Water and Rivers Commission

The Water and Rivers Commission is amalgamating with the Department of Environmental Protection to form the Department of Environment, Water and Catchment Protection

MANAGING THE WATER RESOURCES OF THE ARROWSMITH GROUNDWATER AREA, WA

Interim Sub-Regional Allocation Strategy

Prepared by
Resource Allocation Branch of
Resource Management Division
and Midwest Gascoyne Region

January 2002

ISBN: 0-7309-7576-2

SUMMARY

The groundwater resources of the Arrowsmith Groundwater Area are either fully allocated or approaching full allocation in some subareas. Demand in recent years for licences to explore and take groundwater has been increasing in some subareas to a level that cannot be sustained in the long term. In recognition of the need to manage this increasing demand, the Department of Environment, Water and Catchment Protection (DEWCP) will develop a Sub-Regional Groundwater Management Plan for the Arrowsmith Groundwater Area in consultation with the community and the proposed Midwest Water Resources Management Committee. The new Plan will address the environmental requirements and include full community consultation consistent with the amended *Rights in Water and Irrigation Act (1914).*

The Department has drafted this Interim Allocation Strategy to manage the groundwater resources in the period prior to implementation of the new Plan. This Interim Allocation Strategy is the first review of the 1995 Groundwater Area Management Plan and reports on the issues and topics related to the management of the groundwater resources in the Arrowsmith Groundwater Area. In particular, it will ensure the groundwater resources are managed at the appropriate level in the interim.

New allocation limits have been assigned for some parts of the Arrowsmith Groundwater Area following a review of the hydrogeology of the northern Perth Basin. A new assessment of the recharge to the Yarragadee aquifer in the Allanooka Subarea, for example, has significantly reduced the allocation limit of that Subarea. However, a preliminary evaluation of the groundwater resources to the north of Allanooka may help to compensate for this reduction. In the coastal area, there is also less local recharge to the confined aquifers as groundwater flow is predominantly upward. The decrease in recharge to these aquifers has resulted in a reduction of the allocation limit and hence a reduction in the water available for allocation.

This Strategy adopts a conservative and precautionary approach to water allocation to ensure that the groundwater resource and its beneficial uses are sustained in the long term. The Department will continue to periodically review the sustainable limits as new data and information become available.

Operationally, this document will ensure that licence applications and approvals are processed quickly where groundwater is available for allocation. Applicants are informed of subareas where groundwater is fully committed to avoid needless expectations. Developers are able to obtain information about the status of the groundwater resource before committing to capital investments. This should encourage licence applicants to tap into groundwater resources that are not fully committed, such as those in the central part of the Groundwater Management Area.

This Strategy does not contain the details regarding the physical and technical aspects of the Arrowsmith Groundwater Area. This is intentional, as this Strategy should be viewed as an operational document. Full technical details are available from the supporting documentation to which the reader is referred.

TABLE OF CONTENTS

FIGURES

TABLES

APPENDICES

1 INTRODUCTION

The Department of Environment, Water and Catchment Protection (Department) manages the water resources of Western Australia in partnership with other government agencies, businesses and the community. The Department's primary role is to ensure the State's water resources are appropriately managed to support sustainable development and conservation of the environment for the long-term benefit of the community. This is achieved through a water allocation, policy and licensing process, which ensures that water is used efficiently and within sustainable limits.

The groundwater resources in some subareas of the Arrowsmith Groundwater Area (AGA) are either fully allocated or approaching full allocation. More recently, the Department has received a large number of applications for accessing significant quantities of groundwater in the AGA placing added pressure on the resource to satisfy the demand. In some subareas, the demand exceeds supply, which if satisfied, could threaten the long-term sustainability of these resources. This Interim Allocation Strategy has been prepared by the Department to provide information to organisations, industry and individuals about the way in which the groundwater resources of the AGA are to be managed until the Sub-Regional Groundwater Management Plan can be developed and implemented in the AGA.

This Strategy should be considered as a precursor to the Management Plan, which will be developed in consultation with community groups and stakeholders in the area. The Management Plan will review the allocation limits presented in this Strategy following a detailed assessment of the ecological water requirements and the volume of groundwater that will be provided to any groundwater dependent ecosystems.

The interim allocation limits, which have been estimated for each of the aquifers identified in the AGA, are based on the available information in 2001and varying levels of certainty. To finalise the review and introduce a higher level of certainty, additional information will need to be collected, evaluated and reported on in the forthcoming Management Plan. Consequently, this Strategy adopts a conservative and precautionary approach to ensure that the groundwater resources, and its beneficial uses, are sustained in the long term.

This Interim Allocation Strategy was available for public comment for a period of one month. All holders of groundwater licences and any person or organisation interested in the management of the groundwater resources in the AGA were encouraged to carefully read this document.

1.1 Objective of the Strategy

Groundwater management in Western Australia is based on a partnership arrangement between the community and government. Whilst this process works well, there is a need to apply consistent and objective criteria when allocating resources, and at the same time, protect the natural environment dependent on these resources. The objective of this Interim Strategy is to allocate groundwater for consumptive use in a way that contributes to the fullest extent possible, the sustainable economic and social

development of the AGA whilst protecting key ecological values of groundwater dependent ecosystems.

The guidelines and initiatives for achieving this objective are contained in this document. It sets out the reasoning for the decisions and implements a set of licensing rules that will ensure the resource is allocated in a fair manner and used in a sustainable way.

1.2 The Arrowsmith Groundwater Area (AGA)

The AGA is located between 210 km and 380 km north of Perth, and covers an area of about 10,308 km^2 (Figure 1). The AGA contains very large groundwater resources in storage in at least nine aquifer systems and has been subdivided into eight Subareas for closer management as shown in Figure 1 and Table 1. The former Dandaragan Subarea has been further subdivided in three subareas based on a reinterpretation of the hydrogeology: Morrison, Tathra and Morrison Subareas.

Table 1. Subareas of the Arrowsmith Groundwater Area

Subarea	Generalised geomorphology
Dongara	Coastal Belt and Bassendean Dunes
Eneabba Plains	Eneabba Plains
Twin Hills	Arrowsmith Region, south of Irwin River
Allanooka	Arrowsmith Region, north of Irwin River
Mingenew	Dandaragan Plateau, north of Arrowsmith River
Tathra	Dandaragan Plateau, south of Arrowsmith River
Morrison	Dandaragan Plateau, south of Coorow - Green Head Road
Darling	Yarra Yarra Region and Darling Plateau (bedrock area)

The Arrowsmith Groundwater Area, together with the Jurien and Gingin Groundwater Areas form part of the northern Perth Basin (Figure 1). The AGA is administered by the Department's Midwest Gascoyne Regional office located in Geraldton.

As detailed in section 3.2.1, the Yarragadee aquifer extends north of the AGA into a portion of the Gascoyne Groundwater Area. This area is referred to as the proposed Casuarina Subarea (Figure 3). The sustainable limit of the Yarragadee aquifer in the Allanooka Subarea includes a large portion of rainfall recharge originating in the proposed Casuarina Subarea. To facilitate effective management of groundwater resources, the northern extent of the Yarragadee aquifer will be incorporated into the AGA. However, the current proclaimed boundary of the AGA does not include the Casuarina Subarea and the Department will endeavour to re-gazette the AGA boundary to include the Casuarina Subarea which will be combined with the Allanooka Subarea to form one management unit.

1.3 Background

To address the importance of the groundwater resources in the northern Perth Basin and the future demand for these resources, the Arrowsmith Groundwater Area Management Plan was developed in 1995 by the ex-Water Authority of WA (Water

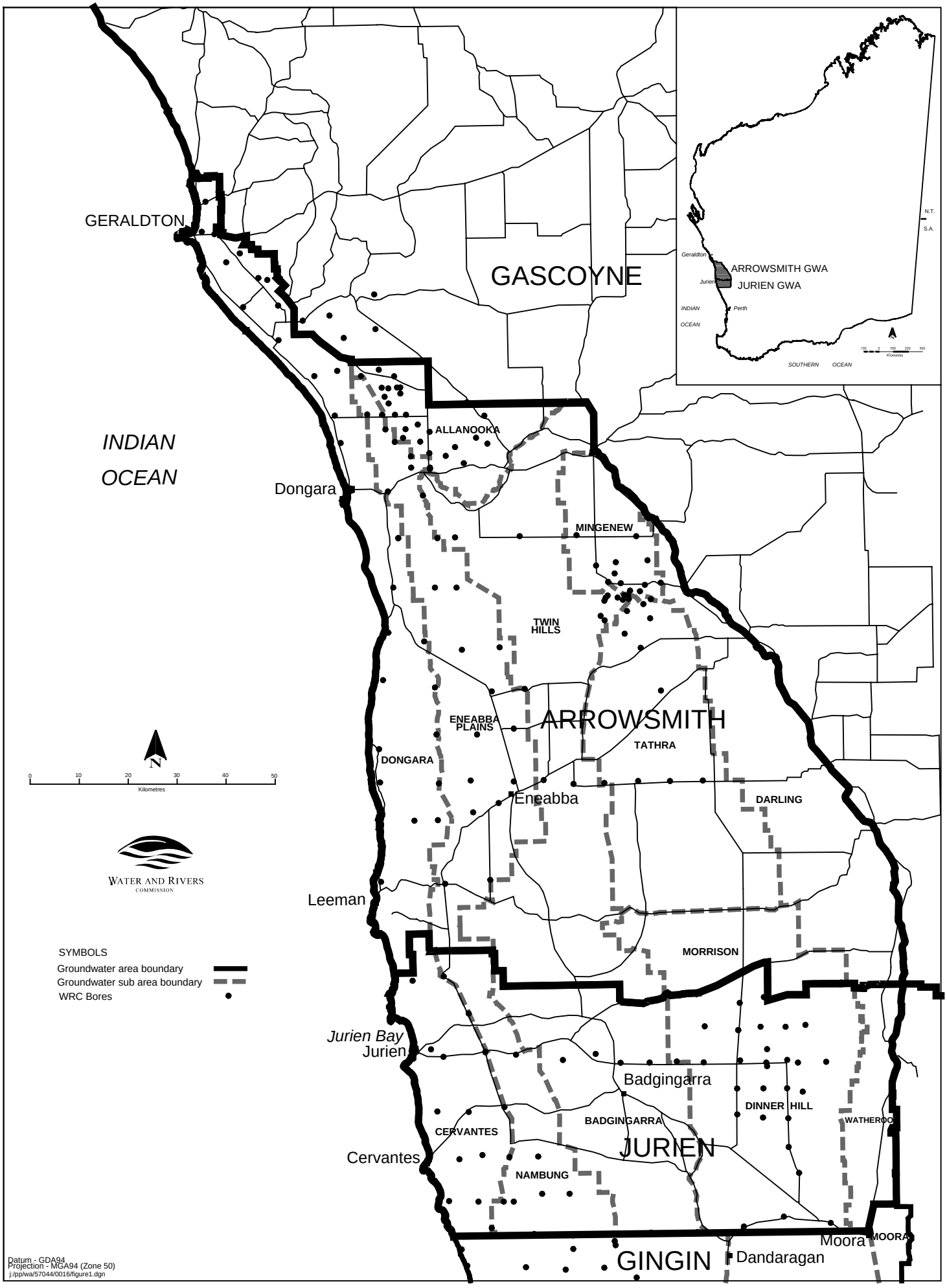

FIGURE 1 - SUB AREAS OF THE JURIEN AND ARROWSMITH GROUNDWATER AREAS

Authority, 1995). The allocation limits currently used for licensing groundwater allocation in the subareas are contained in the 1995 Plan. However, these allocation limits do not account for the environmental values at the level now required by the national water reform initiatives and the State's amended *Rights in Water and Irrigation Act 1914*. The allocation limits in the 1995 Plan cannot therefore be substantiated without further investigation into the environmental and ecological requirements. In addition, full community consultation is now required when developing a management plan.

