The value of recreation at Logue Brook Dam

Prepared for the Department of Water

June 2006
The value of recreation at Logue Brook Dam

Contents

1 Introduction 1

2 Recreation and tourism at Logue Brook Dam 1
   2.1 Recreational activities 1
   2.2 Infrastructure 2
   2.3 Visitor trends 3
   2.4 Visitor numbers 4

3 Social and economic description 5

4 Economic impact of recreation 6
   4.1.1 Visitor expenditure at Logue Brook Dam 6
   4.1.2 Value of expenditure 8
   4.1.3 Employment 9

5 Value of recreational demand 9
   5.1 Consumer surplus 9
   5.2 Travel cost method 10
   5.3 Previous studies 12
      5.3.2 Value of Logue Brook Dam based on Lucas estimates 15
      5.3.3 Other studies 15

6 Conclusion 18

A Visitor expenditure assumptions 20

Boxes, charts, figures and tables

Figure 1 Visitors by month to Logue Brook Dam 4
Figure 2 Measuring consumer surplus 10

Table 1 Estimated visitor numbers at Logue Brook Dam 4
Table 2 Estimated overnight visitor numbers at Logue Brook Dam 5
Table 3 Estimated expenditure by visitors to the Logue Brook Dam 8
Table 4 Estimates of consumer surplus of recreational activity at Logue Brook Dam 13
Table 5 Present values of total recreational benefits for Logue Brook Dam 14
Table 6 Present values of total recreational benefits for Logue Brook Dam: selected discount rates (1991 dollars) 14
Table 7 Comparison of estimates of individual consumer surplus 15
Table 8 Average consumer surplus values per activity per day per person from recreation demand studies – 1967 to 1998 (2005 A$) 17
Table 9 Expenditure assumptions (excluding accommodation) based on visitor group 20
1 Introduction

This report on the value of recreation at Logue Brook Dam has been prepared by ACIL Tasman for the Department of Water. The report provides estimates of the economic value of recreation using an update of a travel cost analysis of recreational demand carried out by Lucas (1991). It also provides an estimate of the economic impact of visitors to the dam on the local economy. The economic value of the dam is an estimation of the value a person places on having access to that resource whilst the economic impact is the economic activity generated by spending at and around the resource.

The economic impact of recreation at Logue Brook Dam can be measured by the amount of expenditure by visitors to the dam on goods and services in the local economy. The economic value of the dam is estimated by adjusting the Lucas results to 2005 dollars and comparing them with similar studies carried out elsewhere. This report should not be interpreted as a critique of the Lucas study.

Logue Brook Dam is located in the Shire of Harvey approximately 120 kilometres south of Perth. The current primary uses of the dam are irrigation and recreation.

This report focuses on the economic and social value of recreation in and around the Logue Brook Dam. All recreation activities within a two kilometre radius of Logue Brook Dam have been considered in this analysis as this is the approximate area that would become inaccessible should recreation activities be excluded from the dam.

2 Recreation and tourism at Logue Brook Dam

2.1 Recreational activities

Logue Brook Dam is a popular recreation area for day trippers and overnight visitors. The dam and surrounding forest offer a number of recreation activities including:

- Land based activities
  - Cycling – Munda Biddi trail

---

The value of recreation at Logue Brook Dam

- Bushwalking – unmarked and marked trails
- Sightseeing by vehicle along the many tracks around the dam
- Horse riding
- Picnics and barbeques
- Camping and caravanning
- Off road motorcycle and four wheel driving

Water based activities
- Water skiing – there is a gazetted water skiing area preventing skiers from going too close to the dam wall and outlet tower. There is also a recommended skiing route.
- Canoeing
- Sailing and windsurfing
- Swimming
- Marroning and fishing – the marron season is regulated by the Department of Fisheries. There are bag limits and regulations for trout fishing which are managed by the Department of Fisheries.

Activities further afield include the towns along the South West Highway and the growing number of tourist related activities along this route including wineries, historic sights, cheese factory, and nature-based activities (including the nearby Harvey, Waroona and Drakesbrook dams).

2.2 Infrastructure

There is a good level of public infrastructure that supports recreation at the dam. This includes:
- Tracks to allow vehicles access to the dam and forest
- Boat ramp
- Picnicking facilities including tables, barbeques, a gazebo
- Marked walking trails including supporting information boards
- Lookout
- Munda Biddi bicycle trail
- Public toilets.

