



Department of  
Environment

MANAGING A SUSTAINABLE FUTURE  
FOR THE  
GNANGARA GROUNDWATER RESOURCES

## **GNANGARA MOUND**

## **STAKEHOLDER ISSUES AND PERSPECTIVES**



May 2005

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*Terrestrialisation of Lexia Wetland adjacent to monitoring bore GNM16*

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## 1.0 Introduction

The most valuable and largest source of affordable good quality fresh water in the Perth region is the Gnambarra groundwater resources. These resources have for many years supported a variety of ecological, social and economic uses.

Over the years, the groundwater resources have come under pressure from a number of sources. The combination of low rainfall and increasing demand has resulted in a situation that is no longer sustainable. The current situation threatens not only the ecological but the many social and economic uses supported by the groundwater resources. The immediate task is deciding how to return the Gnambarra groundwater system to a condition of sustainability for the generations of today and the future.

The Department of Environment (DoE), through the Water and Rivers Commission (WRC), has responsibility for developing a management plan for the Gnambarra groundwater resources. As one of the early steps in the planning process, interviews were conducted with representatives of the many groups and organisations with an interest in the future of the Gnambarra groundwater resources. The goal was to acquire an overview of the various views and perspectives of key stakeholders regarding the current and future management of the resources.

The objectives of the interview process were to:

- provide stakeholders with background information on why a groundwater management plan is needed;
- identify stakeholder issues and concerns regarding existing and future uses of the Gnambarra groundwater resources;
- identify issues on which consensus exists and those where there are differences.
- access the local knowledge of stakeholders;
- explore how best to involve stakeholders and the public in planning the future of the Gnambarra groundwater resources; and
- build working relationships with key stakeholders.

This report describes the study methodology and provides an analysis of stakeholder perspectives on the current and future management of the Gnambarra groundwater resources.

## 2.0 Methodology

In total, 76 individuals were interviewed in the period 15 February to 19 April 2005 (Appendix A). Collectively, these individuals represent a cross-section of the many private and public sector stakeholders associated with the Gnamangara groundwater resources. Interviews were conducted with representatives of community groups, environmental groups, university-based academics, industry groups, agricultural interests, state government agencies, local governments, and ratepayer groups.

A key stakeholder not included in the interview process was the Aboriginal community. A separate Department of Environment funded study into Aboriginal water issues will be conducted by Estill and Associates, specialists in Aboriginal cultural and social issues. Their findings will be available later in the year.

Each potential participant was initially contacted by telephone to request an interview. If the individual agreed to the interview, a convenient day, time and location was arranged and they were sent a confirmation letter and a brief background document (Appendix C & D).

The interviews were conducted in a face to face fashion. An interview guide was used to ensure that the following four themes were explored across all interviews (Appendix B):

- Theme 1: The planning challenge and key issues/concerns surrounding the future of the Gnamangara groundwater resources;
- Theme 2: Allocation of the Gnamangara groundwater resources;
- Theme 3: Actions needed to ensure a sustainable future for the Gnamangara groundwater resources; and
- Theme 4: Community involvement in the planning process for the Gnamangara groundwater resources

Notes were taken during the interviews and, with the individual's permission, tape recordings were also made. The interviews ranged in duration from 40 minutes to 2 hours. Completed interviews were typed up in an expanded note format. To confirm the accuracy of the notes, the tape recordings were checked and the interview notes were sent to interviewees for their review, if requested.

The interviews were conducted by three trained individuals. In addition to the use of an interview guide, consistency of data collection was addressed through interviewer observation. At the start of the interview process, several of the interviews were attended by two interviewers. In such instances, one of the interviewers took the lead, while the second interviewer observed the process.

The interview results were analysed via a coding process. The process was used to organise data around the four initial themes and to identify emergent (i.e., additional) themes. The interview notes and tape recordings were reviewed multiple times and, a number of dominant themes emerged (see Chapter 3). On some themes there was considerable agreement while others revealed sharp differences of opinion among stakeholders.

The major strength of in-depth interviewing as a research methodology 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.

However, due to its qualitative nature, the ability to calculate empirical results is limited. It is not possible to do the same statistical analysis on the interview data collected in this study that one could with questionnaire-based survey data. There are several reasons for this. Firstly, the methodology did not require that the same number of individuals be interviewed from each stakeholder category (e.g., horticulture, state government agencies, environmental interests, industry) and the overall number of individuals is small. Secondly, the same questions were not asked of each interviewee. Although each was asked to comment on the same four themes, the exact same questions were not asked of each individual. In addition, there were instances in which certain interviewees raised additional issues that were not discussed during other interviews.

For the purposes of this study the above limitations were not problematic since the intent of the interviews was to gain an overview of the range of issues important to key stakeholders. The objective was not to determine what percentage of each stakeholder category held a specific position on a particular issue. To the extent possible we have employed qualitative terms to provide the reader with an indication of the extent to which certain issues or perceptions were held across or within particular stakeholder categories.

Finally, the findings in this report should be treated as a snap shot in time. Stakeholders expressed their views based on the information they had at the time of the interviews. Many interviewees noted that at this early stage in the planning process it was difficult for them to comment on certain themes and issues because they had limited background information. As additional information is provided to stakeholders, it would not be surprising if some individuals or groups modify some of their views.

### 3.0 Analysis of themes

The analysis of interview data revealed the themes and sub-themes shown in Table 1. Each is discussed in the following sections of the report.

Table 1. Themes and sub-themes

Theme	Sub-theme
A. Existing conditions	<ul style="list-style-type: none"><li>• Declining groundwater levels</li><li>• Water quality</li></ul>
B. Resource management	<ul style="list-style-type: none"><li>• Past and current management</li><li>• Sustainability</li><li>• Whole of government approach</li></ul>
C. Groundwater allocation	<ul style="list-style-type: none"><li>• The allocation process</li><li>• Natural environment as a water user</li><li>• Water trading</li></ul>
D. Demand management	<ul style="list-style-type: none"><li>• Water use efficiency</li><li>• Water pricing</li><li>• Water reuse</li></ul>
E. Management options	<ul style="list-style-type: none"><li>• Ecological features</li><li>• Pine plantations</li><li>• Horticulture</li><li>• Private unlicensed bores</li></ul>
F. Community involvement	<ul style="list-style-type: none"><li>• General public</li><li>• Key stakeholders</li></ul>

#### 3.1 Existing conditions

Prior to the interviews, participants were sent a brief background document which described the existing pressures on the groundwater resources and some of the impacts that had already been experienced at several locations (Appendix D). This included the fact that the water table had dropped significantly in some parts of the study area and some groundwater dependent ecosystems (e.g., wetlands, Banksia woodlands, etc) had shown signs of stress.

##### 3.1.1 Declining groundwater levels

All of the interviewees agreed that the water levels were indeed declining. Several individuals indicated that the water table was dropping to different extents over the study area. This is consistent with the background information provided to the participants (Appendix B). However, others believed the water levels were dropping in a uniform manner across the study area.

Some interviewees noted that they had witnessed surface water levels dropping and the death of some groundwater dependent vegetation. Some owners of private bores had noted the decline in surface water levels but had not experienced any lowering of water levels in their backyard bores.

