



Our ref: CEOW1249/07
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Hon R C Kucera, APM JP MLA
Chair
Economics and Industry Standing Committee
Parliament House
PERTH WA 6000



Dear Hon Kucera

Water Licensing and Services Inquiry

Thank you for your letter of 16 November 2007 inviting the Department of Water (DoW) to make a submission to the Inquiry into Water Licensing and Services being undertaken by the Economics and Industry Standing Committee. The DoW particularly appreciates that extension of time granted to the DoW to enable it to prepare a fulsome submission.

The attached submission addresses each of the Inquiry's terms of reference and provides additional background information that may be of assistance to the committee in its deliberations.

The DoW looks forward to the opportunity to give evidence to the committee through its formal hearings, building on the two briefings that the DoW has already provided to the committee.

In the meantime, if the committee requires any further information, please contact Mr Mike Rowe, Manager Policy Coordination and Reform Branch, Policy and Planning, the Department of Water on 6364 7142 or email mike.rowe@water.wa.gov.au.

The DoW looks forward to working closely with the Economics and Industry Standing Committee in the course of conducting its inquiry.

Yours sincerely

J Ruprecht
A/DIRECTOR GENERAL

14 December 2007

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**Department of Water submission to the Economics and Industry
Standing Committee Inquiry into Water Licensing and Services**

14 December 2007

Executive summary

1. Having regard to the urgency of the water reform agenda, and in the context of this inquiry, the Department of Water maintains that there are very significant benefits of water licensing, both to assist in the management of water resources and to provide security of access to commercial water users.
2. Particularly in the face of climate variability, it is in commercial water users' best interest to have secure access to water, in the form of a water licence or, in the future and where consumptive pools are established, a water access entitlement. The Department of Water maintains that these entitlements will become increasingly valuable into the future.
3. In recognition of these benefits, and of the desirability of the user-pays principle, the Government of Western Australia has committed to the introduction of water licence administration fees. This fee recovers a large proportion, but not all, of the Department of Water's costs in relation to administering water licenses.
4. The notion of user pays and cost recovery for water resources management and planning are important principles to which the Government of Western Australia subscribes and are also requirements of the National Water Initiative (NWI). The Government of Western Australia, through the Department of Water, is participating in national processes to develop agreed principles and framework for cost recovery for water resources management and planning.
5. The introduction of a water licence administration fee partially meets the requirements of the NWI. The further adoption of cost recovery elements is also a general condition of funding provided to the Department of Water through the Australian Government Water Fund, administered by the National Water Commission.
6. Ultimately, however, the decision as to how much of the cost of water resources management and planning is recovered from water users and for what purpose, remains a decision for each jurisdiction. In this context, the Government of Western Australia has indicated it intends to issue a reference to the Economic Regulation Authority on this matter at some point in the future, in order to provide advice to the Government as to an appropriate water resource management and planning cost recovery regime for Western Australia.
7. This inquiry is also considering whether water licensing requirements should extend to certain types of activities currently exempt, including garden bores. The Department of Water maintains that this would incur considerable additional cost, for little additional benefit. It is important to note that garden bores drawing from the unconfined aquifer are generally not competing with water used for potable supply or commercial purposes, and are in fact taking pressure off scheme supply.

8. Lastly, the Inquiry is also considering whether the National Water Initiative (NWI) is able to accommodate a variety of water licensing systems. The Department of Water considers that it is implementing the requirements of the NWI by ensuring that Western Australia is able to maintain existing water licensing arrangements where appropriate, and adopt new, as yet unlegislated forms of entitlement, such as water access entitlements as a share of consumptive pools.
9. Coupled with this, statutory water management (allocation) plans, developed to reflect the water resource management requirements of each water system, will ensure that Western Australia's water resource management and licensing arrangements remain suitably flexible to suit the diverse water management systems and use across Western Australia.

Introduction

10. The Department of Water welcomes the opportunity to make this submission to the Economics and Industry Standing Committee Inquiry into Water Licensing and Services.
11. This submission addresses each of the inquiry's seven terms of reference and, in this introduction, provides background to Western Australia's water resources and their management, as well as summarising the Government of Western Australia's water reform agenda.
12. The Department of Water would be pleased to provide additional information in support of this submission or other matters the Economics and Industry Committee may wish to consider in undertaking this inquiry.

Background

Western Australia's water resources

13. Western Australia is a vast state with diverse climatic conditions and water resources.
14. Compared with the other states and territories of Australia, few large river systems exist in Western Australia. A significant number of rivers and streams flow only during the wet season and some may not flow at all for several years. As a result, the surface water resources are not generally a reliable source of water and not utilized to the same degree that groundwater is.
15. Groundwater systems are located throughout the state, with large sedimentary basins that contain significant volumes of easily accessible fresh groundwater mainly along the south west coast where the major population centres have been established. Further inland, groundwater exists in fractured rock aquifers and old river beds. Much of this water is hypersaline and is mainly used to support mining activities.
16. Appendix A provides additional detail on water resources in Western Australia.
17. Given climate change and variability, particularly the drying climate experienced in the south west of the state, the nature and availability of surface water resources and groundwater systems is changing. This has placed increased pressure on securing water entitlements for water users and the environment. In this context, statutory water management plans, new forms of water entitlements and metering are vital to managing our water resources.

The management of Western Australia's water resources

18. The Water Resources portfolio was created in 2005, in recognition of the strategic importance of water to Western Australia and the need to provide direction across a wide range of water matters.
19. The Minister for Water Resources is responsible for the Department of Water, Water Corporation, Busselton Water Board and Aqwest (Bunbury Water Board).
20. The Department of Water was established in October 2005. The passing of the *Water Resources Legislation Amendment Bill 2006* on 5 December 2007 means that the Water and Rivers Commission has been abolished and powers and functions have been transferred to the department and the Minister for Water Resources.
21. The Department of Water is responsible for water policy and planning and the overall management and regulation of water resources in Western Australia. Important accountabilities include water resources investigation and assessment, providing security for water for the environment and other community uses, licensing water for use and managing catchments, source protection, drainage planning and floodplains. In addition, the Department of Water is also responsible for coordinating water industry policy in Western Australia.
22. To effect its resource management functions, the Department of Water operates primarily under the *Rights in Water and Irrigation Act 1914* which outlines the allocation, licensing and management of water resources in Western Australia. There are however a raft of other Acts which relate to water resource management. These Acts, including the *Rights in Water and Irrigation Act 1914*, are currently being rewritten with the intent of incorporating these Acts into one piece of legislation in order to modernise, strengthen and simplify the legislative framework.

The importance of water reform to Western Australia

23. The inquiry comes at an important time in the evolution of Western Australia's approach to water resources management, as the Government of Western Australia has embarked on a significant water reform agenda.
24. In recognition of the significant environmental, social and economic values of water the State Government released *State Water Plan 2007* in May 2007 which provides strategic direction for the management of our water resources in Western Australia. The plan establishes a vision for water resource management and water policy and planning frameworks. Over 100 priority actions are outlined for implementation over the next five years by nine lead government agencies
25. The water reform agenda needs to be pursued urgently and with vigour.

26. Both as a signatory to the intergovernmental agreement on a NWI and in its own right, the Government of Western Australia has embraced the need for improved management of the state's water resources, particularly in the face of reduced water availability in parts of the state, impacts of climate change, and continued increases in demand across all water use sectors.
27. The auditor general's 2003 *Second Public Sector Performance Report* addressed the results of a *Control, Compliance and Accountability Examination in relation to the Management of Water Resources in Western Australia*. This audit found major challenges to the management of Western Australia's water resources and identified some of the factors contributing to this including:
- a doubling in demand for water over the last 15 years
 - a 33 per cent decline in funding in real terms since 1998 for core water resource management operations of investigation, assessment, planning, licensing and regulation
 - amendments in 2001 to the *Rights in Water and Irrigation Act 1914*. These amendments have considerably increased workload by requiring more rigorous environmental assessment and greater community consultation.
28. The auditor general recommended a strategic approach to addressing the challenges identified, and the government responded by providing additional resources to the then Water and Rivers Commission to undertake additional activities.
29. Notwithstanding this, the challenge to manage water resources remains significant and is ongoing.
30. In response to these challenges, the Department of Water is progressively reviewing its estimates of water availability and demand in order to better plan for and manage water resources.
31. Further, government must move quickly to establish improved frameworks, processes and techniques for water resources management. Some of the key deliverables of the water reform agenda include:
- legally binding statutory water plans, developed in consultation with the community, to firmly direct water allocation for commercial use, basic rights and the environment
 - more secure water entitlements in the form of longer-term water licences and, where appropriate, water access entitlements as a share of a consumptive pool to provide greater business certainty to water users
 - increased metering and measurement of water use to protect water users' entitlements, support compliance monitoring and improve water planning processes and decision making;

- the recovery of a portion of the State Government's costs of water resources management and planning from water users and the community, with a first step being the introduction of water licence administration fees.
32. Many of the reforms contemplated in the NWI and supported by the Government of Western Australia cannot be achieved in Western Australia without significant legislative reform. The Government of Western Australia is currently consolidating and modernising Western Australia's water legislation, including that which relates to water licensing, the *Rights in Water and Irrigation Act 1914*.
33. As the responsible department of state, the Department of Water is leading the development of new water resources management and water services legislation, as well as, the implementation of the whole-of-government *State Water Plan 2007* and Western Australia's implementation plan for the NWI.
34. Together, these initiatives will provide Western Australia with a framework designed to protect the environment and to ensure there is enough water for long term economic and social needs in the face of reduced water availability and increased demand.
35. The community benefits of water reform include but are not limited to:
- better management of water resources so that various and often conflicting demands can be met
 - the availability of better information as to how water is used and the amount of water that is available
 - improved planning with greater community involvement
 - a greater contribution by commercial users to the costs of the management of water
 - improved water allocation
 - improved water efficiency and water use.¹
36. Some of the benefits of the reforms for the individual licensed water users include:
- better access to water information
 - increased certainty on access to water
 - expanded opportunities for water trading
 - greater security of water entitlements thus creating investment confidence
 - improved understanding of water use efficiency through metering
 - continued access to water for livestock and domestic use.

