# Upper Collie Water Management Plan

## Issue Scoping Report

**Beckwith Environmental Planning Pty Ltd**

Prepared for

**Department of Water**
**Government of Western Australia**

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The support of both the Perth and Bunbury Offices of the Department of Water are appreciated. We extend a special thank you to Jessica Scott, Trudy Evans and Brendan Kelly for their assistance with this study.

Sincerely,

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## Report authorship

This document is the property of Beckwith Environmental Planning Pty Ltd. The opinions and recommendations in this report are those of the authors and do not necessarily reflect Department of Water policy or positions. Any questions or comments regarding this report should be directed to Dr Jo Ann Beckwith, Director, Beckwith Environmental Planning Pty Ltd via email jbeckwit@bigpond.net.au or phone (08) 9450 8711.

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## Cover photographs

Top left: Long Pool on the Collie River South Branch, February 2007
Bottom right: Irrigation release from Wellington Dam, January 2007

# Executive Summary

## Background

The Upper Collie Catchment includes the surface water resources of the upper Collie River, its tributaries, and the reservoirs of the Wellington and Harris dams as well as the groundwater resources of the Collie Coal Basin. Collectively, these water resources support a variety of uses and values; including coal mining and power generation, public water supply, irrigated agriculture, recreation and tourism, and the maintenance of cultural, aesthetic and ecological values. Over time the pressures on and the competition for these water resources has grown.

The Department of Water is the State Government agency responsible for water resource management. Currently, the DoW does not have a water management plan to guide its licensing and allocation decision-making for the ground and surface water resources of the Upper Collie Catchment. The Department has made a commitment to develop an initial water management plan by the end of 2007 and a statutory water management plan by 2010.

## Issue Scoping

Beckwith Environmental Planning was retained to conduct an issue scoping study. The objectives were: to identify stakeholder issues regarding current and future surface and ground water allocation and resource management in the Upper Collie Catchment; to identify water features with notable social and/or cultural values and the water conditions required to sustain these values; and to provide advice regarding public engagement in the development and implementation of the Department's initial plan. The study included interviews with a diverse range of stakeholder interests (e.g. agriculture, mining and industry, the Indigenous community, local and state government, the natural environment, landholders, tourism and recreation).

## Dominant Issues

The future consumptive and recreational use of Wellington Reservoir was the most discussed topic in the stakeholder interviews. Possible future consumptive uses identified by stakeholders included irrigated agriculture, the industry and energy sector, and the Water Corporation's Integrated Water Supply Scheme. The potential impact on recreational use if there is change in the consumptive use was a concern to many.

Many discussed the potential for conflict should a decision be made to remove recreation from Wellington Reservoir to accommodate changes in use (e.g. transfer to the IWSS). Many stakeholders requested that a range of options be evaluated using a transparent process before a decision is made about the future of recreation on Wellington Reservoir. This would include options to increase the level of water treatment rather than reducing recreation.

Stakeholders also discussed the value of water below Wellington Reservoir. Water is released from the reservoir during summer for irrigated agriculture in the Collie

Irrigation District. This water also supports a modified downstream environment and associated social values (e.g. canoeing, Aboriginal heritage). A reduction (e.g. piping the irrigation water directly from the dam) or a change in release timing (e.g. changes in how Wellington Reservoir is used) may diminish these values. Those who commented do not want to see these values diminished.

Many of the stakeholder representatives noted that the withdrawal rate of the groundwater from the Collie Coal Basin is exceeding the sustainable yield of the resource. The bulk of the groundwater withdrawn is through mine dewatering, which is required in order to create a safe mine work environment. This use is governed by State Agreement Acts. Stakeholders recognised mine dewatering as a priority use but still expressed concern about the withdrawal rate.

Some stakeholders identified negative effects they attributed to the rate of groundwater withdrawal. These included reductions in stream flow in the Collie River South Branch, less water in river pools and land subsidence. The most talked about of these issues were the pools. Pools on the South Branch and East Branch of the Collie River are currently supplemented by Verve Energy and Griffin Coal, respectively. Many stakeholders view the pool supplementation issue as very much a Cardiff or Buckingham issue of limited interest to those not directly affected. However, for those local stakeholders who value the pools, the future of the supplementation program is a significant issue. They would like the program to continue but with modifications to address the water quality (e.g. iron) and delivery issues (due to the overflow method the pools are 'unnaturally' high in summer).

The South Branch and East Branch pools were among a number of water features identified as having non-consumptive social values. A large majority of those interviewed identified the Wellington Dam/Reservoir and the Collie River immediately below the Wellington Dam as having significant social value. The other feature identified in the majority of interviews was Lake Kepwari. Other features identified were the Harris Reservoir, several former mine voids (i.e. Stockton Lake and Black Diamond A), and river pools on the Collie River (e.g. Minninup Pool).

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# Acronyms

| | |
|---|---|
| CALM | Department of Conservation and Land Management |
| CWAG | Collie Water Advisory Group |
| DAFWA | Department of Agriculture and Food Western Australia |
| DEC | Department of Environment and Conservation |
| DoCEP | Department of Consumer and Employment Protection |
| DoE | Department of Environment |
| DoH | Department of Health |
| DoIR | Department of Industry and Resources |
| DoW | Department of Water |
| GSTWSS | Great Southern Towns Water Supply Scheme |
| IWSS | Integrated Water Supply Scheme |
| SWDC | South West Development Commission |
| WC | Water Corporation |
| WRC | Water and Rivers Commission |

# 1 Introduction

## 1.1 Background

The Upper Collie Catchment includes the surface water resources of the Harris Reservoir, the Wellington Reservoir, and the upper Collie River and its tributaries, including the Harris and Bingham rivers. It also includes the groundwater resources of the Collie Coal Basin (Map 1).

Collectively these ground and surface water resources support a variety of consumptive and non-consumptive uses and values. These include coal mining and power generation, public water supply, irrigated agriculture, recreation and tourism, and the maintenance of cultural, aesthetic and ecological values.

The Department of Water (DoW or Department) is the State Government agency responsible for water resource planning in Western Australia. Currently, the Department does not a have a water management plan to guide its licensing and allocation decision-making for the ground and surface water resources of the Upper Collie Catchment.

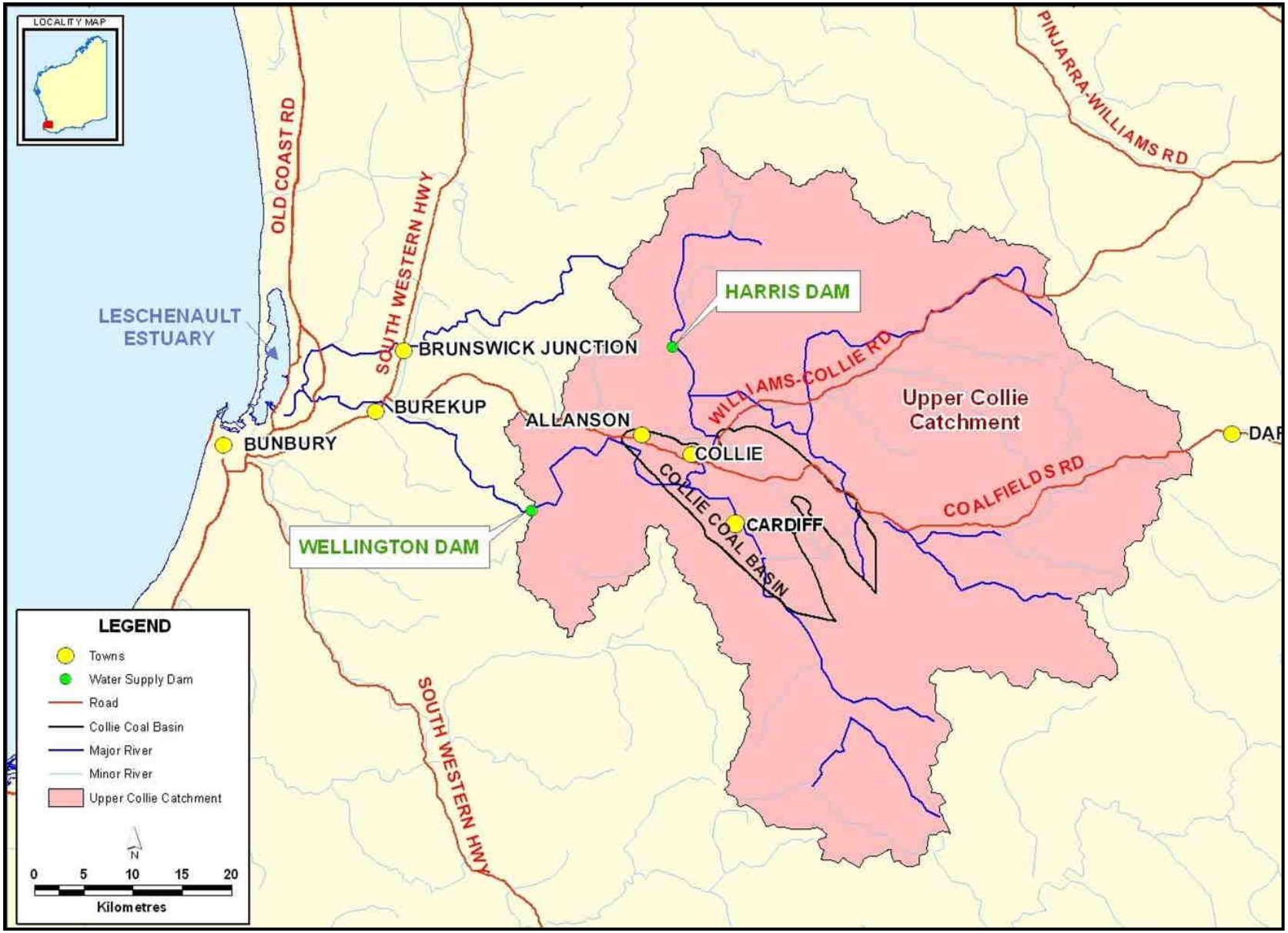
The development of a plan is timely as the pressures on these water resources are growing, especially the demand for consumptive use. Most notable are proposals to develop additional coal-fired power stations in the Collie area. If built these would require a substantial increase in the volume of cooling water needed. In combination with further coal mining activity, this could place additional pressure on groundwater resources that are already experiencing withdrawal above the level of sustainability.

The demands placed on surface water resources are also increasing. Water from the Wellington Reservoir supports irrigated agriculture in the Collie Irrigation District[1] as well as recreation activities. Other consumptive water users may have a longer-term interest in this large surface water resource. These include both industry (e.g. the energy sector) and the Water Corporation to supply the Integrated Water Supply Scheme.

The Department of Water has made a commitment to the National Water Commission[2] to develop a statutory[3] water management plan for the water resources of the Upper Collie Catchment by the end of 2010. The water planning will occur in two stages. The first stage is to prepare an initial water management plan due for release in 2007. The second stage of work will be the development of the statutory water management plan by the end of 2010.

[1] The Collie Irrigation District is located downstream of the Wellington Reservoir, west of the Burekup Weir.
[2] The Commission is the Federal Government body responsible for helping drive national water reform.
[3] Statutory means that the plan will be legally binding.

Map 1 Upper Collie Catchment



**Water Management Planning Objectives**

The initial water management plan will:

- Provide rules and policies to support sustainability outcomes in management and licensing decisions, including managing the impact of use
- Provide clear requirements for industrial water users to mitigate and minimise the impact of groundwater abstraction and identify how compliance will be ensured
- Facilitate secure water supply for current and future needs (including use and non-use demand)
- Address elements of Water Law Reform particularly relevant to water management in the Upper Collie Catchment
- Guide sustainable water management during the period while further technical work and legislative reform continues.

## 1.2 Issue Scoping

The Department retained Beckwith Environmental Planning to conduct an issue scoping exercise. The objectives of the scoping exercise were to:

- Identify stakeholder issues regarding current and future surface and ground water allocation and resource management in the Upper Collie Catchment.
- Identify water features stakeholders view as having significant social and/or cultural values and the water conditions required to sustain these values.
- Provide advice regarding the integration of public engagement in the development and implementation of the Department's initial water resource management plan.

**Method**

Issue scoping is a technique used to gain an understanding of the range of stakeholder perspectives on a particular topic. In this case, the topic is the future management of ground and surface water resources in the Upper Collie Catchment.

The outcomes of a scoping exercise can assist an agency to:

- Identify areas of agreement and shared perspectives as well as those with the potential to generate conflict.
- Identify stakeholders with complementary perspectives or needs and thus the potential for partnerships.
- Focus its efforts on issues important to stakeholders.
- Monitor progress on these issues over the course of the water planning process.

The issue scoping exercise generated data through in-depth interviews with representatives of a range of stakeholder interests. The major strength of in-depth interviewing is the rich data it generates. In contrast to a methodology such as a questionnaire, the conversational style of interviews allows the individual to use their own words and delve more deeply into the reasons behind their positions and perceptions. To the extent possible, interviews were conducted individually and face-to-face rather than in groups.

To encourage consistency in data collection, a semi-structured interview format was applied. An interview guide was used to ensure that the following 12 issues were explored during all interviews (Appendix A):

- Key water resource issues
- Potential barriers to successful water resource management
- Priority water uses for resource allocation
- Ecological water needs
- Pool supplementation
- Surface water use and impacts
- Groundwater use and impacts
- Potential future water uses
- Water quality issues
- Climate change
- Community engagement needs during planning and plan implementation
- Water features with notable social/cultural values

Stakeholders were asked additional questions reflecting their specific interests in water resource management.

The interviewer took hand written notes during interviews and, with the individual's permission, interviews were tape recorded to ensure accuracy. The interviews ranged in duration from 45 minutes to 2.5 hours. The typed interview notes and tape recordings were reviewed multiple times and the data was organised into themes.

The scoping exercise was not designed to provide a statistically representative sample of stakeholder or community opinions. Rather, the objective was to ascertain the range of perspectives held by the stakeholders.

However, to give an indication of the level and type of responses obtained in the interviews a simple frequency analysis was conducted. The data from each interview was entered into a database. The database consisted of a series of variables (i.e. issue themes and sub-themes) and response categories. To allow within group and between group comparisons, each interview participant was assigned to one of 9 stakeholder categories. The variables and stakeholder categories are provided as Appendix B.

**Participants**

With the assistance of the Department's Bunbury Office, key stakeholder interests and representatives were identified. For each stakeholder interest, one or more stakeholder representatives were identified for an interview. This included representatives of local governments, relevant state government agencies, local environmental groups, industry, agriculture, the Nyungar community, tree plantations and recreation interests.

Prospective interviewees were contacted by telephone and email to request their participation and arrange a convenient date and location for an interview. In total, 62 stakeholder representatives were interviewed in the period January-March 2007 (Appendix C).

All those interviewed will receive a copy of the scoping report. The Department will make the report available on its website: www.water.wa.gov.au.

## 1.3 Report Format

Chapters 2-4 examine key themes arising from the stakeholder interviews. Chapter 5 examines water features with notable social values and their social water requirements. The final chapter discusses the integration of community engagement in the development and implementation of the DoW's initial water management plan for the Upper Collie Catchment.

# 2 The Water Resources

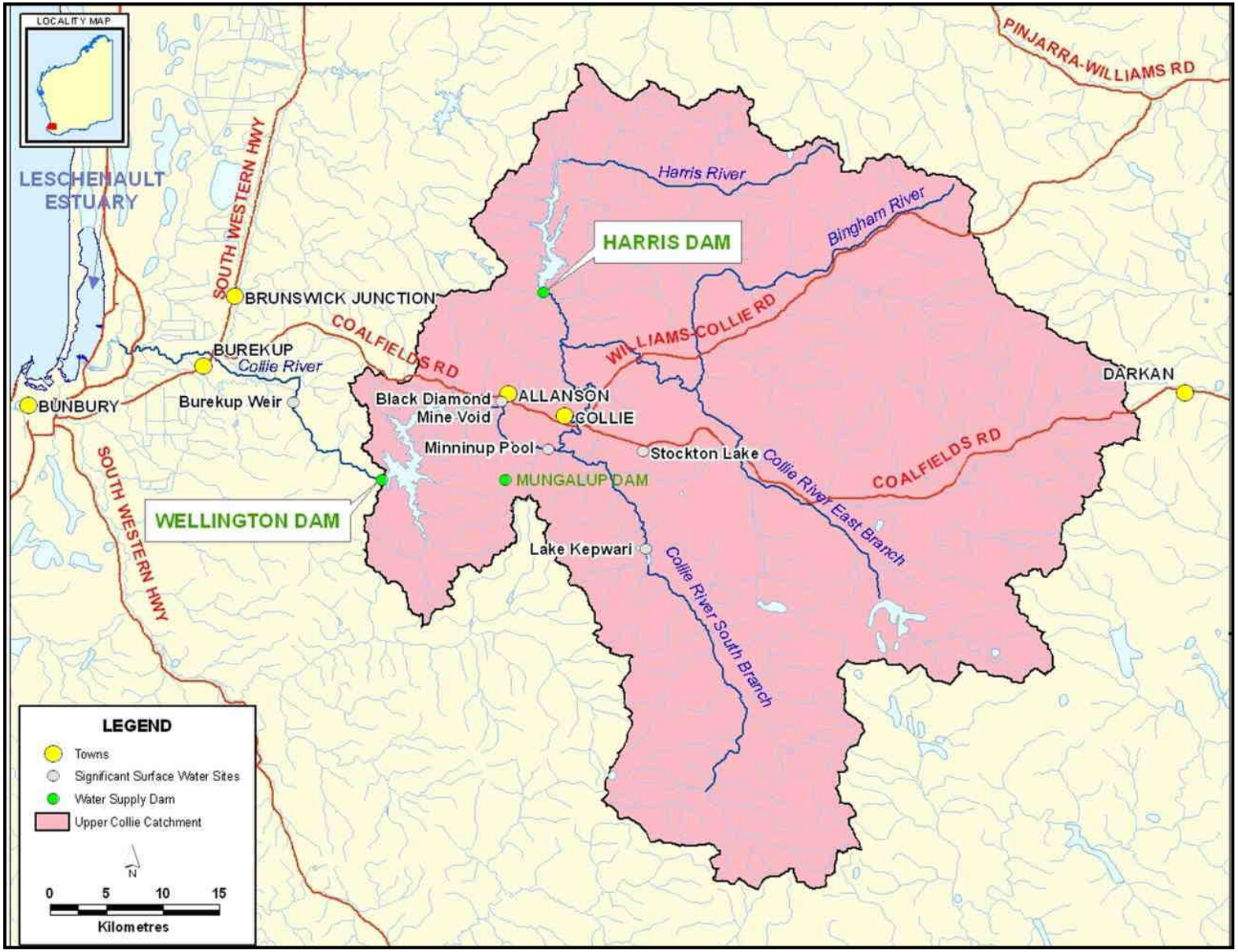
## 2.1 Surface Water

The main river in the Upper Collie Catchment is the Collie River. Its largest tributaries are the East Branch, the Bingham River, the Harris River and the South Branch (Map 2). Northeast of the Town of Collie, the East Branch and the Bingham River converge to form the Collie River. From this point, the Collie River flows westward and is joined by the Harris River downstream of the Harris Reservoir. Flowing southward, the Collie River passes through the Collie townsite and converges with the South Branch. The Collie River then flows westward where it enters the Wellington Reservoir. Below the Wellington Reservoir, the Collie River continues westward through the Wellington National Park, past the Burekup Weir, before discharging to the Leschenault Estuary.