There are also several privately owned businesses which are used by those participating in recreation activities at the dam. These include the Lake Brockman Tourist Park (café, caravan, park home chalet and camping sites) and Camp Logue Brook which is a 7th Day Adventist holiday camp. The Tourist Park is the only formal area where camping is allowed however wild/bush camping outside the Tourist Park occurs particularly in peak
accommodation periods. The Tourist Park collects camping fees and maintains these sites on behalf of CALM.

### 2.3 Visitor trends

Consultation with key tourism stakeholders indicated that:

- The majority of visitors visit the Logue Brook area in summer to take advantage of water-based activities. However, school groups and semi-permanent residents of the Lake Brockman Tourist Park visit the area all year round.
- Peak visitor times are the Christmas and New Year period and the Easter holidays as per Figure 1.
- CALM estimates that two thirds of visitors stay for the day and the remainder stay overnight. However, consultation with local businesses suggested overnight visitors make up around 20 per cent of visitors.
- The primary visitor groups are:
  - local people who visit the area as a day trip
  - families and young groups from Perth who stay overnight and sometimes longer in the school holidays
  - school groups who stay from Monday to Friday (four nights)
- The primary reason for locals to visit the Logue Brook area is to swim, picnic and/or waterski.
- The primary reason for overnight visitors to visit the area is to waterski, bush walk, ride off road bikes, go 4WD’ing, camp and to use the area as a base to visit the region.
- The primary reason for school groups to visit the area is to use the facilities at and around Camp Logue Brook and to use the area as a base to visit the region.

There is also a growing amount of people using the Munda Biddi bicycle trail.
The value of recreation at Logue Brook Dam

2.4 Visitor numbers

It is difficult to determine how many visitors enter the Logue Brook Dam area each year as there are no formal numbers recorded. CALM has a vehicle counter located at the entry to the dam. However, this only records vehicles crossing over the dam wall and does not record vehicles travelling on the south side of the dam to the Lake Brockman Tourist Park. Nevertheless it is reasonable to assume that most visitors to the area drive across the dam wall as it is a scenic route and this counter therefore provides a reasonable estimate of total visitor numbers to the dam. Other visitors include those using the Munda Biddi bicycle trail. Table 1 provides an estimate of the total number of visitors to Logue Brook Dam whilst Table 2 provides an estimate of the total number of visitor nights.

Table 1 Estimated visitor numbers at Logue Brook Dam

<table>
<thead>
<tr>
<th></th>
<th>2002/03</th>
<th>2003/04</th>
<th>2004/05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dam wall</td>
<td>23,000</td>
<td>25,000</td>
<td>30,000</td>
</tr>
<tr>
<td>Munda Biddi</td>
<td></td>
<td></td>
<td>1,800</td>
</tr>
<tr>
<td>TOTAL</td>
<td>23,000</td>
<td>25,000</td>
<td>31,800</td>
</tr>
</tbody>
</table>

Data source: Dam wall and Munda Biddi provided by CALM, other numbers provided by Lake Brockman Tourist Park.

While Table 1 shows visitor numbers increasing over time, the number of visitors staying overnight has decreased. This is a function of several variables including:

- Rising cost of holidays caused by increased fuel costs and so on
The value of recreation at Logue Brook Dam

- Low dam water levels which have resulted in the early closure of the water ski season.

**Table 2  Estimated overnight visitor numbers at Logue Brook Dam**

<table>
<thead>
<tr>
<th></th>
<th>2001</th>
<th>2003</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lake Brockman Tourist Park</td>
<td>2,000</td>
<td>2,000</td>
<td>2,000</td>
</tr>
<tr>
<td>Camp Logue Brook</td>
<td>3,150</td>
<td>2,190</td>
<td>2,750</td>
</tr>
<tr>
<td>Wild camping</td>
<td>600</td>
<td>600</td>
<td>600</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>5,750</td>
<td>4,790</td>
<td>5,350</td>
</tr>
</tbody>
</table>

Data source: Lake Brockman Tourist Park, Camp Logue Brook

Note: the number of visitors to Camp Logue Brook increased in 2005 due to a longer water ski season because of improved water levels.

### 3 Social and economic description

The Shire of Harvey is located in the South West region of Western Australia. Both the Shire and the South West support a diverse economy and a large population base.

In 2005 the population of the South West was estimated to be 140,846 or 7 per cent of the population of Western Australia. This is the largest population of any region in Western Australia. The majority of the population lives in and around the major centres of Bunbury and Busselton on the coast and at Collie in the Darling Range.