¹ Water Reform made Simple- Department of Water 2007

Term of reference—one

The benefits to, cost to and imposts on irrigators, industry, community and environment of a licensing system for the taking of water from groundwater or stream flow.

37. Water is critical for the wellbeing of people and the environment, and Western Australia's economic development.

Rights in Water and Irrigation Act 1914

38. The importance of Western Australia's water resources to the wider community and the state's economic and social development was appreciated early in the state's history. The Western Australian Parliament enacted the *Rights in Water and Irrigation Act* in 1914, vesting the right to use, flow and control any water resource, either surface water or groundwater, to the Crown.

39. The regulatory controls of the *Rights in Water and Irrigation Act 1914* are designed to:

- encourage the responsible development of water resources by limiting abstraction from a water source (aquifer or catchment) to a level which can be sustained over the long-term
- allocate resources for beneficial private and public purposes and to meet environmental requirements
- enable the resources to be shared in an equitable manner
- protect existing water users from unacceptable impacts.

40. The taking and using of water without appropriate authorisation from the Water and Rivers Commission (Department of Water) (in the form of a licence or other right provided for under the Act) is prohibited. A licence is required to take groundwater from all artesian wells throughout the State, non-artesian wells located within groundwater areas proclaimed under the Act and the taking of surface water in proclaimed surface water areas, streams or irrigation districts.

41. Licences to construct or alter wells and permits to interfere with the bed and banks of watercourses may be granted in addition to a licence to take water.

42. On 11 December 2007, there were 12 889 water licenses recorded with the Department of Water consisting of 11 121 groundwater licences, 879 surface water licences and 889 licences to construct or alter wells or permits to interfere with beds and banks. Table 1 provides a breakdown of these licence types by region.

Table 1 *Water licences by region at 11 December 2007*

	Atrium	Kimberley	Kwinana Peel	Midwest	Pilbara	South Coast	Swan Avon	South West	Total
Groundwater	139	194	2364	686	276	469	4703	2290	11 121
Surface water	38	63	73	11	6	0	165	523	879
Permits/ 26D licences	22	14	143	103	224	15	190	178	889
								Total	12 889

43. Traditionally, licences have been closely linked to the land, by requiring licence holders to have legal access to the land where the water is taken from. The main aims of regulating water use are to prevent water users from disrupting each other's water supply and ensure the water resources are used effectively for the benefit of the community.

44. All licences to take and use water contain a set of terms and conditions detailing the licensee's responsibilities for the use and management of the water resources to which the licence applies. These conditions may vary depending on the water resources being accessed, the local issues and the volume of water taken. They normally specify the volume of water that may be taken in any given year, the requirement to use the water within a specified period and in some cases require the licensee to monitor, manage and report any impacts that the taking of the water may have on the water resources, the environment and other water users.

45. Licence applicants have the right to appeal the commission's decision if their application is refused. There are no third party rights of appeal.

46. Licensees may transfer all or part of their water entitlement on a permanent basis or through an agreement allowing another person to temporarily access their entitlement. This major change was included in the 2001 amendments to the *Rights in Water and Irrigation Act 1914*. The ability to transfer water entitlements enables the reallocation of water resources to higher value uses, benefiting the wider community.

47. Farm dams are only licensed when:

- they are located within an area proclaimed under Part III of the *Rights in Water and Irrigation Act, 1914* (a surface water area or irrigation district or just a single water course, e.g. Gingin Brook), and
- they are taking water from a natural water course either a dam on the water course or by direct pumping (sometimes into an off-stream dam), and
- the use of the water is non-riparian (riparian rights allow water to be taken for fire fighting, stock watering, household use and irrigation of up to 2 hectares associated with a dwelling).

48. There is no requirement to licence dams that collect water only from overland flow (often called turkey nest dams) or rainfall (excavations that do not intercept groundwater). These are the types of dams that occur very commonly throughout the wheatbelt of Western Australia.

Benefits of a water licensing system

49. The Department of Water maintains that there are considerable benefits to irrigators, industry, the community and environment of a well-managed water licensing system.

50. The benefits of water licensing include, but are not limited to

- ensuring licensed water users have secure access to an increasingly precious resource for which they derive a benefit
- protecting current and future water users by reducing the risk of over allocation of water resources
- protecting existing licensed water users from unacceptable impacts from other water users
- allowing the Department of Water to ensure water allocations decisions are sustainable
- allowing the Department of Water to establish licence conditions that protect water sources and water quality and ensures water is used under the conditions required by local practice, relevant by-laws and relevant decisions of committees
- ensuring water use is consistent with land use planning instruments, policies of other government agencies and intergovernmental agreements
- ensuring sufficient water is available for public drinking supplies
- allowing trading of entitlements to occur, providing additional options for licensed water users in the management of their businesses.

51. Although the need to proclaim water systems and actively licence water use is not universally accepted or welcomed, it is worth noting that increasingly, advisory groups and industry sectors are requesting more active water management by the Department of Water.

52. A recent example is in the Margaret River Wine Region. The Margaret River Wine Industry Association and Whicher Water Resource Management Committee have both advocated that proclamation and licensing would benefit that industry by providing secure access to water entitlements. As a result, priority catchments in the region such as Wilyabrup have recently been proclaimed, so that the area can be actively managed through licensing.

Imposts of a water licensing system

53. The Department of Water considers that the obligations imposed on licensed water users are balanced by the benefits gained from having a water licence.
54. Some of the obligations imposed on licensed water users by virtue of having a water licence, include requirements to:
- comply with various license conditions, including for example, obligations to meter and report water use (for licenses of greater than 500000 kilolitres) or comply with a water use efficiency plan (local governments)
 - periodically apply for a renewal of water licenses
 - pay a water licence administration fee for those licences greater than 1500 kilolitres.
55. As part of the Government of Western Australia's commitment to water reform, new water resources management legislation is currently being drafted which is intended to replace the *Rights in Water and Irrigation Act 1914*. While aspects of the current water licensing system is proposed to be preserved and carried forward, the new legislation is intended to give effect to other forms of water entitlement and water management systems, such as those expressed through the intergovernmental agreement for the NWI. Further information on this matter is provided under term of reference seven.

Term of reference—two

The full cost incurred by the Department of Water for administration of the current water licence system.

56. In 2005-06 the Department of Water established that the full cost incurred by it for the administration of the water licence system was \$5.8 million.

57. Detailed estimates of the water licence administration costs for 2006-07 and 2007-08 are not available, however, they are estimated to be in the order of \$6.3 million and \$6.6 million respectively. An in-depth analysis would identify more accurately the cost associated with administering water licences in these years.

58. The previous and proposed water licence administration fees recover a proportion of the Department of Water's costs from water users associated with the following activities:

- receipting and assessment of:
 - 5C licences to take water (including new applications, renewals, amendments)
 - Transfer, trades and agreements to take water (5C)
 - 26D licences to construct or alter wells (including new applications and amendments);
 - 11/17/21A permits to interfere or obstruct bed and banks (including new applications and amendments).
- community input (costs incurred in relation to advisory committees)
- compliance and enforcement costs (costs associated with surveys and enforcement actions)
- defence of appeals to the State Administrative Tribunal
- licensing support (database maintenance, training to regional licensing officers, support expertise for regional staff).

Development of water licence administration fees

59. The recently disallowed water licence administration fee arrangements were developed following consultation arising out of the Irrigation Review² (completed in May 2005) and the government response to that review (September 2005), which resulted in the establishment of the Water Reform Implementation Committee.

60. The Water Reform Implementation Committee in turn consulted on a range of water reform directions, including cost recovery arrangements and a suggested fee schedule, in 2006. That committee finalised its advice³ to government in December 2006. The Government Response to the Blueprint for Water Reform⁴, issued in February 2007, clearly

² The Irrigation Review – Final report (2005)

³ Government Response to A Blueprint for Water in Western Australia (2007)

⁴ Government Response to A Blueprint for Water in Western Australia (2007) Paragraph 42. p 20

indicated the Government's intention to implement water licence administration fees from 1 July 2007 and the fee structure to which the government was committed (Table 2).

Table 2 *Water licence administration fees agreed through Government Response to A Blueprint for Water Reform in Western Australia*

Licence class	Entitlement class-kilolitres per year	Fee charged
	Application fee	\$200
1	0 - 5000	\$200
2	5000 – 150 000	\$325
3	50 001 – 100 000	\$600
4	100 001 – 500 000	\$1200
5	500 001- 1 000 000	\$1800
6	1 000 001- 5 000 000	\$2400
7	> 5 000 000	\$3000

61. Following concerns expressed by licensed domestic water users and some licensed surface water users, the Minister for Water Resources initiated modifications to the fee structure originally included in the government response.