The Wellington Dam and Reservoir are located within the boundary of the Wellington National Park. The Wellington Reservoir is the single largest reservoir in the South West. It was built in 1933 as a source of water for irrigation. Over the years, its original storage capacity of 35 GL was augmented several times by increases to the height of the dam wall. The last increase occurred in 1960, bringing the storage capacity to its current 186 GL. By the 1950s, the reservoir was also supplying drinking water to the Great Southern Towns Water Supply Scheme (GSTWSS). However, increasing salinity levels resulted in its eventual replacement by the new Harris Reservoir as a source of water for the GSTWSS. A 2 megawatt hydro-power plant was constructed in the 1950s, directly downstream of the Wellington Reservoir. Owned by Verve Energy, the facility is no longer in operation.

The Harris Reservoir was constructed in 1990 as the new source of public water supply for the Town of Collie and the 31 towns connected to the GSTWSS. Located on the Harris River (approximately 12 km north of Collie), it has a storage capacity of 72 GL. Water from the Harris Reservoir (i.e. Lake Balingall) is treated before transport to the GSTWSS. Chlorine is added for disinfection and the pH is stabilised by adding lime and carbon dioxide. Fluoride is also added to the water (Department of Water 2007).

Map 2 Collie Surface water



As part of the Water Corporation's Stirling-Harvey Redevelopment Scheme, opened in 2002, a 16 kilometre water pipeline was constructed to enable 5 GL of water to be moved from the Harris Reservoir to Stirling Reservoir for use in the Integrated Water Supply Scheme. However, this water transfer has not occurred in recent years due to lower water levels in the Harris Reservoir[4]. "Once a new treatment plant is established at Harris Dam to maintain water quality during periods of low water level … the Water Corporation plans to once again undertake transfers to Stirling [Reservoir]" (DoW 2007, pg. 1).

Table 1 Comparison of water storage

| Facility | Surface area | Storage capacity | Sustainable yield | Allocation |
|---|---|---|---|---|
| Wellington Reservoir | 1,609 ha | 185.0 GL | 85.1 GL | 68.0 GL |
| Harris Reservoir | 9,575 ha | 72.0 GL | 17.0 GL | 15.0 GL |
| Mungalup Reservoir | 162 ha | 0.7 GL | | 0.5 GL |
| Serpentine Reservoir | 1,067 ha | 137.7 GL | | |
| Mundaring Reservoir | 676 ha | 63.6 GL | | |

## 2.2 Ground Water

Since coal was discovered in the area in 1883, Collie has become the State's main centre for coal production and power generation. The Town of Collie and smaller nearby communities, including Cardiff, were established near the early underground coal mines. Since 1994, all coal mining in the area employs the open cut method. Griffin Coal and Wesfarmers Premier Coal are the two coal production companies in Collie.

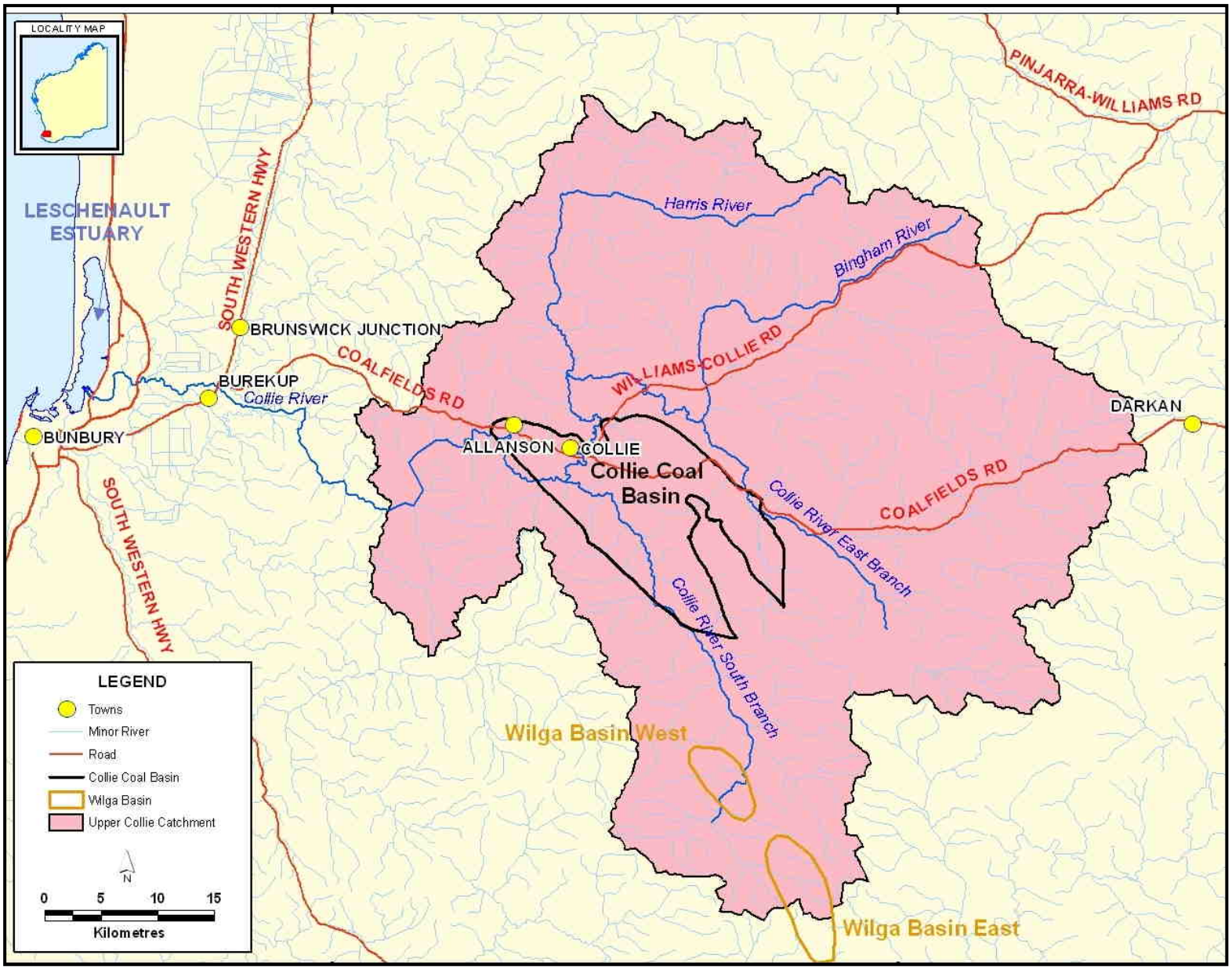
The main groundwater resources of the Upper Collie Catchment are concentrated in the Collie Coal Basin (Map 3). The Basin is bilobate in shape and covers an area of 230 $km^2$ near the Town of Collie. It contains significant groundwater and coal resources. The Collie Coal Basin was proclaimed as part of the Collie Groundwater Area in June 1977.

The Collie Coal Basin is divided into two sub-basins (Map 3). The Cardiff Sub-basin contains 67% of the Basin's groundwater resources with the remaining 33% in the Premier Sub-basin (CWAG 1996). A second, smaller groundwater basin, the Wilga Basin, is located south of the Collie Coal Basin. The unproclaimed Basin contains groundwater and coal resources. In addition to the Collie and Wilga Basins, there are a number of small pockets of groundwater in the catchment. However, they are difficult to delineate and the DoW considers them too small for management purposes.

The surface of the Collie Coal Basin is gently undulating with streams, creeks and swamps in low-lying areas. Open-cut coal mining in the Collie Coal Basin has created numerous mine voids where mining has ceased. Over time, as the groundwater levels return, the old mine voids flood and become mine lakes. Deeper than natural lakes, several of the former mine voids are now used as lakes for recreation purposes (i.e. Stockton Lake, Lake Kepwari[5] and Black Diamond A).

[4] The transfer from Harris Reservoir to Stirling Reservoir has only happened in one year. The licence condition indicates that the transfer will only happen once regional needs are met.
[5] Lake Kepwari is scheduled to be opened for recreational use in late 2007.

Map 3 Collie Coal Basin



The mined coal is used primarily to generate electricity at three power stations near Collie. Verve Energy's[6] two major coal-fired power stations in the Collie area provide electricity to the South West Interconnected System[7]. Opened in 1966, the Muja Power Station is 22 kilometres east of Collie. The Muja Power Station has four 200 megawatt (MW) generating units[8]. Opened in 1999, Verve's Collie Power Station is situated 10 km north of Collie and is capable of producing more than 300 MW of electricity. Brine, or saline wastewater produced during the cooling process, is transported via pipeline to an ocean outfall[9] for disposal.

The third power station, Bluewaters I, will be operated by Griffin Energy[10]. Construction has commenced on the 208 MW coal-fired power station. The station is located 10 km north east of the Collie townsite. Coal supplies for the station will be sourced from Griffin Coal. Commissioning of the station is expected by late 2008 (South West Development Commission http://www.swdc.wa.gov.au).

Bluewaters I is designed in a modular fashion to facilitate future growth. Griffin Energy is seeking to develop a second power station – Bluewaters II (Griffin Energy 2006).

## 2.3 Future Demand for Consumptive Use

If demand increases it is most likely to come from the energy sector and public water supply for the Integrated Water Supply Scheme. Although the water in Wellington Reservoir is still too brackish for use as public water supply, the Water Corporation is planning ahead and has applied to the Department of Water for a 17 GL allocation from Wellington Reservoir. The application requests 12 GL for inclusion in the IWSS and 5 GL of industrial water for use by Verve Energy (Water Corporation 2004a). The Department of Water has yet to make a determination on the Water Corporation's application (Water Corporation 2004a).

Additional water demand would be generated if two proposals for industrial parks near Collie are realised. The Shotts Industrial Park, a development proposed by the Shire of Collie and the South West Development Commission, would be located 12 km east of Collie, near the old Shotts townsite. The proposed park would serve heavy industrial needs. The second proposal is The Griffin Group's Coolangatta Industrial Park. Griffin Coal's Bluewaters I coal-fired power station would form the foundation of the industrial park located 10 km north east of the Collie townsite.

Industries outside the Upper Collie Catchment are another potential source of water demand. The Worsley Alumina refinery is located in the upper portion of the Brunswick River catchment, just west of the Upper Collie Catchment. The refinery is licensed by the DoW to use 2.1 GL per year from the Augustus River (a tributary of the Brunswick River). In order for a planned expansion to proceed, Worsley Alumina needs to increase its licensed allocation to 2.6 GL per year (Strategen 2005). The company has identified

[6] Verve Energy was created in April 2006 when Western Power separated into four businesses as part of the State Government energy market reforms.
[7] The South West Interconnected System (SWIS) provides electricity to an area bounded by Geraldton to the north, Kalgoorlie to the east and Albany to the south.
[8] On 30 April 2007 Verve Energy closed four 60MW generating units at the Muja Power Station.
[9] The outfall is off Buffalo Road, north of the Leschenault Estuary.
[10] Griffin energy is a subsidiary of The Griffin Group.

several potential future water supply options. These include: water from a service provider (e.g. Water Corporation), nearby regional surface sources (e.g. Wellington Reservoir), coal field dewatering (i.e. Collie) and greater use of the Augustus River (Strategen 2005).

The Kemerton Industrial Park is located 17 km north of Bunbury. Currently, the industrial park uses local groundwater resources to provide their supply. Increased demand may arise if new industry establishes in the park. Several stakeholders identified the water resources of the Upper Collie Catchment and in particular Wellington Reservoir are possible sources to meet this future demand. Several stakeholders identified Alcoa's alumina refinery at Wagerup Refinery as a possible source of future demand.

Several of those interviewed view the former hydro-power station at Wellington Reservoir as a lost opportunity. There are two proposals to refurbish the former hydro-power plant. One proposal is to reopen the hydro-power plant in conjunction with development of a desalination plant. The desalination plant would reduce the salinity of water from Wellington Reservoir making it viable for use by the Integrated Water Supply Scheme. The desalination plant would rely on power from several sources, including the hydro-power plant. The second proposal is to reopen the hydro-power plant as a "green power" venture and part of a tourist attraction featuring the Wellington Dam.

# 3 Surface Water Use

## 3.1 Wellington Reservoir

**Salinity**

In stakeholder interviews, the dominant water quality issue was salinity (80% of interviews). High salinity levels in the Upper Collie Catchment, have limited the potential use of some surface water resources including the Wellington Reservoir. Prior to the 1960s, land clearing for agriculture in the Upper Collie River Catchment resulted in the replacement of deep-rooted trees and vegetation by shallow-rooted annual crops and pastures. This allowed the watertable to rise, bringing salt stored in the soils to the surface and eventually into streams.

**Salinity Levels** (Mayer et al 2005)

| **Classification** | |
|---|---|
| Fresh | <500 mg/L TDS |
| Marginal | 500-1,000 mg/L TDS |
| Brackish | 1,000-2,000 mg/L TDS |
| Moderately saline | 2,000-5,000 mg/L TDS |
| Saline | >5,000 mg/L TDS |
| Highly saline | 10,000-35,000 mg/L TDS |
| Brine | >35,000 mg/L TDS |
| Hypersaline | >50,000 mg/L TDS |

Seawater contains 35,000 mg/L TDS

In 1933, the water in the Wellington Reservoir was 'fresh' at about 280 mg/L total dissolved solids (TDS) (Water and Rivers Commission 2001a). Despite the introduction of clearing controls upstream of the Wellington Reservoir in the 1970s, salinity levels continued to rise and eventually exceeded the drinking water guidelines[11]. In the early 1990s, Wellington Reservoir was replaced by the Harris Reservoir as the source of public water supply for the Great Southern Towns Water Supply Scheme.

By 1990, clearing controls and an extensive reforestation plan had helped to arrest the trend of increasing salinity in the Wellington Reservoir. However, by 2001, the water in Wellington Reservoir was still only 'marginal' at around 945 mg/L TDS (DoW 2006). The State Salinity Strategy (State Salinity Council 2000) identified the Upper Collie Catchment as one of five water resource recovery catchments[12] and set a salinity target of 500 mg/L TDS by 2015 for the Wellington Reservoir.

The **Collie Recovery Team** was formed in 1995 to help restore fresh water to the Wellington Reservoir. It consists of farming, community and agency representatives with the Department of Water (formerly the Water and Rivers Commission) as the lead agency. The 12 member team includes: landholders from the East Branch, James Well and South Branch of the Collie; catchment representatives from the West Arthur and Collie Shire Councils; Department of Water; Department of Agriculture and Food; Department of Environment and Conservation; Water Corporation; and Verve Energy.

[11] Water at or below 500 mg/L TDS achieves the drinking water quality guideline for salinity (National Health and Medical Research Council and Natural Resource Management Ministerial Council 2004).
[12] Water resource recovery catchments were selected based on two criteria: (1) existing or future water sources for the South West and (2) without active management would deteriorate beyond recovery.

**Scouring**

Since 1976, water from the base of Wellington Reservoir is scoured as part of the dam's maintenance. The scouring water is released to the Collie River following the first saline inflows of the season and when a difference exists in salinity levels between the top and bottom of the reservoir. This helps minimise the loss of fresh water over the top of the dam and removes the most saline water from the base of the reservoir.

Those stakeholders who commented on the scouring process accept it as part of managing the reservoir. Some were unsure as to when water is released from the reservoir for scouring versus releases for irrigation. Scouring typically occurs between June and August whereas the irrigation season is from October to April (Harvey Water www.harveywater.com.au).

**Irrigated Agriculture**

Although the Wellington Reservoir has a storage capacity of 186 GL, its annual sustainable yield is 85.1 GL. Currently the only consumptive user of water from Wellington Reservoir is Harvey Water.

Harvey Water has a licensed allocation of 68 GL/year (Economic Regulation Authority 2006). Of this, the majority is for irrigated agriculture while the remainder goes to industrial use (i.e. Doral Mining), historical releases and water losses from Harvey Water's open channel system. Harvey Water has been using approximately 50 GL annually or 74% of its allocation (Water Corporation 2004a).

Harvey Water uses the water from the Wellington Reservoir to meet the needs of irrigated agriculture in the Collie Irrigation District. Water released for irrigation is temporarily stored downstream at Burekup Weir. Here it is diverted into Harvey Water's channel system and delivered to its agricultural customers.

Harvey Water works closely with the Water Corporation (the Dam owner) to time the irrigation releases from the reservoir. It takes approximately 20 hours for the water to travel from the Wellington Reservoir to the Collie Irrigation District.