All of the interviewees perceived the declining water levels as a problem. Several believed the problem was at a critical point. The impact on horticulture and ecological values in the area were provided as evidence in support of this view; as was the ever increasing demand for water arising from urban growth.

There was consensus that the existing condition of the groundwater resources warranted immediate action on the part of government. However a couple of individuals viewed the water levels as a relatively minor issue. Rather than focusing efforts on the management of the Gnangara groundwater resources, they advocated concentrating efforts on finding additional water sources to meet the needs of the Perth metropolitan region (e.g., water transfer from the Kimberley and/or South West Yarragadee).

Interviewees pointed to a variety of water users as the source of the problem. Water consumers (public and private sector) were identified because they are responsible for the direct abstraction of the water. Government agencies were also blamed for how they managed the resources, allocated the water amongst users and managed land uses.

Almost half of those interviewed identified the pine plantations as a significant contributor to the lower groundwater levels. The horticulturalists in particular viewed the pine plantations as the primary source of drops in water levels. Others viewed horticulturalists and local government as over-consumers of groundwater and hence the source of declining water levels.

More than a third of interviewees attributed declining water levels to two additional factors: climate change and natural climatic fluctuations (cycles). Of these interviewees, several viewed climate change and natural climatic fluctuations as primary causes of declining water levels, but most viewed them as secondary factors.

### **3.1.2 Water quality**

Water quantity issues dominated those of water quality. Only a few interviewees brought up the issue of water quality. When water quality was raised it was most often with respect to acid sulphate concentrations in the soil, the potential for dryland salinity to affect the region and for fertilizer run off to cause contamination. As discussed in section 3.4.4, a few interviewees mentioned water quality issues in relation to water reuse. When prompted, most interviewees acknowledged the importance of water quality but placed it a distinct second to issues of quantity as a concern.



## **3.2 Resource management**

### **3.2.1 Current and past management**

There was consensus that the Gngangara groundwater resources needed better management. This concern was expressed in a number of ways, predominately:

- little was being done to manage the resources;
- lack of tangible evidence of action being taken to manage the resources; and
- current management is too slow to be effective.

The majority of those interviewed believed that if additional measures had been taken earlier to better manage the consumptive uses, the current level of negative impact on the groundwater resources would not be evident today. Almost everyone wanted to see steps taken to manage the Gngangara groundwater resources in a manner that would result in a sustainable future.

Some interviewees believed that current management efforts were occurring too slowly to be effective. A number of the state agency representatives in particular attributed this to resource managers being overburdened by day to day groundwater-related issues. This left them with too little time to dedicate to longer term strategic planning for the future of the groundwater resources. Hence, management has been reactive instead of proactive, responding to the outcomes rather than the causes of the problems. One interviewee summarised their perception of past and current management efforts by stating: “our collective management has been a dismal failure”.

Criticism of past and current resource management efforts was typically accompanied by an acknowledgement that management of a complex system, such as the Gngangara groundwater resources, is a daunting task. At the same time this was not viewed as a legitimate excuse for perceived inaction. Many of those interviewed expressed frustration with the perceived lack of action by government to rectify the existing situation. When asked what they would like to see happen, several individuals summed up their feelings by simply stating “Do Something!”

State government agencies in both the water resource and land management sectors were identified as contributing to the existing problems with the groundwater resources. A common view was that no single agency had full jurisdiction over management of the system, hence a combination of agencies were at fault. The DoE, as the resource manager, and the Water Corporation, for perceived over abstraction as a major licence holder, were among the most frequently mentioned agencies. The Department of Conservation and Land Management (CALM), the Department of Planning and Infrastructure (DPI) and Forest Products Commission (FPC) were also identified due to the roles played by land management and land use planning. It was also evident that some interviewees did not have a clear understanding of the various roles and responsibilities of these agencies.

### **3.2.2 Sustainability**

The goal of a groundwater management plan would be to ensure a sustainable future for both the groundwater resource and its dependent uses. The concept of sustainability is central to the planning exercise.

The State Sustainability Strategy defines sustainability as “meeting the needs of current and future generations through an integration of environmental protection, social advancement and economic prosperity”.

The concept of sustainability was raised either explicitly or implicitly during most interviews. A couple of individuals referred to the State Sustainability Strategy when defining the term. Some interviewees defined ‘sustainability’ as the consideration of social, economic and environmental issues and concerns so as to achieve a balance between the three in decision-making. Many commented that reaching decisions that reflect a good balance or integration among environmental, social and economic objectives was not easy and may require trade-offs.

Others discussed the concept of sustainability implicitly. They talked about the various characteristics of sustainability, including: incorporating social, economic and environmental factors and goals in decision-making, intergenerational equity (i.e., impact on future generations) and the precautionary principle.

Interviewees discussed not only the value of the resource to current users but the need to maintain its value for future generations. The majority of those interviewed perceived the risks associated with inaction as much greater than those resulting from moving forward in the resource management process despite not having a full understanding of the resource.

### **3.2.3 Whole of government approach**

An overwhelming number of interviewees felt that a groundwater management plan should be developed through a ‘whole of government’ process. This approach reflected the perception that no single agency caused the problem and no single agency had full jurisdiction to fix the problem.

It was also seen as appropriate because groundwater management needs to incorporate not only environmental but social and economic considerations. Many noted the relationship between land use and water resource planning. This meant that not just water resource oriented agencies but agencies involved in land use planning needed to be involved. The DPI was identified as a key agency because of the impact land use has on groundwater resources (e.g., rate of recharge, contamination in run-off from urbanised areas). There was also recognition that the availability of groundwater could restrict land use activities in some areas.

There was some recognition that government agencies have begun to work together. Examples include the East Wimmeroo Land Use and Water Management Strategy (DPI and local government) and the Waterwise on the Farm program (Department of Agriculture and DoE). These initiatives were seen as steps in the right direction but

provisions for a whole of government approach to planning for the Gngangara groundwater resources were still needed.

The majority indicated that successfully achieving a ‘whole of government approach’ would not necessarily be an easy task. One individual compared the challenge of successfully implementing a ‘whole of government’ approach to a “unicorn – absolutely beautiful but does not truly exist”. Others were more optimistic, noting that not only was such an approach possible but necessary if the groundwater resources are to be managed in a sustainable manner.

A number of potential barriers to successful implementation of a ‘whole of government approach’ were identified. A perceived lack of political will was identified by some as a barrier to success. Strong political will was viewed as important since a number of tough decisions may need to be made by government. Among the tough decisions most frequently identified was the issue of water allocation, that is, who would receive water and in what quantities. It was speculated by some that political will might be low because tough choices are not always popular choices and thus carried risks for politicians hoping to be re-elected.

A second barrier was the perceived lack of coordination between state government agencies with an interest in the future of the Gngangara groundwater resources. Those holding this view came from both the public and private sectors. Agencies were seen as too often working within their own boxes (i.e., just within their agency) rather than collaborating with other agencies to find solutions to resource management issues.