62. Licensed water users with a volumetric entitlement of less than 1501 kilolitres were excluded from paying a water licence administration fee. This was intended to introduce equity for those with domestic bore licenses in areas where licensing was required under specific management regimes, such as in the Albany groundwater area. This reduced income to the Department of Water from fees by approximately \$540 000.

63. Under the model in Table 2 licence fees were intended to be charged according to the storage capacity. In response to concerns raised by industry representatives in the horticultural industry, (mostly in the south-west region) the revised fee structure below (Table 3) farm dams that are licensed will be charged according to the licensed use of water from the dam, rather than the licensed storage capacity of the dam.

64. Table 3 shows the revised fee structure that was adopted and implemented on 1 July 2007 by regulations established under the *Rights in Water and Irrigation Act 1914*.

Table 3 *Schedule of fees (now disallowed)*

License class	Entitlement class kiloliters per year	Fee
1	0-1 500	Free
2	1 500-5 000	\$200
3	5 001-50 000	\$325
4	100 001-5000 000	\$1200
5	500 001-1 000 000	\$1800
6	1 000 001-5 000 000	\$2400
7	> 5 000 000	\$3000

65.

66. Three separate disallowance motions were introduced in the Legislative Council on 23 September 2007 and were further debated on 22 November 2007, resulting in the disallowance of the regulations establishing the water licence administration fees. Following agreement between the Government of Western Australia and the Greens (WA) a new fee schedule is being prepared (Table 4), and will likely be in effect by 1 January 2008.

Table 4 *Revised structure of water licence administration fee*

Licence Class	Entitlement Class Kilolitres per year	Fee (\$)
1	1501–5000	100
2	5001–50 000	150
3	50 001–100 000	250
4	100 001–500 000	700
5	500 001–1 000 000	1600
6	1 000 001–5 000 000	2500
7	5 000 001–10 000 000	4000
8	More than 10 000 000	6000

67. As a consequence of the disallowance motion, and at the time of preparing this submission, the Department of Water is no longer able to collect water licence administration fees or issue invoices. The Department of Water is currently seeking legal advice on the status of the monies already collected and outstanding under the previous water licence administration fee.
68. Less funding will be recovered through the proposed new water licence administration fee schedule than that disallowed. The Minister for Water has given an undertaking that the Government of Western Australia will address this shortfall in funding to the Department of Water .

How water licence administration fees were constructed

69. The Department of Water established the original schedule of fees by assessing costs for the administration of water licences. The fees were calculated by determining the amount of work hours required for the volume of water licenced, the portion of the budget spent in that category and the licence support required (including the delivery of training to regional officers, the maintenance and enhancements of the data bases, including data validation and cleansing and the provision of support and expertise for regional licensing staff).
70. Additional costs related to the establishment of community advisory committees required under the Water and Rivers Commission Act 1995, compliance and enforcement and expenses incurred in providing information, property surveys and the defence of appeals brought before the State Administrative Tribunal were also taken into account.

71. Table 5 summarises the breakdown in costs and the number of projects pertaining to the administration of water licences that was used to generate the approved structure of water licence administration fees introduced on 1 July 2007 using information from 2005-06.

Table 5 *Department of Water costs associated with licensing for 2005-06*

Deliverable	Cost	Number of projects
Licensing	\$4 145 918	12
Compliance	\$812 875	7
State Administrative Tribunal	\$237 965	4
Community Input (WRMCs)	\$243 653	4
Licensing Support (database administration)	\$386 986	3
Total	\$5 827 397	30

Table 6 provides estimates of the number of hours pertaining to the administration of licences.

Table 6 *Description of licence class*

Entitlement class (kL)	Description	Hours / licence
0 – 5000	Fast track assessments - small domestic, non-commercial activities, hobby farms. Includes all 26D licences (new, renew and amended), 11/17/21A permits (new, renew and amended) and all 5C licences for allocations less than 5,000 kL per annum (new, renew, amended, transfers, trades and agreements).	7
5000–50 000	Some fast track assessments for 5C licences - generally commercial, large scale domestic.	11
50 000–100 000	Moderate assessment requirements for 5C licences, no fast track assessments.	20
100 000–500 000	Moderate assessment requirements for 5C licences, compulsory advertising and review of submissions.	40
500 000–1 000 000	Full assessment required for 5C licences, metering conditions, reporting requirements.	60
1 000 000–5 000 000	Full assessment required for 5C licences, operating strategies, hydrogeology reporting, metering.	80
> 5 000 000	Full assessment required for 5C licences, operating strategies, hydrogeology report, metering, DoW modelling and hydrology work.	100+

Table 7 summarises the budget requirements by class of licence in relation to full cost recovery.

Table 7 *Budget requirement for seven licence classes*

Category	Licences in force	Hours per licence	Total hours per category	Break down	Amount of budget required (\$)	Average cost per annum
1: 0 – 5 000	5279	7	36953	19%	\$1 098 644.43	\$208.12
2: 5 001 – 50 000	5,752	11	63272	32%	\$1 881 130.90	\$327.04
3: 50 001 – 100 000	1,114	20	22280	11%	\$662 403.54	\$594.62
4: 100 001 – 500 000	898	40	35920	18%	\$1 067 932.45	\$1,189.23
5: 500,001 - 1,000,000	179	60	10740	5%	\$319 309.42	\$1,783.85
6: 1,000,001 - 5,000,000	253	80	20240	10%	\$601 752.58	\$2,378.47
7: > 5,000,000	66	100	6600	3%	\$196 223.67	\$2,973.09
Total	13541		196005	100%	\$5 827 397.00	

Table 8 indicates the revenue that would have been recovered under the original fee structure prior to the exclusion of limited stock and domestic.

Table 8 *Licence classes - fee*

Licence Class	Approx. fee required to achieve full cost recovery	% recovery of proposed water licence administration costs	Proposed annual fee (per licence)	Revenue from Annual Licence Fee (\$)
1	\$208.12	100%	\$200	1 055 800
2	\$327.04	100%	\$325	1 869 400
3	\$594.62	100%	\$600	668 400
4	\$1189.23	100%	\$1200	1 077 600
5	\$1783.85	100%	\$1800	322 200
6	\$2378.47	100%	\$2400	607 200
7	\$2973.09	100%	\$3000	198 000
			Total Revenue	5 798 600

72. The cost of implementation and ongoing administration of the licence administration fee has not been quantified and therefore is not included in the above estimates.

73. Proposed new water resources legislation will extend cost recovery provisions to enable costs associated with water resources management and planning to be recovered, should a future Government determine that this is to occur. This issue is addressed in more detail under terms of reference three and four.

Term of reference—three

The extent to which the water licence administration fees meet cost recovery requirements the NWI places on the state with respect to services delivered to water users.

74. Western Australia has agreed to national water reforms that include improved cost recovery arrangements. In doing so, the Government of Western Australia acknowledges that allocating costs to users encourages more efficient use of scarce water resources and government services. Costs should be allocated between different water users and the broader public according to the contribution that each party makes to the costs being incurred, as far as is practicable.
75. Licence administration fees recover most of the cost of administering the licensing system, but do not recover other water resource management or planning costs.
76. The Department of Water considers that the introduction of water licence administration fees partially meets the intent of the NWI and stated requirements of the Australian Government.
77. The components of the NWI that place cost recovery requirements on Western Australia include:
- the terms of the NWI Intergovernmental Agreement
 - *Western Australia's Implementation Plan for the National Water Initiative*
 - the terms of funding deeds for Western Australia's Water Smart Australia projects, funded through the Australian Government Water Fund, administered by the National Water Commission.

Requirements of the NWI Agreement

78. The general requirement for cost recovery is set out in paragraph 64 (iv) of the NWI Agreement:

64. The Parties agree to implement water pricing and institutional arrangements which:

- iv) give effect to the principles of user-pays and achieve pricing transparency in respect of water storage and delivery in irrigation systems and cost recovery for water planning and management;⁵*

Further elaboration is contained in paragraphs 67 and 68:

67. The States and Territories agree to bring into effect consistent approaches to pricing and attributing costs of water planning and management by 2006, involving:

⁵ Intergovernmental Agreement on a National Water Initiative, paragraph 64 p. 13

- i) *the identification of all costs associated with water planning and management, including the costs of underpinning water markets such as the provision of registers, accounting and measurement frameworks and performance monitoring and benchmarking*
- ii) *the identification of the proportion of costs that can be attributed to water access entitlement holders consistent with the principles below:*
 - a) *charges exclude activities undertaken for the Government (such as policy development, and Ministerial or Parliamentary services)*
 - b) *charges are linked as closely as possible to the costs of activities or products.*⁶

68. *The States and Territories agree to report publicly on cost recovery for water planning and management as part of annual reporting requirements, including:*

- i) *the total cost of water planning and management*
- ii) *the proportion of the total cost of water planning and management attributed to water access entitlement holders and the basis upon which this proportion is determined.*⁷

79. Most other jurisdictions already have some cost recovery arrangements for water resource management and planning in place, although they vary considerably in their application and scope and in the way that they are set. Further details are contained in the Water Planning and Management Stock Take Report⁸ compiled by the National Water Commission and are summarised below.

New South Wales: Approximately two thirds of the costs of water planning and management costs are attributed to water users. These are collected through annual licence fees, imposed through a combination of fixed, volumetric and metered use charges. Charges vary between regions and water sources. Fees are set by the independent price regulator.