Several stakeholders noted that timing the release of irrigation water can be tricky. Burekup Weir can store only a one-day supply of water for irrigators. If more water is released from the reservoir, it flows over the top of the Weir. These stakeholders would like the system to be more efficient. Solutions offered were: (a) raising the Weir although it would be costly or (b) piping the irrigation water directly from Wellington Reservoir to circumvent the need for Burekup Weir.

The water from Wellington Reservoir is not of optimal quality for irrigated agriculture. Several stakeholders indicated the salinity content is restricting the types of crops that can be grown. A reduction in salinity would likely stimulate a shift from irrigated pasture to higher value, but less salt tolerant, horticultural crops.

If salinity of the irrigation water decreased a number of stakeholders indicated that water demand from the Collie Irrigation District would likely decrease. The ability to grow higher value crops would make the conversion of the existing channel system to a piped[13] system more economically feasible. As has occurred in the Waroona and Harvey Irrigation Districts, the conversion would significantly reduce the amount of water lost to leakage and enable irrigators to use more water efficient technology (e.g. pivot systems).

As part of its water licence, Harvey Water is required to release a small amount of water annually to the Henty and Ferguson Rivers and the Brunswick River to satisfy historical uses such as the Brunswick Junction pool. It was suggested these releases be reviewed to determine if they are (a) meeting their intended purpose or (b) still necessary.

**Reservoir recreation**

The recreation of Wellington Reservoir and its surrounds was discussed by a number of stakeholders (80%). While the dam is managed by the Water Corporation, the area around the reservoir is managed by the Department of Environment and Conservation (DEC)[14] as part of the Wellington National Park. In late 2006, the DEC released its *Draft Management Plan for Wellington National Park and Westralia Conservation Park* (CALM 2005).

Recreational fishing, canoeing, marroning and swimming were identified as popular activities. Although the reservoir is not stocked, recreational fish species include redfin, perch and trout. Motor boats and thus water skiing are not allowed on the reservoir. Nearby camping, picnicking and bush walking opportunities complement the water-based activities.

Many stakeholders view public water supply for the Integrated Water Supply Scheme as a likely use of Wellington Reservoir at some point in the future. They were also aware that water quality risk managers consider water-based recreation an incompatible use on public water supply. Many discussed the potential for conflict should a decision be made to remove recreation from Wellington Reservoir to protect public water supply quality. It was noted that an attempt five years ago by the Water and Rivers Commission to consult with the Collie community regarding the development of a source protection plan for the Wellington Reservoir was not well received.

[13] The starting point for such a pipeline has not been explored.
[14] The Department of Environment and the Department of Conservation and Land Management amalgamated to for the Department of Environment and Conservation on 1 July 2006.

Many did not believe the removal of recreation was necessary in order to protect public health. Many stakeholders requested that a range of options be evaluated using a transparent process before a decision is made about the future of recreation on Wellington Reservoir. This would include options to increase the level of water treatment rather than reducing recreation. Some stakeholders gave examples of overseas or eastern states experiences to support their contention that recreation and public water supply can co-exist. To emphasise their position, some local stakeholders stated they would be happy to pay more for their drinking water if it meant recreation could remain on the reservoir.

The ongoing case of Logue Brook, where the Water Corporation plans to shift the consumptive use of water from 'irrigation and recreation' to 'irrigation and public water supply', was given as an example where recreation may lose out to public water supply protection. A decision has not yet been made on Logue Brook. This case prompted calls for an evaluation of options to include the impact or cost of finding an alternative recreation resource to replace recreation activities removed from the reservoir. Most stakeholders rejected any suggestion that the loss of recreation access at Wellington Reservoir could be offset by the recently developed Lake Kepwari. Stakeholders view Lake Kepwari as a positive addition to the community's recreation assets and a draw card for those interested in water skiing in particular. However, they do not perceive it as a replacement venue for recreation. Due to the differences in their characteristics (e.g. size, natural amenity, type of activities), they view comparing Lake Kepwari with Wellington Reservoir as a case of comparing apples with oranges.

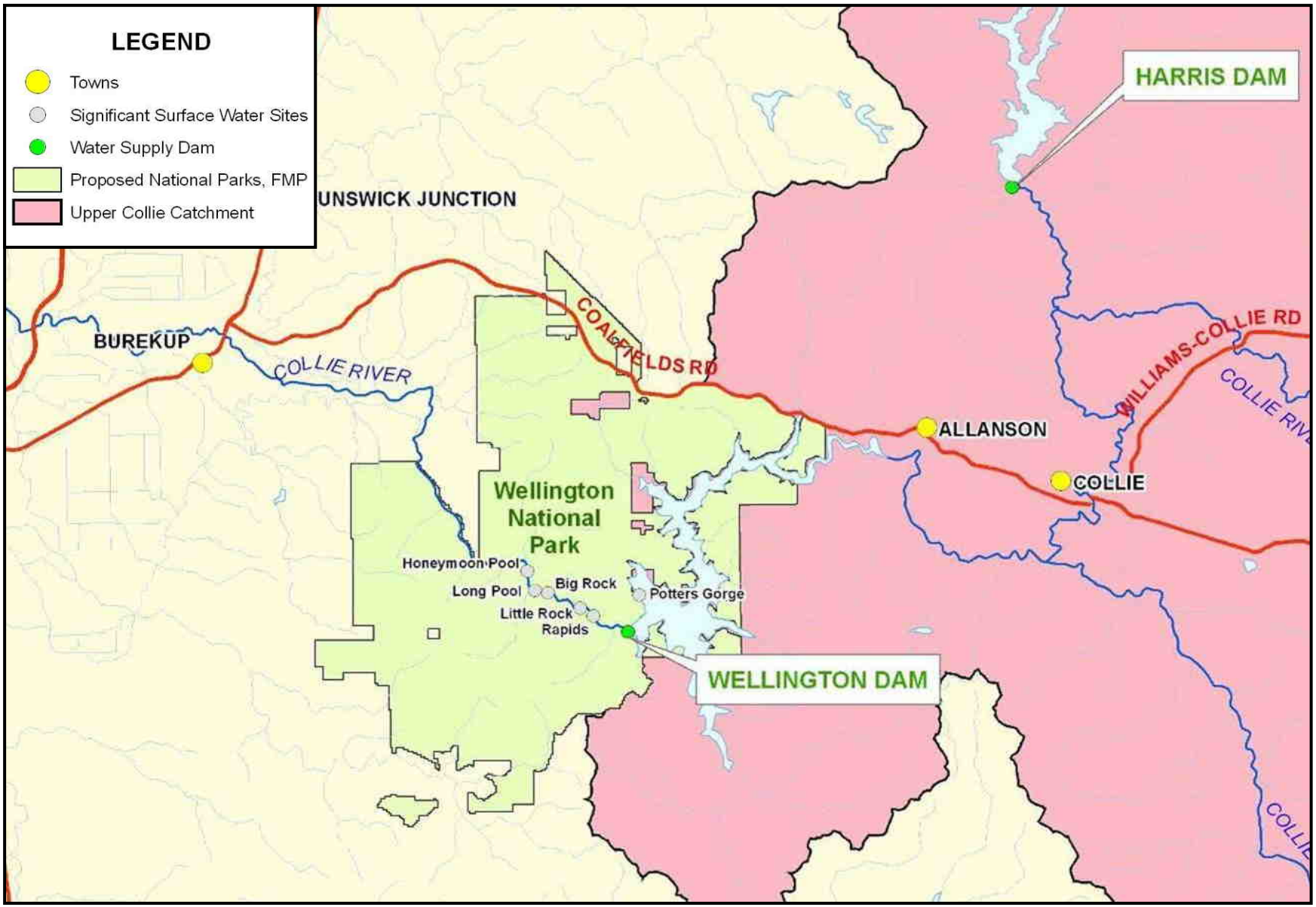
Many of those interviewed (48%) commented that while a public water supply source protection plan would, on paper, reduce the risk to water quality and public health a smaller risk reduction would be realised in practice. The risk would not be reduced to the intended level if measures in the plan cannot be fully implemented. Several stakeholders noted that recreation activities such as marroning are prohibited on Harris Reservoir. Yet, despite clear signage and agency patrols, it is well known that a significant amount of marroning still occurs. At present there are three State Government agencies that patrol the Wellington Reservoir - the Department of Fisheries (fishing and marroning regulations); the Department of Environment and Conservation (fires, rubbish and anti-social behaviour); and Water Corporation's catchment officers. The agencies noted that, at current resource levels, not all undesirable behaviour can be eliminated.

Some stakeholders noted that other uses in the catchment could also pose a threat to public water supply quality in Wellington Reservoir. The community of Allanson, upstream of the reservoir, is serviced by septic tanks and was the most frequently cited example. A couple of stakeholders mentioned forest management and its potential threat to water quality (e.g. erosion, dieback) and potential to reduce run-off (e.g. canopy density). Stakeholders questioned how the source protection plan would address these potential sources of contamination.

**Recreation downstream of the reservoir**

Within the Wellington National Park, there are five Department of Environment and Conservation managed recreation venues downstream of the Wellington Reservoir along the Collie River (Map 4). This includes The Rapids, Big Rock, Little Rock, Long Pool and Honeymoon Pool sites. The sites offer a variety of recreation opportunities, including marroning, fishing, picnicking, camping and canoeing.

Map 4 Wellington National Park Recreation Sites



A number of stakeholders commented on the popularity of these locations, especially the two larger sites (i.e. Long Pool and Honeymoon Pool). The DEC and some stakeholders noted that these areas often reach capacity during school and public holidays. The DEC has recently upgraded and hardened its visitor facilities downstream of the reservoir.

**Aboriginal Cultural Values**

The entire Collie River is a registered mythological heritage site (ID 16713) under the *Aboriginal Heritage Act*. The river is connected to Ngarngungudditj Walgu, a mythical water snake deemed responsible for creating the Collie River, the Collie River valley hills and the Leschenault Inlet (Department of Conservation and Land Management 2005).

The Department of Environment and Conservation consulted with Nyungar elders in the development of the Draft Management Plan and the upgrading of recreation sites downstream of the Wellington Reservoir, including camping areas along Lennard Track. The importance of protecting Aboriginal cultural values limits the potential to expand recreation venues such as Honeymoon Pool. Following consultation with the Nyungar community, DEC prohibited informal camping along Lennard Track to minimise disturbance to the natural environment and protect cultural values.

**Future allocation options**

During the scoping interviews, the following future allocation scenarios were put forward by stakeholders for the Wellington Reservoir:

- **Scenario A:** A large allocation is made to public water supply for the Integrated Water Supply Scheme (IWSS). If at the time of the allocation, the water had yet to attain the drinking water guideline for salinity, it would be transferred by a new pipeline to either Serpentine Reservoir or South Dandalup Reservoir for storage and buffering before use in the Integrated Water Supply Scheme. The remaining water under the diversion limit would be allocated to irrigated agriculture (i.e. Harvey Water). This volume of water may or may not meet its water needs.
- **Scenario B:** A large allocation is made to public water supply from the Reservoir in combination with groundwater from the Collie Coal Basin (i.e. mine dewatering). Additional water for public water supply may be obtained from irrigated agriculture (i.e. Harvey Water) through: a water trade of the savings made by piping the Collie Irrigation District, purchasing all or part of unused water allocations, or purchasing entitlements from those irrigators willing to sell. Remaining water from Wellington Reservoir would be supplied to irrigated agriculture or industry.
- **Scenario C:** Meeting the water needs of irrigated agriculture (i.e. Harvey Water) is given highest allocation priority. The remaining water under the diversion limit would be allocated to the Water Corporation for inclusion in the IWSS. As a Scenario, the IWSS bound water would be sent to Serpentine or South Dandalup reservoirs if the drinking water guideline had not yet been achieved. The difference between Scenarios A and C is the allocation priority assigned to meeting the water needs of irrigated agriculture (i.e. Harvey Water).
- **Scenario D:** As in Scenario B, the water needs of irrigated agriculture (i.e. Harvey Water) are given highest allocation priority. However, the remaining divertible water would be allocated to local and regional industry (e.g. Verve Energy, Griffin Energy,

Kemerton Industrial Park). Pipelines would need to be constructed to transfer the water to the industrial sites.

- **Scenario E:** As in Scenario B, the water needs of irrigated agriculture (i.e. Harvey Water) are given highest allocation priority. However, the remaining divertible water would be allocated to a combination of public water supply (i.e. IWSS) and local and regional industry.
- **Scenario F:** A large allocation is made to industry (e.g. Kemerton, Verve Energy, Griffin Energy, Alcoa and Worsley Alumina). This would require the construction of pipelines to transfer the water to industrial sites. Remaining water would be allocated to irrigated agriculture.

## 3.2 Harris Reservoir

The Harris Reservoir is located on the Harris River approximately 10 km north of the Collie townsite. The reservoir has a capacity of 72 GL and an annual sustainable yield of 17 GL[15] (DoW 2007).

The Water Corporation has the only licensed allocation from the Harris Reservoir. It is licensed to use 15 GL annually[16] (DoW 2007). Of this, 10 GL is for the Great Southern Towns Water Supply Scheme and the Muja Power Station and 5 GL[17] for inclusion in the Integrated Water Supply Scheme and Worsley Alumina via pipeline transfer to the Stirling Reservoir. The Water Corporation has applied to renew its licence and increase its allocation from 15 GL to 17 GL (DoW 2007). The DoW has yet to make a determination on their request.

The Great Southern Towns Water Supply Scheme supplies water to farmland and rural communities in the South West and Great Southern Region, including Collie, Narrogin, Lake Grace and Hyden. Many stakeholders accept public water supply as the priority use for water from Harris Reservoir.

The transfer of water to the Integrated Water Supply Scheme via Stirling Reservoir has not occurred in recent years due to low water levels, organic matter and tannins colour the water (DoW 2007). “Once a new treatment plant is established at Harris Dam to maintain water quality during periods of low water level … the Water Corporation plans to once again undertake transfers to Stirling [Reservoir]” (DoW 2007, pg. 1).

A Draft Drinking Water Source Protection Plan has recently been prepared for the Harris Dam catchment (DoW 2007). “Limited approved and managed recreation occurs in the catchment, namely the Bibbulmun Track[18] and an overnight accommodation hut” (DoW 2007, viii). Recreation is limited to reduce the risk of contamination to the Harris Reservoir. As numerous stakeholder noted illegal marroning still occurs. There are recreation facilities just downstream of the reservoir outside of the public water supply catchment; this would remain the case, under the source protection plan.

[15] The sustainable yield is currently being reviewed by the DoW.
[16] The licence indicates the water needs of the region must be provided for before transferring to the IWSS.
[17] The transfer from Harris Reservoir to Stirling Reservoir has only happened in one year.
[18] The Bibbulmun Track is a popular walking track that extends from Perth to Albany.

The Water Corporation is required to annually release water from the Harris Reservoir to help reduce the salinity in the Wellington Reservoir. The release was a ministerial condition placed on the Water Corporation at the time of the dam's construction. Releases of fresh water from the Harris Reservoir are intended to dilute the more saline water in the Collie River.

Several stakeholders expressed concern that the required release from the Harris Reservoir has not occurred the past few years. They noted that in summer, the portion of the Collie River that passes through the townsite often becomes stagnant. The stakeholders want the release renewed to improve water quality in the Collie River. This could also increase the River's social value and benefit recreational events such as the Collie Descent canoe race[19].

## 3.3 Mungalup Reservoir

Mungalup Dam is located 6 km south west of the Collie townsite on Mungalup Brook, a small tributary to the Collie River. Built in 1935, it is a Water Corporation operated dam. The Water Corporation has a licence to take 0.5 GL per year from the reservoir to supply drinking water to residents in Mungalup and the southern part of the Town of Collie (Water Corporation 2004b). The water is fluoridated and disinfected prior to distribution (Water Corporation 2004b).

In 2004 a drinking water source assessment was conducted to identify potential sources of contamination to the public water supply source (Water Corporation 2004b). The next step will be the preparation of a drinking water source protection plan for the public water supply source catchment. There is no public use (e.g. recreation) of the reservoir other than the Bibbulmun Track along its eastern boundary.

One stakeholder commented that the public water supply system's water pressure is poor and attributed this to aging infrastructure. They questioned whether the reservoir would continue to be used for public water supply in the longer term.

## 3.4 Minninup Pool

Minninup Pool is located on the Collie River, south of the Collie townsite. It was identified by stakeholders as a popular area for swimming, picnicking and canoeing. The site is often busy during school and public holidays and is used primarily by local residents. The site has a grassed bank area and a small sandy beach, as well as picnic tables and a carpark. The hardened portion near the pool is managed by the Shire of Collie while the remainder is managed by the DEC. Because the water is calm, the pool is popular for "family-style canoeing". More 'serious' canoeists prefer other areas, such as the section of the Collie River upstream of the pool.

The pool is a registered mythological Aboriginal Heritage site (Site ID 15330). It is where Ngarngungudditj Walgu rested after creating the Collie River, the Collie River valley hills and the Leschenault Inlet (CALM 2005).

[19] The canoe race has been held since 2003 and runs from the Harris River Winery to Black Diamond A.

**Between Harris Dam and Minninup Pool**

Recreational pursuits upstream of Minninup Pool identified by stakeholders include swimming, fishing, marroning and canoeing. Local stakeholders noted that swimming in the river used to be a more popular activity than it is today. The exception is Minninup Pool where the numbers have remained steady.

The reduction in river swimmers was attributed to the presence of nardoo (Section 5.6) and the opening of the Collie swimming pool[20]. One stakeholder indicated that while some marroning occurs in the river, Wellington Reservoir is a much more popular marroning site for locals.

## 3.5 Pool Supplementation

Pool supplementation was a topic of discussion in 40% of the interviews. Those who did not discuss the pool supplementation either did not feel knowledgeable enough about the issue or they did not have an interest in the issue.

Many stakeholders view the pool supplementation issue as very much a Cardiff or Buckingham issue of limited interest to those not directly affected. However, for those local stakeholders who value the pools, the future of the supplementation program is a significant issue.