Some attributed this to state agencies competing for the same financial resources or seeking lead agency status over a natural resource (e.g., groundwater). Others felt that higher levels of government involvement (e.g., Ministerial and/or Cabinet level) were required to encourage agency coordination by supplying agencies with appropriate funding to cover the additional work created by multi-agency planning initiatives. Some contended that state agencies were so financially stretched by day to day operations that there were few funds left for collaborative planning efforts among agencies.

Those individuals who went so far as to describe how a ‘whole of government approach’ might be set up for a Gngangara groundwater planning initiative typically identified a similar approach. A first step would be ensuring that each of the agencies had a shared understanding of the needs and problems faced by the other agencies. The creation of an institutional arrangement conducive to collaborative multi-agency planning was also important. Additional conditions included the active support of higher levels of government, such as Ministers and/or Cabinet members, to get such an approach moving. Strong leadership was also viewed as important in order to mobilise the agencies involved and hold them accountable. Several interviewees felt that such leadership needed to come from outside government whereas others saw a particular government agency (e.g., the DoE, CALM, or the DPI) spearheading the multi-agency planning initiative.

### **3.3 Groundwater allocation**

#### **3.3.1 The allocation process**

Water allocation requires making decisions regarding how much water will be made available for different types of uses (e.g., public water supply, horticulture, other agriculture, industry, recreation, private household bores, etc) and under what conditions. The majority of interviewees recognized that making water allocation decisions was not easy.

During the interviews, individuals were often asked how they would prioritise among users in an allocation process. Most were hesitant to do so. They often indicated that they either did not know enough about the groundwater resources or were unfamiliar with current allocation processes. In particular, they wanted to possess a better understanding of the amount of water entering the groundwater system as well as the amount leaving the system (e.g., due to abstraction). They also wanted to know the amount of water currently abstracted by each type of user (e.g., gardens, horticulture, public water supply, etc). Even if this information was known to them, many felt they would still want to rely on experts to help prioritise user allocations.

Others began prioritising among users but stopped mid-way because they did not want to disadvantage any single user. They often identified that it was hard to find a *balance* between users, one that did not result in sizeable negative impacts for any single user.

One interviewee commented that the primary allocation principle of ‘first come, first served’ used by the DoE, through the Water and Rivers Commission (WRC), had proven problematic. It resulted in those who made their applications first receiving groundwater allocations while little, if any water remained for others in the same area if they applied for water later on. This was seen as especially problematic for the study area due to the pressure increasing urbanisation was placing on water demand (development and human consumption) in the northern suburbs and beyond. The interviewee proposed that the WRC consider reducing some of the existing allocations and reallocating the water to others in the same area.

Rather than allocating water on a ‘first come, first served’ basis some interviewees indicated that the length of tenure in an area or the value of the activity supported by the water should be considered.

A couple of interviewees believed that over allocation had already occurred in some areas. It was suggested that a solution would be to reduce the existing water allocations equally across all users. They stated that “if everyone has to take their medicine, they should all take equal amounts”. Another interviewee contended that it was politically untenable to consider taking water back from existing licensees.

One interviewee identified that before allocation could occur a cap based on sustainable yield would need to be set and adjusted annually based on yearly rainfall. The price would need to be adjusted based on the annually defined yield, e.g., cost more when less water is available. Adjustments would also need to be made to allocations, i.e., less water would mean proportionate redistribution of the available water. This approach was

complimented by the idea that no future water users should be able to apply for a license, unless the license is for trading water between current users.

A number of other issues related to allocation, including water trading, water re-use and quantities of water being consumed, are discussed in other sections of this report.

### **3.3.2 Natural environment as a water user**

In discussions of how water might be allocated among uses, the majority of those interviewed viewed the natural environment as a water user. However, some individuals viewed the natural environment (i.e., ecological values) as different from other types of water users. Rather than being another water user, one person viewed the natural environment as the source from which other users drew their water.

It was clear that the vast majority of interviewees valued the role of the natural environment in relation to the Gngangara groundwater system. The lakes, wetlands, and the Yanchep National Park cave system were the most commonly cited groundwater dependent environmental features. With respect to the value of the natural environment, some individuals emphasised its intrinsic value but more commonly the ecological functions (e.g. water purification) and/or anthropogenic (human) uses were raised during the interviews.

The declining water level in lakes and wetlands was often flagged in terms of the negative effects on aesthetic values (i.e., negative visual impact) and recreational use. For example, a few individuals recalled a time when Lake Gngangara was an enjoyable place to visit on a weekend or afternoon to engage in water skiing or other water-based recreational activities. They described the current condition of the lake as “little more than a salt flat”. This change was attributed to a decline in groundwater levels. Existing recreational uses such as racing four wheel drives and motorbikes on the dry lake bed were seen as contributing to the spread of dieback, degrading fringing vegetation and making the area more prone to fires.

Several individuals commented on tree deaths within *Banksia* woodlands, specifically in areas surrounding bores owned by the Water Corporation. These impacts were attributed to over abstraction for public water supply.

In discussions about the future of the pine plantations, some interviewees discussed the potential impact of thinning or clearing the pines on the breeding habitat of Carnaby’s Black-Cockatoo (see 3.5.2). While the cockatoos were viewed as part of the ‘natural’ environment, the pine plantations were typically seen as part of the man-made environment.

Discussions of allocating water among the various water users revealed a tension between a desire for conservation of the natural environment (e.g., retention of ecological values) and meeting the needs of other water users (e.g., horticulture, public water supply). The majority of interviewees stated that in some situations other water users may take priority over the environment as a water user. This would apply in cases where meeting the groundwater needs of the natural environment would result in detrimental effects on human uses (e.g., horticulture).

The background information provided prior to the interviews (Appendix D) noted that water levels in a number of the wetlands, lakes and caves were being artificially maintained by agencies such as the DoE, CALM and the Water Corporation pumping water into them. Several interviewees had previously been unaware that water was being pumped into particular areas and that this had been occurring for a number of years. This practice was often viewed as unsustainable in the long term, but acceptable by most in the short term, at least until a better scientific understanding of the system was attained.

Of those who were prompted to choose an outcome, at least half indicated that if ecological features could not be maintained 'naturally' in the longer term, then they should no longer be augmented.

Some interviewees questioned whether the benefits of augmentation were sufficiently large enough to warrant the negative socio-economic impacts. They noted that water assigned to augmentation would not be available for other uses.

A few interviewees made specific reference to the cave systems. They placed a different or higher value on the caves than on the wetlands and lakes. They saw the caves as a unique ecosystem and in need of indefinite supplementation. Maintaining the cave ecosystem via water augmentation was compared to a zoo by one interviewee where the augmentation of the cave system was warranted for the preservation of threatened and endangered species and for general public education.

### **3.3.3 Water trading**

The interviews revealed that only a small proportion of interviewees were either aware of water trading as a concept or saw its potential relevance in managing the Gngalara groundwater resources. Further, many of those who had heard of water trading had limited knowledge of the existing WRC policies related to water trading (i.e., *Transferable Water Entitlements for Western Australia - Statewide Policy No.6*) or unused licensed water entitlements (i.e., *Management of Unused Licensed Water Entitlements - Statewide Policy No.11*).

Although interviewees were not asked a specific question regarding water trading, several individuals raised the issue during their interviews. Each supported water trading programmes in which those licensed users not fully using their allocation could sell their excess water to the highest bidder.