1.4 Legislative and Policy Framework

Groundwater management in Western Australia is guided by legislation, regulations, policies and strategies at the national and State level. Predominantly it is State legislation that governs decision making on water management issues within the Arrowsmith Groundwater Area.

National Policy

National Strategy for Ecologically Sustainable Development (1992)
This policy establishes the need to develop and manage, in an integrated way, the quality of water resources and to develop mechanisms that aim to maintain ecological systems whilst meeting economic and social needs.

National Strategy for Conservation of Australia's Biological Diversity (1993)
This strategy commits governments to:

- Improve knowledge about biological diversity; and
- Protect ecosystems through legislation and policy.

Strategic Framework for Water Reform, COAG (1994)
The Council of Australian Governments Water Reform Framework Agreement outlines reforms of the nation's water resources. All States are required to pursue these reforms. Amongst many others, the COAG Water Reforms pertinent to the CGA are:

- Sustainable use of the water resources;
- Provision of water for the environment; and
- Establishment of a Tradeable Water Entitlement (TWE) market

National Principles for the Provision of Water for Ecosystems (1996)
Agricultural and Resource Council of Australia and New Zealand (ARMCANZ) goal for providing water for the environment is to 'sustain and where necessary restore ecological processes and biodiversity of water dependent ecosystems'.

Allocation and Use of Groundwater – A National Framework for Improved Groundwater management in Australia (1996)

ARMCANZ recognised that groundwater has economic and social importance and has major potential impacts on the wider natural resource base. The Framework sets out 12 recommendations regarding the sustainable use of groundwater.

State Legislation and Policy

Groundwater allocation and conservation is administered by the Department in accordance with the *Rights In Water and Irrigation Act 1914* (*RIWI Act*) as amended. This Act is the primary instrument for water management and regulation in Western Australia.

Under the RIWI Act, the right to use, flow and control groundwater is reserved in the Crown. This Act requires the compulsory licensing of groundwater bores in the Arrowsmith Groundwater Area, except where the use of bores is either exempt under section 26C or by local by-law created under section 26L of the Act.

Regulatory controls are designed:

- To encourage the responsible development of groundwater resources and limit abstraction from the aquifer to a level which can be sustained over the long-term;
- To allocate resources for beneficial private and public purposes and to meet the environmental requirements of the area;
- To enable the resources to be shared in an equitable manner; and
- To protect present and future sources of groundwater for public water supplies and for private use, where appropriate.

A list of recent Department policy documents is given in Section 12.

1.5 Current Investigations

The Department is carrying out the following work to assist in developing appropriate allocation policies:

- Determination of the groundwater dependent ecosystem and level of dependency in the region (see section 3.1). The results of this preliminary study will determine the water requirements of any groundwater dependent ecosystems (Ecological Water Requirements) and how much water will be provided to the environment taking the social and economic values into consideration (Environmental Water Provisions). The determination of EWRs will be completed by June 2002 and the EWPs will be identified in consultation with the community, which will take until June 2003 at the earliest.

- Completion (June 2001) of a comprehensive review of the hydrogeology of the Coastal Plain between Cervantes and Leeman. Preliminary results suggested that the original allocation limits in some subareas needed to be substantially reduced. The implications of these changes for existing licensees and current applicants will need to be addressed by the Department in consultation with the community.

- CSIRO Land and Water is currently undertaking a three-year research program to quantify groundwater recharge to the Parmelia and Yarragadee aquifers in the northern Perth Basin. The first year has been completed but the following years (2002 and 2003) are subject to funding. The results will enable the allocation limits of these major aquifers to be refined.

2 GROUNDWATER RESOURCES AND RECHARGE CHARACTERISTICS

The groundwater resources of the AGA are contained in eight sedimentary aquifer systems and one fractured rock aquifer system as shown in Figures 2 and 3 and Table 2. Of the eight aquifers, the superficial, Parmelia and Yarragadee aquifers currently provide most of the water for public water supply, agriculture and mining.

Table 2. Aquifers of the Arrowsmith Groundwater Area

Unconfined aquifer	Semi-confined to confined aquifer
Superficial	Otorowiri
Surficial	Parmelia
	Yarragadee
	Cattamarra
	Eneabba
	Lesueur
Fractured bedrock	

2.1 Unconfined Aquifers

The superficial aquifer (Figure 2) forms an extensive shallow unconfined aquifer system containing large groundwater resources held in sand, gravel and limestone. Properly constructed production bores tapping this system are capable of yielding up to 25 L/s (2000 m^3/day). The groundwater is generally brackish to saline in the coastal area with a salinity in excess of 1000 mg/L Total Dissolved Solids (TDS) near salt lakes. Fresh groundwater with a salinity of less than 1000 mg/L TDS is found along the Gingin Scarp and locally in the coastal dunes as a thin layer above saline groundwater.

Groundwater in the unconfined surficial aquifer system occurs only locally. Groundwater is sometimes found in alluvial and colluvial deposits, sand associated with laterite, and palaeochannel sediments. Bores yields are generally small (less than 1 L/s or 100 m^3/day), however the groundwater is generally fresh.

It is believed that these aquifers are usually unsaturated in the AGA because the watertable is generally deep (up to 80 m). Bores yields are generally small (less than 1 L/s or 100 m^3/day) and the groundwater is generally fresh.

These unconfined aquifers are recharged directly from rainwater infiltrating into the watertable. However, there may be recharge from the underlying aquifers in the coastal area, but this has not been quantified. The impacts of pumping are generally localised and the throughflow component is small. For this reason the unconfined