Victoria: Water resource monitoring and local planning and studies are undertaken largely by regional water corporations, which are funded entirely through user charges. Costs of the strategic-level planning and management undertaken by the state government are not recouped. Licence fees are composed of fixed and volumetric components. Charges vary between regions and water sources. Fees are set by the independent price regulator.

⁶ Intergovernmental agreement on a national water initiative, paragraph 67 p. 14

⁷ Intergovernmental agreement on a national water initiative, paragraph 68 p. 14

⁸ NWI Steering group on Water Charges (February 2007): Water planning and management stock take: Cost recovery for water planning and management in Australia.

Queensland: Queensland has an interim annual licence fee, an interim annual volumetric charge for some self-supply users and various fixed and volumetric charges for groundwater in some declared management areas. In March 2006, implementation of a new system of charges was suspended pending review, and have still not been implemented. The new system would attribute costs between users and Government on an impactor-pays basis, based on advice from independent consultants.

South Australia: Some planning and management costs are recovered through the *Save the River Murray Levy* and licensing fees. Some costs incurred by regional natural resource management (NRM) boards are recovered by a NRM water levy. However the majority of the cost of planning and management is not passed on to users.

Tasmania: Planning and management costs associated with regulating the take of water from rivers by licensed water extractors are passed on to water users. Twenty per cent of the cost of water planning and management associated with water assessments is attributed to and recovered from users. Fees vary according to volume and between regions.

80. Together with all other jurisdictions, the Government of Western Australia, through the Department of Water, is represented on a Steering Group for Water Charges, which is developing nationally agreed principles for cost recovery of water resources management and planning, as well as a framework for the sorts of activities that might be expected to be recovered from water users.
81. It is anticipated that these draft principles and framework will be considered by the Natural Resource Management Ministerial Council by May 2008 and that Western Australia and the Australian Government would then negotiate implementation of the principles.
82. The Minister for Water Resources has indicated that revised cost recovery arrangements will be put in place following the passage of the water resources legislation. These cost recovery arrangements will be informed by an independent review by the Economic Regulation Authority of the costs to be recovered and of the method of cost recovery. It is anticipated that review would include public consultation and would assess options including fees based on the volume of water entitlement and/or use and catchment based fees.

Commitments in Western Australia's Implementation Plan for the National Water Initiative

83. Progress against implementation plans is one of the elements that the National Water Commission will assess when it undertakes its biennial assessment of progress with the reform, and in formulating advice on actions required to better realise the objectives and outcomes of the NWI.⁹

84. The cost recovery requirements of Western Australia's Implementation Plan for the NWI are set out in section 5.2 of the plan. These address both the introduction of licence administration fees and full cost recovery.

85. With regard to licence administration fees, the implementation plan states:

The licence administration fees would cover assessment of applications and licence renewals, checking compliance with licence conditions, maintaining licensing databases, management of appeals and community awareness (water resource management committees).

and

Preparation of systems and arrangements has progressed in anticipation of a tentative implementation date for administration fees of July 2007.¹⁰

86. With regard to broader cost recovery of water management and planning, the implementation plan acknowledges the development of the principles and framework for cost recovery by the Steering Group on Water Charges. It states:

Further consideration by the Government of Western Australia will be undertaken to determine the most appropriate way to implement the recommended cost recovery mechanisms. In any event, any introduction of further cost recovery will take place only after extensive consultation and the completion of statutory water management plans and the establishment of longer-term secure water access entitlements.¹¹

According to the plan implementation of cost recovery would commence in July 2008, but completion is "ongoing"¹²

⁹ National Water Commission (May 2005) Guidance on the preparation of implementation plans for the National Water initiative.

¹⁰ Government of Western Australia (April 2007) Western Australia's Implementation Plan for the NWIp 55

¹¹ Government of Western Australia (April 2007) Western Australia's Implementation Plan for the NWIp 56

¹² Government of Western Australia (April 2007) Western Australia's Implementation Plan for the NWIp 57

Conditions in funding deeds under the Australian Government Water Fund

87. The third obligation on the Government of Western Australia in relation to cost recovery is through funding conditions expressed in deeds for Water Smart Australia grants (\$14.9 million) under the Australian Government Water Fund. A sample of a completed funding deed is attached to this submission.

88. The funding agreements for Department of Water's four Water Smart Australia projects all contain general conditions including the following:

In performing the Project, you [Western Australia] agree

- *To commence implementing cost recovery charging for water planning and management by December 2008, with further charging elements to be in place by July 2009;*

89. In confirming acceptance of this funding condition, the Department of Water advised the National Water Commission (NWC) that:

In relation to the last condition, Western Australia will have commenced implementing some cost recovery charging for water planning and management by December 2008 through the implementation of a water licence administration fee and intends to progress further charging elements by July 2009. However, it is important to note that this timeframe is dependent on new water resources legislation being proclaimed which will provide a head of power for charging mechanisms as well as Government of Western Australia decisions in relation to the form of any additional cost recovery.

90. Prior to the disallowance of licence administration fees, Western Australia had complied with the general funding condition to commence some cost recovery charging.

The extent to which licence administration fees meet NWI requirements

91. The implementation of water licence administration fees meets part of the policy intent to implement cost recovery for water resources management and planning in Western Australia. However, the further recovery of costs associated with other activities, including for example, metering, is contemplated in the draft national principles and framework.

92. The following sections compare the requirements of the relevant paragraphs of the NWI intergovernmental agreement with the approach undertaken and proposed to be undertaken in relation to water licence administration fees.

93. *"implement water pricing... that give effect to the principles of user-pays and achieve pricing transparency in respect of... cost recovery for water planning and management" [Agreement, 64 (iv)]*

The licence administration fees give effect to user pays and pricing transparency only for licence administration costs, which are a subset of the cost of water planning and management. The sections below further explain the extent to which the recovery of licence administration costs meets the above objective.

94. *"identification of all costs associated with water planning and management" [Agreement, 67(i)]*

"the identification of the proportion of costs that can be attributed to water access entitlement holders" [Agreement, 67(ii)]

"The licence administration fees would cover assessment of applications and licence renewals, checking compliance with licence conditions, maintaining licensing databases, management of appeals and community awareness (water resource management committees)" [Implementation plan, p 55].

The system of licence administration fees has identified costs associated with the licence administration system as described in the implementation plan. Further detail on the identification of costs of the licence administration system is provided in response to term of reference two.

95. *"charges exclude activities undertaken for the government" [Agreement, 67(ii)(a)]*

Licence administration fees do not include activities undertaken for government, such as policy development and ministerial and parliamentary services.

96. *"charges are linked as closely as possible to the costs of activities or products" [Agreement, 67(ii)(b)]*

Licence administration includes assessment of applications and licence renewals, checking compliance with licence conditions, maintaining licensing databases, management of appeals and community awareness (water resource management committees). These activities are directly related to the creation and protection of water users' entitlements.

97. Furthermore, licence administration fees do not include recovery of the cost of any activities or products that:

- are not related to water management
- are not a consequence of self-supply water use by licence holders for example, they do not recover costs of water storage and delivery.

98. *"report publicly on cost recovery for water planning and management as part of annual reporting requirements" [Agreement, 68]*

The NWI's annual reporting requirements are contained in paragraph 104 (i), which requires the Natural Resource Management Ministerial Council to report to the Council of Australian Government (COAG) on progress in implementing the NWI agreement.

99. *"the proportion of the total cost of water planning and management attributed to water access entitlement holders and the basis upon which this proportion is determined." [Agreement, 68 (ii)]*

The costs of licence administration can be attributed to water users because it is directly related to creating and protecting users' entitlements.

The scope of total costs of water planning and management in Western Australia (beyond licensing costs) are yet to be defined.

100. *"Preparation of systems and arrangements has progressed in anticipation of a tentative implementation date for administration fees of July 2007." [Implementation plan, p 55]*

Licence administration fees were introduced to come into effect by July 2007 but were disallowed in November 2007.

Term of reference– four

The penalty or cost that might be applied to Western Australia by the commonwealth under the NWI, if there was minimal or no cost recovery for services provided to water users by the Department of Water.

101. Unlike water reforms progressed under the 1994 Council of Australian Governments reform agenda there are no 'progress payments' to jurisdictions tied to achieving the requirements of the NWI.
102. Rather, to be eligible for funding from the Australian Government Water Fund, a state or territory government must have signed, and be actively implementing, the NWI.
103. As outlined under the previous term of reference, the Australian Government (through the National Water Commission) has imposed a general condition in funding deeds for projects funded under the Water Smart Australia program in relation to Western Australia commencing and progressing cost recovery for water resource management and planning.
104. Subclause A. 10 of the Schedule requires the Department of Water :
To commence implementing cost recovery charging for water planning and management by December 2008, with further charging elements to be in place by July 2009.
105. The funding deeds could be interpreted to suggest that the Australian government could decide to reduce funding to the government of Western Australia (and specifically the Department of Water) if this funding condition was not met.
106. The National Water Commission has advised the Department of Water that should the Government of Western Australia not meet the funding conditions under the Water Smart Australia programme, it would negotiate the implications of this breach with the Government of Western Australia.

Term of reference—five

Whether water licences and/or licence administration fees should be required for taking water under arrangements that are currently exempt; for example, residential bores drawing from an unconfined aquifer.

