is willing to pay on average \$0.07 per year for the protection of 10,000 hectares of bush. It has been assumed that this figure is transferable for wetland areas. The values provided "are useful for making a "first-pass" assessment of the size of non-market value" and developing indicative non-use values.

Following the guidelines for transferring the prices to a regional level, a scaling factor of 20 has been applied to allow for household's greater willingness to pay to protect local environmental assets. The willingness to pay is also multiplied by an aggregation factor of 45% to account for the potential bias in survey respondents as people unwilling to pay to protect assets are less likely to fill out the survey. This has been applied to the estimated 2.75 million households in NSW. Based on the guidelines provided in the report, the estimated nominal existence value for the Menindee Lakes is approximately \$8.23 million.

4.4 Summary

The current total economic value of the Menindee Lakes has been estimated at \$90.3 million. This value includes the direct, indirect and non use value of ecosystem goods and services provided by the lakes. When assessing the potential growth of the tourism sector in the area, the total value could increase to over \$105 million per annum. A detailed breakdown of each of the different value components are outlined in **Table 4.2**.

Table 4.2: Economic Value of Menindee Lakes

Component	Total Value (\$/year)	
	Current Value (2010)	With Tourism Development
Direct Use		
Consumptive	\$0	\$0
Non-Consumptive	\$2,352,000	\$17,540,000
Indirect Use		
Water Filtration	\$55,907,500	\$55,907,500
Flood Control	\$10,450,000	\$10,450,000
Water Storage	\$2,203,000	\$2,203,000
Habitat Provision	\$11,162,500	\$11,162,500
Carbon Sequestration	N.a	N.a
Groundwater Recharge	N.a	N.a
Sub Total	\$79,723,000	\$79,723,000
Non Use		
Existence Value	\$8,229,809	\$8,229,809
Total Economic Value	\$90,304,809	\$105,492,809

Source: AECgroup, Various sources.

5. Conclusion

The Menindee Lakes are an iconic ecological and cultural asset of national importance. Despite remaining virtually untouched for 50 years, the region is beginning to appreciate the significance of the wetlands as reflected through the push to gain Ramsar listing.

The Menindee Lakes were very dry for almost a decade, resulting in significant declines in the number of visitors. Ensuring a more stable water supply for the wetlands due to Murray Darling Basin Authority's ongoing work to rejuvenate the Murray Darling Basin, and receiving government support for local projects has the potential to result in the Menindee Lakes becoming one of the most important and popular tourism attractions in outback NSW. The Kakadu National Park attracts over 200,000 visitors annually supporting the fact that wetlands are attractive tourism destinations. While the Menindee Lakes is unlikely to ever rival Kakadu National Park in terms of visitation or scale of biodiversity, it does boast advantages such as proximity and access to Australia's largest cities. Potential tourism opportunities associated with the Lakes include:

- Indigenous tourism;
- Ecotourism;
- Bird watching;
- Outdoor recreation;
- Accommodation; and
- Art and culture.

Anecdotal evidence from consultation with local tourism representatives indicates that visitation to the Menindee Lakes has increased significantly in the last 12 months due to the significant increase in water levels. Further tourism development, investment and marketing will continue to result in increased visitation. Assuming development of the tourism sector over the next five years, it has been estimated that the Menindee Lakes has the potential to attract 20,000 day trip and 60,000 overnight visitors annually. With the Menindee Lakes having the potential to be an iconic and tourism ecological asset, these projections are believed to be conservative. However, tourism business and infrastructure investment will be required to make Menindee Lakes more attractive to potential visitors.

As demonstrated in the economic benefit assessment, the Menindee Lakes are conservatively estimated to have a total economic value of over \$90 million per annum through recreation, tourism, water filtration, flood control, water storage, habitat provision and other environmental benefits. With the future development of the local tourism sector, the total value could increase to over \$105 million per annum. Such significant economic benefits support the need to protect the sensitive ecosystem and facilitate investment so the Menindee Lakes can achieve its full growth potential.

References

- Australian Conservation Foundation (2010). *Wetlands: underpinning a robust rural economy. A briefing paper on the economic benefits of Australian wetlands Hattah Lakes case study*. Accessed on 3rd February 2011 from www.acfonline.org.au
- Department of Environment and Heritage (2010). *The Riverland Ramsar Site Management Plan 2010-2015*. Adelaide
- Molesworth, R & Molesworth, S (2010). *Menindee Lakes Wetlands Project – Stage One: Project Concept*.
- NSW National Parkes and Wildlife Service (2008). *Far West Region Tourism Strategy 2008-2013*.
- Pagiola, S., Von Ritter, K., & Bishop, J. (2004). *Assessing the economic value of ecosystem conservation, the World Bank Environment Department, Paper #101, in conjunction with The Nature Conservancy and the IUCN - The World Conservation Union*.
- Sinclair Knight Merz (2010). *Darling River Water Saving Project – Part B, Final Report*. Accessed on 17th February 2011 from www.environment.gov.au
- Schmidt, C.E (2008). *The economic cost of wetland destruction, paper presented to the 52nd Australian Agricultural and Resource Economics Society conference, Canberra, 5-8 February 2008*. Accessed on 23rd February 2011 from www.alloccasionsgroup.com
- State Water Corporation (2009). *Menindee Lakes Facts and Figures*. Accessed on 17th February 2011 from www.statewater.com.au
- Tourism NSW (2010). *Travel to Outback NSW – Year Ended September 2010*. Accessed on 23 February 2011 from www.corporate.tourism.nsw.gov.au
- Tourism NT (2010). *Regional Tourism Profile Kakadu-Arnhem Year ending December 2009*. Accessed on 23 February 2011 from www.tourismnt.com.au
- Tourism Research Australia (2010). *Travel by Australians – September 2010 Quarterly results of the national Visitor Survey*. Accessed on 23 February 2011 from www.ret.gov.au
- Van Bueren, M. & Bennett, J. (2000). *Estimating community values for land and water degradation impacts, National Land and Water Resources Audit taken from the Australian Natural Resources Atlas*. Accessed on 23rd February 2011 from www.anra.gov.au
- Woodward, R. & Wui, Y. (2001). *The economic value of wetland services: a meta-analysis, Ecological Economics, 257-270*.



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