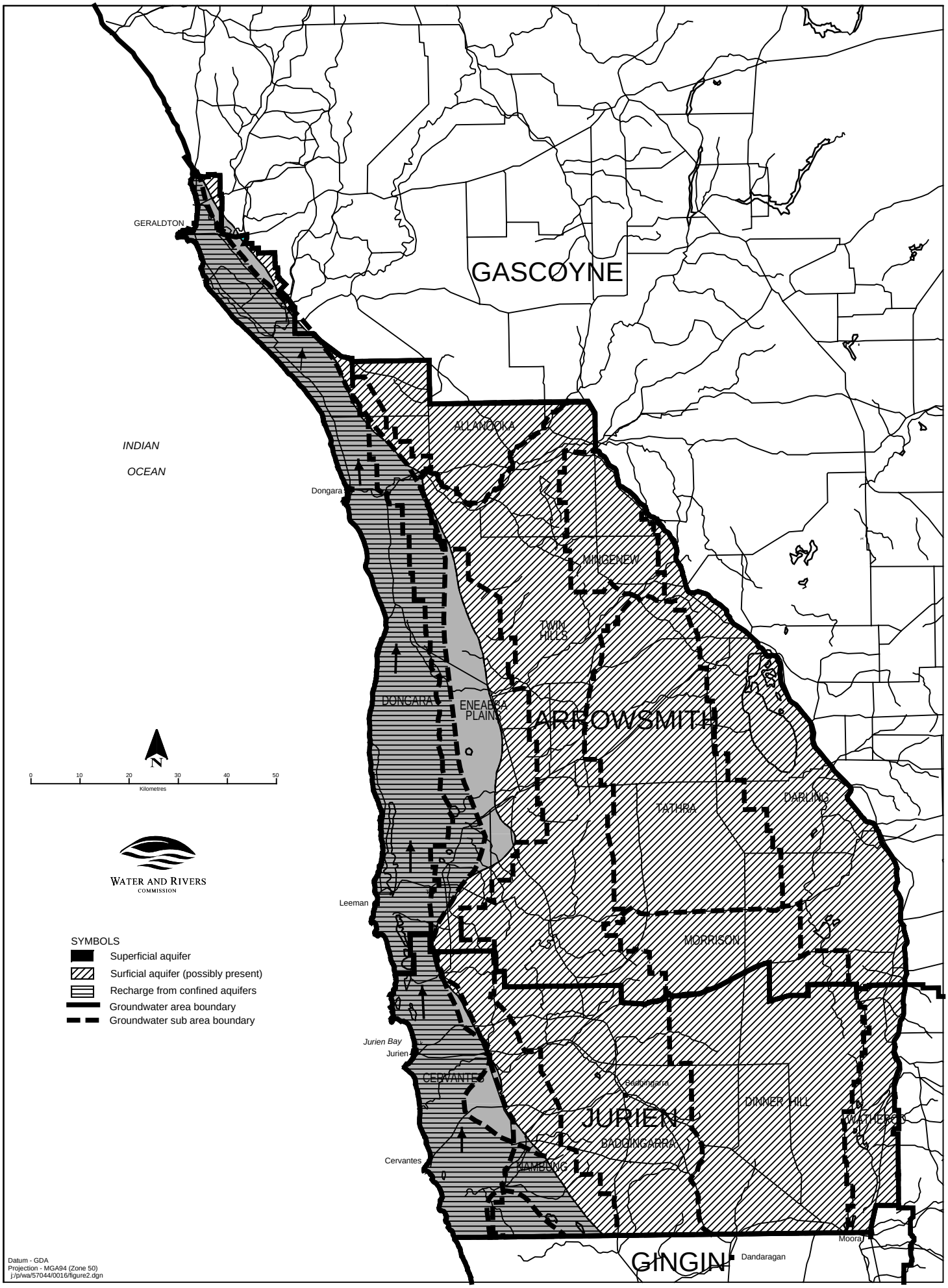

FIGURE 2 - UNCONFINED AQUIFERS IN THE JURIEN AND ARROWSMITH GROUNDWATER AREAS

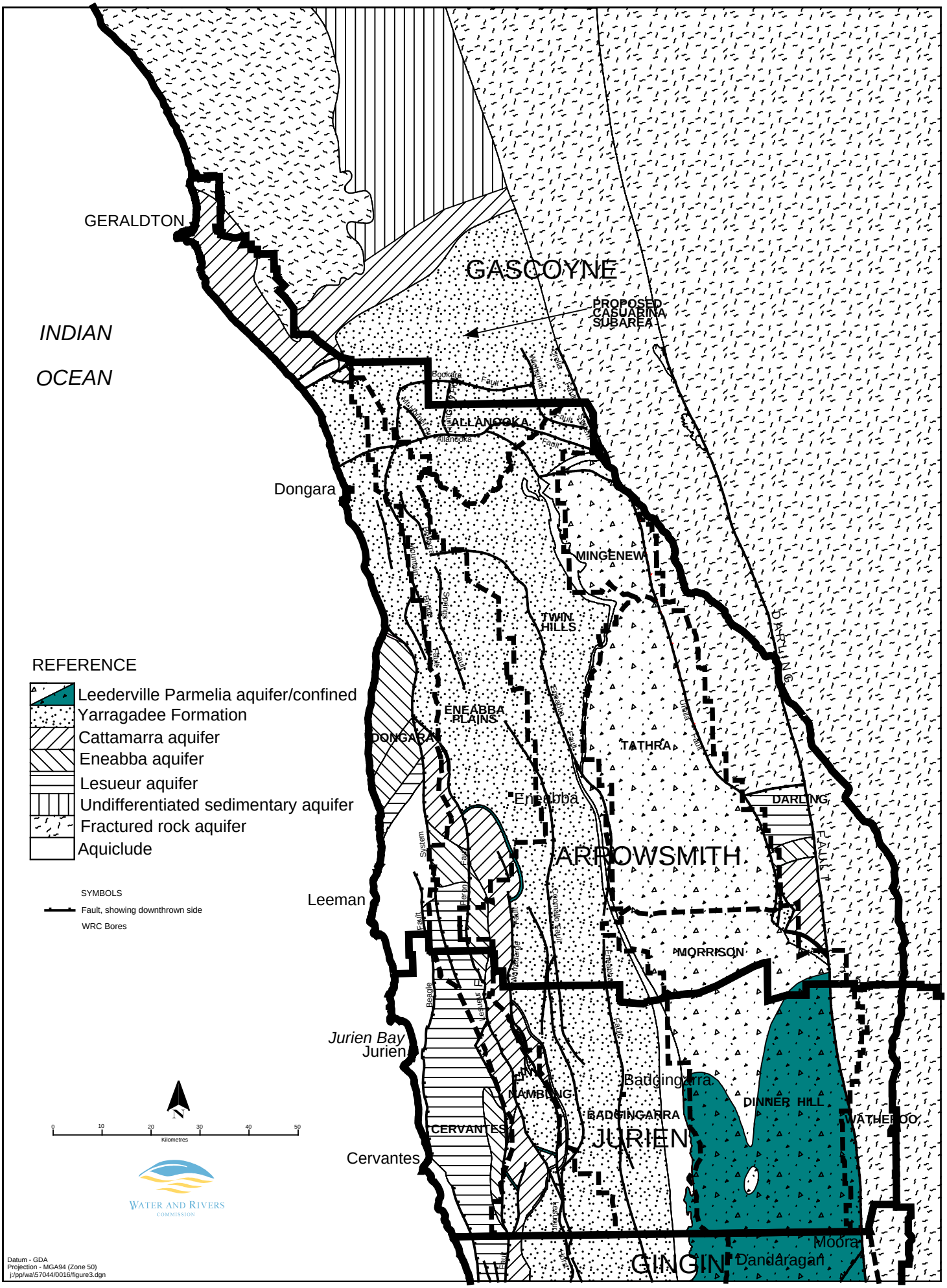

FIGURE 3. CONFINED AQUIFERS IN THE JURIEN AND ARROWSMITH GROUNDWATER AREAS

aquifers of the AGA have been divided into relatively small subareas for closer management (Figures 1 and 2).

2.2 Semi-confined to Confined Aquifers

The semi-confined to confined aquifers (Figure 3) are hydraulically connected with the overlying superficial or surficial aquifers and are recharged from groundwater that infiltrates vertically from the overlying sediments. Recharge is generally high where the aquifers are semi-confined, however recharge is limited were they are confined. The Yarragadee aquifer in the Mingenew, Tathra and Morrison Subareas is overlain by a layer of impermeable material, which restricts vertical recharge to this aquifer system.

The semi-confined and confined aquifers form extensive deep aquifers providing yields of up 60 L/s (5000 m^3/day). Groundwater is generally fresh except in the eastern and coastal area. These areas typically contain brackish to saline groundwater. The high salinity in the Darling Subarea is caused by leakage from the saline Yarra Yarra Lake system.

For all aquifer systems, the Department considered rainfall recharge to estimate groundwater availability. Rainfall recharge is obtained by considering a percentage of local mean annual rainfall that falls over the land area where soil types allow vertical seepage to occur.

Generally, the weathered and fractured rock aquifers east of the Uralla Fault (Figure 3) have a small storage capacity and provide low bore yields of up to 6 L/s (500 m^3/day) from highly fractured and weathered zones. The groundwater quantity and quality however, are highly variable and caution should be used in utilising this resource.

A major finding of the reinterpretation of the recharge characteristics shows that no direct recharge from rainfall is taking place in the confined aquifers in the coastal area as the groundwater flow is predominantly upward (Figures 2 and 3). This has important implications for revising the allocation limits.

In general, recharge to the unconfined aquifers is based on direct rainfall infiltration while recharge of the semi-confined and confined aquifers is based on downward leakage of groundwater from the overlying unconfined aquifers and throughflow from the recharge areas. There has been no direct measurement of recharge rates in the AGA hence the recharge rates for this Interim Strategy are based on extrapolation from estimates elsewhere and an understanding of hydrogeological principles. As such, the rates are conservative and precautionary, and will remain so until further work can be undertaken to increase the level of confidence.

3 SUSTAINABILITY PRINCIPLES

Sustainability must foster a long-term perspective to the management of groundwater resources in the AGA. Firstly, groundwater is not a non-renewable resource, nor is it a completely renewable resource. It has however, two major components, an almost non-renewable (not in our lifetime) component (storage) and an almost renewable component (recharge). For long-term sustainability to occur, only the renewable component should be used and the rate of usage should not be continuously greater than recharge.

Second, the effects of both current and future development must be considered in any management strategy. Third, the long-term effects of pumping, such as salt water intrusion, are not instant. They manifest themselves slowly over time, sometimes many years, and these delays must be recognised and managed. Finally, temporary losses from storage can be tolerated, however continuous losses from storage cannot and must not be permitted. Temporary losses should be balanced by intervening additions to storage. By ensuring this happens with proper management, there is no reason why the AGA should not continue to provide an assured supply of good quality water in perpetuity.

3.1 Environmental considerations – EWR / EWP principles

The management of groundwater allocation includes the determination of specific criteria, including the volume of water, required to sustain ecosystems dependent on this water. This requirement is formally known as the Ecological Water Requirement (**EWR**). EWRs are determined through the identification of values and beneficial uses and the subsequent establishment of constraints such as critical water levels in wetlands; rates of groundwater flow to discharge zones; sufficient throughflow to maintain the salt water interface; etc.

The volume of water that will actually be provided to the environment is formally known as the Environmental Water Provision (**EWP**). EWPs include the determination of the social and economic values that would be impacted upon if the full EWRs were to be allocated to the environment. Clearly, some groundwater dependent ecosystems must be afforded full protection by providing them their full EWRs. Conversely, other groundwater dependent ecosystems should perhaps not be given full protection if it results in unacceptable social and economic impacts. The objective is to strive for a sensible balance between the environmental requirements and the social/economic realities. This balance must be agreed to and provided through active community consultation and participation in the decision making processes. However, Environment Protection Authority (EPA) approval is required (Statewide Policy No. 5, see Section 12) if EWPs are to be less than EWRs. The notion of sustainability therefore, takes the above into consideration.

Section 1.5 details current investigations that will determine the water requirements and provisions for groundwater dependant ecosystems. This information will be presented in detail in the Sub-regional Groundwater Management Plan that will follow this Strategy.

3.2 Sustainable Yield / Allocation Limit Relationship

The Sustainable Yield of an aquifer system is difficult to quantify and will always be subject to error. It relates to a pumping regime that if continuously exceeded, will cause water levels and/or pressures to decline and water quality to deteriorate, both of which threaten the ability of the aquifer system to supply the required quantity and quality of groundwater in perpetuity, and adversely impact groundwater dependent environmental values. The Allocation Limit is related to the Sustainable Yield and is set by the Department for every aquifer system in every subarea to ensure that aquifer utilisation is sustainable. This is achieved by monitoring water levels and quality changes. Sustainable Yields and Allocation Limits are not static and may be amended over time with better knowledge on how aquifers respond to pumping stresses over time.

Total licensed allocations in all subareas in all aquifers will not be permitted to exceed the allocation limit as determined in this Strategy. Appendices B and C provide the allocation limit and the water availability for each aquifer (if present) in each subarea in the AGA.

3.2.1 Allocation Limit

The allocation limit is the maximum level of allocation (including public water supply held in reserve) as authorised by the Department, that can be utilised on an annual basis, which allows acceptable levels of pumping stress, and protects dependent economic, social and environmental values. The allocation limits are set by considering aquifer recharge, the water requirements of dependent ecosystems (EWRs), and the volume of water that will be provided to the environment taking into consideration the social and economic impacts of such a provision (EWPs). To take a non-precautionary approach may result in an unacceptable risk to both the groundwater dependent ecosystem and the individual enterprise relying on the aquifer system.

The allocation limit for each aquifer system is derived from a percentage of rainfall recharge over the area in which the aquifer occurs. In addition, preliminary EWRs have been accounted for in this process. On a subarea basis, the allocation limit for each aquifer is derived from the percentage of rainfall recharge over the portion of the subarea in which the aquifer occurs. The calculation of allocation limits is presented in Appendix A.

There are exceptions to this principle. The methodology used to establish the allocation limit of the Parmelia aquifer in the Morrison Subarea is based on rainfall recharge over the whole aquifer system and redistributed on a subarea basis. This principle allows for more equitable distribution of the available resource. The allocation limit for the Yarragadee aquifer in the Allanooka Subarea includes a large portion of recharge originating in the recharge area north of Allanooka (proposed extension of subarea boundary) (Figure 3). The allocation limit for both the Eneabba and Lesueur aquifers in the Eneabba Plains Subarea includes some recharge from the adjacent Cattamarra aquifer.

The detailed EWRs and EWPs have not as yet been determined for the AGA, hence the allocation limits in this document should be considered only as interim. The Department has set preliminary EWRs for the superficial and surficial aquifers representing **30%** of rainfall recharge based on conservative estimates in other parts of the Perth Basin. This means that 70% of rainfall recharge is available for consumptive use. This estimate takes into account wetlands, groundwater dependent vegetation as well as the static location of the saltwater interface along the coastline. The preliminary EWRs for the semi-confined and confined aquifers have been set at **10%** of rainfall recharge to allow for maintenance of springs and groundwater dependant vegetation in discharge areas. This means that 90% of rainfall recharge is available for consumptive use.

4 WATER AVAILABILITY

Appendices B and C show the interim allocation limits and derivation of the groundwater availability for each aquifer in each subarea in the AGA. The level of licensed allocation, public water supply reserves, applications for allocation, and the sum of these, is compared to the interim allocation limit. This determines the water availability for each subarea. Table 3 summarises groundwater use and availability as of January 2002.