The population of the Shire of Harvey was estimated to be 19,669, which is the third largest of any South West Local Government Authority behind Bunbury and Busselton. Major towns in the Shire of Harvey include Australind, Harvey and Brunswick whilst there are smaller populations in the towns of Benger, Binningup, Cookernup, Myalup, Roelands, and Wokalup.

The South West has the largest Gross Regional Product of any region valued at $6.8 billion in 2004/05. This contribution is a reflection of the sophisticated nature of the economy with the agriculture, mining, retail, tourism and construction sectors providing a valuable source of employment and economic activity.

The Shire of Harvey has a number of industries which provide a significant contribution to the South West economy. These include agriculture, agricultural processing, minerals processing and tourism.
4 Economic impact of recreation

The tourism industry is an important component of the South West economy. It not only provides employment for local residents, it provides an additional economic contribution through spending on goods and services by visitors.

Around 1.7 million visitors stayed overnight in the South West in 2003/04 and 1.6 million people visited the region for a day trip. Nearly all (85%) visitors were Western Australian. It is estimated that overnight visitors from Western Australia stayed on average of 3.5 nights in the region spending around $608.8 million or around $358 per head.

Most tourism activity in the South West is focussed on the coastal areas and the wine regions. Tourism activity in the Shire of Harvey is centred close to the coast and in the Darling Range. The Darling Range and surrounds provide a number of tourism and recreation opportunities that take advantage of local reservoirs, the jarrah forest, historical towns, wineries, and the Bibbulmun and Munda Biddi tracks.

The tourism industry therefore provides an important economic contribution to the Shire of Harvey. Tourism WA\(^2\) reports that in 2004 there were 362 people employed in the tourism sector in the Shire of Harvey, which represented 8 per cent of employed people in the Shire.

4.1.1 Visitor expenditure at Logue Brook Dam

One method for estimating the value of recreation to the local economy is to measure its economic impact by providing an estimate of the direct and indirect expenditure made by visitors to Logue Brook Dam on goods and services in and around the region. In other words, this is the extra expenditure made in the region as a result of visitors to Logue Brook Dam. Stakeholder consultation found that the main direct expenditure for visitors to Logue Brook Dam is:

- Accommodation
- Fuel for cars, bikes and boats
- Supplies such as food, hardware and so on
- Other expenditure such as gifts, souvenirs and meals.

Indirect expenditure includes purchases by the businesses located at Logue Brook Dam on goods and services to maintain their business. This expenditure may include items such as fuel, food and so on.

Accommodation

Nearly all overnight visitors to Logue Brook Dam stay at the Lake Brockman Tourist Park, Camp Logue Brook and at informal camp sites around the dam. Some visitors stay at motels in Harvey and in rural accommodation surrounding the dam, but this share of overnight visitors is thought to be low.

Fuel

Consultation suggested that most visitors to Logue Brook Dam travel to and from the site without purchasing fuel in the surrounding area. However, those that visit the area for an extended stay tend to purchase fuel. It is thought that most fuel is purchased in the town of Harvey.

Significant fuel purchases are made by owners of ski boats who carry enough fuel from Perth for one or two days skiing but require additional supplies. As the boats require premium quality fuel, purchases are made at the BP service station in Harvey, which is the only fuel outlet in the vicinity that carries this product. Other fuel is purchased for fuel intensive activities such as motorcycle riding and 4WD'ing.

Supplies

It is thought that the majority of visitors to Logue Brook Dam bring the bulk of their food and hardware supplies with them. Local businesses report that overnight visitors purchase “top up” supplies from supermarkets in Harvey. The Cookernup General Store also reported sales of ice, basic foods and hardware such as tarpaulins, fishing gear and so on.

There is some evidence that liquor is purchased from Cookernup and Harvey however, it is thought that most visitors bring their own supplies.

Other expenditure

There is a small amount of expenditure on other activities such as at wineries, the cheese factory, and arts and crafts. However, this value is difficult to determine.

There is some evidence that overnight visitors to the Logue Brook Dam purchase evening meals in restaurants and cafes in Harvey.

Indirect expenditure

Businesses located at Logue Brook Dam indicated that the majority of their purchases were for catering purposes and were made from companies in Perth.
and Bunbury. Minor purchases such as “top up” supermarket groceries and so on were made in Harvey. This expenditure has not been estimated as it is considered to be small and there is a risk of double counting as it is often already recognised in the costs of goods and services (such as accommodation and meals) provided by these businesses.