Both the Collie River South Branch and East Branch are ephemeral. During summer, large sections dry out reducing the rivers to a series of pools. Historically, the pools were "… maintained by groundwater in reaches on the Basin in all but the most adverse summers" (Collie Water Advisory Group 1996, p 3).

Over the years, extensive coal mining in the Collie Coal Basin resulted in lower groundwater and less discharge to the pools. The potential negative effects on the pools were initially obscured by the coal companies disposing their mine water to the rivers along with saline water from the Muja Power Station. However, in the 1990s, mine water was no longer viewed as wastewater but as a 'resource' for use in the power stations as cooling water. At this time, the Muja Power Station adopted a zero discharge policy (CWAG 1996). These two factors resulted in the release of much less water to the river system.

By 1994, residents in the Cardiff/Collie Burn and Buckingham areas were raising concerns about the decline in water levels in their domestic wells. Declines in pool water levels were also evident. In 1995, the State Government created the Collie Water Advisory Group (CWAG) "…to review the water resources management issues in the Collie Basin and recommend to Cabinet a strategic water-management plan…." (WRC 2002, p 46).

[20] The Collie Swimming Pool is a 50m heated pool.

CWAG determined that the Buckingham Bridge Pool on the East Branch of the Collie River had been "affected by [groundwater] pumping" and the South Branch of the Collie River was "probably affected by groundwater abstraction" (CWAG 1996, 12). It recommended that groundwater abstraction be minimised and eight designated pools be maintained over a two-year period to preserve their "environmental and recreational values". CWAG (1996) anticipated that groundwater levels would recover over the two-year period negating the need for long-term pool supplementation.

Supplementation began in the summer of 1995/96 but by 1999 it was evident that groundwater recovery was taking longer than predicted. The WRC advised CWAG "… that the watertable would have been above the bed level of all pools all year round, under current climatic and land clearing conditions and without the influences of past mining and groundwater abstraction" (CWAG 1999, p 3). CWAG concluded that "groundwater level depression near river pools on the South Branch of the Collie River will continue to cause some pools to remain dry for prolonged periods during summer until groundwater levels in the vicinity recover" (CWAG 1999, p 2). They predicted similar impacts would occur on the East Branch at the Buckingham and Duderling pools.

The Collie Water Advisory Group (1999) recommended that supplementation continue during the summers of 1998/99 and 1999/00 and added Duderling Pool to the list of nominated pools (Table 2). It was noted that, in the longer-term, the future of supplementation should depend on consideration of a number of factors: social values, environmental values, rate of groundwater recovery and the cost of supplementation (CWAG 1999).

Table 2 Pools designated for supplementation

| South Branch Pools | East Branch Pools |
|---|---|
| Long Pool | Buckingham Bridge Pool |
| Walker Pool | Duderling Pool[21] |
| Cox Pool | |
| Cardiff Pool (Town Pool) | |
| Graham Pool | |
| Piavanini Pool | |
| Chinaman Pool | |

The supplementation of the pools has continued under an arrangement between the DoW, Verve Energy and Griffin Coal. Currently, Verve Energy supplements the South Branch pools, while Griffin Coal supplements the two East Branch pools. For the companies, their participation in the supplementation program is as much about being good corporate citizens and members of the local community as it is about redressing impacts.

The pools are supplemented in summer using an overflow (cascading) technique. The supplemental water is released to the pool furthest upstream (i.e. Long Pool on the South Branch), with the other pools filling as the water cascades downstream. Stakeholders familiar with the pools noted that Piavanini Pool and Chinaman Pool do not receive much, if any, supplemental water. However, this is not a concern to residents as Piavanini Pool

[21] Duderling Pool was added to the list of supplemented pools by CWAG in 1999.

has lower social and ecological values relative to the other pools and Chinaman Pool maintains sufficient water year round.

Local residents use many of the pools for swimming and in some cases canoeing. Representatives of the Cardiff community indicated that the cascading technique is creating an 'unnatural' environment with a number of the South Branch pools having too much water in summer. They would prefer the use of a piped supplementation system to avoid inundation of riparian vegetation and provide 'natural looking' conditions. They referred to a consultant's report (Welker Environmental Consultancy and Streamtec Pty Ltd 2001) that had recommended replacing the cascading system with a piped system.

There are also concerns about the quality of the supplemental water used in the South Branch. Community representatives noted the reddish-brown colour of the water and residual staining at several pools. In March 2007, supplementation of the South Branch pools was abandoned for the remainder of the summer due to water quality issues including high levels of iron in the water. Cleanup is currently underway.

A third concern pertained to Graham Pool. Anecdotal evidence was presented that supplementation of this pool is ineffective as the water level quickly drops following supplementation.

Those who use and value the pools would like the supplementation program to continue but with modifications to address the water quality and delivery issues. They would also like the DoW to provide monitoring data so they can draw their own conclusions as to the effectiveness of the supplementation.

There were a small number of stakeholders who questioned the benefit of filling pools they believed would otherwise dry out under natural conditions.

## 3.6 Former Mine Voids

There are old mine voids scattered across the landscape. These are the remnants of abandoned open cut mining activity. Mining companies are finding innovative ways to utilise these old mine voids as new surface water resources. Three of the mine voids are now artificial lakes for recreation – Stockton Lake, Lake Kepwari[22], and Black Diamond

[22] Lake Kepwari is scheduled to be opened as a recreation facility in late 2007.

A. Another mine void, Western 5H, is part of a project to test the viability of using mine lakes for commercial aquaculture.

**Stockton Lake**

Stockton Lake is a former mine void located 7 km east of Collie, off the Collie-Darkan Road. The water level is 'topped up' via mine dewatering. A number of stakeholders identified Stockton Lake as a popular recreation area for water skiing and camping. The DEC-managed area provides basic facilities, which stakeholders identified as barbeques and long drop toilets. It was noted that, due to its small size, the Lake can only support 4-5 boats and the area often reaches capacity during school and public holidays. It is predicted that the opening of Lake Kepwari will reduce the pressure on Stockton Lake.

Due to run-off from a nearby mine site, the Lake has experienced elevated acidity levels. Signs advise water skiers and swimmers to limit their time in the water, especially those individuals with sensitive skin. One stakeholder noted that Lake Stockton was closed to the public during the 1994/95 summer when it became too acidic but was reopened in the winter of 1995 when it returned to a safe level. However, several stakeholders noted they have been using Stockton Lake for years and have not yet experienced any problems.

**Lake Kepwari**

Lake Kepwari is a 103 ha artificial lake created from the Western 5B mine void. Located 13 km south east of the Collie townsite, the former Wesfarmers Premier Coal mine site was closed in 1997 (WRC 2002).

In addition to the measures typically undertaken in modern mine site rehabilitation, the plans for Lake Kepwari include end uses such as picnicking, camping and water sports (e.g. water skiing). The development of Lake Kepwari is being guided by the South West Development Commission and the Lake Kepwari Working Group[23] (GHD 2006). When the Lake becomes operational as a recreation venue, it will be handed back to the DEC for management.

To fill the Lake, Wesfarmers Premier Coal obtained a DoW license to divert water from the Collie River South Branch. Until groundwater levels in the surrounding Basin recover, the Lake will likely require supplementation to 'top up' its water level.

Several stakeholders noted that acidity in the Lake is still too high for recreational activities. They noted acidity will need to be reduced before the Lake is scheduled to open to the public in late 2007.

**Black Diamond A**

Black Diamond A is an old mine void located west of Collie, just south of Allanson. It was one of the earliest open cut mines in the area. The void filled naturally with water, and is now a popular recreation spot for Collie residents (e.g. swimming). The site is not actively managed as a recreation venue and a perimeter fence is used to dissuade visitors – albeit ineffectively – for safety reasons.

[23] The Lake Kepwari Working Group includes representatives from State Government, the Shire of Collie, the Collie Chamber of Commerce and Industry, Wesfarmers Premier Coal, the Centre for Sustainable Mine Lakes and the local community.

Several stakeholders noted that, similar to many other mine voids, the water is acidic. It is also difficult to see the bottom of the void due to the green-blue colour of the water. Coupled with fluctuating water levels, this can make swimming dangerous.

**Mine void acidity**

Sixty per cent of interviewees mentioned the acidity levels in the former mine voids used for recreation. Overburden materials, removed in open cut coal mining, oxidize when exposed to air and create acid sulphate soils. Stormwater can transport the sulphuric acid into nearby water bodies such as mine voids (Lund & Thompson 2005). One stakeholder raised the prospect of acidic conditions mobilising heavy metals and indicated the acidic lakes should be tested for heavy metal contamination[1]. Several others would like to know whether acidity is an issue for the Collie River or other areas near coal mining activities.

**Aquaculture**

Wesfarmers Premier Coal, in conjunction with the Centre for Sustainable Mine Lakes, is using its Western 5H mine void to test the viability of using mine lakes for commercial aquaculture. The Collie Aquafarm includes six aquaculture ponds next to the old mine void.

Water from the void is pumped into a limestone treatment system to reduce its acidity to a neutral state. The water is further treated in a microphyte pond and carbon enhancement system (Wesfarmers Premier Coal 2003). The treated water is put into a holding dam and then distributed to aquaculture ponds containing floating fish cages (Muresk Institute of Agriculture 2000). The Collie Aquafarm is currently undertaking an economic feasibility study to determine its commercial viability.

## 3.7 Private Use

There are eight small (i.e. less than 0.1 GL each) surface water licences held for private use. Seven licence holders have dams along the Collie or Harris Rivers. The other licence holder pumps directly from the Collie River. In total, these licences account for less than 0.2 GL of the surface water allocated from the Upper Collie Catchment. The water is used for a variety of purposes, including domestic use, irrigated agriculture and lawn and garden irrigation.

The DoW will be undertaking a water use survey in the catchment in May 2007. The survey will help determine the actual amount of surface water being used and whether some currently unlicensed use requires licensing. Under s9 of the *Rights in Water and Irrigation Act* 1914, a landholder can take water without a license for stock[24] or domestic purposes if a river passes through their property or the property is contiguous to a river. Water uses that do not meet these criteria are required to be licensed by the DoW. An example would be instances where stock is raised under intensive conditions.

[24] Under the s21(4) *Rights in Water and Irrigation Act* 1914 intensive conditions: "are confined to an area smaller than that required for grazing under normal conditions and are usually fed by hand or by mechanical means".

## 3.8 Agriculture Upstream of Wellington Reservoir

Agriculture occurs in a number of areas upstream of Wellington Reservoir, including north of the Collie townsite, along the Collie River East Branch, and along the Collie River South Branch. Stakeholders indicated that much of the agricultural land is sheep farming; with a few orchards and vineyards.

Several stakeholders indicated that at present most farms rely on on-farm soaks as their primary water source for agriculture. This is because the Collie River has too much salt to be used and the East Branch is reduced to small pools during summer.

However, stock occasionally wander down to the river's edge. To protect water quality and riparian zones from stock, it was noted that many farmers in the Collie area have fenced riparian zones. This has reduced vegetation trampling, erosion and nutrient loading. However, reducing stock presence in riparian zones has had unintended side effects. Several stakeholders identified weeds, such as the blackberry tree, fire and vermin as issues. One stakeholder noted that although his/her riparian zones are fenced he/she allows stock into these zones periodically to trample the vegetation to reduce the fire risk. Several stakeholders indicated they wanted additional work done to manage the riparian zones.

Stakeholders from the agricultural sector did not expect growth in the agricultural industry. However, one stakeholder wanted to ensure that, as the overall demand for consumptive use increases, a small amount is set aside for agriculturalists for future use.

## 3.9 Environmental Flows

Many stakeholders noted the importance of environmental flows in sustaining dependent ecological values. Ecological water requirements have been defined for ecosystems below both Wellington Reservoir (Hardcastle et al. 2003) and Harris Reservoir (Welker Environmental Consultancy and Streamtec Pty Ltd 2000), as well as the South Branch of the Collie River (Welker Environmental Consultancy and Streamtec Pty Ltd 2001). The DoW defines ecological water requirements (EWRs) as "the water regimes needed to maintain ecological values of water dependent ecosystems at a low level of risk" (WRC 2000a p.12). The EWRs assist in setting environmental water provisions as part of the water allocation process. The environmental water provisions (EWPs) "may meet in part or in full the ecological water requirements" (WRC 2000a p. 12).

Currently, the releases of irrigation water from Wellington Reservoir not only support agriculture but provide some water for the environment between Wellington Reservoir and Burekup Weir (Scott per comm. 2007). As discussed earlier (See Section 3.1), several alternative allocation scenarios were suggested by stakeholders for the future use of water from Wellington Reservoir. Some scenarios would include significantly reducing or even eliminating releases of irrigation water from Wellington Reservoir. Stakeholders noted

that evaluation of such scenarios would need to consider the potential impact of reduced releases on dependent ecosystems and other values (e.g. recreation) downstream.

Several stakeholders questioned whether the required releases of water from Harris Reservoir intended to help support downstream ecological values are occurring.

Through its allocation policies, the DoW clearly discriminates between the water requirements of dependent ecosystems and consumptive water uses. Under current operating arrangements at Wellington Reservoir[25], the same water can simultaneously meet the needs of both dependent ecosystems and those of consumptive users (e.g. irrigated agriculture).

Several stakeholders indicated that they discriminate between ecosystem use and consumptive uses but want the two uses to be treated the same. They do not want ecosystem use having automatic status as a priority use, especially if the demands on a water resource start to exceed its ability to meet the needs of the various water users (including dependent ecosystems). It was suggested for instance that, if the available water from a resource decreased under drought conditions, the DoW should take the position that all water users, including dependent ecosystems, would receive less of their 'allocation'; thereby equitably sharing the risk across all users.

## 3.10 Salinity Management

**East Branch Diversion Trial**

In 2005, the Department of Water, The Griffin Group and Harvey Water commenced a two-year trial to divert brackish early winter flows, stopping them from entering Wellington Reservoir. The trial was implemented as part of the Collie River Salinity Recovery Plan. The East Branch of the Collie River was selected for the trial as it contributes the greatest percentage (39%) of salt to the Reservoir (DoW 2006). With the start of the winter flows, the brackish water is pumped from the East Branch into a temporary weir and then into Griffin Coal's Chicken Creek 4 mine void where it is stored.

In 2005, the trial diverted nearly 1GL of brackish water from the East Branch. This water contained 2,978 tonnes of salt or the equivalent of a 32 mg/L TDS drop in salinity in Wellington Reservoir (DoW 2006). By the end of year two the trial had improved the water quality entering the reservoir to 418 mg/L TDS.

Many stakeholders (65%) mentioned that they are encouraged by the results to date from the diversion trial. However, many noted that several questions need to be answered before a decision is a made regarding a full-scale diversion: including storage capacity and effects on stream flows and dependent flora and fauna.

The Collie Recovery Team is currently considering the merits and logistics of implementing a full-scale diversion.

[25] Water is released from Wellington Reservoir but is not taken for irrigated agriculture until it reaches Burekup Weir.

### Desalination

Forty percent of interviewees raised the prospect of either a privately or government funded desalination plant. One proposal would take marginal water from the Wellington Reservoir and reduce its salinity to meet the drinking water guideline. The second proposal would produce fresh water by desalinating brackish water from the East Branch diversion at Griffin Coal[26]. Several stakeholders suggested that Verve Energy's ocean outfall pipeline be used to dispose of the brine produced by a desalination plant.

### Revegetation

About half of those interviewed commented on revegetation efforts in the catchment. They credited the revegetation of cleared land and efforts to retain native vegetation for allowing salinity levels to reach a steady state (of around 945 mg/L TDS) in Wellington Reservoir. While they expected some additional revegetation as part of the Salinity Recovery Plan, most felt the most significant gains had already been achieved. It was noted that despite their positive impact, revegetation efforts have not produced as large a drop in salinity levels as initially predicted. Some of those interviewed called for further evaluation of the effectiveness of the revegetation program in reducing salinity.

### Tree Plantations and Water Interception

While supportive of the use of tree plantations for the purpose of salinity reduction, a small number of interviewees expressed concern about possible negative impacts. These included: reduced water quality due to erosion following harvesting or herbicide and pesticide run-off; reduced runoff due to interception; and social impacts (e.g. fewer residents; reduced sense of community). Some tree plantation supporters commented that its industry code of practice results in less chemical usage than on the average farm. In August 2006, the Forest Industries Federation of WA released its updated *Code of Practice for Timber Plantations in WA*. The Code is a best practice manual for the establishment and management of hardwood and softwood plantations in WA.

Tree plantation industry representatives indicated that the effect of its plantations, like any other land use in a catchment, should be factored into water resource modelling and management decisions. However, where tree plantations were established as part of a recognised salinity recovery strategy, as in the Upper Collie Catchment, they should be given a different status in the regulatory framework than tree plantations established primarily for commercial purposes. In addition, if tree plantation owners are required in the future to obtain water licences (i.e. water entitlements), existing tree plantations should be 'grandfathered' into the new licensing regime rather than being treated as a new water use.

### Deep drainage

Two interviewees suggested the use of deep drainage along the East Branch as an option for salinity reduction. The technique involves the construction of 2-3 meter deep sub-surface drains that transport water and dissolved salts away from a site and allow existing land uses to continue. It has been used with mixed results to reduce salinity levels in parts of the Wheatbelt (Deep Drainage Taskforce 2000). A trail drain (approximately 1.2 m deep) has been constructed at Spencer's Gully along the Collie River Each Branch.

[26] It is proposed that the desalination plant be located Bluewaters Power Station.

# 4 Groundwater Use

## 4.1 Background

In 1979, two State Agreement Acts were put in place to govern mining in the Collie Coal Basin. Griffin Coal operates under the *Collie Coal (Griffin) Agreement Act* 1979 while Wesfarmers Premier Coal operates under the *Collie Coal (Western Collieries) Agreement Act* 1979.