Table 3. Groundwater Allocation and Availability in the Arrowsmith Groundwater Area (January 2002)

Dongara Subarea	Number of licences	Allocation range (KL/yr)	Water availability (KL/yr)
Superficial aquifer	98	1000-730,000	2,518,915
Surficial aquifer			Aquifer absent
Parmelia aquifer			Aquifer absent
Yarragadee aquifer	3	48,000-470,000	3,922,000
Cattamarra aquifer			200,000
Eneabba aquifer			None
Lesueur aquifer			None
Eneabba Plains Subarea			
Superficial aquifer	8	1000-30,000	12,497,830
Surficial aquifer			Unknown
Parmelia aquifer			Aquifer absent
Yarragadee aquifer	11	15,000-15,000,000	3,715,000
Cattamarra aquifer			200,000
Eneabba aquifer	1	700,000	1,300,000
Lesueur aquifer			1,330,000
Twin Hills Subarea			
Superficial aquifer			Aquifer absent
Surficial aquifer	2	10,000-70,000	Unknown
Otorowiri aquifer			500,000
Parmelia aquifer			3,400,000
Yarragadee aquifer	4	1500-6,000,000	37,718,000
Cattamarra aquifer			500,000
Eneabba aquifer			400,000
Lesueur aquifer			None

Allanooka Subarea	Number of licences	Allocation range (KL/yr)	Water availability (KL/yr)
Superficial aquifer			Aquifer absent
Surficial aquifer			Unknown
Parmelia aquifer			Aquifer absent
Yarragadee aquifer	6	1,500-12,000,000	575,750
Cattamarra aquifer			Aquifer absent
Eneabba aquifer			Aquifer absent
Lesueur aquifer			
Mingenew Subarea			
Superficial aquifer			Aquifer absent
Surficial aquifer			Unknown
Otorowiri aquifer			100,000
Parmelia aquifer	5	14,000-400,000	5,337,000
Yarragadee aquifer			Aquifer absent
Cattamarra aquifer			Aquifer absent
Eneabba aquifer			Aquifer absent
Lesueur aquifer			Aquifer absent
Fractured rock aquifer	2	14,000-40,000	Unknown
Tathra Subarea			
Superficial aquifer			Aquifer absent
Surficial aquifer			Unknown
Parmelia aquifer	7	18,000-1,055,000	28,658,000
Yarragadee aquifer			700,000
Cattamarra aquifer			50,000
Eneabba aquifer			100,000
Lesueur aquifer			100,000
Fractured rock aquifer	2	18,000-21,000	Unknown
Morrison Subarea			
Superficial aquifer			Aquifer absent
Surficial aquifer			Unknown
Otorowiri aquifer			100,000
Parmelia aquifer			3,500,000
Yarragadee aquifer			1,000,000
Cattamarra aquifer			50,000
Eneabba aquifer			Aquifer absent
Lesueur aquifer			Aquifer absent
Fractured rock aquifer			Unknown
Darling Subarea			
Superficial aquifer			Aquifer absent
Surficial aquifer			2,500,000
Parmelia aquifer			100,000
Yarragadee aquifer			200,000
Cattamarra aquifer			400,000
Eneabba aquifer			400,000
Lesueur aquifer			1,400,000
Fractured rock aquifer			Unknown

Allocation limits in the confined aquifers in the coastal area have been significantly reduced because no local recharge from rainfall is taking place as groundwater flow is predominantly upward.

The main implications and recommendations for each of the aquifers in the Groundwater Area are as follows:

Surficial and superficial aquifers

- Applicants requesting a groundwater allocation of more than 25,000 KL/yr from a single bore from the surficial aquifer, or 50,000 KL/yr from a single bore from the superficial aquifer, will be required to provide the Department with a geophysical bore log in addition to a lithological log to prove that the bore is screened into the unconfined aquifers;

- Due to the large number of wetlands and other environmentally significant features in the Area, applicants requesting more than 250,000 KL/yr from the superficial aquifer will need to first obtain a licence to explore for water. The licence will allow the applicant to prove the resource can supply the required volume, investigate the potential impacts of the proposed pumping to the environment and other users, and to optimise the pumping regime to limit these impacts; and

- At the conclusion of the investigation, the applicant is required to submit a hydrogeological report to the Department, adhering to the Department's guidelines for such reports (see Section 12). The Department will then consider the issuing of a licence to take water if the impacts of the proposed pumping are assessed as acceptable.

Parmelia aquifer

- The allocation limit for the Parmelia aquifer has not been determined with an acceptable degree of confidence. However, the local expression of interest for this aquifer significantly exceeds the estimated limit. Please refer to Table 3 and Appendices B and C for the available groundwater for each subarea.

Yarragadee aquifer

- Up to 37,718,000 KL/yr of groundwater may be available for consumptive use in the Twin Hills Subarea but the resource is limited in the rest of the area;

Other sedimentary aquifers

- The Otorowiri aquifer refers to saturated lenses of sand within the Otorowiri Siltstone. It can provide domestic and stock water supply.

- The Cattamarra and Eneabba aquifers are now considered as two distinct aquifers as opposed to one single aquifer (Cattamarra Coal Measures) in the 1995 Arrowsmith Groundwater Area Management Plan (Water Authority, 1995); and

- Recharge to the Cattamarra, Eneabba and Lesueur aquifers is now believed to be much smaller as groundwater flow is predominantly upward in the coastal area (Figures 2 and 3).

Weathered and fractured rock aquifers

- The bedrock along the eastern boundaries of the AGA contains weathered and fractured rock aquifers which are generally unproductive but can supply useful volumes of groundwater for small scale uses in some areas;

- Generally, allocations in these aquifers will not be restricted but it is important to be aware that reliance on these aquifer systems for a primary source of water poses some risk; and

- The Department strongly advises that applicants planning to access these aquifer systems obtain expert advice on the aquifer's ability to meet their short and long term water requirements

4.1 Climate Change

Climate change is a problem where cause and effect is separated over very long time scales. Climate change may pose a future risk to water supply, but predicting the degree of impact is made difficult by the long response times and large uncertainties. As the scientists grapple with predicting the impacts of climate change on water supply, it is wise for both water managers and water users not to ignore it but to be aware that it may impact on the availability of water in the future.

The allocation limits for the subareas in the AGA were calculated on the basis of the current understanding of the prevailing climate conditions. A long term shift to drier years, may impact on the rainfall patterns which will affect the recharge characteristics and ultimately reduce the availability of water. This in turn could result in a reduction of the allocation limits, which may require a corresponding reduction in water entitlements and water use. On the other hand, a long term shift to wetter years could have the opposite effect. However, it should be noted that response times to climate change would be greater for confined aquifer systems and corresponding impacts are likely to be less.

Climate change is a whole of community concern and whilst there is no immediate need to incorporate climate change into this Interim Allocation Strategy, all water users should be aware that climate change is real and it may impact on the way water is allocated and used in the future.

4.2 Risks Associated with the Interim Allocation Limits

Full utilisation of the interim allocation limit of the Parmelia aquifer in the Dandaragan Subarea is subject to a low level of risk**.** This is because the sustainable yields are based on relatively conservative rainfall recharge rates and the aquifer is subcropping. In some areas, land clearing exceeds 90% of the land area, allowing more rainfall recharge.

Full utilisation of the interim allocation limit of the Eneabba aquifer in the Eneabba Plains Subarea is subject to a moderate level of risk. This is because the allocation limits were calculated using rainfall leakage over the respective subarea and have not

taken into account potential leakage from the overlying superficial aquifer induced from groundwater abstraction from the confined aquifers because of unreliable data.

Full utilisation of the interim allocation limit of the Yarragadee aquifer in the Allanooka Subarea is subject to a higher level of risk. Risk factors include a low level of hydrogeological knowledge; low level of current use and therefore little ability to assess system response to increased stress; and demand in excess of availability.

Although there is an acceptable risk associated with the interim allocation limits for the Allanooka Subarea, actual water use in all subareas is significantly less than the allocation limit and will remain so for a number of years. As the utilisation of the aquifer increases, the allocation limit will be reviewed and reduced if water levels and/or water quality decline is deemed to be unacceptable for long term sustainability.

The allocation limit in the Allanooka Subarea can be enhanced by incorporating the groundwater availability from the recharge area to the north (proposed Casuarinas Subarea of the Gascoyne Groundwater Area) (Figure 3 and Appendices B and C). This has the potential to effectively increase the total water availability, however the current allocation limit in the Allanooka Subarea cannot be increased until further investigative evaluation work is carried out.

4.3 Public Water Supply held in Reserve

Table 4 shows the current allocations held in reserve by the Department for future public water supply (PWS). These reserves are committed and as such, are included together with licensed allocations when determining the percentage of allocation limit that is currently authorised for use (Appendices B and C). These reserves will be reviewed during the preparation of the Sub-regional Groundwater Management Plan.

Table 4. Current public water schemes and reserves in the Arrowsmith Groundwater Area

Subarea	Aquifer	Current PWS Allocation (KL/yr)	Proposed PWS reserves (KL/yr)
Dongara	Superficial	740,000	1,000,000
Eneabba Plains	Superficial		2,000,000
	Yarragadee	800,000	1,000,000
	Lesueur	470,000	0
Allanooka	Yarragadee	12,000,000	8,000,000
Twin Hills	Yarragadee	0	5,000,000
	Lesueur	0	100,000
Mingenew	Parmelia	720,000	2,000,000
Tathra	Parmelia	640,000	2,000,000
Morrison	Parmelia	0	500,000
Total		**15,730,000**	**21,600,000**

The PWS reserves may, under special circumstances, be used to offset changes to allocation limits that may impact on existing licensees. The reserves may also be used to cater for population growth, or land developments of State significance. The Department is currently assessing the feasibility of temporary utilisation of these reserves for short term beneficial uses. Such decisions will be made on a case by case

basis. As detailed in the Statewide Policy No. 6 (see Section 12), water service providers or other proponents seeking access to these reserves may be required to purchase or lease these allocations at current market price should the resource become fully allocated and a water trading market is established.

5 GROUNDWATER LICENSING GUIDELINES

The Arrowsmith Groundwater Area is a Proclaimed Groundwater Area under the *Rights in Water and Irrigation Act (1914)*, and as such, access and use of groundwater is subject to licensing. Consequently, licences are issued under Part III of the RIWI Act and in accordance with Department policy, which is to licence water use up to sustainable limits only where there is an immediate need and efficient water use can be demonstrated.

The broad guidelines for dealing with either current licensees or applicants requesting access to the groundwater resources in the AGA are outlined below. These guidelines apply to all aquifers and will remain current until the Groundwater Management Plan is finalised, or until changes to the guidelines are authorised by the Department.

Further information on licensing and other aspects of the Act can be obtained by accessing the information pamphlets (Appendix D) from the regional office in Geraldton.

5.1 Existing Licences

If a licensee is not utilising all of the authorised allocation in accordance with the approved development, the licensee will be asked to explain why the allocation should not be reduced to better reflect current use and near future requirements. Licensees may be required to collect monthly water usage figures and provide them to the Department on an annual basis.

The Midwest Gascoyne Region will also conduct random surveys of use in the following subareas:

- Yarragadee aquifer in the Allanooka Subarea
- Yarragadee aquifer in the Dongara Subarea
- Eneabba aquifer in the Eneabba Plains Subarea
- Lesueur aquifer in the Eneabba Plains and Twin Hills Subareas

Random surveys of use for the remaining subareas may be undertaken at a later time as water use in these subareas approaches the interim allocation limits.

The Department will act to reduce unused portions of licensed allocations when there is no clear justification that extenuating circumstances have resulted in part of the entitlement not being used. The ‘use it or lose it’ rule will be strictly adhered to, to ensure unused allocations are not hindering sustainable development

5.2 Current Letters of Intent

Whilst the Department is no longer issuing letters of intent, it will honour current letters of intent but only until their expiry date.

If the applicant has met all the conditions in the letter of intent, the Department will honour its commitment and issue the applicant with a licence, provided the licence issue does not result in or contribute to over-allocation.

5.3 Expired Letters of Intent

Holders of letters of intent that have expired and have not applied for extensions will be informed in writing that the Department's commitment to the letter of intent has also expired. Their application will then have no formal commitment attached and will be considered along with other pending or new applications.