Those supporting water trading believed that by giving groundwater a market value it would be more respected as a resource by users. This was contrasted with current water use practices that were viewed as less than optimal and not consistent with good resource management.

For a couple of interviewees the concept of water trading was connected to the notion of water ownership, in that water was traded from one owner to the next. From this perspective, water was treated not only as a commodity to be bought and sold but as a property right. This view conflicts with current water policy which treats water as a common property resource and thus a licensed allocation is not attached to an individual property right.

One interviewee expressed concern that water trading in fully allocated areas could result in windfall profits for those individuals who had been fortunate enough to get their licence applications in early with the WRC (i.e., the first come first served principle). The interviewee was concerned that those holding water licences would become wealthy through the sale of their much sought after water allocations. This was viewed as inequitable. It was recommended that for water trading to be equitable in such situations, pre-existing water allocations would need to be reviewed and water redistributed amongst users within the area before trading could continue.

### **3.4 Demand management**

The majority of those interviewed saw reducing the demand for water as a key component of the groundwater resource management equation. The most commonly raised forms of demand management were water use efficiency, water pricing and water reuse.

#### **3.4.1 Water use efficiency**

The majority of the interviewees advocated working towards greater water use efficiency through water wise programs. Each category of water user was seen as being able to incorporate additional water wise techniques. For example, the manner in which local governments watered their public open spaces and sports grounds was often cited. It was suggested that they modify the quantity and time of day they water. Another example applicable for builders was using water sensitive design in new developments and offering native vegetation landscaping packages.

Horticulturalists were viewed as another sector that could improve its water use efficiency. Many believed that substantial water savings could be made if water use practices were changed within the industry. One horticulturalist noted the substantial water savings he had achieved as a result of water use efficiency research. Not all horticulturalists agreed that substantial savings were possible, believing instead that many operations, especially the larger ones, had already adopted water use efficient practices and technologies.

However, the horticulturalists were happy to review their practices if supported by government in terms of research and financing. Education was identified by horticulturalists and others as central to better water use efficiency. Several horticulturalists identified the Water Wise on the Farm programme (co-sponsored by the Department of Agriculture and the DoE) as a recent water use efficiency initiative. There was a perceived need for even greater government support and longer-term security (see section 3.5.3) for horticulturalists in their efforts to become more water efficient.

#### **3.4.2 Future residential development**

Urbanisation continues to extend northward in the study area. A number of interviewees, including some land developers, identified the need for water sensitive urban design (WSUD) as a water saving mechanism in future subdivisions. This included the use of native vegetation for landscaping, household water saving measures (e.g., rainwater

tanks), use of recycled water in water features (e.g., ponds), and stormwater drainage systems. Some interviewees viewed best management practices (BMPs) for channelling stormwater as a way to protect ground and surface water from surface runoff, which could potentially contain pollutants (e.g., oil from paved surfaces). Recycling of stormwater was raised as a potential management option.

Several of those interviewed from the land development sector emphasised the need for water resource planning to acknowledge the current shifts in development trends. New residential developments are replacing the traditional quarter-acre block with smaller residential lots including less private garden space but larger public open spaces.

### **3.4.3 Water pricing**

The cost of water was raised by several interviewees. Several individuals commented that the problem was not the availability of water because sources such as the desalination of seawater meant a limitless resource. Rather, the problem was the cost of making the water available for consumers.

Others viewed water pricing as a potential means of curbing water demand. Several interviewees advocated setting a quantity of water to meet a household's basic domestic needs and charging this at a certain rate. Any volume of water used above this basic amount should be priced at a significantly higher rate. This was viewed as an equitable approach as low income households would be able to affordably meet their basic domestic uses.

Others advocated a system in which the rate paid for water reflected the value society placed on the use of that water. Uses that were highly valued would be less expensive than those considered less valuable to society.

Several individuals argued that water is at present severely under priced. An industrial consumer of water drew a parallel between the price charged for water and the price charged for phone usage. The interviewee noted that the monthly phone bill was often many times more expensive than the monthly water bill. It was stated that since both services are essential by today's standards, their prices should be more comparable.

### **3.4.4 Water reuse**

Close to half of the interviewees identified a need to recycle waste water. Waste water was seen as a valuable but untapped resource. Some were perplexed as to why such a valuable resource has remained unutilised.

The majority of those who identified waste water reuse as an option did not explore the types of water (e.g., industrial, agricultural, household, stormwater) to be recycled. Similarly potential barriers to waste water reuse were raised by only one interviewee who questioned the potential health implications of using recycled waste water on irrigated crops. In terms of potential reuse applications, several were proposed: outdoor household use (e.g. gardens and lawns), industrial reuse, and groundwater recharge (pumping recycled water back into the aquifer).



An interviewee from the industry sector believed that many industrial users of water were interested in having access to the wastewater. In industrial clusters, not all water users may want to recycle. The industries interested in recycling would like to have access to this stream of waste water. The water would be reused within their industrial production processes.

Through the media, a few individuals had heard of managed aquifer recharge via the use of waste water. Treated waste water would be re-injected into the groundwater system as a means of increasing the rate of recharge. Those who discussed the aquifer recharge process viewed it positively.

The EPA (2005) recently released a discussion paper on this topic titled *Managed Aquifer Recharge Using Treated Wastewater on the Swan Coastal Plain*. It explores potential applications of managed aquifer recharge using recycled waste water, including: preventing salt water intrusion; irrigation in horticultural areas; restoring groundwater levels; integrated water management in new residential areas; and to increase drinking water supplies.

### **3.5 Management options**

During the interviews, a number of potential management measures were put forward as components of a groundwater management plan.

#### **3.5.1 Environmental features**

A number of ecosystems (e.g., caves, wetlands and lakes) in the study area are dependent on groundwater for their survival. As discussed earlier (see 3.3.2), many did not advocate a long-term continuation of the current practice of supplementing groundwater dependent ecosystems negatively impacted by over abstraction.

Two alternative approaches were suggested. The first was to reduce groundwater abstraction (either public or private supply) in the areas immediately surrounding the groundwater dependent ecosystems. This was viewed as providing the opportunity for natural water levels to return in these areas.

The second approach was to allow the wetlands and lakes to dry out with the hope that rainfall would increase over the long-term. Some interviewees questioned whether continuation of the current augmentation practices was sustainable in the context of a drying climate.

Several interviewees indicated that if groundwater dependent ecosystems were to have a future then land use practices in their vicinity needed to be compatible and not impose additional stresses on these features.

### **3.5.2 Pine plantations**

Almost half of the interviewees viewed the pine plantations as a significant user of water but a low priority water user. Thinning or clearing the pine plantations was proposed to provide additional groundwater recharge and thereby increase groundwater levels. Many felt that significant gains in recharge could be attained in this manner. However a few interviewees believed the groundwater gains might not be as great as some hope it to be.