4.1.2 Value of expenditure

Overnight visitors provided the most valuable per capita expenditure on local goods and services through their purchase of accommodation and in some instances purchases on other goods and services such as fuel, groceries and so on. Per capita expenditure amongst day visitors is smaller as these visitors tend to spend less in the region by fuelling up near their homes and bringing their own supplies.

Whilst it is not possible to provide an exact estimation of visitor expenditure, Table 3 provides an estimation of likely expenditure. The assumptions underlying these calculations are listed in Appendix A.

Table 3 Estimated expenditure by visitors to the Logue Brook Dam

<table>
<thead>
<tr>
<th></th>
<th>Overnight visitors</th>
<th>Day visitors</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accommodation</td>
<td>144,062</td>
<td>0</td>
<td>144,062</td>
</tr>
<tr>
<td>Fuel</td>
<td>152,857</td>
<td>0</td>
<td>152,857</td>
</tr>
<tr>
<td>Supplies</td>
<td>76,429</td>
<td>75,571</td>
<td>152,000</td>
</tr>
<tr>
<td>Souvenirs etc</td>
<td>7,643</td>
<td>37,786</td>
<td>45,429</td>
</tr>
<tr>
<td>Meals</td>
<td>61,143</td>
<td>5,571</td>
<td>136,714</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>442,133</strong></td>
<td><strong>188,929</strong></td>
<td><strong>631,062</strong></td>
</tr>
</tbody>
</table>

Note: Expenditure by businesses located at Logue Brook Dam have not been included in this analysis.

Based on these assumptions it is thought that overnight visitors account for around $440,000 or 70 per cent per annum of expenditure whilst day visitors account for around $190,000 of expenditure. Total expenditure is around $630,000 per annum equating to around $20 per person per day. In comparison, Tourism WA estimates that per person expenditure on tourism in the South West is $102 per day. The difference in values at Logue Brook Dam and the South West is a function of the high level of day visitors to the dam compared to the South West where most visitors are overnight visitors, and the relatively low cost of accommodation at Camp Logue Brook and the Lake Brockman Tourist Park compared to higher end accommodation offered in the remainder of the Region.

---

3 Tourism WA (2004). *South West Tourism Factsheet 2004*, p 15 states that per person expenditure is $358 over 3.5 nights.
4.1.3 Employment

Employment at the businesses located at Logue Brook Dam is estimated to be around four full time equivalent staff. This estimation is based on two staff at Camp Logue Brook and two staff (the owners) at Lake Brockman Tourist Park.

As the impact of visitor expenditure on local businesses located in Yarloop, Harvey and Cookernup is relatively small compared to their overall turnover, it is doubtful that Logue Brook Dam has an impact on employment levels at these businesses.

5 Value of recreational demand

5.1 Consumer surplus

The monetary value an individual places on a recreation site can be measured by the consumer surplus. In the context of this study consumer surplus is an estimate of the welfare loss as a result of the closure of Logue Brook Dam to recreation. This is the difference between amount the individual currently pays to visit the dam (the market price) and the maximum amount the individual would be willing to pay rather than forgo visiting the dam.

In other words it is the difference between the willingness to pay for a trip to the dam (area A+B) and total trip cost (area B) in Figure 2. Figuratively, it is the area below the demand curve (the willingness to pay for a trip) and above the price line (the price actually paid), i.e. the shaded area A in Figure 2.

Individual consumer surpluses can be aggregated to measure the total welfare change.\(^4\).

---

Recreation sites typically do not command a price in the market (i.e. they are non-market goods) so there is a need to find an alternative means of estimating their value. A range of techniques have been developed to provide valuations of non-market goods and services. One such method is the travel cost method (TCM).

In the case of recreation sites, market prices do not exist because the inputs and outputs are not sold in the market. However, a range of techniques have been developed to provide valuations of these non-marketed goods and services.

### 5.2 Travel cost method

TCM uses the cost of travel incurred by individuals visiting a recreation site as a measure of how much they are willing to pay (WTP) to visit the site. Travel costs typically include fuel, entry fees, meals and accommodation and the opportunity cost of travel time. Individual WTPs are aggregated to provide a total valuation of the recreation site in question.

The economic value measured by TCM is the ‘use value’. Use value relates to actual use of the recreation site (e.g. a visit to the site), planned use (e.g. a visit planned in the future) or possible use (the option value). The other component of economic value is the ‘non-use’ value. The non-use value refers to the

---

5 The travel cost method is a prominent example of the revealed preference approach to the valuation of environmental amenities and natural resources. The other basic approach to valuation is the stated preference method. Contingent valuation is the most notable example of this approach.
The value of recreation at Logue Brook Dam

willingness to pay to maintain a recreation site in existence even though there is no actual, planned or possible use.