For applicants that have formally applied in writing for an extension to their letter of intent, the Department will consider the work undertaken by the applicant to meet the conditions in the letter.

- If it is determined that the applicant has made reasonable attempts to meet the conditions, and/or has met most of the conditions outlined in the letter, the Department may extend the letter of intent for a further 60 days.

- If it is determined that the applicant has not made any reasonable attempt to meet the conditions while the letter of intent was valid, the Department will inform the applicant that the letter of intent and the Department's commitment have now expired.

5.4 Existing Licences for Exploration Purposes

Existing licences for exploration purposes have been issued in the past for a period of up to 10 years to some applicants that have applied for licences take water for a specific purpose. This allows the applicant to investigate whether there is sufficient water available to meet the desired requirements of the development plan and to determine the likely impacts caused by pumping.

- In some cases, applicants have been informed that the Department gives no guarantee that a licence to take water will be issued at the completion of the investigation. **This position is reiterated and reinforced here**. Applicants should also be aware of the new interim allocation limits and the water availability in their Subarea (as shown in Appendices B and C) before embarking on an exploration program. This updated information is available from the Department's Geraldton office

- Holders of current licences for exploration purposes who have not started any exploration work, are advised that the allocation limits in some subareas are interim only and under review. A reduction in the allocation limit may impact on the likelihood of obtaining a licence to take water or for the quantity sought,

particularly for those exploring for water in the Parmelia aquifer system in subareas that are close to full allocation.

- Licence holders are further advised that it is likely that applications for a licence to take water in these subareas and aquifer systems may be refused, even if the drilling program has confirmed the presence of sufficient groundwater to meet their needs.

- Licence holders of expired licences for exploration purposes who have not undertaken any exploration work, are hereby informed that their expired licence will not be renewed. This will generally not be a problem in under-allocated subareas as a new exploration licence may be issued for a term defined by the Department (generally no longer than 12 months). However, the Department advises that holders of expired licences for exploration purposes in fully allocated subareas or areas where demand already exceeds supply should not undertake any drilling work or other activity as it is unlikely that licences for taking water will be issued.

5.5 Applications for New Licences for Exploration Purposes

- The Department may issue a groundwater exploration licence for a period of 12 months, or as otherwise determined by the Department, in subareas where the interim allocation limit is not fully committed (see Table 3 and Appendices B and C).

- The Department will continue to issue groundwater licences for exploration purposes in subareas where the interim allocation limit is fully committed only in cases to allow the assessment of the aquifer performance for the purpose of future groundwater trading (see Section 6).

- Licences for exploration purposes do not guarantee that a licence to take water will be forthcoming or indicate what quantity of water will be available under any subsequent licence.

5.6 Pending Licence Applications

Currently there are many licence applications to take water under consideration with no commitments from the Department. These applications will be assessed using the interim allocation limits in this document.

5.7 New Licence Applications

- New applicants should be aware of the interim allocation limits and the on-going review. New applications will be assessed using the new interim allocation limits. Applications for licences to take water in subareas that are fully allocated will be refused.

New applications will be generally considered on a ‘first in–first served’ basis (see Section 6). This is the current Department’s practice. Where sufficient water is

available to meet the applicant's requirements, a licence may be issued after the applicant has met all the Department's conditions.

5.8 Renewal of Existing Licences

- Groundwater licences to take water are valuable documents that should be kept in a safe place and not allowed to expire.

- It is the licence holder's responsibility to make an application to extend the term of the existing licence prior to the expiry date.

Generally, when a licence to take water expires in an under-allocated subarea and the licensee has abided by all the licence conditions, the licence will normally be extended for a further period. However, if a licence to take water expires in a fully-allocated subarea, and the licensee has abided by all the licence conditions, there is no guarantee that the term of the licence will be automatically extended and the licensee may need to show cause why the term of the licence in its entirety should be extended. If a licensee has not abided by all the licence conditions in a fully-allocated Subarea, the licence is unlikely to be extended.

In addition, if at the time of application, licensees are using less water for the approved purpose than the licensed allocation, the licensee will be asked to show cause why the allocation should not be reduced to better reflect the amount of water actually being used.

5.9 Applications for Increasing an Existing Allocation

An application to increase a licensed allocation will be treated as new application for additional water requested.

5.10 Advertising Licence Applications

An applicant is required to advertise any new and additional applications to take water in excess of 100,000 KL/yr in a newspaper circulating daily in the State and in the local media.

5.11 Development Plans and Monitoring Conditions

Applications for large allocations must be accompanied by a detailed development plan and timetable that stipulates their required water need for each stage of the development. Should the total requested water be available, the Department may gradually increase the allocation to satisfy the water needs in accordance with the agreed development timetable. If the proposed development does not take place or is delayed, the licensee should show cause why the allocation should be renewed for the following years or stages. In the event that less water is required for the development than originally anticipated, or there is adverse impact on other users or the environment, the licence allocation may be reduced.

Conditions can be applied to licenses to monitor and report on aquifer performance in response to groundwater abstraction. Some key performance indicators can include

the routine measurement of groundwater levels and salinity. Monitoring is not necessarily restricted to the development area, but where required, the Department can also request off-site monitoring of impacts. This information is used in conjunction with the Department's regional water monitoring program to ensure protection of neighbouring groundwater users, minimise environmental degradation and maintain the long term sustainability of the aquifer system.

5.12 Domestic and Stock Water

Domestic and stock water demand is given a high priority in areas where no reticulated water supply exists.

Section 5C of the RIWI Act details that all persons must have a licence to take artesian groundwater and non-artesian groundwater in areas proclaimed under section 26B for any purpose, including domestic and stock supplies.. A licence is also required to be issued under section 26D of the Act prior to constructing artesian bores located anywhere in the Western Australia and non-artesian bores in areas proclaimed under section 26B of the Act. However, the Department is currently preparing statewide guidelines for managing domestic and stock water supplies. Until these guidelines have been prepared, all persons wishing to construct and/or use existing bores for domestic and stock supplies should contact the regional office in Geraldton.

6. ALLOCATION PRINCIPLES

The Department's current practice of water allocation is the *first in - first served* (FIFS) approach. This means that the water is generally allocated in order of application. However, there is increasing competition for access to water resources in the AGA which has raised community interest in how water is allocated and whether the FIFS principle is appropriate from a water sharing perspective.

The Department is currently reviewing the FIFS principle together with other mechanisms for water allocation. These deliberations will be subject to community consultation with the development of the Management Plan.

In the interim, the Department will assess new applications for large allocations in accordance with the following guidelines and order of priority:

- Groundwater will continue to be allocated on a FIFS basis in the interim, until the total licensed allocations reach 70% of the subarea's allocation limit. Applications in excess of 70% will be deferred.

- In addition to the above, individual applications will be limited to a maximum of 10% of the subarea's allocation limit. Any application for a new or amended licence that requests greater than 10% of the allocation limit will be referred to the Water Resources Management Committee for recommendation to the Department.

- Prior to reaching 70% of the allocation limit, the Department will publicise that the allocated resource will reach this limit soon and will invite formal applications from interested parties for the final allocation stage.

- The Department will continue to approve individual allocations for small enterprises up to a maximum of 10,000 KL/yr after the 70% trigger is reached.

- Once 70% of the allocation limit has been allocated, all new large applications (in excess of 10,000 KL/yr) will be treated together, subject to a reserve allocation being made for reasonable domestic and stock water requirements.

- The remaining 30% of the available water would be allocated according to a number of options such as:

  a) Continue to allocate water on a FIFS basis;
  b) Restrict individuals to a percentage of the available water;
  c) Allocate water on a merit selection basis based on a weighting of environmental, social and economic criteria;
  d) Allocate water by auction or tender process; and
  e) Other methods or a combination of the above.

  The preferred option(s) and specific criteria and weighting will be determined through the Water Resources Management Committee process.

- In addition to the above principle, annual reporting of monthly pumping, including flow metering, will become mandatory at the 70% trigger for all non-domestic and stock bores with an allocation of 20,000 KL/yr or more. This is a significant shift from current policy which states that only allocations in excess of 500,000 KL/year require metering in the area. Accurate usage is vital to identify "sleeper" allocations for groundwater trading and to ensure usage impacts can be determined.

- Once 100% of the allocation limit has been allocated, the Department will not issue any further licences to take water. The Department will continue to monitor the impact from pumping as usage approaches the allocation limit which can then be refined based on the performance of the resource.

- The introduction of water markets can then be assessed once the sustainable yields have been refined with a high degree of confidence. Licences for exploration purposes may only be issued to allow proving up a water resource in anticipation of obtaining an entitlement through trading.

7 TRADEABLE WATER ENTITLEMENTS (TWEs)

The amended *Rights in Water and Irrigation Act (1914)* enables the implementation of Tradeable Water Entitlements (TWEs) in Western Australia. This enables a licence holder to trade all or part of the licensed entitlement to take water, to another water user.

The Department is currently developing statewide guidelines (see Section 12, Policy No 6) that will provide the framework for how trading can operate.

Trading is a market-based instrument that can be used to:

- Reallocate scarce groundwater resources to uses with higher economic benefit;
- Achieve more efficient use of water resources;
- Allow the water industry to respond to changing conditions; and
- Assist regional development.

Groundwater trading also offers the potential to solve difficult management issues as demand for use of a limited resource increases. It allows new developments access to water in a fully allocated system. The market offers an alternative to 'command and control' approaches by allowing a redistribution of water to users of higher economic value and higher efficiency within the bounds of acceptable environmental changes.

TWEs must operate within the water resource management planning framework, including adequate technical assessment of resource availability community and industry consultation and liaison. TWEs become effective only where licensed allocations have reached allocation limits and when impacts of proposed trades are considered acceptable by the Department.

Groundwater trading will be introduced to particular subareas when they become fully allocated. The Department in partnership with the Midwest Water Resources Management Committee (see Section 7) will develop the local trading rules.

Information on the rules of trading, applications to trade, technical assessments and notification, should be made to local Department of Environment, Water and Catchment Protection Officers listed in Section 9.

8 PROPOSED WATER RESOURCES MANAGEMENT COMMITTEE

The Department has commenced the process of establishing approximately sixteen community-based Water Resources Management Committees in Western Australia over the next ten years. One identified Water Resources Management Committee is proposed to be established in the Midwest locality that will include the AGA and some of the Gascoyne Groundwater Area to the north. The timing on the establishment of the Midwest Water Resources Management Committee will be dependant on water use demand pressures in the AGA, and is likely to occur when a number of Subareas (particularly in the Parmelia and Yarragadee aquifers) approach 70% of their allocation limit. When established, the Midwest Water Resources Management Committee will assist in regularly reviewing the effectiveness of the Interim Allocation Strategy until the Sub-Regional Groundwater Management Plan for the AGA has been developed, with their assistance. It is proposed that the Midwest Water Resources Management Committee will:

- Provide for and encourage the community to take an active role in the management of water resources through membership and representation on the Committee;

- Help the Department to determine a fair and equitable water allocation decision and that there is a balance between the community interest and effective management of the resource and any identified dependent ecosystems;

- Have an active role in the allocation planning, licensing and compliance processes;

- Increase community awareness of water resource issues;

- Provide an opportunity for the exchange of views and knowledge between the community and the Department;

- Assist the Department in the resolution of disputes;

- Develop access and use policies that will drive sustainable groundwater development; and

- Advise the Department on water related issues.

