



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

Environmental management of groundwater abstraction from the Jandakot Mound

Annual compliance report to the Office of the Environmental Protection Authority

July 2011 – June 2012

Looking after all our water needs

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Office of the Environmental Protection Authority
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Department of Water
December 2012

Department of Water

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1 Introduction

This report describes the Department of Water's compliance with conditions and commitments, including water level criteria, given in *Ministerial Statement No. 688* (Government of Western Australia 2005) for the period 1 July 2011 to 30 June 2012. The report also outlines environmental monitoring, management actions, research initiatives and consultation the department undertakes to manage the groundwater resources of the Jandakot system in a sustainable manner.

Ministerial statement No. 688 sets environmental water provisions in the form of water level criteria at 23 sites across the Jandakot Mound. There are 10 wetland sites, nine terrestrial phreatophytic vegetation sites and four rare flora sites across the Jandakot, Perth and Cockburn groundwater areas (Figure 1 and Table 3).

Ministerial conditions and commitments were established in 1992 to manage the development of groundwater abstraction for public water supply and expected private abstraction. The conditions and commitments have been revised over time to remove sites where the environmental values identified for protection have been lost due to causes other than abstraction. These causes include the drying climate, land clearing and disturbance related to changing land use. The most recent revision removed fifteen sites and amended the water level criteria at two wetlands and three terrestrial vegetation sites. Reduced recharge and changes in land use continue to contribute to non-compliance.

The Department of Water manages abstraction by licensing within allocation limits that are set for each aquifer and groundwater subarea. Licensing and allocation limits are the main mechanisms that the department use to manage Jandakot groundwater resources. The department also guides the appropriate use of domestic garden bores. The department aims to meet water level criteria and to minimise environmental impacts associated with abstraction. The allocation limits for the Jandakot groundwater area were originally endorsed by the EPA in 1992 as part of the development of Stage 2 of the Jandakot Groundwater Scheme. These allocation limits are currently under review to reflect changes to rainfall and recharge.

Totals of licensed entitlements from groundwater subareas on the Jandakot Mound that influence Ministerial sites, focusing on entitlements from the Superficial aquifer, are given in this report (Tables 1, 2 and 3). In 2011–12 water levels at most Ministerial sites stabilised or improved. This was in response to increased recharge from higher rainfall and reduced abstraction compared to the previous year. The number of sites non-compliant with water level criteria reduced from seven in 2010–11 to five in 2011–12 (Table 1).

Table 1 *Rainfall, water use from the Superficial aquifer and number of sites non-compliant with absolute minimum water level criteria*

	Jandakot Mound (Superficial aquifer)		
	2009–10	2010–11	2011–12
Rainfall (mm) ¹	606.2	552.8	838.0
Public water supply entitlements (GL)	4.00	5.11	2.80
Private licensed entitlements (GL)	37.39	37.15	35.28
Non compliance ²	3/23	7/23	5/23

¹ Rainfall figures are for the months July to June, corresponding with the annual reporting period. They were recorded at Perth Airport BOM station.

² The number of sites non-compliant with absolute summer minimum water level criteria. For full details of compliance see Table 4 and Table 5.

2 The Jandakot groundwater system

The Jandakot system provides water for public open space, horticulture, industry and gardens, and contributes to Perth's public water supply. The system comprises three main aquifers:

- the shallow unconfined Superficial (water table) aquifer known as the Jandakot Mound
- the deeper, mostly confined Leederville aquifer
- and the deeper, mostly confined Yarragadee aquifer.

The Jandakot Mound refers to the mounding of the watertable within the Superficial aquifer to the south of the Swan River. The Jandakot Mound has a higher long-term average rainfall than the Gnangara Mound. However, due to a thinner sequence of unconfined sediments and less surface area the Jandakot Mound has less capacity for storage of groundwater than the Gnangara Mound. The superficial geology explains the relatively rapid response between recharge from rainfall and levels of the Superficial aquifer.

Ecosystems in direct connection with the Superficial aquifer are at risk of being affected by abstraction and reduced rainfall. Most of the Jandakot Mound is separated from the deeper Leederville aquifer by a confining layer of Kardinya shale that extends under all the Ministerial sites except Lake Forrestdale. These impermeable shales limit the potential for inter-aquifer impacts of abstraction across most of the Mound. The disconnection created by the shales means abstraction from the Superficial aquifer has a greater impact on wetlands on the Jandakot Mound than abstraction from the deep aquifers.