Both use value and non-use value can incorporate the social benefits of recreation. What they do not include is the intrinsic value of a recreation site. Intrinsic value is the value residing in the site that is unrelated to human preferences or even human observation.

TCM exploits the basic demand relationship where the quantity demanded varies negatively with price. People living closer to the site face a lower cost of travelling to the site and, all else constant, therefore probably take more trips.

Two alternative methods are commonly used in the travel cost model to measure WTP:

- The individual travel cost method uses the annual number of visits per person to the recreation site
- The zonal travel cost method measures the annual number of trips per capita from a specified geographic zone. Zones are defined by dividing the area around the site so that the average cost of travel to and from the site is the same across each zone.

The zonal model has fallen out of favour because of its lack of consistency with basic theory. However, it has fewer data requirements and adjusts automatically for frequency of visits by individuals. That is, zones that are farther away from the site of interest will produce fewer trips for given individuals and smaller frequencies of households taking trips. Nevertheless, when data are limited, the zonal model can provide a useful approximation.

While the individual TCM is preferable for statistical precision, the choice of method is often dictated by the degree of variability in the number of trips taken. The zonal model is used where it is necessary to incorporate enough variation into the number of trips taken to be able to estimate a demand function.

The number of visits to a site is assumed to be influenced by:

- The cost and time of travel to the site
- The quality of the recreational site
- The amount of discretionary time available to the individual
- Income

---


The value of recreation at Logue Brook Dam

- Opportunity cost of time (as reflected in the wage rate or some fraction thereof)
- Availability of substitute sites.

In its simplest form the travel cost model is a single-site model of the number of trips to a recreation site a person makes over a year (or any other time period). The price of the trip is the cost of reaching the site, which includes a person’s travel expenses and the time cost of making the trip.

However, travel costs alone will not explain an individual’s demand for a recreation site. Other factors, including demographic variables, tastes and preferences, substitute and complementary goods, site quality and congestion, also determine demand.

The basic TCM makes the following assumptions:
- Individual behaviour related to increasing costs of travel corresponds to the changes in demand for the activity, which would occur if process changed
- Individuals derive no utility or disutility from the time spent travelling to the site
- The purpose of the trip is to visit the site and there are no alternative recreation sites available
- All visits are assumed to involve the same amount of time at the site
- Part of the cost of travel is the opportunity cost of the individual’s time.

Data on costs and time of travel to the site and other relevant variables are collected from individual visitors in surveys. These data are used to estimate a demand function for recreation at the site.

5.3 Previous studies

Lucas 1991 study

The only reported study of the value of recreation at Logue Brook Dam is the Lucas (1991) study of the economic benefits of recreation activities occurring at Waroona and Logue Brook dams. This study, which compared TCM (the zonal model) and contingent valuation as techniques for valuing the recreational benefits of the two reservoirs, found TCM to be the most appropriate technique.

---

Using survey information collected from visitors to Logue Brook and Waroona Reservoirs, Lucas constructed demand curves for recreation at both sites. The consumer surplus, which provides an estimate of the visitors’ willingness to pay for recreation opportunities available at the recreation site for recreational activity, was estimated as the area under the demand curve.

A key assumption in Lucas’s study is the opportunity cost of travel time. Lucas follows Cesario (1976) and uses a proportion of the hourly wage rate as a proxy for the opportunity cost of time travel.

Table 4 presents Lucas’s estimates of consumer surplus for four different proportions of the hourly wage rate taken to represent the opportunity cost of time travel. The Lucas standard case assumed a proportion of post-tax hourly rate of 0.3 as the opportunity cost of travel time. This is consistent with Cesario’s finding that the value of time with respect to non-work travel is between one-fourth and one-half and the figure suggested by the US Water Resources Council at that time. In contrast, Larson (1993) argued that a long run view suggests that the full wage is the appropriate opportunity cost of time.

Table 4: Estimates of consumer surplus of recreational activity at Logue Brook Dam

<table>
<thead>
<tr>
<th>Proportion of post-tax hourly wage taken to represent the opportunity cost of travel time</th>
<th>0.1</th>
<th>0.3</th>
<th>0.6</th>
<th>1.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimate of consumer surplus ($1991)</td>
<td>43,574</td>
<td>74,725</td>
<td>116,875</td>
<td>167,225</td>
</tr>
<tr>
<td>Estimate of consumer surplus ($2005)</td>
<td>60,993</td>
<td>104,598</td>
<td>163,598</td>
<td>234,076</td>
</tr>
</tbody>
</table>


Data source: Lucas (1991), Table 6, p.25.