Some interviewees noted that the magnitude of potential gains in recharge would be influenced by the choice of land use that replaced the pine plantations. Several future land uses were proposed for the area currently covered by pine plantations. These included: a continuation of pine plantations, revegetation using native plants, clearing the pines to use the land for recreation, urbanisation, or some combination of these. Development of a dedicated horticultural precinct in an area currently occupied by pines was an option particularly popular with those from the Wanneroo area. It was seen as a means of providing a secure future for horticulture in the region.

Only a few individuals commented on whether or not the endangered Carnaby's Black-Cockatoo, who feed on the pine plantations, would be negatively impacted by thinning or clearing activities. Those who believed the cockatoos may be negatively impacted noted that it was not just the loss of habitat due to clearing the pine plantations that was a concern. It was the cumulative impact of plantation clearing plus the additional loss of habitat due to the increasing urbanisation on the Swan Coastal Plain.

### **3.5.3 Horticulturalists**

As a group, the horticulturalists interviewed were concerned about the future of their industry. Both issues of land security (i.e., effects of urban sprawl) and groundwater availability were threatening the longer-term viability of the horticulture industry in the Wanneroo area.

In addition to water, horticulturalists needed additional land for expansion and crop rotation. It was pointed out that both land and water security issues must to be resolved for the horticulture industry, as well as the viticulture industry, to be sustainable in the study area.

As a solution to these concerns some pointed to a land use proposal to establish a new horticulture precinct where one of the pine plantations currently exists (see 3.5.2). The potential use of recycled water from nearby urban development to supply the proposed precinct with water was raised by several interviewees.

While some horticulturalists were somewhat optimistic regarding the future of horticulture in the region, others had a bleak outlook fearing that no matter the steps taken to increase groundwater recharge, the industry eventually would be squeezed out due to encroaching urbanization.

During the interviews, horticulturalists were often asked to consider a hypothetical scenario in which horticulture was considered no longer compatible with other land and water uses in the area. Under such a scenario, the horticulturalists indicated that some individuals would simply leave the industry at that point while others would look to

relocate their operations. Gingin was the area seen as the most likely for relocation. However, a couple of individuals familiar with the Gingin area believed it had neither the land nor the water resources available to support additional horticulture.

One person explained that if society determined that horticulture was incompatible with environmental objectives for the area, then horticulturalists should not be the only ones to pay for maintaining a common good (i.e., the natural environment). In these circumstances, regardless of whether horticulturalists left the industry or relocated, compensation by government was viewed as warranted by a number of interviewees.

Among the non-horticulturalists, many advocated maintaining the horticulture industry in the Wanneroo area. Some saw value in preserving 'small business' interests. Horticultural operations were seen by many outside the industry as small businesses although as several horticulturalists noted many are multi-million dollar operations. Others pointed to the Wanneroo horticulture industry's contribution to Perth's food supply, referring to it as the 'salad bowl' of the State. In addition, locally produced food was viewed by some as more desirable than reliance on imported food.

As noted in Section 3.4.1, some of those interviewed believed the existing horticultural operations could be made more water efficient.

### **3.5.4 Private unlicensed bores**

More than half of those interviewed raised the issue of private unlicensed bores (e.g., backyard bores used for watering lawns, small vegetable patches and flower gardens). A number of individuals commented that the current rules for unlicensed private bore owners did little to encourage water efficiency and were inequitable when compared with the rules that applied to consumers on the Integrated Water Supply System (public water supply). Several suggested that unlicensed private bore users should pay for their water.

Restricting the frequency and time of day bores could be used was raised by some as a way of making the system more equitable and water efficient. Currently those on public water supply can use their sprinklers only on their two allocated watering days, either once in the morning before 9am or in the evening after 6pm. However, bore owners can water lawns and gardens any day but only after 6pm and before 9am. Examples of private bore owners watering in the middle of the day were commonly cited as an example of inequity. Many of these interviewees appeared to be unaware that bore owners are restricted concerning the time of day watering is permitted.

Of those who raised the issue of private unlicensed bores, the majority identified a need for bores to be metered. This was often identified as a priority item in the resource management planning process. Metering was viewed as laying a foundation for allocation planning because it would contribute to a more accurate picture of resource use.

Several interviewees identified a conflict between the incentives being provided for sinking bores and the decreasing water levels found in the study area.

Others, including some individuals without private bores, were hesitant to recommend metering. They viewed the cost of meters as too high when compared with the gains in groundwater recharge from limiting unlicensed bore use.

### **3.5.5 Water Corporation**

A number of individuals gave examples of over abstraction by the Water Corporation that had resulted in incidents of *Banksia* dying in proximity to some public water supply bores. It was advocated that the Water Corporation take greater care and make any needed adjustments to its operating practices to avoid any reoccurrences. Some noted that the Water Corporation had already made some modification to its pumping regimes in response to the 1991 incidence of drawdown effects on groundwater dependent vegetation.

Other than encouraging greater water use efficiency on the part of the Water Corporation's consumers, little specific comment was made regarding the volume of water allocated to public water supply. Although a few individuals advocated greater government investment in finding alternative sources of water for public supply, this was typically not raised in the context of reducing the volume of water the Water Corporation is allocated from the Gngangara groundwater resources. However, one interviewee did identify the need to develop new sources to stop the Water Corporation from 'falling back' on the Gngangara groundwater resources during this increasingly dry period.

## **3.6 Community involvement**

The vast majority of interviewees supported the involvement of key stakeholders and the wider community in the groundwater planning process for Gngangara. However, many distinguished between involvement by the key stakeholders (both government and non-government) on the one hand and the general public on the other hand.

### **3.6.1 General public**

Those who commented on the role of the general public in subsequent stages of the planning process typically envisioned a less active role for the wider community than key stakeholders. This view reflected a variety of perceptions about the general public including: they are not interested in the issues, 'they do not want to get involved in the issues', they have less to offer the planning process because they are not 'large' water users, and 'they do not understand or recognise the problem'. The role of the general public was viewed as that of a receiver of information with the hope that they would apply the information and appropriately modify their attitudes and/or behaviours.

Several interviewees noted a need to ensure individuals were water wise in their daily activities (e.g., use water wise shower heads, observe watering restrictions). Some acknowledged ongoing community education efforts (e.g., water wise commercials run by the Water Corporation) but saw room for expansion of such programs.

Several individuals identified additional water wise measures, including a move away from English style gardens towards gardens using native vegetation. This would require that suitable information about native gardens was available as well as local nurseries having stocks of native vegetation available for consumers to purchase.

The majority of interviewees advocated providing information to raise awareness of the challenges facing the Gngangara groundwater resources (e.g., its status, its causes and what this means for the general public). It was felt that the general public was not aware of the problems facing resource managers, nor had they been given reasons why they should be concerned.

It was important that whatever information was disseminated in the community be truthful and unbiased. Some felt that government had not done a good job in this respect. Past efforts received criticism for not accurately depicting situations or not providing enough information to allow the public to make informed choices. Some accused the government of providing the community with only the information they wanted the public to have rather than the whole 'truth'. One interviewee contended that only minimal information had been released about the quantities of groundwater used and how water abstraction was impacting the environment (e.g., ecosystem functioning and biodiversity loss).

### **3.6.2 Key stakeholders**

The majority of stakeholders interviewed wanted to be engaged in the planning process. This meant not simply receiving information from agencies informing them what the agencies planned to do. They sought higher levels of involvement that extended beyond information and education.