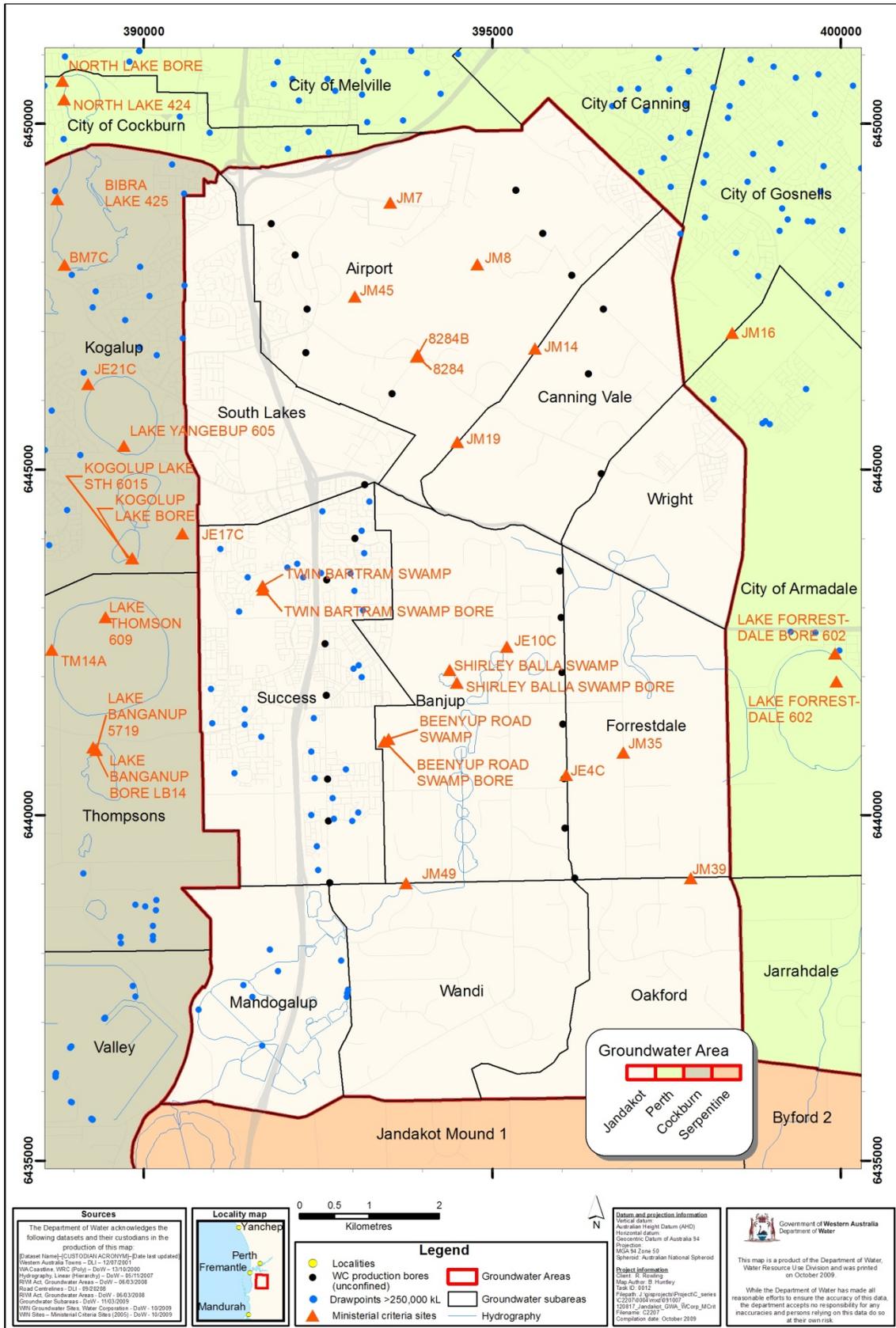


Figure 1 Location of Ministerial sites, public water supply production bores and private licensed entitlements over 250,000 kL from the Superficial aquifer

3 Rainfall and recharge

Annual rainfall across the south-west of Western Australia shows a general drying since the mid 1970s. The CSIRO predicts rainfall in the south-west of Western Australia will continue to decline based on its investigation of climate change (Bates et al. 2010).