In 1982, the State Cabinet endorsed a framework for management of the Collie Coal Basin. This designated coal mining as the primary land use in the Basin and identified that the Basin's water resources be utilised in the best interest of the State.

In response, the Water Authority of Western Australia developed the first water resource management strategy for the Collie Coal Basin. Released in 1988, the strategy identified power generation as the Basin's priority groundwater use.

Currently, the DoW has allocated the Basin's groundwater resources to three categories of use: mine dewatering, power generation and, to a lesser extent, private abstraction (Table 3) (WRL 15 November 2006).

Table 3 Allocation of Collie Coal Basin groundwater resources

| Water Use | Amount (GL/year) |
|---|---|
| Mine dewatering | 49.0 GL |
| Power generation[1] | 17.5 GL[1] |
| Small private users | 0.1 GL |
| Total | 66.6 GL |

[1] Does not include water supplied to power stations via mine dewatering

## 4.2 Mine Dewatering and Power Generation

Both Griffin Coal and Wesfarmers Premier Coal have DoW-issued water licenses to take groundwater through mine dewatering processes. The removal of groundwater from mine sites is needed to create a safe work environment. Only a relatively small amount of the groundwater removed by dewatering is used at the mine site for purposes such as dust suppression. The remainder is disposed in a variety of ways. The water may be stored in a nearby mine void, it may be released to local streams (e.g. the South Branch and the East Branch) or it may be used by other industry.

Prior to construction of the Muja Power Station, the majority of groundwater removed by mine dewatering was released to the environment via the South Branch and the East Branch. Since the Muja Power Station opened, a large portion of mine dewater has been transported via a pipeline to the local coal-fired power stations for use as cooling water. In 2005/06, the Verve Energy power stations used the majority (61%) of the groundwater

removed through mine dewatering. Ninety-two per cent[27] of Verve Energy's water supply came from mine dewatering. The remainder of Verve Energy's water supply was met through its own licensed groundwater production bores (8%) in the Cardiff and Premier Sub-basins and surface water from Harris Reservoir (<1%). The remainder of the mine water is used in mining activities (6%) or released to the environment (33%).

Because the mining operations are governed by State Agreement Acts, the Department of Industry and Resources is responsible for determining the ultimate fate of the water removed from the mine site. As part of that process the Department of Industry and Resources consults with the DoW. Several stakeholders commented that although the two State Government agencies work well together, the process would be simpler and more efficient if only one agency was involved in regulating water use in the Collie Coal Basin.

## 4.3 Small Private Users

The requirements for groundwater licensing are outlined in the *Rights in Water and Irrigation Act* 1914. In proclaimed areas, such as the Collie Coal Basin, a license is required for the construction or modification of groundwater bores (Section 26D). In addition to the coal mines and power stations, there are nine private water users licensed to take small amounts of groundwater from the Collie Coal Basin. Nearly all of these are located in the Cardiff Sub-basin. The groundwater is used for domestic use, irrigation of school grounds and dampening. Collectively, these water users are licensed to take up to 0.1 GL of groundwater annually.

Companies licensed to take large amounts of groundwater (e.g. Griffin Coal, Wesfarmers Premier Coal) are required to report their use to the DoW. However, the amount of water used by private users with licences to take a small volume of water is not monitored. The DoW plans to undertake a groundwater use survey in the Collie Coal Basin in May 2007. This will assist the Department to gain a better understanding of the amount of groundwater use by both licensed and unlicensed users.

## 4.4 Level of Use

Most of the stakeholder representatives (68%) noted that the withdrawal rate of the groundwater from the Collie Coal Basin is exceeding the sustainable yield of the resource. The bulk of the groundwater withdrawn is through mine dewatering. As mentioned earlier this is an essential part of achieving mine safety. The Water and Rivers Commission found that "in the past, the annual groundwater abstraction … has exceeded recharge, causing a basin-wide decline in groundwater levels" (WRC 2002, Summary). Some stakeholders (26%) identified negative changes they attributed to the unsustainable withdrawal of groundwater. These include reductions in stream flow in the Collie River South Branch and East Branch, less water in river pools, and land subsidence.

While the size of the groundwater resource is substantial, the DoW has determined that the annual sustainable yield of the Collie Coal Basin is 22.0 GL. Currently 66.0 GL is allocated to licensed groundwater users. A water resource is over allocated when the percentage of sustainable yield allocated for use exceeds 100%. Collectively, licensed users, including the coal companies, are not currently taking the full amount of

[27] This percentage varies year to year.

groundwater allowed under their licences. In 2005/06, only 40% of the groundwater allocated to consumptive uses was used. However, the level of existing use (26.3 GL) currently does exceed the annual sustainable yield of 22.0 GL.

Coal mining is an activity that incrementally moves across a landscape as new coal resources are developed. Mining activity ceases in some areas as coal resources are exhausted, while new pits exploit coal resources in other parts of the Basin. A few stakeholders noted that since 1995, groundwater levels in some parts of the Basin have been rising. This is occurring in parts of the Cardiff Sub-basin where mining has ceased and groundwater levels are recovering (WRC 2002).

## 4.5 Priority Use and Impact Mitigation

Forty-two per cent of those interviewed expressed concern about the unsustainable withdrawal of groundwater from the Collie Coal Basin. However the importance of coal mining and power generation to the economy and welfare of the community was also acknowledged. Stakeholders view these as the priority uses for the groundwater resources. Discussion focussed on:

- The size of the groundwater resource and its sustainable yield
- Alternative methods for meeting the existing and future water supply needs of the power generation sector
- Actions to redress or mitigate negative impacts due to groundwater withdrawal.

Some stakeholders believe the DoW's estimate of groundwater sustainable yield may be too conservative. They commented that industry hired experts have made more optimistic assessments of the sustainable yield. If the sustainable yield is larger than that calculated by the DoW, the actual use of the groundwater resource may be sustainable. Others were uncertain as to which value is correct but were aware of the difference of opinions among the experts. Resolving the issue of the amount of sustainable yield is seen as important so that groundwater users can plan for the future.

Those stakeholders, who believe the unsustainable use of groundwater has resulted in negative impacts, want the impacts redressed or mitigated. Actions suggested by stakeholders included: continuation of the pool supplementation (see section 3.5), reinjecting the mine water to recharge the Basin, and finding alternative water sources for power generation. Using alternative water resources for cooling water would make more of the water from mine dewatering available for release to the environment. Alternative water resources for cooling water suggested include:

- Wellington Reservoir, if salinity levels are reduced to a suitable level for industrial use
- Desalination of the East Branch Diversion water
- Harris Reservoir if there is additional water available after public water supply demands are met.

Twenty-three percent of stakeholders did not feel they knew enough about the current groundwater situation to comment. They would like additional information about the rate of abstraction, rate of recharge, and sustainable yield.

**Water security for industry**

Industry stakeholders indicated that the power sector's demand for water, especially cooling water, is likely to grow as the sector expands. Although Muja Stages A and B are scheduled to cease operations at the end of April 2007, Griffin Energy is constructing a new power station (Bluewaters I) near Collie and is seeking government approval for a second station (Bluewaters II). There is also the longer term possibility of Verve Energy constructing a Collie B power station.

Industry stakeholders and others highlighted the importance of water security to the power generation sector. Currently water from mine dewatering along with the power sectors own groundwater production bores are meeting the needs of power generators. However, industry stakeholders expect that in time additional sources of water will be needed as the demand for cooling water exceeds that from mine dewatering.

The power generation sector's reliance on mine dewatering for cooling water presents some challenges. Industry stakeholders noted that the demand for cooling water tends to be higher in summer when the demand for electricity is greatest. A sufficient supply of mine water is not always available at these peak times. The use of mine voids to store the water from dewatering for use during peak periods was identified as one positive solution. Augmenting supply with surface water sources of water (e.g. Wellington Reservoir) was another option identified.

Several future groundwater allocation options emerged from the scoping interviews. The options are distinguished largely by the priority use assigned to groundwater.

- **Scenario A** - The priority groundwater use is the power generation sector. This is a continuation of the existing situation with mine water directed to use as cooling water.
- **Scenario B** – The priority groundwater use is public water supply for the IWSS. The power stations would need to meet their water needs through other sources such as Wellington Reservoir.
- **Scenario C** - The priority use of the groundwater removed by mine dewatering is the environment. Environmental uses might include pool supplementation and/or recharging of the aquifer. Any remaining water would be used by local industry including the power stations.

## 4.6 Water Quality

As discussed earlier, many stakeholders identified the high acidity of water in mine voids as a water quality issue, especially in relation to those subsequently developed as recreation venues. However, they did not identify acidity as a water quality issue for groundwater.

However, the DoW (2007) notes that groundwater in the Collie Coal Basin is "generally acidic with pH ranging from 2.6 near the underground and open cut mines to 6.3 near the southern and south eastern boundaries of the Basin. The acidity of the groundwater is attributed to its contact with sulphide bearing sediments" (WRC 2002).

# 5 Social Water Requirements

## 5.1 Definitions

An objective of the scoping exercise was to:

- Identify those water features in the Upper Collie Catchment that stakeholders perceive as having significant social and/or cultural values
- Gather information about their social water requirements.

'Social Water Requirements' are the water characteristics or conditions (e.g. quantity, quality) needed to sustain the social/cultural values of a particular water resource or feature.

Statewide Policy No 5 (*Environmental Water Provisions Policy for Western Australia*) defines social water requirements as "elements of the water regime that are identified to meet social values" (WRC 2000a, p 2). For the purpose of determining social water requirements, social value is defined as: "Aboriginal and other Australian heritage; recreational and tourist pursuits; landscape and aesthetic aspects; and educational and scientific aspects" and in some instances "small-scale domestic and stock water use of rivers and wetlands" (WRC 2000a, p 16).

While a water resource or feature may have other associated social values (e.g. public water supply, irrigation and economic development) these consumptive uses are not included in the WRC definition of social value applied in relation to social water requirements.

## 5.2 Social Value Attributes

Study participants were asked to identify water features in the Upper Collie Catchment notable for their social/cultural values. The attributes stakeholders used when discussing the social values of water features are summarised in Table 4.

Table 4 Attributes associated with a water feature's social value

| Attribute | Indicators |
|---|---|
| Aboriginal heritage/cultural values | Features with Aboriginal heritage values are more highly valued.<br>Indicator:<br>• Includes registered Aboriginal archaeological or mythological sites |
| Non-Aboriginal heritage values | Features with associated European heritage values are more highly valued.<br>Indicator:<br>• Feature is identified by stakeholders as having heritage value (e.g. historical value) |
| Recreation activities | Features used for passive and active recreation activities have a higher social value.<br>Indicators:<br>• Multiple forms of recreation<br>• Recreation facilities are of high quality |

| Attribute | Indicators |
|---|---|
| Aesthetic value | Features with higher aesthetic value have higher social value.<br>Indicator:<br>• Stakeholders identify the feature as having significant scenic value |
| Level of use | Features with higher levels of use are more highly valued.<br>Indicators:<br>• A significant proportion of visitors come from beyond the local area<br>• Use occurs year round, although may have peak seasons<br>• A high number of users |
| Education activities | Features used as a venue for education programs are more highly valued.<br>Indicators:<br>• CALM sponsored education programmes on-site<br>• Used in a Ribbons of Blue Program |
| Research values | Features used for scientific research have higher social value.<br>Indicator:<br>• Used by universities or other institutions for research. |
| Tourism venue | Feature that attract users from beyond the local area have higher social value.<br>Indicators:<br>• A portion of visitors come from outside local area<br>• Promoted as a tourist venue (e.g. Tourism WA website) |
| Condition of feature | Features in good condition are more highly valued.<br>Indicators:<br>• Suitable infrastructure in place to support the social values<br>• Natural setting complements the feature's social values<br>• Water quality is suitable for the social uses of the water feature |
| Threats | Threats to a feature, if realised, can diminish its social value.<br>Indicators:<br>• Reduction in water quality<br>• Reduction in flows |
| Opportunities | Features with opportunities to increase social value are more highly valued.<br>Indicator:<br>• There are plans to modify the feature to enhance its social values |

## 5.3 Identified Water Features

The water features most frequently identified as having notable social/cultural values are shown in Table 5. Wellington Reservoir and the Collie River immediately below the Wellington Reservoir were identified by a large majority (89%) of those interviewed. The only other feature identified by the majority of those interviewed was Lake Kepwari (65%). Not all of those interviewed were familiar with all of the features listed in Table 5.

Table 5 Features identified as having social/cultural values

| Feature | Frequency | |
|---|---|---|
| | Number | Percentage |
| Wellington Dam and Reservoir | 55 | 88.7 |
| Collie River below Wellington Dam | 55 | 88.7 |
| Lake Kepwari | 40 | 64.5 |
| Pools on the Collie River South Branch | 27 | 43.5 |
| Pools on the Collie River East Branch | 25 | 40.3 |
| Stockton Lake | 24 | 37.8 |
| Harris Dam and Reservoir | 16 | 25.8 |
| Minninup Pool | 15 | 24.2 |
| Black Diamond A | 15 | 24.2 |
| Collie River (between Harris Dam and Minninup Pool) | 13 | 21.0 |

Sections 5.4 through 5.7 discuss each of these features.

## 5.4 Wellington National Park

Wellington National Park includes two of the identified water features: (a) Wellington Reservoir (b) the Collie River directly below Wellington Reservoir. Park statistics indicated the Park attracted approximately 145,000 visitors in 1999-2000, although the actual number of visitors is likely higher (CALM 2005). Visitor data is collected only at DEC hardened areas via road counters. It does not take into account those park users who use other entry points (e.g. east side of the reservoir).

Stakeholders indicated the majority of visitors are from intrastate - from the Collie area north to Perth. A tourism industry stakeholder noted that the need to hire a car limited the number of interstate and international visitors. The small number of sealed roads in and around the Park limits the ability to loop and makes the Park less attractive to visitors travelling via hired car.

A number of stakeholders predicted growth in visitor numbers. They pointed to the work by the DEC to develop new camping facilities and projects outlined in the updates *Australia's South West: Destination Development Strategy*.[28] The tourism strategy identifies plans to seal a number of roads in Wellington National Park to improve access to recreation facilities. It is anticipated that the sealing of key roads will be complete by 2012 (Tourism Western Australia 2006). The strategy also identifies a need to explore the requirements for additional accommodation around Wellington Reservoir.

[28] Australia's South West Destination Development Strategy: An Action Plan Approach 2004-2014 was updated in 2006 by the Draft Australia's South West Destination Development Strategy: An Action Plan Approach 2006-2016.

**Wellington Reservoir**

Recreational fishing, canoeing, marroning and swimming were identified as popular activities. Motor boats are not allowed, thus water skiing does not occur on the reservoir. These activities are complemented by nearby camping and picnicking facilities.

Stakeholders highlighted the popularity of Potter's Gorge as a camping area. Located on the western side of the reservoir, at present, it is the only formal camping site upstream of the dam. Camping sites fill up quickly during the public and school holidays, frequently reaching capacity. Because the site is 'first come first served', some individuals get to the site several days before a public holiday in order to reserve a spot for their families. A kiosk near the dam sells a variety of camping provisions (e.g. marron bait) and offers canoes for hire.

Most of the Park's recreation facilities are located on the western side of the reservoir. Some stakeholders indicated that considerable informal camping and fishing occurs along the eastern side. Some families have used off road vehicles to access the eastern shore for generations. The DEC draft management plan proposes the development of seven new camping areas, five on the eastern side and two on the western side of the reservoir. This represents a significant expansion of recreation facilities around the reservoir.

Many stakeholders expressed concern about the potential for recreation to be removed from Wellington Reservoir (See Section 3.1). Stakeholders indicated that Lake Kepwari has been floated as a possible replacement for the values lost at Wellington Reservoir. The stakeholders did not see Lake Kepwari as a replacement. In their view the two presented very different visitor experiences.

The Wellington Dam is listed on the State Register of Heritage Places[29]. Several stakeholders identified Wellington Dam as having heritage value. One stakeholder suggested the dam's heritage value could be used to 'better sell' the area to interested tourists.

**Collie River below Wellington Reservoir**

Within Wellington National Park, there are five DEC managed recreation venues downstream of the Wellington Reservoir (Map 4). These are The Rapids, Big Rock, Little Rock, Long Pool and Honeymoon Pool sites (Table 6).

[29] The register is managed by the WA Heritage Council. It recognises the value and importance of selected places in Western Australia. The register includes buildings, structures, gardens cemeteries, landscapes and archaeological sites.

Table 6 Recreation sites below Wellington Reservoir (CALM 2005)

| Site | Marroning | Fishing | Swimming | Picnicking | Camping | Canoeing |
|---|---|---|---|---|---|---|
| Rapids | ✓ | ✓ | ✓ | ✓ | | ✓ |
| Big Rock | ✓ | ✓ | ✓ | ✓ | | ✓ |
| Little Rock | ✓ | ✓ | ✓ | ✓ | | ✓ |
| Long Pool | ✓ | ✓ | ✓ | ✓ | | ✓ |
| Honeymoon Pool | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

Stakeholders identified Honeymoon Pool and Long Pool as the most popular of the recreation spots. Several stakeholders noted that the pools have water year round and want this condition maintained.

Canoeing is a popular activity downstream of the Wellington Reservoir especially in summer. At a time of year when many of the South West's rivers are dry, canoeists can still use this portion of the Collie River because of the releases of water for irrigated agriculture. Canoeists often time their visits to coincide with the irrigation releases. Harvey Water posts the schedule and quantity of releases on its website. During winter, the opportunities to canoe are limited to the releases of scour water and overflow events at Wellington Dam. Overflow events do not occur every year.

The stretch of river between Wellington Reservoir and Honeymoon Pool provides good conditions for family canoeing. Between Honeymoon Pool and Burekup Weir the rapids increase in pace making conditions better suited to the experienced canoeist.

Recreation stakeholders commented that canoeists rely on a website that provides guidance to canoeing conditions (http://members.iinet.com.au/~rokhor/canoe/waterlevcoll.html). A reading of 1.2m at the gauging station downstream of the reservoir is considered excellent conditions. A reading of 0.8 m is "just paddleable", with some rapids being very rocky.