9 CONCLUSIONS

The Department is moving towards a groundwater allocation system based on the management of the long term sustainability of the resource under clearly defined objectives. Paramount in this is a move away from excessive regulatory controls to more flexible, outcome focused management. The full participation of the community in the decision-making processes is also an important aspect of this new approach. This will be achieved in a number of ways including the establishment of community-based, local Water Resource Management Committees that will provide the Department with assistance and advice on matters relating to the sustainable management of water resources.

One important aspect of effective and efficient management of the groundwater resources lies in achieving a sensible balance between competing environmental, social and economic demands. At the same time, the Department must posses a powerful but fair set of regulations which allow a swift and flexible response to problems. Apart from a clear groundwater allocation and management policy, there is a need for a clear licensing and regulatory policy, the will to adhere to the licensing conditions and regulations, and the will to enact the legislation if need be.

The Department is committed to ecologically sustainable development of the Gingin, Jurien and Arrowsmith Groundwater Areas with the provision that reasonable pumping levels are maintained, water quality does not deteriorate below its beneficial uses, equity of access is maintained and there are no adverse environmental impacts. Development of these groundwater areas will therefore be restricted to the allocation limit as determined for each subarea. In time, as more technical information becomes

available, the allocation limits that are presented in this Allocation Strategy will be amended to reflect the additional information. Clearly, a conservative and precautionary approach is the only responsible management strategy that can be adopted, with the recognition and acceptance of the level of risks associated with decision making based on the current level of technical data.

Clearly, groundwater systems with their inherent complexities and variable characteristics, are difficult to assess at the best of times. Additionally, groundwater investigations are generally costly and time consuming. These constraints however, should not deter the need for more intensive investigations and the following work should be undertaken in the future:

- Groundwater recharge processes and quantification ;
- Improve the monitoring network;
- Determine the ecological water requirements and the water required for the environment and the refinement of allocation limits; and
- Extensive consultation with community groups and stakeholders in the area be undertaken to ensure familiarisation of this strategy and constructive input to the Sub-Regional Groundwater Management Plan.

10 CONTACT FOR FURTHER INFORMATION

For further information, including licensing matters, please contact the following Department's officers in the first instance:

Mr Kim Griffin tel: 9964 5978
Midwest Gascoyne Region
Department of Environment, Water and Catchment Protection
Pass Street
GERALDTON WA 6530

For technical matters, please contact:

Mr Alex Kern
Senior Water Allocation Officer
Department of Environment, Water and Catchment Protection
3 Plain Street
EAST PERTH WA 6004
Tel: 9278 0399

11 REFERENCE

Water Authority of Western Australia, 1995, *Arrowsmith Groundwater Area Management Plan.* Report No. WG153.

12 SUPPORTING DOCUMENTS

Water and Rivers Commission, 2000; Statewide Policy No. 3 Policy statement on water sharing.

Water and Rivers Commission, 2000; Statewide Policy No. 5 Environmental water provisions policy for Western Australia.

Water and Rivers Commission, 2001; Statewide Policy No. 6 Transferable (Tradeable Water Entitlements for Western Australia).

Department of Environment, Water and Catchment Protection, in prep.; Confined aquifer policy.

Department of Environment, Water and Catchment Protection, in prep.; Fractured rock aquifer policy.

Department of Environment, Water and Catchment Protection, in prep.; Guidelines for hydrogeological reports.

APPENDIX A

CALCULATION OF ALLOCATION LIMITS

Groundwater allocation limit calculation – Arrowsmith Groundwater Area

Subarea	Aquifer	Area km^2	Rainfall m/yr	Recharge rate	Total gross recharge GL/yr	Preliminary EWPs based on rainfall recharge over subarea[a] GL/yr	Sustainable yield GL/yr	Previous allocation limit (1995) GL/yr	New allocation limit GL/yr	Net Change GL/yr
Dongara	Superficial	167.50[b]	0.50	0.06	5.03	1.51	3.52	8.0	8.4[c]	
	Yarragadee	2.82		0.05	0.07	0.01	0.1	4.5	4.5[d]	
	Cattamarra	44.69		0.01	0.22	0.02	0.2	0	0.2	+0.2
Eneabba Plains	Superficial	472.50[b]	0.55	0.08	20.79	6.24	14.55	0	14.6[e]	+14.6
	Yarragadee	797.13		0.05	21.92	2.19	19.7	22.5	22.5[f]	
	Cattamarra	90.93		0.01	0.50	0.05	0.5	(~1.0)[g]	0.2	-0.8
	Eneabba	29.19		0.03	0.48	0.05	0.4	(~1.0)[g]	2.0[h]	+1.0
	Lesueur	62.33		0.03	1.03	0.10	0.9	1.8	1.8[i]	-0.9
Twin Hills	Otorowiri	Unknown							0.5[j]	+0.5
	Parmelia	136.96		0.05	3.77	0.38	3.4	0	3.4	+3.4
	Yarragadee	1971.58		0.05	54.22	5.42	48.8	33.0	48.8	+15.8
	Cattamarra	98.63		0.01	0.54	0.05	0.5	1.5	0.5	-1.0
	Eneabba	29.82		0.03	0.49	0.05	0.4	0.5	0.4	-0.1
	Lesueur	9.59		0.03	0.16	0.02	0.1	0.2	0.2[i]	
Allanooka	Yarragadee	544.39		0.10	24.50	2.46	22.0	28.8	28.8[k]	
Mingenew	Surficial	0	0.50					Limited	0 (mostly unsaturad)	
	Otorowiri	Unknown							0.1[j]	
	Parmelia	365.16		0.05	9.13	0.91	8.2		8.2	
	Fractured bedrock	Unknown							Unknown	

Subarea	Aquifer	Area km^2	Rainfall m/yr	Recharge rate	Total gross recharge GL/yr	Preliminary EWPs based on rainfall recharge over subarea[(a)] GL/yr	Sustainable yield GL/yr	Previous allocation limit (1995) GL/yr	New allocation limit GL/yr	Net Change GL/yr
Tathra	Surficial	0	0.50					Limited	0 (mostly unsaturated)	
	Parmelia	1491.80		0.05	37.30	3.70	33.4		33.4	
	Yarragadee	29.26		0.05	0.73	0.07	0.7	0[(l)]	0.7 (brackish)	+0.7
	Cattamarra	6.00		0.01	0.03	0.0	0.03	0	0.1 (brackish)	+0.1
	Eneabba	5.68		0.03	0.08	0.01	0.1	0	0.1 (brackish)	+0.1
	Lesueur	10.68		0.03	0.16	0.02	0.1	0	0.1 (brackish)	+0.1
	Fractured bedrock	Unknown							Unknown	
Morrison	Surficial	0	0.50					Limited	0 (mostly unsaturated)	
	Otorowiri	Unknown							0.1[(j)]	
	Parmelia[(m)]	513.73							4.0[(m)]	
	Yarragadee	11.51 29.26		0.05 0.05	0.29 0.73	0.03 0.07	0.3 0.7	0[(g)]	0.3 (fresh) 0.7 (brackish)	+0.7
	Cattamarra	12.49		0.01	0.06	0.01	0.1	0	0.1 (brackish)	+0.1
	Fractured bedrock	Unknown							Unknown	

Subarea	Aquifer	Area km^2	Rainfall m/yr	Recharge rate	Total gross recharge GL/yr	Preliminary EWPs based on rainfall recharge over subarea[(a)] GL/yr	Sustainable yield GL/yr	Previous allocation limit (1995) GL/yr	New allocation limit GL/yr	Net Change GL/yr
Darling	Surficial	1227.40	0.45	0.065	35.90	10.77		Limited	2.5[(n)]	
	Parmelia	3.51		0.05	0.08	0.01	0.1	0	0.1	+0.1
	Yarragadee	9.66		0.05	0.22	0.02	0.2	0	0.2 (brackish-saline)	+0.2
	Cattamarra	111.73		0.01	0.05	0.01	0.4	0	0.4 (saline)	+0.4
	Eneabba	30.70		0.03	0.41	0.04	0.4	0	0.4 (saline)	+0.4
	Lesueur	112.11		0.03	1.51	0.15	1.4	0	1.4 (brackish-saline)	+1.4
	Fractured bedrock									

(a) 30% for unconfined superficial and surficial aquifers, 10% for confined aquifers.
(b) Area of fresh groundwater (less than 1500 mg/L TDS).
(c) Allocation limit represents 3.5 GL/yr of fresh water (<1500 mg/L TDS) and 4.5 GL/yr of brackish water (>1500 mg/L TDS)
(d) New allocation limit represents the fresh water (<1500 mg/L TDS) component of the aquifer.
(e) Yarragadee and Superficial aquifers are managed together.
(f) Unchanged allocation limit. More detailed investigations justify keeping the same allocation limit.
(g) Previous allocation limit was 2.0 GL/yr for the both Cattamarra and Eneabba aquifers
(h) More detailed investigations justify a higher allocation limit.
(i) Lesueur and Superficial aquifers are managed together.
(j) Nominal allocation has been set because the extent of the aquifer has not been defined yet.
(k) Local recharge component equals to 22.0 GL/yr and a conservative throughflow component of 6.8 GL/yr from the adjacent Casuarinas Subarea has been considered. However, this needs to be confirmed through investigations.
(l) Allocation limit not estimated
(m) Calculation based on a percentage of rainfall recharge over the whole aquifer system and allocation limit redistributed on a subarea area basis (see details on next page)
(n) Nominal allocation has been set because the extent of the aquifer has not been defined yet. The aquifer comprises of the lateritic profile.

ALLOCATION LIMITS FOR THE LEEDERVILLE-PARMELIA AQUIFER IN THE NORTHERN PERTH BASIN BASED ON SUBAREA SIZE

The combined Leederville-Parmelia aquifer is mostly confined by thick shales of the Coolyena Group (e.g. Osborne Formation) in the eastern portion of the Gingin, Jurien and Arrowsmith Groundwater Areas. Aquifer recharge occurs mainly in areas where the Coolyena Group is thin or absent. Consequently, the Department has adopted a calculation methodology to set allocation limit based on a percentage of rainfall recharge over the whole aquifer system and redistributed on a subarea basis. This principle allows for more equitable distribution of the available resource.

The following figures have been used to calculate the allocation limit for each subarea:

- Total area of Leederville-Parmelia aquifer: 4570 km^2 (from groundwater divide to north of Perth region)
- Total recharge of the system: 40.5 GL/year
- Interim EWP set at 10% of recharge: 4.0 G/L year
- Total sustainable yield: 36.5 GL/year
- Allocation/area: 36.5 GL/year / 4570 km^2= 0.008 GL/year/km^2 or 8 000 KL/year/km^2

Subarea	**Area** **Km^2**	**Derived allocation limit** **GL/year**	**Board-approved interim allocation limit GL/year**	**Remarks**
Morrison (Arrowsmith GWA)	500	4.0	**4.0**	Most area covered by uncleared Crown Land and National Park
Dinner Hill (Jurien GWA)	1580	12.6	**12.6**	More water is available for allocation than by calculation using local rainfall recharge
Subarea 4 (Gingin GWA) (Victoria Plain + eastern margin of Wedge Island)	1380	11.0	**11.0**	More water is available for allocation
Subarea 5 (Gingin GWA) (Red Gully)	710	5.7	**8.0**	Previous allocation limit still valid
Subarea 6 (Gingin GWA) (Gingin townsite + Eclipse Hill)	400	3.2	**6.3**	Previous allocation limit still valid
Total	4570	36.5	**41.9**	

APPENDIX B

ALLOCATIONS AND GROUNDWATER AVAILABILITY PER SUBAREA IN THE ARROWSMITH GROUNDWATER AREA

EXPLANATORY NOTES FOR APPENDICES B AND C

The current status of groundwater allocation in each aquifer system in each Subarea is shown in the attached tables. The following is an explanation of the tables.