Very few interviewees favoured the creation of additional committees as a means to engage stakeholders. Committees were described as diversions or roadblocks rather than as forums for meaningful contributions. Many spoke of their past experiences with committees and how they were often ineffective and frustrating. Criticisms of how committees functioned included: lack of power, lack of government support, lack of strong leadership and lack of a clear agenda. One person commented that "committees typically work well for the first four to five meetings but after that they became a time for gossiping."

Some favoured holding community meetings in local areas with clear agendas instead of establishing a committee. These meetings were seen as a means of ensuring that all voices were heard and discussed in the community. This was viewed as a more transparent approach and one that accommodated many more voices than the limited number allowed in a committee. They were also seen to provide a wide audience for mass dissemination of information.

When encouraged to identify additional means of engaging stakeholders or the general public in the planning process, few additional ideas emerged. This may reflect a lack of awareness about the number and variety of techniques that could be used to meet their community involvement objectives.

## 4.0 Conclusions

A number of key messages emerged from the interviews. There was consensus among those interviewed that the Gngangara groundwater resources are under pressure and need to be effectively managed.

The number of competing uses, the high demand for water and the absence of a full understanding of current use were seen as adding to the complexity of sustainable resource management. These factors made both protection of the resource and the allocation of water a challenge for resource managers. Yet, the majority of interviewees were adamant that these factors could not be used as an excuse for inaction.

The DoE's intention to develop a groundwater management plan for the resource was viewed favourably. But the majority of those interviewed believed that such a plan would need to involve multiple government agencies.

A common view was that multiple government agencies had contributed to creating the current problem and as such the solutions would need to draw on the skills and powers of many of the agencies involved in land use planning and water resource management. A whole of government approach was viewed as desirable but many interviewees were aware that interagency coordination and political will were key determinants of success or failure.

Concern was expressed that not enough is known about how much groundwater is actually being abstracted by licensed and unlicensed private bores. The new metering program was viewed as a positive step although some complained that the process for installing meters had already taken too long.

There was agreement that groundwater levels were dropping but not all understood that this was happening to varying degrees across the resources. The drop in water levels was largely attributed to over abstraction for public and private supply. The declining annual rainfall levels were viewed by most as only a secondary factor affecting groundwater levels. The pine plantations were viewed by many as a major water user but they were not viewed as a component of the natural environment.

Allocating groundwater among the competing users was viewed as an important but difficult task. Done poorly, it could result in inequitable and negative outcomes for groundwater users. A tension was seen to exist between the desire to conserve ecological values and also meet the needs of other water users (e.g., horticulture and public water supply). Under certain conditions, many stakeholders were willing to have other water users take priority over the environment with respect to water allocation.

Several individuals advocated water trading whereby licensed users could sell their excess water to the highest bidder. Many of those who had heard of water trading had limited knowledge of the existing DoE policies related to water trading or cases of water trading that have occurred in WA. The view of some that a water entitlement is similar to a property right is inconsistent with state policy which treats water as a common good. Overall, only a small proportion of interviewees raised water trading as an option. This

may in part reflect a lack of awareness of water trading as a concept that is already in use in WA albeit on a small scale.

Thinning or clearing the pine plantations was frequently suggested in the hope that significant gains in recharge could be attained in this manner. However, a few interviewees believed the groundwater gains might not be as great as others were anticipating.

Improved demand management was seen as a means of reducing the pressure on the groundwater resources. More efficient water use, effective water pricing and greater wastewater reuse were the most commonly identified demand management measures. The ideas put forward by interviewees were very similar to those raised by the public during the drafting of the State Water Conservation Strategy.

Many of those outside the horticulture industry believed that significant gains in water use efficiency could be achieved by the industry. Unlicensed private bores were also viewed by some as an inefficient water use. Some perceived current rules for unlicensed private bores as not only inefficient but inequitable when compared with the rules for consumers on the public water supply system.

Wastewater was seen as a valuable but unutilised resource. The potential to recharge aquifers using wastewater was raised by only a small number of interviewees. However, those who advocated its use did not identify any barriers to successful implementation.

Many from within and outside the industry would like to see horticulture have a sustainable future in the Wanneroo area. However, issues of land security and groundwater availability appear to be threatening its long-term viability in the Wanneroo area. Some pointed to a land use proposal to establish a new horticulture precinct where one of the pine plantations currently exists as a solution.

While some horticulturalists were somewhat optimistic about the future of horticulture in the area, others had a bleak outlook fearing the industry would eventually be squeezed out. If that occurred some horticulturalists would leave the industry while others might relocate to an area such as Gingin, provided suitable land and water is available which may not be the case. If horticulturalists were forced by government decisions to either retire or relocate, a number of the interviewees expected that the horticulturalists would receive fair compensation in return.

There was broad support for the involvement of key stakeholders and the wider community in planning the future for the Gngangara groundwater resources. The wider community was generally viewed as taking a less active role than that played by key stakeholders in the planning process. The primary role of the community was seen to be that of information receiver with education the community involvement objective. It was important that any information provided to the community be complete, truthful and unbiased. There was a common perception that the community was not aware of the problems facing the groundwater resources, nor had they been given reasons to be concerned about how it will be managed in the future.

The key stakeholders sought higher levels of involvement that extended beyond information and education. Few favoured the creation of more committees, which were

characterised as diversionary, ineffective and frustrating for participants. Rather, processes that allowed more voices to be heard in a transparent fashion were advocated (e.g., public meetings). It appeared that beyond committees and public meetings, many stakeholders were unaware of the variety of techniques that could be used to meet their public involvement objectives.



# Appendices

## ***Appendix A: List of interviewees***

<b>Interviewee</b>	<b>Affiliation</b>
Mike Allen	Department of Planning and Infrastructure
Russell Anderson	Horticulturalist
Trina Anderson	City of Swan
Lex Bastian	WA Speleological Group
Sue Bathols	Lake Gngangara Conservation and Community Group
Frank Battini	Consultant
Eugene Bouwhuis	Department of Industry and Resources
David Bright	Wildflower Society, Northern Suburbs Group
Alan Brown	Department of Defence
Gavin Butcher	Forest Products Commission
Leon Cazirri	Horticulturalist
Jane Chambers	Murdoch University
David Charles	TiWest Joint Venture
Daniel Chatley	Landcorp
Vivian Chung	University of Western Australia
Allan Crawford	City of Swan
Frank Cvitan	City of Wanneroo
David Davies	City of Joondalup Residents Forum
Owen Donovan	Department of Conservation and Land Management
James Duggie	WWF
Simon Fraser	Shire of Gingin
Mike Freeman	Department of Industry and Resources
Ray Froend	Edith Cowan University
Alex Gardner	University of Western Australia
Peter Gell	Department of Defence
Ross George	Department of Agriculture
Graham Gibbs	ET and GE Gibbs Coogee Springs
Dianne Guise	MLA, Wanneroo Electorate
John Hackett	Landcorp
Rosanna Hindmarsh	Ellen-Brockman Catchment Group
Sue Hurt	Swan Groundwater Advisory Council
Ivan Ivankovic	Strawberry Growers Association/Horticulturalist
Philip Jennings	Wetlands Conservation Society, WA
Jon Kaub	Conservation Council WA
Kerry Langlands	Strawberry Fields
Gary Lawther	LWP Property Group
David Lewis	Landcorp
Michael Martin	Water Corporation
Leonnie McMahon	Birds Australia Ltd
Andy McMillan	WA Farmers Federation
Joe Miotti	Water Corporation
Andrew Moore	Department of Planning and Infrastructure
Danny Murphy	LWP Property Group
Lyndon Mutter	Department of Conservation and Land Management
Brock Nanovich	Horticulturalist
Mick Nanovich	Horticulturalist
Jason Neave	Horticulturalist
John Neave	Horticulturalist