107. Water licence administration fees did apply and are proposed to apply only to water licences with a volumetric entitlement of 1501 kilolitres or more.
108. A number of water taking activities are exempt from licensing and therefore are not subject to a water licence administration fee, including:
- water used for livestock and domestic purposes state-wide
 - water taken by way of a riparian right
 - domestic garden bores in metropolitan Perth
 - dewatering activities with limited impact, e.g. construction.
109. Of particular interest to this inquiry is the question of whether residential bores, drawing from an unconfined aquifer, should be required to be licensed.
110. The large quantities of fresh groundwater found at shallow depths in most coastal areas around the state, have encouraged the installation of a large number of garden bores. These bores support the large individual housing lots each, with its own lawns and gardens that require significant volumes of water to be maintained.
111. It is estimated there are some 155 000 garden bores in Perth (from Australian Bureau of Statistics reports, the Water Corporation's database, surveys and administration of the Waterwise rebate scheme). This is equivalent to around 30 per cent of households having access to a garden bore.
112. These bores pump some 120 gigalitres of groundwater per year from the shallow unconfined aquifer, equivalent to around a fourth of all groundwater taken for all purposes in the Perth region.
113. The Department of Water considers that requiring licences for residential bores drawing from an unconfined aquifer (and therefore the payment of licence fees) is undesirable and unnecessary because this would:
- significantly increase the resources required to licence and police over 170 000 garden bores across the State (an additional \$30 million may be required annually)
 - reduce the number of additional garden bores being installed in suitable areas, and thereby increase the demand on potable scheme water supplies at a time when those supplies are stretched due to changing climatic conditions
 - be unlikely to provide better management outcomes.

114. In addition:

- garden bore use is regulated through restrictions
- the amended Waterwise Rebate Scheme will ensure that most new garden bores are installed in suitable areas and will not adversely impact the environment or other water users
- the current management approach will increase the community's awareness of issues related to garden bores.

115. Garden bores installed in urban areas generally utilise the excess groundwater that has been introduced into the unconfined aquifer due to urbanisation. Land clearing and the introduction of hard surfaces like roads have increased the amount of rainwater that leaches into the aquifer to become groundwater. This excess water is lost to urban area by drainage. Bores are therefore effectively a stormwater recycling system, and the unconfined aquifer can be viewed as a 'rainwater tank in the ground'. The groundwater taken by garden bores is also generally unsuitable for potable use due to the nutrients and the traces of chemicals it may contain (requiring expensive treatment if it were to be used for this purpose).

116. Garden bores do not generally compete with other water uses such as potable water supply scheme provision, commercial irrigators or with the mining or process industries.

117. The large number of garden bores create the impression that they contribute to the lowering the water levels, are adversely impacting the local environment and therefore must be actively managed through licensing. However, a recent study of the status of Perth's groundwater conducted by the Department of Water concluded that the major factors influencing the groundwater table levels in Perth were climate and the location and depth of drains, rather than garden bores.

118. Garden bores offer numerous advantages including:

- reducing the demand on the potable scheme water supply and offsetting the need for developing new water supply schemes
- using water fit for a purpose (untreated groundwater rather than highly treated and expensive scheme water for watering lawns and gardens)
- acting as a stormwater recycling system
- reducing drainage requirements around many areas of Perth
- counteracting any water level rises (during average rainfall years) following urbanisation that could potentially harm the local environment.

119. However, not all areas are suited to the installation of garden bores due to environmental, hydrogeological and social issues. The Department of Water has identified areas where a subsidy to support the installation of garden bores in the Perth region is available.

120. The Department of Water has developed a management approach to garden bores that includes:

- identifying the areas that are not suitable for the installation of more garden bores and discouraging the drilling of garden bores in those areas
- encouraging the drilling of more garden bores in suitable areas through a rebate scheme
- controlling the overwatering habits of garden bore owners by restricting the times and days of watering
- continually monitoring the unconfined aquifer being tapped by garden bores
- accounting for the water used by garden bores
- undertaking information and awareness campaigns on the proper use of garden bores
- undertaking surveys to understand and quantify the community's attitudes to garden bores and their watering habits
- giving consideration to a possible register of garden bores.

This approach will apply to garden bores in both metropolitan and rural areas.

Term of reference—six

What recognition needs to be given to the cost incurred by landholders in harvesting water, including dam construction costs.

121. There have been suggestions that water licensees should not have to pay water licence administration fees because they have financed their own dams.
122. Water licence administration fees only contribute towards the cost of administering the water licensing system. Expenditure by licensees on harvesting water does not reduce the cost of the licensing system. It would be inappropriate for the amount of a licence fee to be reduced because of funds spent by a landholder in harvesting water.
123. The licensee also derives a benefit, in many cases a financial gain, from the works utilising water vested in the Crown and it is therefore reasonable to expect that they should contribute to the costs of licence administration.
124. Furthermore, licence holders who have made business investments in water harvesting works have an interest in ensuring that their water entitlements are reliable and secure in order to protect the value of their investments. These investors are key beneficiaries of a robust licensing system. Indeed, investment without the security of a water licence may be severely jeopardised.

Term of reference—seven

The extent to which the NWI provides for a range of different licensing systems.

125. One of the key outcomes of the NWI is to provide a framework for water entitlements that achieves: “effective and sustainable resource management, improved environmental outcomes, providing a greater certainty for water users and an equitable share of water consistent with its availability.”¹³

126. To achieve this outcome the NWI establishes the concept of water access entitlements. These water access entitlements are described as “a perpetual or open-ended share of a consumptive pool of a specified water resource determined by the relevant water plan.”¹⁴

127. While it is fair to say that water access entitlements are the primary form of water entitlement envisaged under the NWI, they are not the only licensing system contemplated.

128. Indeed, paragraph 33 provides for the continuation of water licences as currently exist in Western Australia, under certain circumstances.

33. *The provisions in [the paragraphs relating to water access entitlements] are subject to the following provisions:*

- a. *fixed term or other types of entitlements such as annual licences will only be issued for consumptive use where this is demonstrably necessary, such as in Western Australia with poorly understood and/or less developed water resources, and/or where the access is contingent upon opportunistic allocations, and/or where the access is provided temporarily as part of an adjustment strategy, or where trading may otherwise not be appropriate. In some cases, a statutory right to extract water may be appropriate*
- b. *an ongoing process will be in place to assess the risks of expected development and demand on resources in poorly understood or undeveloped areas, with a view to moving these areas to a full entitlement framework when this becomes appropriate for their efficient management.*

129. *Western Australia’s Implementation Plan for the NWI (2007)*, which has been accredited by the National Water Commission, identifies that “in Western Australia, it is anticipated that three forms of water entitlement will co-exist to varying degrees, depending on the nature of the water resource system:

- water licences
- water access entitlements

¹³ Western Australia’s Implementation Plan for the National Water Initiative, 2007 p. 17

¹⁴ Intergovernmental agreement on a national water initiative, paragraph 28 pp.5-6.

- basic rights (existing statutory and common law rights for riparian, livestock and non-scheme domestic use).¹⁵

130. The implementation plan further identifies statutory water plans as being the mechanism to determine which water rights will exist in the areas the subject of the plan. Where there is no plan, water licensing similar to the existing arrangements under the *Rights in Water and Irrigation Act 1914* will continue.

131. It is important to note that water access entitlements and consumptive pools cannot be established under existing legislation. These arrangements would be established through new water resources legislation currently in preparation.

132. The NWI is sufficiently flexible to provide for a range of water licensing and entitlements systems. This flexibility, together with the expectation that statutory water management (allocation) plans will also recognise localised water management issues and responses, ensures that Western Australia does not have to adopt a 'one size fits all' approach to the future roll-out of water planning and licensing arrangements.

¹⁵ Western Australia's Implementation Plan for the National Water Initiative, (2007) p. 17

Appendix A

Water resources in Western Australia

The availability of adequate water supplies defines the lifestyle and the degree of social and economic growth that can be supported in a region. The occurrence of easily accessible water resources to a degree determines the location of major population and industry centres.

Although Western Australia is arid, it has significant water resources that can be developed to support most of the state's needs.

Most of the useable water resources in Western Australia are found in groundwater systems. Large sedimentary basins that contain significant volumes of easily accessible fresh groundwater exist along the west coast of the state where the major population centres were established. Further inland, groundwater exists in fractured rock aquifers and old river beds and is mainly used to support mining activities.

Compared with the other States and Territories of Australia, few large river systems exist in Western Australia. A significant number of rivers and streams flow only during the wet season and some may not flow at all for several years. As a result, the surface water resources are not a reliable source of water and not utilised to the same degree as groundwater.

Groundwater resources

Overview

Of all the Australian States, Western Australia has the highest groundwater use, and in contrast to the other states (excluding Northern Territory), groundwater use dominates over surface water. The availability of groundwater throughout the state is essential to the mining and pastoral industries, and most horticulture activities. Groundwater is also the sole source of water for more than 80 towns and forms more than half of the Perth's water supply. Apart from public drinking water supply, all groundwater users are self-supply, drawing water from their own bores.

Groundwater occurs in three main geological environments, each with contrasting hydrogeological characteristics: unconsolidated sediments or superficial deposits, sedimentary basins and fractured rocks.

Superficial deposits

Superficial deposits are relatively shallow sands and gravels associated with coastal plains, river valleys and dune sands. They form unconfined aquifers in which the upper surface of the groundwater is a watertable. They are recharged directly from rainfall or by runoff. As these aquifers are close to the surface, they are most commonly utilised for domestic and stock uses and irrigation purposes. The impact of taking the groundwater (drawdown effects from pumping) are generally localised.