Lucas used the estimates of consumer surplus (annual recreational benefit) to derive a present value of the future stream of total recreational benefits. These are shown in Table 5.

Lucas derived four demand curves based on the assumption made about the opportunity cost of travel time.


The value of recreation at Logue Brook Dam

Table 5  **Present values of total recreational benefits for Logue Brook Dam**

<table>
<thead>
<tr>
<th>Annual recreation benefit ($)</th>
<th>Present value of recreational benefit ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5 years</td>
</tr>
<tr>
<td>43,574</td>
<td>183,551</td>
</tr>
<tr>
<td>74,725</td>
<td>314,771</td>
</tr>
<tr>
<td>116,875</td>
<td>492,324</td>
</tr>
<tr>
<td>167,225</td>
<td>704,418</td>
</tr>
</tbody>
</table>

Note: Present value calculated using a discount rate of 6% and an opportunity cost of travel time of 0.3 of the post-tax hourly wage. The standard case is shaded. 

Data source: Lucas (1991), Table 16, p.33.

As part of a sensitivity analysis, Lucas examined the impact on the present value of the future stream of total recreational benefits at discount rates of 4 per cent, 6 per cent and 8 per cent. The results of this analysis are shown in Table 6.

Table 6  **Present values of total recreational benefits for Logue Brook Dam: selected discount rates (1991 dollars)**

<table>
<thead>
<tr>
<th>Discount rate</th>
<th>Present value of recreational benefit ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5 years</td>
</tr>
<tr>
<td>4%</td>
<td>332,661</td>
</tr>
<tr>
<td>6%</td>
<td>314,771</td>
</tr>
<tr>
<td>8%</td>
<td>298,354</td>
</tr>
</tbody>
</table>

Note: Present value calculated using an opportunity cost of travel time of 0.3 of the post-tax hourly wage. Data source: Lucas (1991), Tables 16, 17 and 18, p.33. The standard case is shaded.

In the Lucas standard case of a:

- 30 year time horizon
- six per cent discount rate, and
- opportunity cost of travel time equal to 0.3 times the average post-tax hourly wage rate,

The present value of the recreation benefits is $1,028,575 (1991 dollars) and $1,439,764 (2005 dollars). If the opportunity cost is equal to the average post-tax hourly wage rate, the present value of the recreation benefits increases to $2,301,818 (1991 dollars) and $3,222,005 (2005 dollars). This is the Lucas upper estimate.

Based on the estimates of the consumer surplus, the average amount of consumer surplus received by individuals visiting Logue Brook Dam varies from $5.45 to $20.90 (in 1991 dollars). The estimate for the Lucas standard case was $9.34 in 1991 dollars. The estimates in 2005 dollars are $7.63 to
$29.26 per person per visit and $13.07 for the Lucas standard case\textsuperscript{13}. Given that around 80 per cent of visitors are day visitors, these figures can be assumed to per person per day for the purpose of comparison with other studies.

### 5.3.2 Value of Logue Brook Dam based on Lucas estimates

The volume of water proposed to be taken from Logue brook dam is 5.3 gigalitres. On the basis of this amount the standard Lucas estimate yields a value of water for recreation of 0.91 cents per kilolitre of water\textsuperscript{14}. If we use the Lucas upper estimate the value of water increases to 2.03 cents per kilolitre.

Note that as the number of recreation substitutes becomes more limited, (the area for recreation diminishes), this value is likely to rise.

### 5.3.3 Other studies

#### The Lucas comparison

Table 7 shows a comparison of the Lucas estimates of individual consumer surplus with estimates of average consumer surplus from similar studies of recreation benefits quoted by Lucas.

<table>
<thead>
<tr>
<th>Study</th>
<th>Recreation Site</th>
<th>TCM Method</th>
<th>Average individual consumer surplus (2005 dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seller, Stoll and Chavas (1984)(US)</td>
<td>Four lakes in East Texas</td>
<td>Individual TCM</td>
<td>$31.47, $58.08, $77.44, $249.27</td>
</tr>
<tr>
<td>Farber (1988)(US)</td>
<td>Coastal wetlands in Louisiana</td>
<td>Zonal TCM</td>
<td>$11.00 - $33.01</td>
</tr>
<tr>
<td>Harris and Meister (1983)(NZ)</td>
<td>Lake in New Zealand</td>
<td>Zonal TCM</td>
<td>$19.61</td>
</tr>
</tbody>
</table>


\textsuperscript{13} See note to Table 7 for details on the inflation of the Lucas estimates.