Groundwater levels of the Superficial aquifer depend directly on recharge from rainfall. Comparison of medium term (post July 1975) and short-term average rainfall (post July 1997) for the Perth Airport (BOM site 9021) show further declines since the 1970s (Figure 2). In 2011–12, 838.0 mm of rain was recorded at Perth Airport, the highest annual total since 2007–08. This followed three years of low annual rainfall.

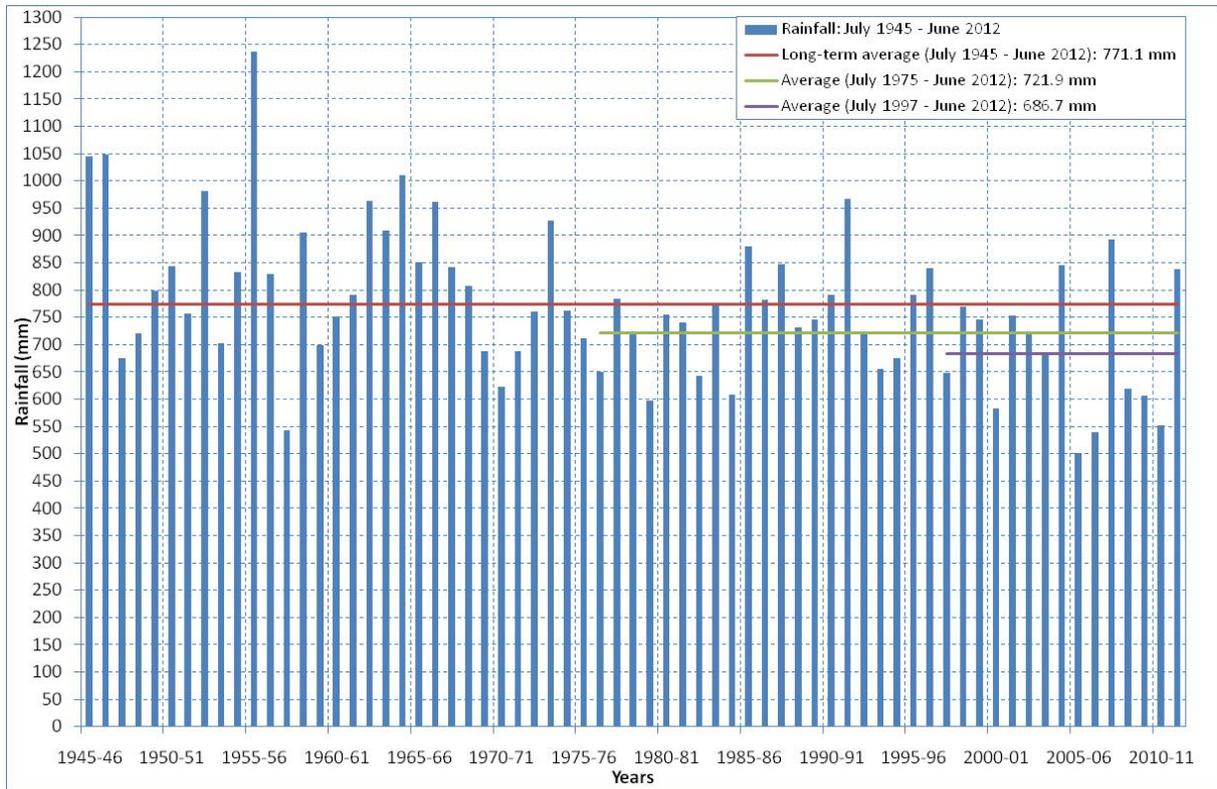


Figure 2 Long-term rainfall by water year (July 1945 – June 2012) for Perth Airport BOM site 9021

Note: Data sourced from the Bureau of Meteorology.

4 Groundwater use

Ministerial sites are located in administrative subareas in the Jandakot, Perth and Cockburn groundwater areas (see Figure 1). Licensed entitlement figures given below and in Tables 1, 2 and 3 are for all subareas which impact on Ministerial sites.

4.1 Public water supply

For public water supply purposes, the Gnangara and Jandakot groundwater systems are managed together as part of the Integrated Water Supply Scheme. The Jandakot contribution to the scheme is relatively small. The Jandakot Groundwater Scheme Stages 1 and 2 for public water supply are fully commissioned and no further development of the Superficial aquifer is currently proposed. Licensed entitlements for public water supply are from the Superficial and Leederville aquifers. Entitlements from the Superficial aquifer are within the Jandakot groundwater area only.