<b>Interviewee</b>	<b>Affiliation</b>
Andrew O'Farrell	City of Joondalup
Dale Park	WA Farmers Federation
Russel Perry	Capricorn Village Joint Venture
Dale Putland	City of Swan
Nicole Roach	Yellongona Catchment Group Coordinator
Peter Ruscoe	Turf Grass Association of WA
Clayton Sanders	Department of Conservation and Land Management
Jackie Sinclair	Naturalists Club – Northern Districts <sup>1</sup>
Jim Sweetman	City of Swan
Linda Taman	Swan Catchment Centre/North East Catchment Committee
Phil Thompson	City of Wanneroo
Lloyd Townley	Consultant
Nick Trandos	Horticulturalist
Jim Turley	Vegetable Growers Association
Giz Watson	MLC, North Metropolitan Electorate
Ray Wills	WA Chamber of Commerce and Industry
Nevin Wittber	Forest Products Commission
Paul Woodcock	Botanic Golf Gardens
Eric Wright	Department of Agriculture
Renata Zelinova	Quinns Rocks Environment Group

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<sup>1</sup> Interview included: Jeph Sinclair, Willard Libby, Alan Notley, Johanna Notley, Mary Hackett, Heather Ramdohr, Harold Bennetts, Robert Willis, and Marlene Madden from the Naturalist Club – Northern Districts.

## ***Appendix B: Interview guide***

## **Themes (and Possible Questions):**

### ***Theme A: The planning challenge and key issues/concerns surrounding the future of the Gnamangara groundwater resources***

- What is your understanding of the condition of the groundwater resources? Do you think there is a problem?
- What has created the problem?
- From your group's/organization's perspective, what are the key issues or concerns?
- Are there additional issues and concerns held by other stakeholders or sections of the community?

### ***Theme B: Allocation of Gnamangara groundwater resources***

- A key part of managing a water resource is determining which users will be given access to the resource and how much water they will be allowed to use. This includes both human uses such as public water supply, irrigation, and recreation, as well as environmental uses such as lakes and wetlands.

Would you like to see any changes in how the groundwater is allocated to various human and environmental uses? [Note: May need to explain concept of allocation depending upon the stakeholder]

- Do you think priority should be given to some users or uses over others? Explore (include human versus ecological uses).
- How would you like to see the water resources allocated? What process do you think should be used to allocate the water resources?

### ***Theme C: Actions needed to ensure a sustainable future for the Gnamangara groundwater resources.***

- A goal of the planning process is to ensure that the Gnamangara groundwater resources are managed in such a way that they will be both ecologically and socio-economically sustainable. "Sustainability" has become a planning buzzword. What does this term mean to you in the context of Gnamangara?
- Are there any decisions or actions that could be taken to help make the Gnamangara groundwater resources more sustainable? [If the person focuses only on alternative sources such as desalination or Kimberley water then follow up and ask about measures that could be applied specifically to the Gnamangara area.]
- Have you heard of any other possible actions to manage the groundwater? If yes, what do you think of those ideas?

- What advice would you offer the Department of the Environment as it develops a management plan for Gnangara's groundwater?
- At the end of the day, what recommendations do you think will be in the DoE's management plan for Gnangara?

***Theme D: Public involvement in the planning process for Gnangara***

[Possible preamble: Public involvement is one of those terms that can mean a lot of different things. Involvement can take many forms ranging from simply receiving a newsletter in the mail or accessing a website through to hands on involvement by participating in a series of workshops. Not all groups want to participate in the same manner or on similar issues.]

- From your group's perspective, what type(s) of involvement would your group like to have in this planning process?
- What sort of involvement would you/or your group be willing to undertake as part of the planning process?
- Are there some key questions that you would like to see answered during the planning process?
- Have you or your group worked with the Department of the Environment or the Water and Rivers Commission on water resource issues in the past? Was this a positive or negative experience? [If no experience with DoE or WRC then ask about land use or other planning initiatives especially in that geographic area]
- What advice do you have for the Department of the Environment as far as public involvement on this ( or any ) project is concerned?

***Appendix C: Introduction letter***



Dear XXXX

Thank you for agreeing to meet to discuss the future of the Gnamangara groundwater resource. As we discussed, the Department of Environment has commenced preparation of a Water Resource Management Plan for this valuable natural resource.

At this early stage in the planning process we are meeting with a range of key stakeholders, such as you, to gain a better understanding of the views held in the community. This will help the DoE in its efforts to plan a future for this groundwater resource that is ecologically, socially and economically sustainable.

As agreed, I will be meeting with you on XX (date) at XX (time), at XX (location).

During the interview, the following topics will be explored:

- The current condition and uses of the groundwater resource;
- Possible changes to the current use(s) of the groundwater resources;
- Ways of managing the groundwater resource to ensure a sustainable future; and
- Roles for stakeholders, including yourself and others who may share your interests, in the development of the Gnamangara Groundwater Management Plan.

Once the interviews are complete, you and the other interview participants will receive a draft summary report of the interview findings for your review. A final report will be made publicly available.

Please note that the summary report will not permit association of any individual's identity with specific responses or findings. With your permission, your name and affiliation will appear in a participants list as an appendix.

The attached materials provide some general background information on the Gnamangara groundwater resource and the challenges we face in managing it now and in the future.

If you have any questions or concerns please do not hesitate to contact me on XXXX or a/h on XXXX.

I look forward to meeting you.

Yours sincerely,

## ***Appendix D: Background information***

# A Sustainable Future for the Gnangara Groundwater System

## Introduction

Our State's environment, economic livelihood and the community's lifestyle, health, food production and industry depend on the availability of affordable good quality fresh water. The most valuable and largest source of such water in the Perth region is the Gnangara groundwater resource. With its large volume of easily accessible fresh groundwater, this resource has for many years supported a variety of ecological, social and economic uses.

The groundwater resource extends for approximately 2,200 km<sup>2</sup> over the Swan Coastal Plain between Perth and Gingin. Land use in the northern portion of the Gnangara groundwater resources are dominated by pine plantations, National Park, Crown land, nature reserves, and dryland pasture. The southern portion of the Mound is largely urbanized with irrigated horticulture prominent in the Wanneroo and West Swan districts.

The groundwater resource consists of a system of three layered aquifers (i.e., the Superficial, Leederville and Yarragadee aquifers). Most lakes and wetlands in the region are surface expressions of the aquifer closest to the surface (i.e., the Superficial aquifer). Many of the significant environmental features are dependent on accessing the shallow groundwater of the Superficial Aquifer for their survival.