As the groundwater found in superficial deposits also supports environmental values (maintaining wetland levels, supporting vegetation) groundwater exploitation must be capped to protect these values.

Ancient river valleys in the interior of WA contain sands known as palaeochannel aquifers. These are confined by overlying clays and generally contain saline or hypersaline groundwater, recharged at extremely low rates. Due to the low quality of groundwater, palaeochannel aquifers do not support any significant environmental values and some level of storage depletion is allowed to support economic activities (mining). Groundwater use from these aquifers is not capped but rather managed on the impacts of individual operations.

Sedimentary aquifers

Sedimentary basins contain thick and extensive aquifers that cover large areas. Recharge from rainfall or runoff may be concentrated in small areas, while the remainder of the area is confined, (overlain by impermeable clay or shale). Basins may contain sediments with thicknesses of over 10 000m, where fresh water may extend down to several thousand metres with saline water found at greater depths.

Aquifers may occur at different depths, with little or almost no hydraulic connection between them. Sedimentary basins contain major aquifers with significant groundwater resources however, recharge is generally limited. Drawdown effects may be propagated tens of kilometres away from pumping centres.

To ensure that groundwater from sedimentary aquifers is utilised sustainably, and the impacts to any hydraulically connected superficial aquifers or to the environment (at the recharge areas) are manageable, groundwater draw needs to be capped.

Fractured rock aquifers

Fractured rock aquifers occur in crystalline igneous and metamorphic rocks and cemented sandstones. Groundwater occurs only in widely spaced cracks or fractures which generally do not extend beyond a few hundred metres in depth. Groundwater conditions are difficult to assess, given the localised nature of fracturing and drawdown impacts from pumping may be localised along particular fracture zones. Fractured rock aquifers are mainly pumped to dewater mines and for mine water supply.

Due to their nature, groundwater drawn from fractured rock aquifer is not capped and these aquifers are managed on a 'take what you can basis' and on the acceptability of the impacts, where these can be quantified.

Existence on groundwater in Western Australia

Perth Basin

The Perth Basin is Western Australia's most important groundwater resource. It extends from Augusta in the south to Geraldton in the north. It contains the superficial aquifers of the coastal plain and extensive confined aquifers, principally the Leederville and Yarragadee aquifers.

The superficial aquifer is very extensive around Perth, where it is composed of up to 60m of unconsolidated sands, recharged directly by rainfall. Elsewhere the superficial sediments are thinner and the aquifer is not as significant. The watertable is close to the surface on much of the coastal plain, giving rise to wetlands.

In the Gnangara Mound just north of Perth, the superficial aquifer is utilised for Perth's water supply drawn from below banksia woodland and pine plantations. In Perth, it supports horticulture activities, irrigation of public open space and recreational parks, while some 120 gigalitres per year is used by unlicensed domestic garden bores. The aquifer is also used extensively for horticulture (vegetables, vines, olives, flowers and turf) on coastal Spearwood soils north and south of Perth.

The confined aquifers extend throughout most of the basin. The main aquifers are the Leederville (between 100 to 400m deep) and Yarragadee (down to 1100m). These two regional aquifers are used for water supply to Perth, Geraldton, Bunbury, Busselton and other smaller towns, and for the mineral sand industry at Eneabba, Capel and Cooljarloo.

The Leederville aquifer also supports irrigated crops on good quality soils, principally vines in the Swan Valley, vines and field crops (eg potatoes) at Jindong south of Busselton, and olives and tree crops north of Gingin.

The Yarragadee aquifer found at greater depths is not as easily accessible. However, increasing use is made of this aquifer for irrigation of dairy pasture on the more sandy soils south of Bunbury.

Groundwater salinity in all aquifers in the Perth Basin is variable, being generally low south of Bunbury (less than 500mg/L), and rising northwards, with pockets of brackish or saline groundwater in areas close to the Darling Fault, and on the eastern coastal plain. Groundwater salinity has been found to increase below horticultural operations utilising the shallow aquifer, due to leaching of salts concentrated by evaporation and the addition of fertilizer.

Constraints on groundwater use are needed to maintain water levels in wetlands in the superficial aquifer and to manage potential sea water intrusion in both the superficial and the confined aquifers. Confined aquifers have comparatively low recharge rates but very large groundwater storages.

Allocation limits in the Perth Basin are derived in the first instance by consideration of recharge or throughflow, and are refined after analysis of groundwater level monitoring by modelling of abstraction impacts. Most of the state's monitoring bores are in the Perth Basin, with water level records commencing in the 1970s. Two large regional groundwater flow models cover Perth and the South West Yarragadee and are being used to assess impacts for licensing and allocation purposes. The models will also be used to determine the level of acceptable pressure head declines in the regional confined aquifers.

Climate change and land use also affect recharge to groundwater, and there is no control over high water using crops such as pines and tagasaste.

Collie Coal Basin

The Collie Coal Basin contains up to 1500m of Permian sandstone aquifers bearing coal seams. Recharge to the basin is directly from rainfall and natural groundwater discharge is to the Collie River.

The groundwater system has been highly disturbed to facilitate open cut and underground coal mining. Groundwater storage is being depleted by dewatering and the water produced is utilised for power generation.

Groundwater is also pumped to maintain water in river pools. Saline runoff from the East Collie River is being discharged into mine voids to prevent increasing salinity in the Wellington Reservoir.

Goldfields

Groundwater has only been used on a large scale in the Goldfields since the introduction of carbon-in-pulp techniques in the mid 1980s, which enabled the use of saline water in ore processing. The region is characterised by granitic bedrock with intervening greenstone belts (metamorphic rocks hosting the gold and nickel deposits). Drainage is internal to salt lakes which occur in former drainage lines (palaeodrainages) that have not flowed for millions of years. Sandy sediments from 40 to 100m deep in the palaeodrainages known as palaeochannels, form the region's main aquifers and contain groundwater which is mainly saline or hypersaline (up to six times the salinity of seawater).

Periodic reviews of hydrogeologic data have indicated that although there is no significant recharge, water levels in the palaeochannel aquifers have stabilised at present pumping rates due to inflow of groundwater from the bedrock and adjacent aquifers. It is however, believed that groundwater in the palaeochannels is essentially non-renewable over the short term and storage depletion is allowed in support of the mining activities.

Mining operations for gold and nickel mostly obtain water from borefields tapping the groundwater in the palaeochannels, with minor use from fractured bedrock aquifers. Dewatering of mines also produces saline groundwater and the excess which cannot be used for processing is disposed mainly to salt

lakes. Due to the distance between the various mines and their borefields there is little competition for accessing the groundwater resources.

Potable water in the south of the Goldfields is supplied by pipeline from Mundaring Weir near Perth while towns in the northern goldfields, rely on small scale local groundwater supplies.

Murchison Gascoyne

Groundwater conditions in the Murchison are similar to the Goldfields except that mines are more remote from each other and most of groundwater utilised for mining is produced from fractured bedrock and shallow calcrete aquifers. Groundwater from shallow superficial aquifers is utilised for pastoral purposes and the salinity decreases northwards across the region.

The most important groundwater resources around Carnarvon are the sand deposits on either side of the Gascoyne River and the artesian Birdrong Sandstone aquifer.

The shallow groundwater from the river bed sands of the Gascoyne River at Carnarvon supports a valuable horticultural industry, principally bananas. The resource is fully utilised by metered self-supply landowners along the river banks. The volume of groundwater allowed to be pumped is limited by the need to contain intrusion of saline water. In times of drought, water is supplied to the horticulturalists by the Water Corporation from a bore field tapping the alluvium deposits upstream of the town.

Brackish and saline artesian groundwater from the Birdrong Sandstone aquifer in the Carnarvon Artesian Basin has historically been developed for pastoral use, with flowing bores discharging into bore drains. The aquifer is as much as 600m deep with water temperature up to 60 degrees. A recent program of capping and controlling flows has led to decreased discharge. There is also minor use of the resource in salt harvesting and desalination for potable supply at the coastal settlements of Useless Loop, Denham and Coral Bay. Preliminary groundwater modelling is being undertaken to provide options for better managing the resource.

Pilbara

The Pilbara is underlain by granite-greenstone terrane and relatively undeformed Hamersley Basin sediments, both of which contain banded iron formations with localised high grade iron ore deposits.

Major groundwater resources are limited to the valleys in the Hamersley Basin. The most important aquifers are the karstic Wittenoom Dolomite, and overlying valley fill which includes aquifers in channel iron deposits and calcrete. Groundwater is recharged by runoff from periodic cyclones and is generally fresh. Saline groundwater occurs in the internally draining upper Fortescue valley beneath The Marsh.

Due to the limited information available, a precautionary approach has been adopted to determine the sustainability limits. Groundwater abstraction is managed mainly by the acceptability of the impacts to the environment and other water users.

Groundwater is mainly used for iron ore processing and for supply to the mining towns with limited competition between users due to the distances involved. A feature of groundwater use in the Pilbara is the relatively large amount of fresh groundwater discharged to normally dry creeks and rivers from dewatering iron ore and manganese mines. In the eastern Pilbara, groundwater is also used by the Nifty copper mine and Telfer gold mine. Groundwater from the Millstream calcrete on the Fortescue River is piped 110 km to the West Pilbara towns of Karratha, Dampier, Roebourne and Wickham and abstraction is limited by the requirement to maintain spring flows to the permanent springs and river pools.