Fishing is another popular recreational activity downstream of the reservoir. A stakeholder, responsible for organising fishing competitions in the South West, provided anecdotal evidence that inland fishing, such as that on the Collie River, is growing in popularity in the South West.

The area downstream of Wellington Reservoir has been a focus for the Ribbons of Blue programme. Activities have included water quality sampling and tree planting. The Ribbons of Blue is a DoW environmental education programme designed to increase community awareness about local water quality issues.

Although the area below Wellington Reservoir is not within the boundaries of the Upper Collie Catchment, the future of the water features below the reservoir is closely linked to water resource management decisions for Wellington Dam and Reservoir. The release of water from the reservoir supports recreation, Aboriginal heritage and aesthetic values below the reservoir.

Several stakeholders noted that if releases from the reservoir were significantly reduced or stopped, visitors may chose to camp at the reservoir instead. This would increase the

reservoir's social value. However, the reservoir does not necessarily provide the same experiences as below the reservoir. For example, rapids below the reservoir provide canoeing experiences which are not available at the reservoir.

A decision to remove recreation from Wellington Reservoir to protect water quality, would likely increase the social value of the recreation sites below the reservoir. However, a number of stakeholders indicated the downstream area is often at capacity during school and public holidays. There are no plans to further develop the area to accommodate additional visitors.

## 5.5 Harris Reservoir

Marroning and picnicking are popular activities at Harris Reservoir. Picnickers are provided views of the reservoir and the surrounding forest. There are large signs posted on either side of the sealed roads leading to the reservoir identifying illegal activities in the catchment. Marroning is an illegal activity because the Harris Reservoir is a public water supply source. The picnic and barbeque area is directly downstream of the reservoir and outside of the public water supply catchment.

A *Draft Drinking Water Source Protection Plan* has recently been developed for the Harris Dam Catchment Area (DoW 2007). Enforcement of the plan may reduce the amount of illegal marroning. However, this would represent a loss in social value of the water feature. A number of stakeholders believe illegal marroning will continue regardless of the source protection plan.

In terms of heritage, the Harris River is a registered mythological heritage site (ID 21905) under the *Aboriginal Heritage Act*. The Harris Dam is listed on the State Register of Heritage Places.

## 5.6 Collie River

The Collie Visitor's Centre promotes the Upper Collie Catchment as the 'Collie River Valley'. This is an indication of the River value to the area's tourism.

**Between Harris Dam and Minninup Pool**

Social values attributed to the stretch of river between Harris Dam and Minninup Pool included aesthetic values and recreational pursuits such as canoeing, swimming, fishing and marroning.

The Collie River hosts two canoeing events each year. The Collie Marathon Relay is held each October and is now in its seventh year. It is a multi-sport event, including a 27 km road bike ride, 15 km horse race, 10 km canoe paddle, 1 km swim, 25 km mountain bike ride, and a 10 km run. The river is the focal point of the relay with race components occurring on or along the river, including a lunch break at Minninup Pool.

The second event is the Collie Descent, first held in August 2003. The race starts at the Harris River Winery (north of the Collie townsite) and follows the river through the townsite to the back of Black Diamond near the Allanson townsite. Race organisers are seeking endorsement from Canoeing WA to make the race a sanctioned event. Once this

happens, race organisers are hoping to grow the event from the normal 20 competitors[30], to a smaller version of the Avon Descent. A canoeing enthusiast noted that the Avon Descent has suffered low water levels over the past few years but did not envisage the Collie Descent experiencing a similar problem for canoeing.

Recreation stakeholders indicated that the optimum water depth is 4-5 m for the Collie River. The minimum water depth is 1m.

For the Collie Descent, the Mungalup Tower gauging station is used to determine if enough water is available for the race. The race requires a reading of 10.7 m at this station, which is equivalent to a river depth of 0.55 m, to enable canoeists to paddle downstream. One stakeholder noted that if this water level is not available, event organisers try to adjust the weirs downstream of the Collie townsite to prop up water levels along the race course.

The river passes through the Collie townsite. There are a several picnic sites and walkways along the river that take advantage of the aesthetic values of the River.

However, several stakeholders commented that the views are being negatively impacted by the proliferation of nardoo (*marsilea drummondii*) in the Collie River near the townsite. They noted that the nardoo became more prevalent following major flood events in 1964 and 1982. For these Collie area residents, the nardoo diminishes the aesthetic amenity of the river and reduces its attractiveness as a swimming venue. Several stakeholders wondered what could be done to reduce the prevalence of nardoo in the river around the Collie townsite and if the nardoo might have negative environmental or health impacts.

**Nardoo**

*Marsilea drummondii* (nardoo) is a common and widespread fern of wetland areas across inland Australia. Its flexible stems allow plants to adapt to small changes in water level while keeping their leaves on the water surface to access light and carbon dioxide. The species grows in shallow, still or sluggishly flowing water and in seasonally wet habitats. Its distribution is closely linked with flooding regimes and can form dense coverings following flood events. It is not a threat to human health. http://www.anbg.gov.au/cpbr/WfHC/Marsilea-drummondii/index.html

[30] Due to liability issues, organisers are unable to promote the event until it is sanctioned.

**Flooding**

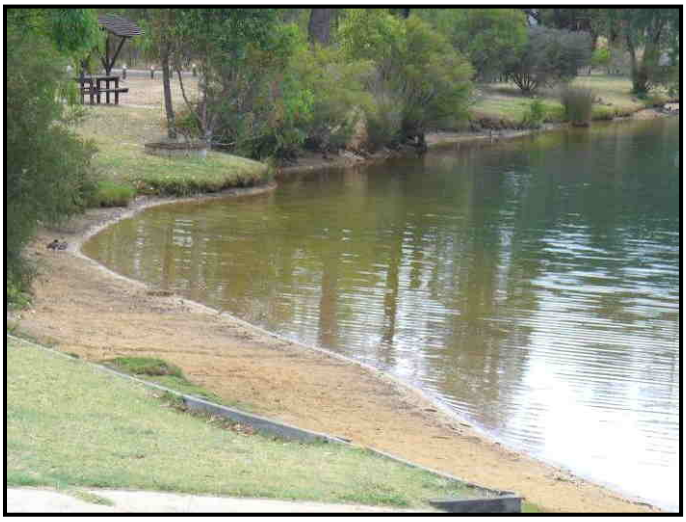
The Collie River flooded in 1945, 1963, 1964, 1974 and 1982. The 1964 flood was a 1 in 40 year flood, while the 1982 flood was a 1 in 25 year event. The other floods were 1 in 10 year events.

COLLIE - Same view when Collie River not in flood.

COLLIE - Medic Street during 1964 Collie River flooding.
(Photo courtesy of Collie Camera Club)

Source: Water and Rivers Commission 2000b

**Minninup Pool**



Minninup pool is a popular swimming, canoeing, and picnicking area for area residents. The site has a grassed bank area and a small sandy beach, as well as picnic tables and a carpark. The area is surrounded by dense vegetation.

Several stakeholders identified the pool as the most popular location along the river to swim. It is popular because it has been developed as a recreation spot; is free of nardoo; and deep enough to cater for swimming.

Several stakeholders identified the heritage value of the pool. The pool is a registered mythological Aboriginal Heritage site (Site ID 15330). It is where Ngarngungudditj Walgu rested after creating the Collie River, the Collie River valley hills and the Leschenault Inlet (CALM 2005). Stakeholders also noted its non-Aboriginal heritage values.

Several stakeholders indicated that water is available year round, at suitable depths for swimming and canoeing. They want the existing water conditions maintained. The water is typically several metres deep.

**Collie River South Branch Pools**

The pools are a local feature of high value to the Cardiff community. The social values attributed to the pools, include recreation, water for stock, fire suppression and aesthetics. Recreational pursuits include swimming and canoeing. Only a few of the pools are large enough to support canoeing. A number of properties abutting the river have stock, which receive water from the pools (when it is available). Local residents indicated that there are limited local water resources for fire suppression, thus the community would be dependent on the pools if a fire was to break out. The stakeholders also identified the aesthetic value of the pools as important to Cardiff residents' area.

The Cardiff Residents Association regularly checks the pools, to ensure enough water is being supplied through supplementation. When problems arise (e.g. dry pools) the Association contacts the DoW to rectify the problem.

For those without local knowledge, the pools are difficult to access. Many of the pools are surrounded by private property and fencing and the access roads are not obvious. It is accepted local practice for local residents to cross fences and pass through private property to use the pools.

Long Pool is the most popular recreation pool during summer. Stakeholders identified desired water depths for three of pools located close to Cardiff (Table 7). Local stakeholders indicated that without supplementation the pools would dry up and the social values would be diminished.

Table 7 Pool social water requirements

| Pool | Stakeholder recommended depth (metres) | Depth without supplementation (metres)[1] | Maximum depth of pool (metres) [2] |
|---|---|---|---|
| Long Pool | 6 | 4.9 | 6.5 |
| Cardiff Pool | 4-5 | 1.3 | 3.5 |
| Walker Pool | 4 | 3.2 | 4.2 |

[1] Based on surrounding groundwater table contours assessed by the DoW in April 2006
[2] At cease-to-flow level

The stakeholders noted that the water quality issues associated with the supplementation water (e.g. iron residue) are diminishing the social values of the pools. Stakeholders would like to see the social values restored through the use of better quality supplementation water. Iron was identified as the biggest problem to date. However, stakeholders noted they can see the visual impact of high iron levels (e.g. rust-coloured staining of the river bank) but other water quality problems may exist but not be visible. They wanted water testing to be done to determine if other water quality issues exist.

### Collie River East Branch Pools

Two pools on the Collie River East Branch are currently supplemented by Griffin Coal – Buckingham Bridge Pool and Duderling Pool. Bore water stored in Chicken Creek is released, flowing into Duderling Pool and then to Buckingham Bridge Pool.

The pools are highly valued by local community members. Social values include recreation (i.e. swimming), fire suppression and stock. Several stakeholders indicated the pools have played a key part in the life of the local community for many years.

One stakeholder noted that the supplementation water is supporting more than Buckingham Bridge Pool and Duderling Pool. There is often overflow from the two pools. This water is able to support pools downstream of Buckingham Bridge Pool. The social values of these pools were not identified by the stakeholder.

### Aboriginal heritage values

The entire Collie River is a registered mythological heritage site (ID 16713) under the *Aboriginal Heritage Act*. The river is connected to Ngarngungudditj Walgu, a mythical water snake thought to have created the Collie River, the Collie River valley hills and the Leschenault Inlet (CALM 2005) (See Section 3.1).

## 5.7 Former Mine Voids

### Stockton Lake

Stockton Lake is a popular spot for local water skiers. The lake is small and often reaches capacity during summer.

Several stakeholders believe acidity levels are too high in the lake for recreational pursuits. However, several other stakeholders indicated "they have used the lake for years and have not experienced problems". The Lake is a site used by the Centre for Sustainable Mine Lakes for research on mine void acidity.

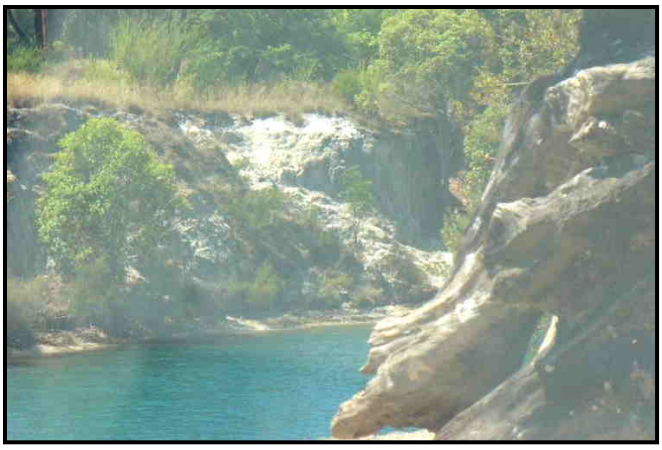
### Lake Kepwari

The plans for Lake Kepwari include uses such as picnicking, camping and water sports (e.g. water skiing). Forty-two percent of stakeholders commented on the innovative approach taken to develop a water-based recreation venue out of an old mine void. They believe it will add value to the area, in terms of recreation and tourism opportunities by providing different (e.g. water skiing) but complementary recreation opportunities to those at Wellington Reservoir. Several stakeholders indicated organizations such as Jet Ski Australia have already expressed interest in hosting events at the Lake.

Several stakeholders noted that the Lake's acidity is still too high for recreation. Work is currently being undertaken to rectify this problem. The Centre for Sustainable Mine Lakes has been helping to monitor the acidity levels.

**Black Diamond A**

Black Diamond A is a popular swimming spot for Collie residents. The site is not actively managed and the Shire does not encourage its use due to liability issues.



Several stakeholders noted that the water in Black Diamond A is acidic. The Centre for Sustainable Mine Lakes has undertaken research at the void, including the collection of data on acidity.

Some in the community have encouraged the development of tourism facilities at Black Diamond A. In November 2006, the Collie Shire Council was asked by the Department for Planning and Infrastructure to provide comment on two development applications. The first application proposed development of a tavern and tourist accommodation as well as rebuilding the Allanson Bridge to facilitate travel via the back road to the Wellington Reservoir. The second application proposed a low level ski park and eco-park for accommodation.

The Shire Council expressed concern about the applications (Shire of Collie 2006). Among their concerns were:

- Some of the area proposed for development is overburden, which may create stability issues.
- The land would need to be rezoned prior to the applications proceeding.
- The Draft Wellington National Park and Westralia Conservation Park Management Plan indicates the area is a "planned drinking water source" and applications may conflict with this plan.

## 5.8 Summary of Feature Characteristics

**Social/Cultural Values of Water Features**

All of the water features in Table 5 have multiple associated social values. Recreational pursuit was the dominant social value. Table 8 displays, for each water feature, the social/cultural values identified by stakeholders. Lake Kepwari is a unique case as it is a newly redeveloped water feature scheduled to open in late 2007. The values identified in Table 8 reflect those stakeholders identified the Lake as offering once it commences operation.

A water feature received a ✓ for a social value if at least one stakeholder identified that value for that feature. Thus, Table 8 should not be interpreted as a consensus view of the social values associated with a water feature.

Table 8 Stakeholder identified social values by feature

| Feature | Aboriginal heritage/cultural | Non-Aboriginal heritage[31] | Aesthetic | Education | Research | Fire suppression | Water for stock | Tourism | Recreation | Canoeing | Swimming | Water skiing | Fishing | Marroning | Picnicking | Camping |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wellington Dam and Reservoir | ✓ | ✓ | ✓ | | | | | ✓ | | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ |
| Collie River below Wellington Dam | ✓ | | ✓ | ✓ | | | | ✓ | | ✓ | ✓ | | ✓ | | ✓ | ✓ |
| Lake Kepwari | | | | | ✓ | | | ✓ | | | ✓ | ✓ | | | ✓ | ✓ |
| Pools on the Collie River South Branch | ✓ | ✓ | ✓ | | | ✓ | ✓ | | | ✓ | ✓ | | | | | |
| Pools on the Collie River East Branch | ✓ | ✓ | ✓ | | | ✓ | ✓ | | | | ✓ | | | | | |
| Stockton Lake | | | | | ✓ | | | | | | ✓ | ✓ | | | ✓ | ✓ |
| Harris Dam and Reservoir | ✓ | ✓ | | | | | | | | | | | | ✓ | ✓ | |
| Minninup Pool | ✓ | ✓ | ✓ | | | | | | | ✓ | ✓ | | | | ✓ | |
| Black Diamond A | | | | | ✓ | | | | | | ✓ | | | | | |
| Collie River (between Harris Dam and Minninup Pool) | ✓ | | ✓ | | | | | | | ✓ | ✓ | | ✓ | | ✓ | |

[31] Natural and cultural heritage values are the qualities that make a specific place important to the community. Heritage values are often separated into natural, historic and Indigenous categories.

**Level of Use**

A feature's level of use is an indicator of its social value. For each feature, Table 9 displays both the seasons of use and the scale of the visitor catchment as indicators of the level of use.

Table 9 Features by level of use

| Feature | Level of use | |
|---|---|---|
| | Season | Visitor catchment[32] |
| Wellington Dam and Reservoir | Year round, peak times are during school and public holidays | Local and north to Perth |
| Collie River below Wellington Reservoir | Year round, peak times are during school and public holidays | Local and north to Perth |
| Lake Kepwari | Likely to be year round with peak times during school and public holidays | Local and region |
| Pools on the Collie River South Branch | Year round, swimming during summer | Very local (Cardiff) |
| Pools on the Collie River East Branch | Year round, swimming during summer | Very local (Buckingham) |
| Stockton Lake | Peak time during summer | Local and vicinity |
| Harris Dam and Reservoir | Year round, illegal marroning | Local and vicinity |
| Minninup Pool | Peak time during summer (swimming) | Local and vicinity |
| Black Diamond A | Peak time during summer (swimming) | Local |
| Collie River (between Harris Dam and Minninup Pool) | Year round, canoeing in winter/spring | Local |

**Existing conditions, threats and opportunities**

Whether or not a water feature is in a condition that complements its social values is an indicator of its current value. For instance, a river pool traditionally used as a swimming venue would have its value diminished if the water became contaminated. Alternatively, a water feature with high aesthetic value but limited public access could have its social value increased if access and facilities complementary to the feature's aesthetic value were provided.

Table 10 identifies, for each water feature, the existing condition of the water feature with respect to its identified social values, perceived threats to those values, and opportunities to increase the feature's social value.

[32] Does not take into account special events such as the Collie Descent.