Sustainable Allocation Limit
The allocation limit is synonymous with the sustainable yield. This limit refers to the maximum volume of groundwater that is licensed for consumptive use on an annual basis. It represents the annual pumping volume that can be sustained in the long term. Inherent in the allocation limit is the provision for the environment (see Section 3).

Total Licensed Allocation
The licensed allocation can also be referred to as the licensed entitlement. This is the total volume of groundwater that is authorised for consumptive use under groundwater licences. The maximum licensed allocation cannot exceed the allocation limit.

% of Limit (1)
This refers to the total licensed allocation as a percentage of the allocation limit. It cannot exceed 100% although under some circumstances, the Department may determine that the total licensed allocation should not exceed a percentage less than 100%.

Allocation held in Reserve
The Department may determine that a certain volume of groundwater should be reserved in the interest of future public water supply purposes. As such, this volume will be considered as being committed (see Section 3.3).

Sum of Total Licensed Allocation + Allocation held in Reserve
The sum of the licensed allocation + reserve allocation.

% of Limit (2)
This refers to the sum of the licensed + reserve allocation as a percentage of the allocation limit. It cannot exceed 100%. If the percentage is less than 100%, than licence applications may be considered. If the percentage is 100%, than licence applications will not be considered.

New Licence Applications
This shows the total volume of groundwater under application for groundwater licences.

Sum of Total Licensed Allocation + Allocation held in Reserve + new applications
The sum of the licensed allocation + reserve allocation + applications.

% of Limit (3)
The sum of the licensed allocation + reserve allocation + applications should not exceed 100% of the allocation limit. If the addition of the licence applications exceeds 100% of the limit, then not all applications will be approved.

Balance Available for Licensing
If the sum of Total Licensed Allocation + Allocation held in Reserve + new applications is less than the Sustainable Allocation Limit, all applications will be considered but not all of them will be approved and there will be a balance of unallocated groundwater available.

If the sum of Total Licensed Allocation + Allocation held in Reserve + new applications is more than the Sustainable Allocation Limit, then not all applications will be approved.

ARROWSMITH GROUNDWATER AREA

Dongara Subarea

(As of January 2002)

Aquifer	Sustainable Limit KL/year	Licensed Allocation KL/year	% of Limit (1)	Reserved Allocation KL/year	Licensed + Reserved Allocation KL/year	% of Limit (2)	New Applications KL/year	Licensed + Reserved + New Applications KL/year	% of Limit (3)	Balance available for licensing KL/year
Superficial	8,000,000	3,682,085	46	1,000,000	4,682,085	59	120,000	5,481,085	69	2,518,915
Surficial	0	0		0	0		0	0		0
Parmelia	0	0		0	0		0	0		0
Yarragadee	4,500,000	578,000	13	0	578,000	13	0	578,000	13	3,922,000
Cattamarra	200,000	0		0	0		0	0		200,000
Eneabba	0	0		0	0		0	0		0
Lesueur	0	0		0	0		0	0		0
Fractured rock	0	0		0	0		0	0		0
TOTAL	12,700,000	4,260,085		1,000,000	5,260,085		120,000	6,059,085		6,640,915

Eneabba Plains Subarea

(As of January 2002)

Aquifer	Sustainable Limit KL/year	Licensed Allocation KL/year	% of Limit (1)	Reserved Allocation KL/year	Licensed + Reserved Allocation KL/year	% of Limit (2)	New Applications KL/year	Licensed + Reserved + New Applications KL/year	% of Limit (3)	Balance available for licensing KL/year
Superficial	14,600,000	102,170	1	2,000,000	2,102,170	14	0	2,102,170	14	12,497,830
Surficial	Unknown	0		0	0		0	0		Unknown
Parmelia	0	0		0	0			0		0
Yarragadee	22,500,000	17,785,000	79	1,000,000	18,785,000	83	0	18,785,000	83	3,715,000
Cattamarra	200,000	0		0	0		0	0		200,000
Eneabba	2,000,000	700,000	35	0	700,000	35	0	700,000	35	1,300,000
Lesueur	1,800,000	470,000	26	0	470,000	26	0	470,000	94	1,330,000
Fractured rock	0	0		0	0		0	0		0
TOTAL	41,100,000	19,057,170		3,000,000	22,057,170		0	22,057,170		27,236,000

Twin Hills Subarea (As of January 2002)

Aquifer	Sustainable Limit KL/year	Licensed Allocation KL/year	% of Limit (1)	Reserved Allocation KL/year	Licensed + Reserved Allocation KL/year	% of Limit (2)	New Applications KL/year	Licensed + Reserved + New Applications KL/year	% of Limit (3)	Balance available for licensing KL/year
Superficial	0	0		0	0		0	0		0
Surficial	Unknown	80,000		0	80,000		0	80,000		Unknown
Otorowiri	500,000	0		0	0			0		500,000
Parmelia	3,400,000	0		0	0		0	0		3,400,000
Yarragadee	48,800,000	6,082,500	12	5,000,000	11,082,500	23	0	11,082,000	23	37,718,000
Cattamarra	500,000	0		0	0		0	0		500,000
Eneabba	400,000	0		0	0		0	0		400,000
Lesueur	200,000	0		200,000	200,000	100	0	200,000	100	0
Fractured rock	0	0		0	0		0	0		0
TOTAL	53,800,000	6,162,500		5,200,000	11,362,500		0	11,362,500		42,518,000

Allanooka Subarea (As of January 2002)

Aquifer	Sustainable Limit KL/year	Licensed Allocation KL/year	% of Limit (1)	Reserved Allocation KL/year	Licensed + Reserved Allocation KL/year	% of Limit (2)	New Applications KL/year	Licensed + Reserved + New Applications KL/year	% of Limit (3)	Balance available for licensing KL/year
Superficial	0	0		0	0		0	0		0
Surficial	Unknown	0		0	0		0	0		Unknown
Parmelia	0	0		0	0		0	0		0
Yarragadee	28,800,000	12,064,250	42	8,000,000	20,064,250	70	8,160,000	28,224,250	98	575,750
Cattamarra	0	0		0	0		0	0		0
Eneabba	0	0		0	0		0	0		0
Lesueur	0	0		0	0		0	0		0
Fractured rock	0	0		0	0		0	0		0
TOTAL	28,800,000	12,064,250		8,000,000	20,064,250		8,160,000	28,224,250		575,750

(Proposed Casuarinas Subarea, Gascoyne GWA) (As of January 2002)

Aquifer	Sustainable Allocation Limit KL/year	Total Licensed Allocation KL/year	% of Limit (1)	Allocation held in Reserve KL/year	Licensed + Reserved Allocation for Allanooka Subarea KL/year	% of Limit (2)	New Licence Applications KL/year	Licensed + Reserved + New Applications KL/year	% of Limit (3)	Balance available for licensing KL/year
Yarragadee	22,500,000			20,000,000	20,000,000	89	0	20,000,000	89	2,500,000
TOTAL	22,500,000	0		20,000,000	20,000,000		0	20,000,000		2,500,000

* The Yarragadee aquifer in the proposed Casuarinas Subarea of the Gascoyne Groundwater Area forms the recharge of the Yarragadee aquifer in the Allanooka Subarea to the south. Throughflow from this aquifer will be allowed to meet groundwater demand in the Allanooka Subarea

Mingenew Subarea (As of January 2002)

Aquifer	Sustainable Limit KL/year	Licensed Allocation KL/year	% of Limit (1)	Reserved Allocation KL/year	Licensed + Reserved Allocation KL/year	% of Limit (2)	New Applications KL/year	Licensed + Reserved + New Applications KL/year	% of Limit (3)	Balance available for licensing KL/year
Superficial	0	0		0	0		0	0		0
Surficial	Unknown	0		0	0		0	0		Unknown
Otorowiri	100,000	0		0	0		0	0		100,000
Parmelia	8,200,000	774,000	9	2,000,000	2,774,000	34	121,600	2,863,000	35	5,337,000
Yarragadee	0	0		0	0		0	0		0
Cattamarra	0	0		0	0		0	0		0
Eneabba	0	0		0	0		0	0		0
Lesueur	0	0		0	0		0	0		0
Fractured rock	Unknown	54,000		0	54,000		0	54,000		Unknown
TOTAL	8,300,000	828,000		2,000,000	2,828,000		121,600	2,949,600		5,437,000

Tathra Subarea (As of January 2002)

Aquifer	Sustainable Limit KL/year	Licensed Allocation KL/year	% of Limit (1)	Reserved Allocation KL/year	Licensed + Reserved Allocation KL/year	% of Limit (2)	New Applications KL/year	Licensed + Reserved + New Applications KL/year	% of Limit (3)	Balance available for licensing KL/year
Superficial	0	0		0	0		0	0		0
Surficial	Unknown	0		0	0		0	0		Unknown
Parmelia	33,400,000	2,742,000	8	2,000,000	4,742,000	14	0	4,742,000	14	28,658,000
Yarragadee	700,000	0		0	0		0	0		700,000
Cattamarra	50,000	0		0	0		0	0		50,000
Eneabba	100,000	0		0	0		0	0		100,000
Lesueur	100,000	0		0	0		0	0		100,000
Fractured rock	Unknown	21,000		0	21,000		0	21,000		Unknown
TOTAL	34,350,000	2,763,000		2,000,000	4,763,000		0	4,763,000		29,608,000

Morrison Subarea (As of January 2002)

Aquifer	Sustainable Limit KL/year	Licensed Allocation KL/year	% of Limit (1)	Reserved Allocation KL/year	Licensed + Reserved Allocation KL/year	% of Limit (2)	New Applications KL/year	Licensed + Reserved + New Applications KL/year	% of Limit (3)	Balance available for licensing KL/year
Superficial	0	0		0	0		0	0		0
Surficial	Unknown	0		0	0		0	0		Unknown
Otorowiri	100,000	0		0	0		0	0		100,000
Parmelia	4,000,000	0		500,000	500,000	13	0	500,000	13	3,500,000
Yarragadee	1,000,000	0		0	0		0	0		1,000,000
Cattamarra	50,000	0		0	0		0	0		50,000
Eneabba	0	0		0	0		0	0		0
Lesueur	0	0		0	0		0	0		0
Fractured rock	Unknown	0		0	0		0	0		Unknown
TOTAL	5,150,000	0	0	500,000	500,000		0	500,000		4,650,000

Darling Subarea (As of January 2002)

Aquifer	Sustainable Limit KL/year	Licensed Allocation KL/year	% of Limit (1)	Reserved Allocation KL/year	Licensed + Reserved Allocation KL/year	% of Limit (2)	New Applications KL/year	Licensed + Reserved + New Applications KL/year	% of Limit (3)	Balance available for licensing KL/year
Superficial	0	0		0	0		0	0		0
Surficial	2,500,000	0		0	0		0	0		2,500,000
Parmelia	100,000	0		0	0		0	0		100,000
Yarragadee	200,000	0		0	0		0	0		200,000
Cattamarra	400,000	0		0	0		0	0		400,000
Eneabba	400,000	0		0	0		0	0		400,000
Lesueur	1,400,000	0		0	0		0	0		1,400,000
Fractured rock	Unknown	0		0	0		0	0		Unknown
TOTAL	5,000,000	0	0	0	0		0	0		5,000,000