\textsuperscript{14} This figure is calculated by dividing the present value of the recreation benefits over 30 years (from Table 6) by 5.3 GL times 30 years.
The value of recreation at Logue Brook Dam

The estimates of average individual consumer surplus in the papers by Seller, Stoll and Chavas (1984), Ralston and Park (1989) and Harris and Meister (1983) apply to the recreation benefits of lakes. The estimates provided by Farber (1988) relate to the recreation benefits of coastal wetlands and are probably less relevant as a comparator.

Overall, the recreation benefits estimated in these studies range from $11.00 to $249.27 per person, excluding the Farber (1988) study. Although Lucas considered that the estimates of recreation benefit for Logue Brook Dam are reasonably consistent with these estimates, the range is quite large, with the Lucas estimates falling in the lower end.

Given the timeframe and resources available for this study, primary research to estimate the recreation value of Logue Brook Dam was not considered. Therefore, despite the reservations expressed above and the absence of any other studies, the Lucas standard estimate (adjusted to 2005 dollars) of around $13 per person per visit is the best available estimate of the recreation value of Logue Brook Dam.

**Benefit transfer**

A technique called benefit transfer was used further test the validity of the Lucas estimates. Benefit transfer, which involves the use the results of previous studies to derive estimates of the value of a site or resource being studied, is used in situations where valuation using primary research is too expensive or time consuming.\(^{15}\)

In benefit transfer jargon the site where the original study was conducted is called the ‘study site’ and the site where the benefit estimate is to be applied is the ‘policy site’.

Several benefit transfer methods have been developed to estimate the value of the ‘policy site’. These are broadly classified into:

- Value transfer, which is the direct application of estimates from original research summary statistics to the ‘policy site’. There are three approaches to conducting value transfers, including transfers of point estimates, transfers of measures of central tendency, and transfers of administratively-approved estimates
- Function transfer, which is the transfer of functions or statistical models that define relationships in the data collected at the ‘study site’. Types of functions include demand functions and meta-regression analysis functions.

---

The approach taken in this study was to apply the measures of central tendency approach to value transfer using the mean of estimates of average consumer surplus values of recreation activities from an annotated bibliography of outdoor recreation use valuation studies undertaken by Rosenberger and Loomis (2001) over the period 1967 to 1998\textsuperscript{16}. These estimates, which were in 1996 US dollars, were adjusted to 2005 US dollars, and then converted to Australian dollars\textsuperscript{17}.

The average consumer surplus values are shown in Table 8. The estimates across all activities range from around $1 to $362. Once again, this range is too wide to enable an estimate of the recreation value of the ‘policy site’, namely Logue Brook Dam to be made.

<table>
<thead>
<tr>
<th>Activity</th>
<th>No. of studies</th>
<th>No. of estimates</th>
<th>Mean of Estimates</th>
<th>Median of estimates</th>
<th>Std error of mean</th>
<th>Range of estimates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Camping</td>
<td>22</td>
<td>40</td>
<td>$50.39</td>
<td>$30.04</td>
<td>$9.13</td>
<td>$2.80-310.53</td>
</tr>
<tr>
<td>Picnicking</td>
<td>7</td>
<td>12</td>
<td>47.01</td>
<td>40.19</td>
<td>16.02</td>
<td>12.36-197.41</td>
</tr>
<tr>
<td>Swimming</td>
<td>9</td>
<td>12</td>
<td>28.11</td>
<td>30.19</td>
<td>7.40</td>
<td>3.04-81.45</td>
</tr>
<tr>
<td>Sightseeing</td>
<td>9</td>
<td>20</td>
<td>47.84</td>
<td>35.07</td>
<td>15.61</td>
<td>0.89-290.12</td>
</tr>
<tr>
<td>Off-road driving</td>
<td>3</td>
<td>4</td>
<td>23.24</td>
<td>26.31</td>
<td>10.40</td>
<td>7.25-55.83</td>
</tr>
<tr>
<td>Motorised boating</td>
<td>9</td>
<td>14</td>
<td>46.33</td>
<td>30.12</td>
<td>19.33</td>
<td>7.31-281.61</td>
</tr>
<tr>
<td>Hiking</td>
<td>17</td>
<td>29</td>
<td>48.84</td>
<td>38.52</td>
<td>13.07</td>
<td>2.59-362.41</td>
</tr>
<tr>
<td>Biking</td>
<td>3</td>
<td>5</td>
<td>60.20</td>
<td>91.12</td>
<td>13.95</td>
<td>29.23-104.36</td>
</tr>
<tr>
<td>Fishing</td>
<td>39</td>
<td>122</td>
<td>59.96</td>
<td>33.50</td>
<td>5.68</td>
<td>2.87-350.09</td>
</tr>
<tr>
<td>General recreation</td>
<td>12</td>
<td>16</td>
<td>40.27</td>
<td>16.64</td>
<td>12.41</td>
<td>1.96-356.15</td>
</tr>
</tbody>
</table>