Table 10 Social Values: Existing conditions, threats and opportunities

| Feature | Condition | Threats | Opportunities |
|---|---|---|---|
| Wellington Dam and Reservoir | • The reservoir is surrounded by state forest, has good water quality for recreation and well maintained recreation sites. | • If the water is allocated to public water supply source for the IWSS, most recreation could be removed to protect the public water supply source from contamination. | • DEC plans to develop several additional camping nodes along the reservoir.<br>• If the volume of water released from the reservoir was decreased, this would likely diminish the downstream social values while increasing those above the dam. |
| Collie River below Wellington Dam | • The river passes through state forest, has good water quality, and well maintained recreation sites. | • Decreases in the frequency, timing or volume of water released from Wellington Reservoir could diminish the downstream social values (recreation, tourism, Aboriginal cultural) | • If water from Wellington Reservoir was allocated to the IWSS and recreation was removed above the dam, this would increase the demand for recreation sites below the reservoir. However, the ability to expand the recreation sites below the reservoir is constrained. |
| Lake Kepwari | • The site is currently in development and thus the surrounding landscape has yet to mature | • If there are elevated acidity levels recreational users may be dissuaded by the elevated acidity levels. However, reduced acidity levels will be a condition of operation. | • The attractiveness of the lake and its surrounds will increase over time as the site matures and facilities are further developed. |
| Pools on the Collie River South Branch | • The pools are supplemented | • Water quality issues (iron content) threaten social uses.<br>• A decision to cease further supplementation would diminish the social values by preventing recreational uses and reducing the aesthetic values | • Modifications to the supplementation program (e.g. improved water quality) could enhance the social values. |
| Pools on the Collie River East Branch | • The pools are supplemented | • A decision to cease further supplementation would diminish the social values by preventing recreational uses and reducing the aesthetic values | • Modifications to the supplementation program could enhance the social values. |

| Feature | Condition | Threats | Opportunities |
|---|---|---|---|
| Stockton Lake | • A former mine void. Elevated acidity levels. Some revegetation has occurred. | • Occasionally high acidity levels may dissuade some prospective visitors.<br>• A decision to reduce the amount of water released into the lake could, depending on scale, diminish some recreational values | • Reduction in acidity levels would enhance its recreational appeal. |
| Harris Dam and Reservoir | • Location within a public water supply catchment limits recreation values. Few visitor facilities provided. | • Increased enforcement of the source protection plan may lead to a reduction in the level of marroning | • None identified |
| Minninup Pool | • The pool is in good condition and is a developed recreation site | • A significant reduction in upstream flows could diminish its social values | • More frequent releases of water from Harris Reservoir might enhance the Pool's social values. |
| Black Diamond A | • The site is undeveloped (e.g. no facilities or proper public access) and has little vegetation | • Acidity levels are elevated | • Development of tourism facilities onsite to enhance its recreation and tourism values. However, there are questions about is suitability on site. |
| Collie River (Harris Dam to Minninup Pool) | • There are developed sites along the river and good flows for canoeing. | • The proliferation of nardoo is diminishing some social values (e.g. aesthetic values, swimming).<br>• A significant reduction in upstream flows could diminish its social values. | • More frequent releases of water from Harris Reservoir might enhance the social values in this segment of the Collie River. |

## 5.9 Social Water Requirements

Many stakeholders found it easy to identify water features within the Upper Collie Catchment with notable social values. However, they often found it more difficult to describe with any precision the conditions needed to maintain the identified values. Stakeholders often found it easier to discuss water quality requirements rather than water levels or flows. Stakeholder perceptions of the water required to support social values are summarised in Table 11 for each feature.

Table 11 Perceived Social Water Requirements

| Feature | Type of social value | Stakeholder views |
|---|---|---|
| Wellington Dam and Reservoir | Recreation | Maintain existing conditions. |
| | Aesthetic | Maintain existing conditions. |
| | Tourism | Maintain existing conditions. |
| Collie River below Wellington Dam | Recreation | Water level criteria based on water height at the gauging station downstream of the Wellington Reservoir (Khorshid n.d.). A reading of 1.2m is excellent. A reading of 0.8 m is "just paddleable", with some rapids being very rocky. |
| | Recreation | Maintain water year round at Honeymoon Pool and Long Pool at a depth to support canoeing. |
| | Aboriginal heritage | Dams diminish the social value. It would be better to mimic a natural flow*. |
| | Aesthetic | Maintain water year round at Honeymoon Pool and Long Pool. |
| | Tourism | Maintain water year round at Honeymoon Pool and Long Pool at a depth to support canoeing. |
| Harris Dam and Reservoir | Recreation | Maintain existing conditions. |
| | Aboriginal heritage | Dams diminish the social value. It would be better to mimic a natural flow*. |
| Collie River (between Harris Dam and Minninup Pool) | Recreation | The optimum depth for canoeing is 4-5 metres. The minimum depth is 1 metre. At one metre canoeists struggle to paddle. |
| | Recreation | The Collie Descent canoe race requires a reading of 10.7 metres at Mungalup Tower gauging station. This is equivalent to a River depth of 0.55 m. |
| | Aboriginal heritage | Mimic a natural flowing system*. Do not construct additional dams. |
| | Aesthetic | Reduce the presence of nardoo in the river. |
| Minninup Pool | Recreation | Maintain water year round at the pool. Water should be at a depth of (at least) several metres during summer to support swimming. |
| | Aboriginal | Mimic the natural flow*. |

| Feature | Type of social value | Stakeholder views |
|---|---|---|
| | heritage | |
| Collie River South Branch Pools | Recreation | Supplement the pools to mimic natural conditions. This includes having water in summer. Water quality suitable for swimming. |
| | Aesthetic | Maintain water quality sufficient to meet aesthetic values. |
| Collie River East Branch Pools | Recreation | Supplement the pools to mimic natural conditions. This includes having water in summer. |
| Stockton Lake | Recreation | Maintain water at a level to support water skiing. Views are divided as to whether or not water quality (i.e. acidity) requires further management. |
| Lake Kepwari | Recreation | Maintain water at a level to support water skiing. Maintain water quality sufficient to meet swimming requirements. |
| Black Diamond A | Recreation | Maintain water levels to meet swimming requirements. |

* Natural flow was not defined (e.g. Pre-European, post-European, etc)

# 6 Community Engagement

## 6.1 Key considerations

A community engagement strategy can take a variety of forms but its objectives and design should reflect the following:

- The planning objectives, activities and timeline (e.g. months, years)
- The characteristics of the issues (e.g. potential for conflict)
- The characteristics of the community (e.g. awareness of issues, understanding of issues, constraints on participation, existing mechanisms for engagement)
- The resources available (e.g. budget, time and skilled personnel)

**Water Planning Timeline**

The Department of Water's planning objectives were described earlier in Section 1.1. The initial water resource management plan for the Upper Collie Catchment will be ready for public comment by the end of 2007. This provides a community engagement timeline of 6-8 months.

**Issue Awareness**

Those interviewed demonstrated a high level of awareness of the water resource management issues in the Upper Collie Catchment. Table 12 displays the percentage of interviews in which particular water resource issues were a focus of discussion. Reducing salinity levels in the Collie River and Wellington Reservoir (80%) and the future of recreation above and below Wellington Dam (80%) were the two issues most frequently discussed in stakeholder interviews. Although supplementation of the South Branch and East Branch Collie River pools received less discussion than other issues in Table 12, it was a focus of discussion in 40% of the interviews. Some stakeholders viewed pool supplementation as very much a Cardiff or Buckingham issue and not one of concern to the broader Collie community.

Again, this data should be interpreted cautiously. The fact that an issue is discussed in an interview is not a strong indicator of the depth of understanding of that issue. Further, some individuals may have been aware of an issue but not felt it of enough concern to warrant discussion in their interview.

Table 12 Frequency of discussion

| Water Resource Management Issue | % of interviews |
|---|---|
| The future of recreation above and below Wellington Dam | 80% |
| Reducing salinity levels in the Collie River and/or Wellington Reservoir | 80% |
| The unsustainable withdrawal of groundwater in the Collie Coal Basin | 68% |
| The allocation of water from Wellington Reservoir for consumptive uses | 60% |
| The acidity of water in former mine voids used for recreation | 60% |
| Meeting the water needs of industry | 52% |
| Supplementation of the Collie River South Branch and East Branch pools | 40% |

None of these water resource issues are new to this community. Over the years, a variety of multi-stakeholder committees have been created to address one or more of these issues. Currently, there are nine committees involved with some aspect of water resource management in the Upper Collie Catchment (Table 14).

A content search of news articles in the Collie Mail shows that issues such as the pool supplementation and the future of recreation on Wellington Reservoir have been community issues since at least 2001. It is likely that the general community in the Upper Collie Catchment has a reasonable level of awareness of these issues as well. However, this assumption should be tested in future community engagement activities.

**Potential for Conflict**

The scoping study identified two issues with significant potential for conflict. These are:

- The future of recreation on and around Wellington Reservoir
- Supplementation of the pools on the Collie River East and South Branches

In the case of Wellington Reservoir, the concern is that allocation of the water resource to public water supply would result in many of the recreational uses being removed to protect the resource from contamination (See Section 3.1). If such a scenario is under consideration, an objective evaluation of options, ranging from removal of most recreation to retaining recreation and using treatment, would assist in advancing this issue. Stakeholders indicated that they need information on the costs and benefits of the various options to reach an informed judgment regarding the future of recreation on and around Wellington Reservoir.

In the case of the pool supplementation program, there is a low level of trust between the local resident action groups and industry. The situation could be improved by inviting representation from both action groups to join the membership of the Pool Supplementation Review Committee. The lack of formal resident representation on the Committee accentuates the differences in power among the parties and encourages an 'us versus them' mentality. Greater resident access to any monitoring data would also be of assistance.

In both cases, greater focus on the use of objective criteria and an agreed upon decision-making processes could assist in resolving these issues and reducing the potential for conflict. As discussed below, the level of trust among the parties to a conflict can greatly influence how easy or difficult the conflict is to resolve.

**Building and Maintaining Trust**

Trust is "an individual's belief in and willingness to act on the basis of, the words, actions, and decisions of another" (Lewicki et al 1998). It is a key element of successful conflict resolution as it is associated with enhanced cooperation, information sharing, and problem solving. Trust theorists believe that trust builds along a continuum of hierarchical and sequential stages. As trust grows to 'higher' levels, it becomes stronger and more resilient and changes in character.

Trust violations occur when the trustor's positive expectations of the trustee (i.e. the violator) are disconfirmed. Violations result in lower subsequent trust and stifle mutual support and information sharing. Serious offenses harm trust severely, often to the point of

complete destruction. They may also stimulate the rapid growth of distrust and escalate a conflict.

Trust building requires mutual commitment and effort, especially when attempting to de-escalate conflict. Lewicki and his colleagues (1995, 1998) have identified steps parties can take to strengthen another party's trust in them:

- Perform competently. One should continuously strive to demonstrate proficiency in carrying out their obligations.
- Behave in consistent and predictable ways. Every effort should be made to ensure that our words are congruent with our subsequent actions and that we honour commitments. We do what we say we will do.
- Communicate accurately, openly and transparently. This includes being clear about the intentions for one's actions and being willing to be monitored for compliance.
- Trust often needs to be given for it to be returned. There is symbolic value in soliciting input and sharing decision control with others.
- Nurturing a common identity creates a sense of unity that can further strengthen trust. Engage in talk and actions that build a sense of 'we' rather than 'me'.
- Create joint products and goals. Working toward the collective achievement of goals can bring the parties together in a way that strengthens relationships and trust.
- A party should make an effort to get to know the other parties, engage in active listening, show a focus on their interests, recognise their contributions, and demonstrate confidence in their abilities.

**The Community**

Most 'communities' consist of many smaller communities or sub-communities. In the case of the Upper Collie Catchment community, there are the mining community, the agricultural community, the Nyungar community, neighbourhood-level communities, and the Town of Collie. Within any community there are those who are already engaged in the issue and who actively participate in ongoing planning activities. This often includes representatives of local government, state agencies, industry, environmental groups, community and regional development agencies, irrigation co-operatives, resource industries, tourism and business. Sometimes, they are called 'key stakeholders'. The issue scoping study focussed on key stakeholders.

In fact, all community members are stakeholders to some extent. The large majority of those living in the catchment do not actively represent any particular interest or sub-community. Rather, they are members of the general community. A community engagement strategy should involve multiple communities or sub-communities within the study area. Some engagement activities are designed with specific sub-communities in mind while others target the larger community.

## 6.2 Levels of Engagement

Different involvement mechanisms offer different degrees or levels of engagement (Table 13). Collectively, these levels are referred to as the 'ladder' of public involvement or engagement. The bottom rungs represent the lower levels of engagement (e.g. information

and education). The upper rungs represent the higher levels of engagement with community control (i.e. self-determination) at the top. Different communities or stakeholders may want different levels of engagement. Some will primarily want information while others may seek a more hands-on role in the decision-making process.

Table 13 Ladder of Public Engagement

| Engagement Level | | Roles |
|---|---|---|
| Higher | Community has control | The agency asks the community to identify the problem and to make all of the key decisions regarding goals and means. It is willing to help the community at each step accomplish its own goals, even to the extent of administrative control of the programme. |
| | Delegated authority | The agency identifies and presents a problem to the community, defines the limits, and asks the community to make a series of decisions, which can be embodied in a plan, which it will accept. |
| | Plans jointly with agency | The agency takes lead in defining and solving the problem but works in a collaborative manner with the community in doing so. During the process, the agency expects to change some aspects of their thinking and plan and changes may be substantial. It employs a more collaborative style than consultation. |
| | Is consulted | The agency tries to promote a plan and seeks to develop the support, which will facilitate acceptance or give sufficient sanction to the plan so that administrative compliance can be expected. It involves two-way communication. The agency may adjust its plan in response to feedback from the community. |
| Lower | Receives information | The agency makes its plan. Information on the plan or planning process is provided to the community at selected points in the planning process. The primary objectives are education and persuasion. The process is dominated by one-way communication. |

## 6.3 Engagement Objectives

The engagement objectives establish what the DoW wants to achieve through its community engagement strategy. The objectives should be specific and achievable. They form the basis for assessing the success of the engagement strategy.

The following is a list of community engagement objectives for the DoW's consideration:

- To inform the community of the need for and objectives of a water resource management plan
- To provide the community with the information to make informed judgements about water planning and key issues
- To ensure all issues of concern to the community have been identified and addressed before the draft water resource management plan is released for public comment
- To demonstrate to the community that their issues and perspectives will be or have been addressed in the planning process
- To foster positive relationships with key stakeholders and the community

## 6.4 Mechanisms for Engagement

**Information**

***Information needs***

The key stakeholders interviewed for the scoping exercise had a lot of background knowledge about the water resource issues in the study area. Many have a long history of involvement in one or more of the water issues.

It is important to understand the intended audience in order to tailor the information which is provided. Some stakeholders may have a basic awareness of an issue while others will have an in-depth understanding.

In this case despite the history of many stakeholders, some frequent gaps in important information and understanding were identified, including:

- The concept of sustainable yield as opposed to the storage capacity of a reservoir or the size of a groundwater resource
- The potential impacts associated with unsustainable groundwater withdrawal
- The existing allocation of water from Wellington Reservoir especially in relation to industry
- Water monitoring (type, location, results)
- How the proposed water resource management plan fits within the broader land and water planning context (e.g. relation to the SW Water Plan, the Collie Catchment Recovery plan for salinity).

In addition, participants identified a variety of points on which they would appreciate additional information from the DoW (see Appendix D).

***Issue primers***

In most instances, local community members will have far less background on the issues than the 'key' stakeholders interviewed for the scoping study. They will need to be brought sufficiently up to speed to allow them to make informed judgements. This should not require that they have to read large technical documents. Instead, it is recommended that the DoW prepare brief (1-3 page) primers for each of the key water resource management issues. A similar primer should be prepared for the project, describing the water planning and decision-making processes. The primers should be written in a form suitable for readers with no significant background in water resource management issues.

Primers should be used at the front end of the planning process, after the issue scoping exercise. As new knowledge or new issues arise, additional primers may be developed or existing primers may to be modified.

The project and issue primers would also assist in:

- The preparation of media statements as needed
- Ensuring that the DoW provides clear and consistent messages to the public

***DoW project webpage***

A webpage presents the opportunity to provide both general and technical information. While general information on the project will satisfy the information needs of many, others will want access to more technical information. It is recommended that the DoW

develop webpages on its website dedicated to water planning in the Upper Collie Catchment.

The content of such a webpage might include:

- Information on the need for a water resource management plan
- An overview of the ground and surface water resources
- Prepared responses to commonly asked questions
- Links to pertinent websites (e.g. salinity recovery catchment)
- Identification of ways the public can contribute to the study
- A mechanism for readers to make comment (e.g. email, comment form)
- Contact information
- Background information documents and technical reports in a downloadable format (e.g. pdf).

The webpages should be promoted through the issue primers and during other engagement activities.

***Central contact and participant database***

The issue primers should include the contact information for the person the reader should contact if they have further questions or want to discuss an issue. It is recommended that the primary public contact person come from the DoW Bunbury Office.

A database should be maintained by the DoW contact person of all individuals who participate in the water planning process for the Upper Collie Catchment. For each individual, the database could include their name and contact information, stakeholder affiliation, key issues, any requests for information, and any commitments made by the DoW in response to the individual, including the status of any action items.

***Local media***

Local newspapers and radio provide an inexpensive and effective means of reaching the local community with information about the planning process, key issues and opportunities for participation. Media outlets include: the ABC Radio Country Hour, the South West Times and the Collie Mail.

The Department should provide the local media outlets with media releases and feature articles at several points in the planning process. Early in the planning timeline, the media should be used to make the local community aware of the water planning process and where they can obtain additional information, request a meeting or provide input. Opportunities for community engagement should also be promoted through the local media. The DoW's community contact person could provide the media outlets with a personal briefing. Highest priority would be given to the Collie Mail as the most local newspaper.

**Consultation**

***Issue Scoping Exercise***

The issue scoping exercise was the first step in consultation with key stakeholders. It is important to build on the momentum generated by the process.