While the total entitlements have increased over time, the proportion licensed from the Superficial aquifer has generally decreased to limit environmental impacts. The volumes of groundwater licensed for public water supply from all aquifers over the reporting period are shown in Table 2. Table 3 shows public supply licensed entitlements from the Superficial aquifer by groundwater subarea.

4.2 Private licensed use

Most of the groundwater currently licensed from the Superficial aquifer is to private users. Groundwater is used for public open space, horticulture, industry, gardens and grounds of institutions and recreation grounds. Over the reporting period, private licensed entitlements from the Superficial aquifer in the Jandakot groundwater area, and in subareas that impact on Ministerial sites within the Perth and Cockburn groundwater areas, remained relatively steady or declined (Table 3). Table 3 shows volumes of private licensed entitlements from the Superficial aquifer by groundwater subarea.

4.3 Garden bores

A small volume of groundwater is abstracted from the Superficial aquifer through domestic garden bores that do not require a licence.

Table 2 *Totals of licensed entitlements from all aquifers within the Jandakot groundwater area and from subareas that impact on Ministerial sites in the Perth and Cockburn groundwater areas*

Aquifer	Public water supply entitlements (GL)			Private licensed entitlements (GL)		
	2009–10	2010–11	2011–12	2009–10	2010–11	2011–12
Superficial	4.00	5.11	2.80	37.39	37.15	35.28
Leederville	6.80	8.12	8.25	0.00	0.00	0.00
Yarragadee	0.80	1.00	0.66	0.00	0.00	0.00
TOTAL	11.60	14.23	11.71	37.39	37.15	35.28

Table 3 Licensed allocations from the Superficial aquifer for groundwater subareas that impact on Ministerial sites across the Jandakot Mound

Groundwater area	Subarea	Ministerial criteria site present	Allocation limit (GL/yr) ¹	Public water supply licensed entitlements (GL/yr) ²				Private licensed entitlements (GL/yr) ³			
				2009–10	2010–11	2011–12	Future Water Reserve ⁵	Quota set by EPA ⁴	2009–10	2010–11	2011–12
Jandakot	Airport ⁵	Yes	4.29	1.18	1.22	0.64	Yes	1.40	1.06	1.31	0.95
	Banjup ⁵	Yes	3.61	0.50	0.73	0.42	Yes	1.80	1.13	0.80	0.71
	Canning Vale ⁵	No	1.35	0.60	0.85	0.45	Yes	0.60	0.17	0.25	0.11
	Forrestdale ⁵	Yes	2.01	0.20	0.21	0.08	Yes	1.67	1.03	1.04	0.98
	Mandogalup	No	3.00					3.00	1.81	1.84	1.88
	Oakford	Yes	1.37					1.37	0.33	0.24	0.24
	South Lakes	No	1.25					1.25	0.58	0.46	0.46
	Success ⁵	Yes	4.30	1.53	2.10	1.22	Yes	2.25	1.31	1.23	1.05
	Wandi	No	1.20					1.20	0.60	0.47	0.47
	Wright	No	0.96					0.96	0.92	0.78	0.81
Total for Jandakot Groundwater area			23.34	4.00	5.11	2.80		15.50	8.94	8.42	7.66
Perth	City of Armadale	Yes	4.00						2.64	2.42	2.96
	City of Canning	No	3.50						2.29	2.33	2.25
	City of Cockburn	Yes	1.00						0.46	0.46	0.48
	City of Gosnells	No	5.50						3.22	3.23	4.18
	City of Melville	No	5.50						4.23	4.14	2.34
Total for Perth Groundwater areas			19.50	0.00	0.00	0.00			12.85	12.58	12.22
Cockburn	Kogalup	Yes	11.46						10.18	10.55	9.86
	Thompsons	Yes	8.70						5.58	5.60	5.55
Total for Cockburn Groundwater areas			20.16	0.00	0.00	0.00			15.75	16.15	15.41
Total for subareas that impact on Jandakot Ministerial criteria sites			63.00	4.00	5.11	2.80			37.39	37.15	35.28

NOTE: In 2011–12 there were minor administrative changes to how the department accounted for water licensed for public water supply. This report presents licensed entitlement data rather than the combination of estimates of abstraction and licensed entitlement data that have been presented in previous compliance reports. Similarly there were minor administrative changes to accounting for a small group of private licences as part of the streamlining of legislation. Therefore, some of the figures presented will differ slightly to those presented in previous compliance reports.