A significant refinement to this approach would be to screen the original studies examined by Rosenberger and Loomis for relevance. Questions that would need to be answered would include:

- How well does the original research context correspond to the Logue brook dam context?
- Are the point estimates in the right units, or can they be adjusted to the right units?
- What is the quality of the original research\textsuperscript{18}?

\textsuperscript{16} Rosenberger, R.S. and J.B. Loomis (2001). This study covered 21 recreational activities plus a category for wilderness recreation. It contains 163 individual studies referenced, providing 760 benefit measures.

\textsuperscript{17} See note to Table 7 for details.

Another source of data is Environment Canada’s (1998) Environmental Values Reference Inventory (EVRI) database\(^\text{19}\). This database is subscription based and was not considered in this study.

## 6 Conclusion

This report has sought to provide an estimation of the value of recreation of Logue Brook Dam in the Shire of Harvey. The report has estimated the economic impact of the dam on the local region by providing an estimation of visitor expenditure in the region. It has also estimated the economic value of the dam by updating previous estimations undertaken by Lucas in 1991. These values must be viewed as estimations only as they rely on incomplete data sets.

The report found that some 32,000 people visit the Logue Brook Dam each year with around 20 per cent of these people staying overnight. The primary recreation activities at the dam are swimming and water skiing which occur in the summer months and Easter school holidays however, the dam is visited throughout the year particularly by school groups.

Given this visitor profile, it is estimated that economic impact of the dam on the local region based on annual visitor expenditure in the Logue Brook Dam area is around $630,000 which is equivalent to $20 per person per day with most of this expenditure incurred by overnight visitors on accommodation at the dam or on general services in the town of Harvey. There is also some expenditure at Cookernup being the closest town and at nearby tourist attractions such as wineries. Overnight visitors accounted for 70 per cent of total expenditure.

While it is recognised that the businesses at Logue Brook Dam incur some expenditure in the local area, the majority of their expenditure is in Perth or Bunbury.

The estimate of the value of recreation at Logue Brook Dam is 0.91 cents per kilolitre. This value was derived by adjusting the Lucas standard estimate to inflate it to 2005 dollars. It is based on Lucas’s travel cost model and assumptions. The results of the comparative analysis were too broad to be able to define any confidence limits for the Lucas standard estimate. However, given the results of the comparative studies, the Lucas standard estimate is of the right order of magnitude. Furthermore, as the number of recreation sites

---

that can be substituted for Logue Brook Dam diminishes, these values are likely to rise.
A Visitor expenditure assumptions

- 32,000 visitors per annum of which around 5,500 stay overnight
- Accommodation based on figures supplied by Camp Logue Brook and the Lake Brockman Tourist Park
- All other estimations based on consultation and estimated by visitor group assuming 3.5 visitors per group. This method was used as it was difficult to determine expenditure per person given that most visitors enter the dam area in groups and therefore share expenses such as supplies, fuel and so on. See Table 9 for estimations
- Expenditure on fuel by day visitors in the Logue Brook Dam area is assumed to be zero as consultation found that most day trippers filled their fuel tanks at the source of their journey.

Table 9 Expenditure assumptions (excluding accommodation) based on visitor group

<table>
<thead>
<tr>
<th></th>
<th>Overnight visitors</th>
<th>Day visitors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$ per group</td>
<td>Total</td>
</tr>
<tr>
<td>Fuel</td>
<td>100</td>
<td>152,857</td>
</tr>
<tr>
<td>Supplies</td>
<td>50</td>
<td>76,429</td>
</tr>
<tr>
<td>Souvenirs</td>
<td>5</td>
<td>7,643</td>
</tr>
<tr>
<td>Meals</td>
<td>40</td>
<td>61,143</td>
</tr>
<tr>
<td>Total</td>
<td>$298,071</td>
<td>Total</td>
</tr>
</tbody>
</table>