Important aquifers also occur along the Pilbara coast in the shallow alluvium of the major rivers. Recharge generally occurs on an annual basis following cyclonic runoff and fresh groundwater is limited to within a few kilometres of the river beds. Groundwater from alluvium is pumped for public supply from as far away as the Yule and the Grey River alluvium to Port Hedland and, from the Cane River alluvium to Onslow.

Kimberley

The Kimberley Region covers the northern Canning Basin which contains regionally significant groundwater resources as well as a potential groundwater resource in the alluvium of the Fitzroy River. Current groundwater use is limited for stock watering and localised base-metal and diamond mines. Surface water is used in the Ord River Irrigation Area however, rising groundwater levels below the irrigated areas is an issue, and trial dewatering of the underlying gravels has been carried out to arrest waterlogging.

In the West Kimberley, large groundwater resources are found in extensive sandstone aquifers along the coast between the mouth of the De Grey river and Derby. Regional groundwater information is limited.

The principal aquifers are the Broome and Wallal Sandstones and the Erskine Sandstone at Derby. Current abstraction from the Broome Sandstone is relatively low with minor horticulture activities near Broome and two commercial melon growers.

Rangelands and desert regions

Groundwater use in the Rangelands is limited to stock watering from shallow bores and wells in superficial deposits, and from deeper aquifers in the Eucla Basin. Groundwater information is limited with groundwater salinity ranging from fresh to saline.

Much of the Desert Region is underlain by extensive aquifers in the Canning and Officer Basins which contain very large groundwater storages of fresh to brackish water. However, due to their remoteness the only current use is for small scale community supply. Exploration undertaken by Anaconda Nickel on the western margin of the Officer Basin for potential supply to the North East Goldfields proved large potential yields of brackish groundwater and significantly more investigation work is required to determine sustainable limits.

Southwest Agricultural Area

The Southwest Agricultural Area is underlain mainly by granitic rocks and a weathered profile up to 60m deep. The hydrogeology is characterised by internal drainage to salt lakes, high groundwater salinity and high salt storage in the unsaturated zone. Fresh groundwater is extremely limited and even suitable supplies of groundwater for stock are difficult to obtain.

Interest in groundwater mainly centres on the water table rise below agricultural land cleared for cereals and pasture and below rural towns causing land and stream salinisation. Some trial dewatering has been carried out to determine the feasibility of lowering water tables.

Surface water resources

Overview

Australia as the driest inhabited continent has the least runoff to rivers as a percentage of the mean annual continental precipitation. In Western Australia, flow in rivers can be highly variable in volume. For example, rivers in the north of the state may not flow for up to three years and then experience large flood flows.

South Coast

The South Coast region includes the area east of Esperance to the Gardner River in the west. Major settlements in the region include Esperance, Ravensthorpe, Albany, Gnowangerup, Mt Barker and Denmark. The Frankland River is the largest river by volume in the region and the eighth largest in the state. It has a mean annual flow of 200gigalitres, which is equivalent to approximately two thirds of the potable water supplied to the state.

The region experiences a Mediterranean climate with hot, dry summers and cool, wet winters. Mean annual rainfall in the region varies from 1400mm in the west to 300mm in the northeast. Winter rainfall is typically associated with cold front systems passing over the region. These fronts are also associated with strong southerly and southwesterly winds. During summer months, high-pressure systems in the ocean to the south of the region result in warmer conditions, although coastal showers can occur.

Rivers generally flow in a southerly or southwesterly direction and discharge into estuaries most of which are permanently or intermittently closed to the

ocean. The region is characterised by internal drainage, with many lakes present in areas underlain by Eocene Epoch sediments. Rivers in the South Coast region can be divided into two groups based on their location in relation to Albany: the Eastern Rivers and the Western Rivers.

Eastern Rivers

Salinity in the South Coast region is an increasing problem. The majority of rivers in the Eastern Rivers group are naturally brackish to saline. However, salinities are typically increasing as a result of catchment clearing. Given the generally saline nature of the Eastern Rivers, there are no major allocation issues. However, there is a rapidly increasing demand for fresh surface water in some river systems, such as Angove Creek, for town water supplies.

Western Rivers

The Western Rivers of the South Coast region are generally fresh with low levels of allocation. However, increases in allocations are expected in the next five years associated with horticultural and viticultural developments. The salinity of the Frankland River is brackish and increasing and the limited quantities of fresh water are highly allocated. It is thought that a large number of the Western Rivers were relatively fresh prior to European settlement however, large scale catchment clearing has resulted in increased stream salinities. The Denmark and Kent River catchments have been selected as the potable water supply recovery catchments in the region and strategies have been developed with the aim of returning stream salinity levels to potable levels within twenty to thirty years.

Also associated with large-scale catchment clearing is the impact of increased streamflow, resulting from increased groundwater discharge and surface runoff to rivers. This has altered the hydrologic regimes of many rivers and wetlands, causing erosion and sedimentation and increasing nutrient and salt loads. The Western River catchments are typically associated with high nutrient levels in particular, the Torbay, Sleeman and Cuppup systems. Outside these areas, nutrient levels are generally at low to moderate levels. Problem areas for contamination include the Yakamia and Robinson Road Drains.

South West

The Blackwood River is the largest river by total annual flow in the region and the fourth largest in the state. It has a mean annual flow of 925gigalitres. The Swan-Avon and Murray rivers are the second and third largest rivers in the region with mean annual flows of 360 and 260gigalitres respectively. The Swan-Avon and Blackwood rivers are also the longest rivers in the region (sixth and seventh longest in the state, respectively). Lake Jasper, located between Augusta and Pemberton, is the largest natural freshwater lake in Western Australia.

The Swan-Avon River has the largest catchment area of any river system in Western Australia, covering almost 126 000 km². Approximately 8000 km² of the Avon River catchment is included in the South West region while the remaining drier 118 000 km² is included in the Mid-West Avon region.

The region experiences a Mediterranean climate characterised by cool, wet winters and hot dry summers. Most of the rainfall occurs in the winter four-month period between May and August. Mean annual rainfall in the region varies from 1300mm in the west to less than 400mm in the east.

The Swan Coastal Plain runs in a north-south direction, rising steeply to the east through the Darling Scarp to the Darling Plateau. The coastal plain is characterised by sandy soils and low-lying swampy land, giving rise to the many wetlands in the region. The plateau terrain ranges from gently undulating to hilly and is dissected by streams rising locally and by rivers originating further inland. The Whicher Scarp begins at a junction with the Darling Scarp and continues in a southerly then southwesterly direction, parallel to the coast. The Blackwood Plateau is bound by the Whicher Scarp to the northwest and the Darling Scarp to the east. It has a gently undulating surface and much of the area is poorly drained and swampy.

This region arguably contains the most severe pressures on water resources in the state. The region contains the majority of the population of the state (90%) including the cities of Perth and Bunbury. Increasing urbanisation is one of the major pressures impacting water resources of the south west region. The high populations exert large demands on the resources and large nutrient pressures through wastewater and intensive agriculture on the coastal plain sands.

There are generally low levels of allocation except for high rainfall areas, where demand can be high. In these areas there is competition between public, private and environmental use. Drinking water sources, such as the Darling Scarp dams, need to be protected from development to ensure future supply. Tributaries along the Darling Scarp are under increasing pressure from urban developments and increased water use has resulted in allocation management issues.

Increasing urbanisation in southwest centres such as Busselton, Mandurah, Bunbury and Margaret River has resulted in increased water supply and hence increased demand pressures. Agricultural intensification throughout the region, including viticulture, horticulture and orchards, has also resulted in increased pressures on water supply.

The Helena, Warren and Collie river catchments have been selected as the potable water supply recovery catchments in the region. The aim is to return or maintain stream salinity levels to potable levels within fifteen to thirty years, which will require significant commitment by government and community if this outcome is to be achieved. The salinity of Wellington Dam on the Collie River has reached the brackish range which impacts on irrigation on the coastal plain.

In low to medium rainfall areas, salinity increases are of concern because of rising groundwater levels in cleared areas, which have resulted in saline

groundwater discharging into waterways. This has impacted on the Scott, Warren, Blackwood and Murray River catchments. Increased waterlogging and salinisation of agricultural land has led to the construction of agricultural drains. This has the potential to increase flood risk and erosion and sedimentation problems, as water is conveyed more quickly to waterways.

Nutrient runoff from cleared land in medium to high rainfall areas is moderate to high, particularly on the Swan Coastal Plain to the Serpentine, Murray and Vasse rivers. Nutrient levels are high in Ellen Brook, which impacts on the Swan-Canning system downstream. High nutrient use has resulted in infestation of weeds and algal blooms in the Swan-Canning system and fish kills in the Swan-Avon system.

Fringing vegetation is generally degraded in cleared agricultural areas but is in good condition in the forested areas. Sedimentation levels are high in all coastal plain rivers and estuaries and the Avon River. Bauxite mining operations in the forested areas have the potential to affect the biodiversity of water resources and cause erosion and sedimentation problems.

Mid-West Avon

The Mid-West region of Western Australia includes the upper part of the Avon River catchment, the Moore and Hill River catchments and the Yarra Yarra and Ninghan drainage basins. The Avon River catchment encompasses a total area of almost 120 000 km², which is nearly 40% of the total area of the southwest drainage division. An area of greater than 90 000 km² of the Avon catchment only flows periodically and is characterised by poorly defined drainage lines.