¹ Allocation limits for the Perth groundwater area were reviewed in 2007 as part of the review of allocation limits for the Gnamptara groundwater areas.

² Public water supply information is from both the Water Resourcing Licensing System and annual reports submitted to the Department of Water by the Water Corporation as a condition of their licence. For consistency with all other DoW corporate reporting the data presented in this table shows annual licensed entitlements sourced from the Water Resourcing Licensing System.

³ Source of private licensed entitlement data is the Water Resourcing Licensing System (2009–10 report run on 1 June 2010. 2010–11 report run on 1 June 2011. 2011–12 report run on 1 July 2012). There have been minor administrative changes to accounting for a small group of private licences as part of the streamlining of legislation. Therefore, some of the figures presented will differ slightly to those presented in previous compliance reports.

⁴ The quota for private licensed allocation was set in accordance with the Environmental Management Program by the EPA in 1992. Since then South Lakes subarea has been expanded to include the Yangebup subarea.

⁵ For subareas containing groundwater reserved for future public water supply, reserve volumes are NOT included in the licensed allocation figures presented

Up to date figures on water availability are available from the Swan Avon or Kwinana-Peel regional offices. 1 GL = 1 000 000 kL. Figures have been rounded to two decimal places.

5 Compliance

Appendices A and B (the 'Audit Tables') detail the conditions and commitments that the Department of Water is required to comply with on the Jandakot Mound (Ministerial *Statement No. 688*).

5.1 Compliance with water level criteria

Ministerial statement No. 688 sets water level criteria at 23 sites across the Jandakot Mound (Figure 1). There are 10 wetland sites, nine terrestrial phreatophytic vegetation monitoring sites and four rare flora sites. Phreatophytic vegetation is vegetation that utilises groundwater to meet at least part of its water needs. Some sites have more than one water level criterion and can be non-compliant with multiple criteria. Water level criteria include:

- preferred minimum water levels
- absolute minimum water levels
- rate of decline and timing of drying (referred to as other water level criteria).

Over 2011–12, water levels at most Ministerial sites stabilised or improved. This resulted in fewer sites being non-compliant with absolute minimum water level and other criteria compared to 2010–11 (Table 4). Non-compliance with absolute minimum water level criteria decreased from seven sites in 2010–11 to five sites in 2011–12. Further detail on compliance across the Jandakot Mound and the circumstances contributing to non-compliance can be found in Table 4, Table 5 and Appendix A. Table 5 includes details of the management and mitigation being undertaken at these sites to improve water levels and future compliance.

Table 4 Sites across the Jandakot Mound non-compliant with Ministerial water level criteria

Year	Non compliant sites					
	Absolute minimum water level criteria			Other water level criterion		
	Wetlands	Terrestrial and rare flora vegetation	Total non-compliant	Wetlands	Terrestrial and rare flora vegetation	Total non-compliant
2009–10	North Lake Bibra Lake Shirley Balla Swamp		3/23	Bibra Lake Thomsons Lake Lake Forrestdale		3/12
2010–11	North Lake Bibra Lake Lake Forrestdale Lake Banganup Shirley Balla Swamp	JM14 JM19	7/23	North Lake Bibra Lake Thomsons Lake Lake Forrestdale Shirley Balla Swamp Beenyup Road Swamp	JM7 JM8 JM45 JE17C	10/12
2011–12	North Lake Bibra Lake Lake Forrestdale Lake Banganup Shirley Balla Swamp		5/23	Bibra Lake Thomsons Lake Lake Forrestdale Shirley Balla Swamp		4/12

Table 5 Sites non-compliant with water level and other criteria over the reporting period, circumstances of non-compliance and management and mitigation being undertaken