APPENDIX C

ALLOCATIONS AND GROUNDWATER AVAILABILITY
PER AQUIFER
IN THE ARROWSMITH GROUNDWATER AREA

ARROWSMITH GROUNDWATER AREA

SUPERFICIAL AQUIFER (As of January 2002)

Subarea	Sustainable Allocation Limit KL/year	Licensed Allocation KL/year	% of Limit (1)	Allocation held in Reserve KL/year	Licensed + Reserved Allocation KL/year	% of Limit (2)	New Licence Applications KL/year	Licensed + Reserved + New Applications KL/year	% of Limit (3)	Balance available for licensing KL/year
Dongara	8,000,000	3,682,085	46	1,000,000	4,682,085	59	0	5,481,085	69	2,518,915
Eneabba Plain	14,600,000	102,170	1	2,000,000	2,102,170	14	0	2,102,170	14	12,497,830
Twin Hills	0	0		0	0			0		0
Allanooka	0	0		0	0			0		0
Mingenew	0	0		0	0			0		0
Tathra	0	0		0	0			0		0
Morrison	0	0		0	0			0		0
Darling	0	0		0	0			0		0
TOTAL	22,600,000	3,784,255		3,000,000	6,784,255		0	6,784,255		15,815,745

SURFICIAL AQUIFER (As of January 2002)

Subarea	Sustainable Allocation Limit KL/year	Licensed Allocation KL/year	% of Limit (1)	Allocation held in Reserve KL/year	Licensed + Reserved Allocation KL/year	% of Limit (2)	New Licence Applications KL/year	Licensed + Reserved + New Applications KL/year	% of Limit (3)	Balance available for licensing KL/year
Dongara	0	0		0	0		0	0		0
Eneabba Plain	Unknown	0		0	0		0	0		Unknown
Twin Hills	Unknown	80,000		0	80,000		0	80,000		Unknown
Allanooka	Unknown	4,500		0	4,500		0	17,500		Unknown
Mingenew	Unknown	0		0	0		0	0		Unknown
Tathra	Unknown	0		0	0		0	0		Unknown
Morrison	Unknown	0		0	0		0	0		Unknown
Darling	2,500,000	0		0	0		0	0		2,500,000
TOTAL	2,500,000	84,500		0	84,500		0	84,500		2,500,000

OTOROWIRI AQUIFER (As of January 2002)

Subarea	Sustainable Allocation Limit KL/year	Licensed Allocation KL/year	% of Limit (1)	Allocation held in Reserve KL/year	Licensed + Reserved Allocation KL/year	% of Limit (2)	New Licence Applications KL/year	Licensed + Reserved + New Applications KL/year	% of Limit (3)	Balance available for licensing KL/year
Dongara	0	0		0	0		0	0		0
Eneabba Plain	0	0		0	0		0	0		0
Twin Hills	500,000	0		0	0		0	0		500,000
Allanooka	0	0		0	0		0	0		0
Mingenew	100,000	0		0	0		0	0		100,000
Tathra	0	0		0	0		0	0		0
Morrison	100,000	0		0	0		0	0		100,000
Darling	0	0		0	0		0	0		0
TOTAL	700,000	0		0	0		0	0		700,000

PARMELIA AQUIFER (As of January 2002)

Subarea	Sustainable Allocation Limit KL/year	Licensed Allocation KL/year	% of Limit (1)	Allocation held in Reserve KL/year	Licensed + Reserved Allocation KL/year	% of Limit (2)	New Licence Applications KL/year	Licensed + Reserved + New Applications KL/year	% of Limit (3)	Balance available for licensing KL/year
Dongara	0	0		0	0		0	0		0
Eneabba Plain	0	0		0	0		0	0		0
Twin Hills	3,400,000	0		0	0		0	0		3,400,000
Allanooka	0	0		0	0		0	0		0
Mingenew	8,200,000	774,000	9	2,000,000	2,774,000	34	89,000	2,863,000	35	5,337,000
Tathra	33,400,000	2,742,000	8	2,000,000	4,742,000	14	0	4,742,000	14	28,658,000
Morrison	4,000,000	0		500,000	500,000	13	0	500,000	13	3,500,000
Darling	100,000	0		0	0		0	0		100,000
TOTAL	49,100,000	3,516,000		4,500,000	8,016,000		89,000	8,105,000		40,995,000

YARRAGADEE AQUIFER (As of January 2002)

Subarea	Sustainable Allocation Limit KL/year	Total Licensed Allocation KL/year	% of Limit (1)	Allocation held in Reserve KL/year	Licensed + Reserved Allocation KL/year	% of Limit (2)	New Licence Applications KL/year	Licensed + Reserved + New Applications KL/year	% of Limit (3)	Balance available for licensing KL/year
Dongara	4,500,000	578,000	13	0	578,000	13	0	578,000	13	0
Eneabba Plains	22,500,000	17,785,000	79	1,000,000	18,785,000	83	0	18,785,000	83	3,715,000
Twin Hills	48,800,000	6,082,500	12	5,000,000	11,082,500	23		11,082,000	23	37,718,000
Yarragadee	28,800,000	12,064,250	42	8,000,000	20,064,250	70	8,160,000	28,224,250	98	575,750
Mingenew	0	0		0	0		0	0		0
Tathra	700,000	0		0	0		0	0		700,000
Morrison	1,000,000	0		0	0		0	0		1,000,000
Darling	200,000	0		0	0		0	0		200,000
TOTAL	105,900,000	36,509,750		8,700,000	45,209,750		8,160,000	53,369,750		40,512,000

YARRAGADEE AQUIFER (As of January 2002)

Subarea	Sustainable Allocation Limit KL/year	Total Licensed Allocation KL/year	% of Limit (1)	Allocation held in Reserve KL/year	Licensed + Reserved Allocation for Allanooka Subarea KL/year	% of Limit (2)	New Licence Applications KL/year	Licensed + Reserved + New Applications KL/year	% of Limit (3)	Balance available for licensing KL/year
Proposed Casuarinas*	22,500,000		0	20,000,000	20,000,000	89	0	20,000,000	89	2,500,000
TOTAL	22,500,000	0		20,000,000	20,000,000		0	20,000,000		2,500,000

* The Yarragadee aquifer in the proposed Casuarinas Subarea of the Gascoyne Groundwater Area forms the recharge of the Yarragadee aquifer in the Allanooka Subarea to the south. Throughflow from this aquifer will be allowed to meet groundwater demand in the Allanooka Subarea

CATTAMARRA AQUIFER (As of January 2002)

Subarea	Sustainable Allocation Limit KL/year	Total Licensed Allocation KL/year	% of Limit (1)	Allocation held in Reserve KL/year	Licensed + Reserved Allocation KL/year	% of Limit (2)	New Licence Applications KL/year	Licensed + Reserved + New Applications KL/year	% of Limit (3)	Balance available for licensing KL/year
Dongara	200,000	0		0	0		0	0		200,000
Eneabba Plain	100,000	0		0	0			0		100,000
Twin Hills	500,000	0		0	0		0	0		500,000
Allanooka	0	0		0	0		0	0		0
Mingenew	0	0		0	0		0	0		0
Tathra	50,000	0		0	0		0	0		50,000
Morrison	0	0		0	0		0	0		0
Darling	400,000	0		0	0		0	0		400,000
TOTAL	1,250,000	0		0	0		0	0		1,250,000

ENEABBA AQUIFER (As of January 2002)

Subarea	Sustainable Allocation Limit KL/year	Total Licensed Allocation KL/year	% of Limit (1)	Allocation held in Reserve KL/year	Licensed + Reserved Allocation KL/year	% of Limit (2)	New Licence Applications KL/year	Licensed + Reserved + New Applications KL/year	% of Limit (3)	Balance available for licensing KL/year
Dongara	0	0		0	0		0	0		0
Eneabba Plain	2,000,000	700,000	35	0	700,000	35		700,000	35	1,300,000
Twin Hills	0	0		0	0		0	0		0
Allanooka	0	0		0	0		0	0		0
Mingenew	0	0		0	0		0	0		0
Tathra	100,000	0		0	0		0	0		100,000
Morrison	0	0		0	0		0	0		0
Darling	400,000	0		0	0		0	0		400,000
TOTAL	2,500,000	700,000		0	700,000		0	700,000		1,800,000

LESUEUR AQUIFER (As of January 2002)

Subarea	Sustainable Allocation Limit KL/year	Total Licensed Allocation KL/year	% of Limit (1)	Allocation held in Reserve KL/year	Licensed + Reserved Allocation KL/year	% of Limit (2)	New Licence Applications KL/year	Licensed + Reserved + New Applications KL/year	% of Limit (3)	Balance available for licensing KL/year
Dongara	0	0		0	0		0	0		0
Eneabba Plain	1,800,000	470,000	26	0	470,000	26	0	470,000	26	1,330,000
Lesueur	200,000	0		200,000	200,000	100	0	200,000	100	0
Allanooka	0	0		0	0		0	0		0
Mingenew	0	0		0	0		0	0		0
Tathra	100,000	0		0	0		0	0		100,000
Morrison	0	0		0	0		0	0		0
Darling	1,400,000	0		0	0		0	0		1,400,000
TOTAL	3,500,000	470,000		200,000	670,000		0	670,000		2,830,000

FRACTURED ROCK AQUIFER (As of January 2002)

Subarea	Sustainable Allocation Limit KL/year	Total Licensed Allocation KL/year	% of Limit (1)	Allocation held in Reserve KL/year	Licensed + Reserved Allocation KL/year	% of Limit (2)	New Licence Applications KL/year	Licensed + Reserved + New Applications KL/year	% of Limit (3)	Balance available for licensing KL/year
Dongara	0	0		0	0		0	0		0
Eneabba Plain	0	0		0	0		0	0		0
Twin Hills	0	0		0	0		0	0		0
Allanooka	0	0		0	0		0	0		0
Mingenew	Unknown	54,000		0	54,000		0	54,000		Unknown
Tathra	Unknown	39,000		0	39,000		0	39,000		Unknown
Morrison	Unknown	0		0	0		0	0		Unknown
Darling	Unknown	0		0	0		0	0		Unknown
TOTAL	0	93,000		0	93,000		0	93,000		Unknown

APPENDIX D

INFORMATION PAMPHLETS

INFORMATION PAMPHLETS

- Building a dam
- Changes to the Rights in Water and Irrigation Act 1914
- Civil remedy
- Community participation and the *Rights in Water and irrigation Act 1914*
- Directions to water users
- How can I appeal against a decision of the Water and Rivers Commission?
- How can I use the register to find out who can take water?
- I am buying a property - How can I get a water licence?
- I am selling my property – What can I do with my water licence?
- I want to change or extend my water licence?
- Rights to take water in licensed areas
- Rights to water in unlicensed areas
- Transferring water licences and entitlements
- What are my obligations as a licence holder?
- What are well licences and permits and how can I apply for them?
- What is a water licence and how can I apply for one?