Due to the large area covered by the region, climate ranges from Mediterranean in the west to semi-arid in the east. In the western part of the region, the climate is characterised by cool wet winters and hot dry summers, with annual rainfall ranging from 450 to 650mm. Inland areas are subject to very hot/dry summers and cold/dry winters. Rainfall decreases in an easterly direction with inland areas receiving less than 250mm annually. The rainfall in inland areas also tends to be more erratic and unreliable.

The western part of the Avon River Basin is characterised by incised river channels on the Darling Plateau, producing about 90% of the flow in the Avon River. Further east, the landscape changes to broad, flat valleys with numerous salt lake chains. The Moore-Hill rivers basin contains both major drainage lines and ephemeral lake systems. The landscape is characterised by sandy coastal plain in the west, rising through the Gingin and Darling scarps, to the Dandaragan and Yilgarn plateaus to the east. The Coonderoo River connects the lake systems in the north of the basin to the Moore River.

West of the Coonderoo River, drainage typically runs from east to west, with most creeks draining internally to salt lakes further inland. The Yarra Yarra and Ninghan Basins are internally draining systems with little well defined drainage, consisting of small creeks feeding into salt lake systems.

Allocation levels are generally low as fresh surface water resources are scarce and groundwater is used extensively. Gingin Brook is highly allocated as it is fresh and increased water use has resulted in stream disputes.

Most rivers in the region are either naturally saline or are increasing in salinity through agricultural development. Catchment clearing has resulted in rising groundwater levels causing waterlogging and salinity problems. Drains have been constructed in much of the region to alleviate the problem however, there is concern that the drains have increased the potential for flooding as water is conveyed more quickly to the river systems.

Murchison-Gascoyne

The Gascoyne River is the longest river in Western Australia and extends for a length of approximately 80 km from the coast at Carnarvon, inland to the east. The Murchison River located further south at Kalbarri is the second longest river in the state. The Gascoyne and Murchison rivers are also the largest by volume in the region (fifth and ninth largest in the state), with mean annual flows of 680 and 150 gigalitres respectively.

The region has a climate varying from Mediterranean with cool, wet winters and hot, dry summers in the south, to arid with hot summers and mild winters in the northern and inland areas. Inland climatic conditions are typically more extreme than experienced on the coast. Annual rainfall varies between 200 and 500mm, with the highest monthly average rainfall occurring between May and July. Northern areas of the region can also be subject to tropical cyclones between January and March, bringing summer rainfall.

The southern Murchison region has been extensively cleared for agriculture, with grain crops contributing significantly to the economy. Clearing has resulted in increased stream salinity, with few fresh streams remaining in the Greenough and Murchison Basins. Further north, the Gascoyne region is largely uncleared, although vegetation has been affected by extensive grazing.

There is generally poor knowledge of the state of rivers in the region, including knowledge of water resources. Allocation levels are low, as there are limited fresh water resources available and, as such, groundwater is widely used.

Pilbara

The Pilbara region covers an area of over 200 000 km², from the Ashburton River in the south to the De Grey River in the north. Towns in the region include the major centres of Karratha and Port Hedland and a number of smaller mining towns. The region experiences extreme weather conditions ranging from severe droughts to major floods, resulting in highly variable river flows. The De Grey is the largest river by volume in the region and the third largest in the state with a mean annual flow of 1000 gigalitres.

The region has a hot, semi-arid to arid climate with average annual rainfall varying between 200 and 350mm. However, recorded annual rainfalls at stations in the Pilbara of between less than 50mm and greater than 1000mm illustrate the extremely variable nature of the region's rainfall. For most of the region, rainfall predominantly occurs during the summer months, with the major falls resulting from cyclonic activity and to a lesser extent from thunderstorms. In the southern coastal area, winter rains resulting from southern low-pressure systems are equally dominant. However, in some years, winter rainfall can be widespread throughout the region and may exceed wet season rainfall.

The region has moderately high relief with the Hamersley Range being the highest range in the state. The two major divides of the river systems are the Hamersley and Chichester ranges. Rivers generally flow in a northerly direction north of the Chichester Range and in a westerly direction south of the range. The region's rivers discharge through direct ocean outlets or disperse through marshy flats. Rivers crossing the coastal plain have extensive floodplains and contribute significant recharge to groundwater resources.

Allocation levels are generally low with the exception of the Harding River, which was dammed to supply potable water to the West Pilbara towns. Salinity is generally low and most rivers are fresh.

Kimberley

The Fitzroy River is by far the largest river, by volume, in Western Australia, with an estimated mean annual flow in excess of 9000 gegalitres. The Ord River has the second largest volume in Western Australia with a mean annual flow of approximately 3000 gegalitres. The Ord River also has one of the largest catchments in the State, extending into the Northern Territory, at over 57 000 km². Lake Argyle on the Ord River, is the largest reservoir in Western Australia, with a capacity of 10 760 gegalitres.

The Kimberley region has a semi-arid to tropical climate with two dominant seasons separated by short transitional periods. To the north of the region are warm tropical waters that provide the energy source for most of the region's rainfall. Annual rainfall varies from 350mm in the south to over 1400mm in the remote northwest coastal area. Almost all (about 90%) of the rainfall occurs between November and April, with falls being light and sporadic for the remainder of the year.

The region has been the scene of much change over the last three decades, particularly in the Ord River catchment. A diversion dam was constructed around which the town of Kununurra has grown and the Ord River Dam was constructed approximately 50 kilometres upstream of the town in 1971. The water impounded behind the Ord River Dam, Lake Argyle, is the second largest man-made lake in Australia after Lake Pedder in Tasmania. The dams have allowed for the development of a major irrigation scheme around Kununurra.

While the construction of the Ord River Dam has provided a constant supply of water to Lake Kununurra and the Ord River Irrigation Area and hydro-electric power for the Argyle Diamond Mine, Kununurra and Wyndham it also has high natural resource value. Lake Argyle is now a major drought refuge area for waterbirds and a migration stopover area for many bird species and a major habitat for freshwater crocodile and fishes.

Streamflow in the Kimberley region generally occurs over the wet season months, November to April inclusive, with little or no flow for the remainder of the year. While the Kimberley region occupies approximately 12% of the total land area of Western Australia it has almost 75% of the state's mean annual streamflow. The Kimberley contains the largest number of pristine and near-pristine river systems in Western Australia. Of the 12 identified Western Australian pristine (also referred to as wild) river systems, 10 are located in the Kimberley with the remaining two located in the Western Plateau region.

There is limited water quality monitoring data available for the Kimberley streams however, the region's surface water resources are generally fresh with low nutrient levels.

Western Plateau

The Western Plateau region of Western Australia includes the following AWRC drainage basins:

- 1202 Nullarbor
- 1203 Warburton
- 1204 Salt Lake
- 1205 Sandy Desert
- 1206 Mackay

The Western Plateau is the largest region in Western Australia, covering 56% of the state. The region is characterised by uncoordinated internal drainage, with almost no major riverine landform features. Desert landscapes dominate, with the Great Sandy, Gibson, Great Victoria and Nullarbor Plain deserts located in the region. The region has extensive sedimentary deposits in which significant groundwater resources occur.

The entire region experiences a hot and arid climate. Rainfall varies from less than 150mm to 350mm a year. Rain in the northern part of the region typically results from tropical summer cyclones. More common infrequent rainfall in the southern part of the region typically occurs as a result of cold frontal systems. Temperatures are extreme, with hot summer days and near freezing winter nights.

The region has very few watercourses. Most are short and all are ephemeral, flowing very infrequently and only for short periods of time following heavy rain. There are no flow or water quality gauging stations located within the region. All major rivers in the region are internally draining that is, they do not drain to the coast. The Nullarbor and Sandy Desert Basins contain coastal areas however, only minor creeks in these areas drain to the coast. As the rivers in the region are located in remote areas, only limited investigations into the conditions of these systems have occurred. Apart from the Kimberley region, the Western Plateau region contains the only pristine (wild) or near-pristine condition rivers in the state. The two wild rivers are Rudall River and Herbert Wash while the near-pristine condition rivers are Savory Creek and Ponton Creek.

Rudall River and Savory Creek are the two major watercourses to the west of the Great Sandy Desert. Rudall River, 120km long and flowing eastwards into Lake Dora, contains fresh water when the creeks and river are running.

Savory Creek, located to the southwest of Rudall River, is 280km long and also flows in an easterly direction into Lake Disappointment. Savory Creek is an extensive creek 150m wide at its maximum, though it may occasionally flood out to a width of 2km. The upper and middle reaches of the river are characterised by a well-defined braided channel, incised to a depth of 20m in places. For the last 50km (east of the McFadden Range), the river divides into several widely separated saline channels up to 10m deep and many minor salt lakes, claypans and saline swamps. Savory Creek starts fresh, but becomes saline east of the McFadden Range.

Ponton Creek is generally in excellent condition however, the watercourses joining the two major salt lake chains are in poor condition. There are several ephemeral watercourses in the southwest of the region, in the Lakes Johnston, Hope and Dundas areas, which are in excellent condition.

Sturt Creek, a major waterway in the region located south of the Ord River in the Kimberley region, is generally in poor condition. The Creek is 170km long and flows into the Lake Gregory wetland system.