***Meetings with Interest Groups***
During the issue scoping study, several non-government stakeholder representatives indicated that their group membership (e.g. Collie Chamber of Commerce and Industry) would welcome a presentation by and discussion with a member of the DoW project planning team. It is recommended that the DoW offer such briefings to interested groups in the community.

***Open Houses***
Open houses create an environment more conducive to discussion than a public meeting. Individuals who might feel uncomfortable airing their views at a public meeting are typically more comfortable with the one-on-one style of dialogue that an open house offers. The typical format for an open house would provide participants with an information packet and have them move through a series of information stations, each dealing with a different aspect of the water management plan. Each information station is staffed by DoW personnel to answer any questions and engage in dialogue on the issue of their station. Attendees can be asked to provide feedback (e.g. brief questionnaire on their recommendations). Open houses usually run in 3-hour sessions.

The open houses would provide an opportunity to partner with other stakeholders. For instance, salinity in the Collie River is a key water resource management issue. At an open house, the DoW's salinity experts could partner with representatives from the Collie Salinity Recovery Committee to resource that section of the open house.

Given the limited timeline it is recommended that an open house be held mid-way through the preparation of the water management plan. A second open house could coincide with the start of the public comment period on the draft plan.

Both daytime and evening sessions should be provided because of the large number of shift workers in Collie. The venue should be well known and easily accessible to all members of the community. Areas with high pedestrian traffic such as a shopping centre can be good venues.

***Nyungar Community***
The importance of consultation with the appropriate Aboriginal community members was highlighted as was the need to have appropriate staff to undertake these activities. Nyungar staff in each of DoW's regional offices was suggested as one means by which this might be achieved.

The Ngalang Boodja Council and Nyungar traditional custodian Joe Northover are key contacts for the local Aboriginal community. Their knowledge and status in the Nyungar community can be of great assistance when identifying Nyungar community representatives and in reviewing planned engagement activities.

The DoW has established a positive working relationship with Nyungar representatives on projects such as the Collie River East Branch diversion trial and the recent clean-up of iron residue from the pool supplementation program. The early involvement of Nyungar representatives in these processes and the strong communication skills of key DoW staff have no doubt contributed to the positive engagement experiences to date.

Stakeholders emphasised the importance of giving cultural and heritage values due consideration in water management decisions. The holders of traditional knowledge are experts in their own right. While Nyungar custodians of traditional knowledge are willing to share their knowledge, there is concern about the protection of Aboriginal intellectual property rights. The Australian Heritage Commission's guide to Aboriginal engagement, *Ask First - A guide to respecting Indigenous heritage places and value* (2002) states, that "Indigenous people must control intellectual property and other information relating specifically to their heritage, as this may be an integral aspect of its heritage value". When an agency such as the DoW seeks access to traditional cultural knowledge, the local Nyungar council (e.g. the Ngalang Boodja Council in the Collie area) typically identifies the appropriate people to participate in that process.

The DoW's Aboriginal Support Unit is in the process of developing a protocol to guide the DoW's engagement with Aboriginal communities on water resource management issues.

**Joint Planning**

***Existing Stakeholder Committees***

Currently there are nine multi-stakeholder committees with either a direct or indirect link to water resource management in the Upper Collie Catchment (Table 13). These committees provide useful forums for the DoW to work with the other Committee members on issues of concern to its members. The DoW sits on seven of these committees.

The option of creating a new multi-stakeholder committee specifically for the DoW's Upper Collie Catchment water management planning was canvassed during the issue scoping study. While a few individuals expressed interest in the concept, the majority noted the large number of existing committees and understandably were not keen on adding another to the list.

It is recommended that the DoW use the existing committees as forums for stakeholder input. The objectives would be to:

- Keep the members of these committees informed of the status of the Upper Collie Catchment water planning and thereby prevent any clashes between DoW's planning efforts and those of other agencies.
- Engage in dialogue on water resource issues of concern to find mutually acceptable solutions.

**Public comment period**

The Draft Management Plan will be released for a 6 week public comment period, in which members of the public will be invited to submit comments on the Draft Management Plan. By this point in the planning process, if the public engagement strategy has been effective, no new significant issues should emerge.

Table 14 Existing Committees

| Committee | Focus | Members |
|---|---|---|
| Collie Salinity Recovery Committee | Salinity reduction in Wellington Reservoir, including development of a recovery plan and projects | DoW, Harvey Water, landowner representatives, West Arthur and Collie Shires, WC, Verve, DEC, Agricultural consultant |
| Collie River Salinity Recovery Project Steering Committee | Salinity reduction in Wellington Reservoir, implementation of the recovery projects | DoW, SWCC, Harvey Water, landowner representatives, West Arthur and Collie Shires, WC, Verve, DEC, DAFWA, Griffin Group, DEH |
| Lake Kepwari Working Group | Development of Lake Kepwari | SWDC, DoW, DEC, DoIR, Shire of Collie, Wesfarmers, Collie Chamber of Commerce and Industry, Centre for Sustainable Mine Lakes, community representatives |
| Collie Industry and Coal Industry Futures Group | Development of the Collie region and coal industry | State MP for Collie, workforce and industry representatives, Shire of Collie, DoIR |
| Wellington National Park Community Advisory Committee | Assisting DEC in the preparation of the Wellington National Park and Westralia Conservation Park Plan | DEC, community representatives, Shire of Collie, Shire of Dardanup, Indigenous community, DoW, tour operator representative |
| Collie River Pools Supplementation Review Committee | Review of pool supplementation of the East and South Branches | DoW, Griffin, Verve, Wesfarmers |
| Collie Basin Research Steering Committee | Water related research in the Collie Basin, including modelling | Shire of Collie, local mining industry representatives, DoW and other government agencies |
| Collie Basin Management Planning Group | Noise and air shed limits for industry in the Collie Coal Basin | Shire of Collie, DEC, DPI, DoH, DoIR |
| Collie Coal Mines Environment Committee | Review and audit Collie coal mining operations | DoIR, DEC, DoW, DAFWA, DoCEP |

## 6.5 Monitoring and Evaluation

The issue scoping report is effectively a snapshot of a point in time. As the water planning process progresses, stakeholder and agency perspectives may change on some issues and a few new issues will likely emerge. Other factors may be introduced (e.g. a new Government policy) to the planning equation and timelines may change. For all of these reasons, the engagement strategy should be monitored periodically. If needed, adjustments should be made to reflect the new circumstances or lessons learned along the way. This will allow the Department of Water to make any needed adjustments (e.g. additional objectives, new activities) to its strategy in a timely and effective fashion.

Monitoring can occur through a combination of actions such as issue tracking through media content analysis, the participant register and the solicitation of comment on the engagement strategy (e.g. open house).

As the planning process progresses, the manager of the public engagement process should be able to say yes to each of the following questions:

- Did we identify all of the stakeholder issues early in the planning process?
- Did we demonstrate to stakeholders that we understood their issues?
- Did we explain to stakeholders how their issues would be addressed in the development of the plan?
- Did we demonstrate how their issues were ultimately resolved and reflected in the draft water resource management plan?

The successfulness of an engagement strategy is determined by the extent to which the engagement objectives (Section 6.3) were met.

Table 14 Summary of engagement mechanisms

| **Community** | **Primary level of engagement** | **Primary mechanism** |
|---|---|---|
| Nyungar community | Consultation | Through the DoW Indigenous Support Unit |
| Key stakeholders | Joint Planning | Meetings with committees which have a major focus on water resources (e.g Collie Coal Mines Environment Committee) |
| | Consultation | Meetings with key stakeholders (e.g. committees, local council, key interest groups, key landholders) |
| General community (catchment) | Information | Issue primers<br>DoW website<br>Local media |
| | Consultation | Open House |

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# Appendix A Interview Guide

## Upper Collie Catchment – Issue Analysis Template

Interview: _____
Date: _____

An analysis of issues

| Issue | Identified unprompted | Discussed when prompted | Perspective |
|---|---|---|---|
| What are the key water resource issues in the study area | | | |
| Which of these issues is of greatest concern | | | |
| What are the potential barriers to successful water resource management in this area? | | | |
| What are the water resource opportunities | | | |
| What water uses should be given priority in the allocation of water? | | | |
| Is there adequate water for the natural environment? Where are the areas with the highest ecological values? | | | |
| Pool supplementation on the South Branch | | | |
| Pool supplementation on the East Branch | | | |
| Use of groundwater by the mining and energy sectors | | | |
| Have there been any impacts from groundwater withdrawal? | | | |
| Is salinity a water quality issue? Is it improving? What needs to happen? | | | |
| Are there other water quality issues? Type, frequency, impact and location. Causes and | | | |

| Issue | Identified unprompted | Discussed when prompted | Perspective |
|---|---|---|---|
| solutions. | | | |
| What are the implications of climate change for water resource management in the Upper Collie. How should it to addressed in the water planning process? | | | |
| What will be the drivers of future water demand in this area? Irrigation, industry, etc. | | | |
| What social values are attached to ground and surface water resources in the Upper Collie Catchment? | | | |
| Prompt social values: recreation, Aboriginal, education, historical, tourism. Location, type, extent, threats, etc. | | | |
| Has there been any increase or decrease in local streamflows? Type, causes, acceptability, actions required. | | | |
| What do you think will be the use of water from Wellington Reservoir in the longer term? | | | |
| Future of recreation on, around and below Wellington Reservoir | | | |
| Lake Kepwari | | | |
| | | | |
| **PUBLIC ENGAGEMENT** | | | |
| Past involvement. Critique. | | | |
| In preparation of the water resource management plan (Short-term) | | | |
| Plan implementation (longer–term) | | | |
| What would be successful public engagement? | | | |

# Analysis of in-stream social values

Interview: _____
Date: _____

| Location | Identified unprompted | Type of values | Current condition and trends | Level of use (frequency, season) | Threats / Pressures | Water requirements (depth, timing, water quality, limits of acceptable change) |
|---|---|---|---|---|---|---|
| Wellington Reservoir (on and around reservoir) | | | | | | |
| Below Wellington Reservoir | | | | | | |
| Harris Reservoir | | | | | | |
| Collie River in town | | | | | | |
| Pools on the South Branch | | | | | | |
| Pools on the East Branch | | | | | | |
| Minninup Pool | | | | | | |
| Stockton Lake | | | | | | |
| Lake Kepwari | | | | | | |
| Black Diamond A | | | | | | |

# Appendix B Database Variables and Stakeholder Categories

| Theme | Sub-theme |
|---|---|
| Supplementation | Supplementation should continue |
| | Supplementation should be modified on the Collie River South Branch |
| | Supplementation is redressing an impact |
| Groundwater management | Industry is a priority use for groundwater |
| | Groundwater is unsustainably being taken |
| | Concerned about the current rate of abstraction because it is causing negative impacts |
| | Need more information about the rate of abstraction |
| | Need more information about the rate of recharge |
| | Do not know enough about the current groundwater situation to make a comment |
| Industry | Concerned that water may be a limiting factor in the longer term for industry |
| | Fit for purpose options should be explored |
| | Need to first consider regional/local needs before transferring water out of the region |
| Water quality | Encouraged by the salinity diversion trial |
| | Concerned about the storage capacity for future diversions |
| | Want more information about the next steps in reducing salinity levels |
| | Acidity is a water quality concern |
| | Desalination is an option for reducing salinity levels |
| Flooding | The dredging which occurred post flood has changed the river |
| Riparian zone management | Weed management is a concern |
| | Want a more comprehensive weed management system to be put in place |
| Water use | Concern that water resources may not meet future demand for industry |
| | Support the irrigated agriculture use of Wellington Reservoir |
| | Irrigation demand for water is likely to decrease |
| | Harris Reservoir should be protected because Great Southern Towns Water Supply Scheme relies on the reservoir |
| | Need greater demand management in Perth |
| | Want certainty about the future availability of water |
| Recreation | Concerned about the potential of recreation being removed from Wellington Reservoir |
| | Policing will be difficult if recreation is removed from Wellington Reservoir |
| | Need coordinated policing of recreation, fishing and water protection |

| Theme | Sub-theme |
|---|---|
| | Lake Kepwari is not a replacement for Wellington Reservoir |
| | Recreation below Wellington Dam will need to be considered if releases from Wellington Reservoir are changed |
| Climate change | Climate change impacts have been experienced in Collie |
| | Climate change needs to be factored into the decision making process |
| Community engagement | Create a new committee |
| | Need to include local knowledge |
| | Local knowledge is under utilised |
| | Need to include local views |
| | Water to be involved further in the planning process |
| | Concerned about broke promises |

| Stakeholder categories |
|---|
| State government |
| Local government |
| Economic interest |
| Agricultural interest |
| Recreation interest |
| Aboriginal interest |
| Environmental group |
| Academic interest |
| Private landholders |

# Appendix C Study Participants

| Name | Affiliation |
|---|---|
| *State Government Agencies* | |
| Wayne Tingey | Department of Water |
| John Platt | Department of Water |
| Mike McKenna | Department of Water |
| Brendan Kelly | Department of Water |
| Eric Wright | Department of Agriculture and Food |
| Mike James | Department of Industry and Resources |
| Lewis Bursztyn | Department of Industry and Resources |
| Dominique VanGent | Department of Industry and Resources |
| Drew Griffiths | Department of Environment and Conservation |
| Neville Welsh | Department of Environment and Conservation |
| Matthew Cuthbert | Department for Planning and Infrastructure |
| Peter Buckley | Water Corporation |
| Peter Godfrey | Department of Fisheries |
| Kim Allen | Forest Products Commission |
| Greg Hodgson | Forest Products Commission |
| Maureen Wright | Department of Sport and Recreation |
| Peter Kemp | Tourism WA |
| Don Punch | South West Development Commission |
| Tom Busher | South West Development Commission |
| Honi Adolphson | Collie-Wellington Basin Water Source Option Steering Committee |
| | |
| *Local Government* | |
| Jake Davidson | Shire of Harvey |
| Peter Anderson | Shire of Harvey |
| Brook Devine | Shire of Harvey |
| Mark Chester | Shire of Dardanup |
| Luke Botica | Shire of Dardanup |
| Tim Batt | Shire of Dardanup |
| Darren Simmons | Shire of Collie |
| Jeff Graham | Shire of Collie |
| Tony Doust | Shire of Boyup Brook |
| Nicole Wasmann | Shire of West Arthur |
| | |
| *Economic Interests* | |
| Kenneth Tushingham | Verve Energy |
| Wayne Trumble | The Griffin Group |
| Ian Piggott | Griffin Coal Mining Pty Ltd |
| David Bills | Griffin Coal Mining Pty Ltd |
| Peter Ashton | Wesfarmers Premier Coal Ltd |
| Dave Chapman | Wesfarmers Premier Coal Ltd |
| Matt Granger | Chamber of Minerals and Energy |
| Jim Weighell | Collie Chamber of Commerce and Industry |
| Jane Fleay | Cardiff Progress Association |
| Geoff Sewell | Cardiff Progress Association |
| Steve Pickering | Hansol PI |
| Rick Mitchell | TimberCorp |

| Name | Affiliation |
|---|---|
| Richard Briedahl | WA Plantation Resources |
| Bob Pearce | Forest Industries Federation (WA) Inc |
| Clayton Hyder | Bunbury-Wellington Economic Alliance |
| Viv Lawrie | Bunbury-Wellington Economic Alliance |
| Trevor Whittington | Bunbury-Wellington Economic Alliance |
| Geoff Calder | Bunbury-Wellington Economic Alliance |
| Dave Chapman | Bunbury-Wellington Economic Alliance |
| | |
| *Agricultural Interests* | |
| Geoff Calder | Harvey Water |
| | |
| *Environment Interests* | |
| Ken Waterhouse | Collie Conservation Group/Western Australian Forest Alliance |
| Steve McKiernan | WA Conservation Council |
| | |
| *Aboriginal Interests* | |
| Joseph Northover | Nyungar custodian |
| | |
| *Recreational Interests* | |
| Marty Wallace | South West Canoe Club |
| Sean Forward | Recreational angler |
| | |
| *Academic* | |
| Tim Storer | Collie TAFE |
| | |
| *Private Landholders* | |
| Ned Rees | Landholder/Collie Recovery Committee |
| Max Ewen | Landholder/Collie Recovery Committee |
| Rosanne Pimm | Landholder |
| Peter Piavanini | Landholder |
| Tony Marinac | Wellington Dam Kiosk |
| Tony Jenour | Landholder/Evedon Bush Resort |

# Appendix D Identified Information Needs

Over the course of the issue scoping study, participants identified a variety of points on which they would appreciate additional information from the DoW. These were:

A. Collie Coal Basin Groundwater
   - What is the sustainable yield?
   - What is the current rate of abstraction?
   - What are the current licensed allocations?
   - How is licensed use monitored?
   - What is the rate of recharge?
   - What does unsustainable withdrawal mean for the health of the system?

B. Supplementation of the Collie River South Branch and East Branch
   - What is the status of the supplementation project?
   - Is water quality being monitored? If so, is the data publicly available?
   - Has there been groundwater recovery around the South Branch pools?
   - What type of groundwater monitoring is occurring? Is this data publicly available?

C. Wellington Reservoir
   - When is scour water released?
   - What is the purpose of releasing scour water?
   - When is water released for irrigation?
   - How will the future of recreation on and around the reservoir be determined?

D. Salinity
   - Has the Collie River East Branch diversion caused any downstream impacts?
   - How is the water from the Collie River East Branch diversion being used?
   - Now that the trial is complete, what are the next steps for the Collie River East Branch diversion?
   - What options are being considered to help reduce salinity levels in Wellington Reservoir (e.g. desalination, deep drainage, further replanting)?

E. Harris Reservoir
   - Water is supposed to be released from Harris Reservoir, when does the release occur?

F. Mungalup Reservoir
   - Why does the Collie townsite receive part of its public water supply from the GSTWSS and part from Mungalup Reservoir?

G. Nardoo
   - What, if any, impact does nardoo have on the Collie River and its social values?

H. Climate change
   - How will climate change be addressed in the planning and decision making process?