This includes around 200 groundwater-fed wetlands and other groundwater-dependent ecosystems including Banksia woodlands and the cave pool fauna of Yanchep National Park. These ecological features in turn support a number of social (e.g., Aboriginal cultural sites, aesthetic features; recreation), and economic (e.g., bee keeping; tourism) values.

As Perth's population has grown, so too has the demand for water and with it the importance of the Gnangara groundwater resource for public water supply. In the early 1990s, approximately 40 per cent of Perth's public supply was met by Gnangara groundwater. Today, this has increased to over 60 per cent as surface water supplies in the Darling Range have decreased due to reduced annual rainfall and run off.

Private groundwater users also rely on the Gnangara groundwater system for agricultural, recreational and domestic uses. Horticulturists and private garden bore owners are the largest private users of groundwater from this region. Irrigation of ovals, parks and golf courses is secondary to these users. Other private bores are used for household, stock, industry and services.

Most private abstractions continue to come from the Superficial aquifer. In recent years, abstractions for public water supply have progressively shifted from the superficial aquifer to the deeper confined Leederville and Yarragadee aquifers. In part this is an effort to reduce impacts on the natural environment.

## Increased demand, less water

In recent years less water has been entering the groundwater system than was predicted when resource management decisions were made several decades ago. This is due to declining annual rainfall in the Perth region for the past 30 years. If or when past higher

rainfall levels will return is unknown. During this time period the demand for water has continued to grow.

The combination of low rainfall and increasing demand has resulted in a situation that is no longer ecologically or socio-economically sustainable. Simply put, more groundwater is leaving the Gngangara system to meet our demands than is being replaced by rainfall.

As a result, the water level has dropped significantly in some areas. In those locations, ecosystems dependent on the shallow groundwater have shown signs of significant stress (e.g. dying native vegetation and wetlands and caves drying up for longer periods). Under the powers of the *Environmental Protection Act 1986*, specific groundwater requirements were set in the 1980s to protect highly valued groundwater dependent ecosystems (e.g., wetlands, caves). These management objectives are currently not being met in a number of locations due to the lowering of the water table.

The current situation threatens not only the ecological but also the many social and economic uses supported by the Gngangara groundwater resource. The immediate task is deciding how to return the Gngangara groundwater system to a condition of sustainability. This would allow the many environmental, social, economic and cultural values of the groundwater resource to be maintained for present and future generations.

While it might be tempting to gamble that former higher rainfall will eventually return, based on current climate change science, this may not occur. In planning the future of the Mound, resource managers must include scenarios in which rainfall levels in the near future (the next 10-20 years) or longer term do not increase significantly, if at all. Failure to consider such scenarios in planning the future of our water resources could prove costly and disruptive.

While more action is needed, the State Government has already taken a number of steps to address problems created by declining water tables in some areas. When groundwater monitoring revealed declining water levels, the Water Corporation in consultation with the Department of Environment shut down or significantly reduced abstraction from 40 bores in sensitive environmental areas.

The Department of Environment and the Water Corporation also commenced artificially maintaining water levels in some lakes, wetlands and caves to maintain their ecological values. CALM has also been pumping groundwater into a number of caves in Yanchep National Park in an attempt to protect threatened aquatic fauna living in cave pools.

While somewhat successful in maintaining water levels and environmental values, these actions have carried a financial cost in the millions of dollars and have increased the need to develop public water supply sources in other areas. Maintaining these levels is not a long-term solution if the water table continues to drop.

In an effort to reduce water demand, the Department of Environment and the Department of Agriculture are co-sponsoring the *Water Wise on the Farm* program to promote greater horticultural water use efficiency in the Wanneroo area. In addition, water restrictions limiting household sprinkler use to two days per week have been in effect across Perth's public water supply system since the summer of 2000-01.

## **Planning for the Future**

Future resource management decisions need to draw upon good science but we do not yet have a full understanding of how the Gngangara groundwater system functions and its relationship to groundwater-dependent ecosystems. Currently a research program involving multiple State Government agencies and the CSIRO is exploring how the Superficial aquifer and deeper confined aquifers (i.e., Leederville and Yarragadee aquifers) work as a system. Scientific investigations, including computer modelling, are assessing the impact of abstracting groundwater from the deeper aquifers on near-surface shallow water levels.

Despite these efforts, more needs to be done if the groundwater resource is to be managed in a sustainable fashion. Planning a sustainable future for the Gngangara groundwater is not an easy task. There are no quick fixes readily at hand. The community is likely to balk at any efforts to further reduce demand through more stringent water restrictions on sprinkler use. The development of alternative water supply sources (e.g., seawater desalination, groundwater from the Southwest Yarragadee, water from the Fitzroy River) has recently garnered considerable media attention as a possible solution. However, even if alternative sources were implemented in the near future, the Gngangara groundwater system would remain a highly valued resource for public water supply and local private use. Gngangara groundwater will remain a far more affordable source of high quality fresh water as demand for public water supply continues to increase due to population growth.

Achieving the best balance among the community's social, economic and environmental aspirations for the Gngangara groundwater resource will likely require some difficult choices on the part of resource managers, the Government and the community. Allocating water to maintain or expand one type of use would likely mean less water would be available for other uses. We need to make wise choices that are fair to those affected and which minimise negative impacts and maximise benefits.

The following questions illustrate the complexity and magnitude of the planning challenge we face:

- Should groundwater be reassigned from public water supply in order to support environmental features?
- How can water security be achieved for the local horticultural industry?
- Should private garden bores be licensed to encourage water efficiency?
- Should the pine plantations be selectively cleared so as to reduce their water uptake near wetlands and caves?
- Should native vegetation be managed by more frequent controlled burning to enhance groundwater recharge?
- What role could wastewater reuse play in stabilising water levels?
- How should the prospect of climate change be factored into our water resource planning?

These are just a few of the questions that need to be answered.

The Department of Environment is responsible for managing and allocating groundwater for public and private use. The Department is currently developing the first comprehensive management plan for the Gngangara groundwater resource. The plan will establish how much water can be abstracted from the various aquifers while still achieving ecological

sustainability. It will describe how water will be allocated to users and the measures needed to manage the groundwater resource responsibly into the future.

But successfully resolving the many issues and competing uses of the Gnamangara groundwater resource is beyond the mandate or ability of any single state government agency. A holistic and whole of Government approach is needed. To that end, the Department of Environment is working with other State Government agencies with an interest in the future of the Gnamangara groundwater resource. This includes the Water Corporation (public water supply), the Department of Planning and Infrastructure (land use), CALM (biodiversity), the Health Department (wastewater reuse), the Department of Agriculture (horticulture and other agricultural uses) and the Forest Products Commission (pine plantations).

The outcomes of the Gnamangara groundwater planning process will directly or indirectly affect many in the community. If we are to be successful in outlining a sustainable future for this valuable groundwater resource, the planning process needs to extend beyond state government agencies. It requires not only State and Local Governments, but communities, environmental groups, and industry working together to set priorities and develop strategies to ensure the sustainable management of the resource.