Site	Relevant criteria	Non-compliance	Circumstances, management and mitigation
North Lake	Absolute summer minimum: 12.68 mAHD. < 0.1 m/yr decline.	2011–12: non-compliant with absolute summer minimum water levels.	<p>North Lake is in the Bibra suite of wetlands located to the west of the crest of the Jandakot Mound. The wetland is in the Cockburn groundwater area to the west of the Jandakot groundwater area.</p> <p>A shallow groundwater systems investigation is currently being completed to improve our understanding of the lake's hydrogeology in relation to its ecological health.</p> <p>Public water supply abstraction from environmentally sensitive bores was reduced in 2011–12 (see section 6.2).</p> <p>The department is currently reviewing allocation limits in the Jandakot groundwater area, considering compliance, water level trends and ecological health at the lake (see section 6.2). The department is also working to ensure future licensing decisions support compliance at Ministerial sites on the Jandakot Mound.</p>
Bibra Lake	Absolute summer minimum: 13.6 mAHD. Not to dry more than two in three years, and preferably less than one in three years.	<p>2011–12: non-compliant with absolute summer minimum water levels. Minimum levels were <13.5 mAHD in all years (staff gauge dries at 13.5 mAHD).</p> <p>2011–12: the lake has dried more than two in three years.</p>	<p>Bibra Lake is in the Bibra suite of wetlands located to the west of the crest of the Jandakot Mound. The wetland is in the Cockburn groundwater area to the west of the Jandakot groundwater area.</p> <p>Public water supply abstraction from environmentally sensitive bores was reduced in 2011–12 (see section 6.2).</p> <p>The department is currently reviewing allocation limits in the Jandakot groundwater area, considering compliance, water level trends and ecological health at the lake (see section 6.2).</p> <p>The department is also working to ensure future licensing decisions support compliance at Ministerial sites on the Jandakot Mound.</p>

Site	Relevant criteria	Non-compliance	Circumstances, management and mitigation
Thomsons Lake	For 30 % of time water levels > 11.8 mAHD (wet year-10 %); 11.3-11.8 mAHD (medium year-80 %); or 10.8-11.3 mAHD (dry year-10 %).	2011–12: the lake dried every summer. Minimum levels at Bore TM14A ranged from 11.3 to 11.0 mAHD. Non-compliant due to levels in range of 10.8-11.3 mAHD for greater than 10 % of the time.	<p>Thomsons Lake is in the Bibra suite of wetlands located to the west of the crest of the Jandakot Mound. The wetland is in the Cockburn groundwater area to the west of the Jandakot groundwater area.</p> <p>A shallow groundwater investigation is currently being completed to improve our understanding of the lake's hydrogeology in relation to its ecological health. Public water supply abstraction from environmentally sensitive bores was reduced in 2011–12 (see section 6.2).</p> <p>The department is currently reviewing allocation limits in the Jandakot groundwater area, considering compliance, water level trends and ecological health at the lake (see section 6.2).</p> <p>The department is working to ensure future licensing decisions support compliance at Ministerial sites on the Jandakot Mound.</p> <p>The Department of Environment and Conservation and the Water Corporation supplement water levels at Thomsons Lake over the winter months.</p>
Lake Forrestdale	<p>Absolute summer minimum: 21.1 mAHD.</p> <p>At least 0.9 m water at peaks levels (22.6 mAHD).</p>	<p>2011–12: non-compliant with absolute summer minimum water levels.</p> <p>2011–12: the lake did not achieve a minimum depth of 0.9 m.</p>	<p>Lake Forrestdale is in the Bennet Brook suite of wetlands located to the east of the crest of the Jandakot Mound. The wetland is in the Perth groundwater area to the east of Jandakot groundwater area.</p> <p>Water levels and water quality are influenced by water flows through the Forrestdale main drain.</p> <p>A shallow groundwater investigation is currently being completed to improve our understanding of the lake's hydrogeology in relation to its ecological health. Public water supply abstraction from environmentally sensitive bores was reduced in 2011–12 (see section 6.2).</p> <p>The department is currently reviewing allocation limits in the Jandakot groundwater area, considering compliance, water level trends and ecological health at the lake (see section 6.2).</p> <p>The department is working to ensure future licensing decisions support compliance at Ministerial sites on the Jandakot Mound.</p>

Site	Relevant criteria	Non-compliance	Circumstances, management and mitigation
Banganup Lake	Absolute summer minimum: 11.5 mAHD.	2011–12: non-compliant with absolute summer minimum water levels.	<p>Banganup Lake is in the Bibra suite of wetlands located to the west of the crest of the Jandakot Mound. The wetland is in the Cockburn groundwater area to the west of the Jandakot groundwater area.</p> <p>Public water supply abstraction from environmentally sensitive bores was reduced in 2011–12 (see section 6.2).</p> <p>The department is currently reviewing allocation limits in the Jandakot groundwater area, considering compliance, water level trends and ecological health at the lake (see section 6.2).</p> <p>The department is working to ensure future licensing decisions support compliance at Ministerial sites on the Jandakot Mound.</p>
Shirley Balla Swamp	<p>Absolute summer minimum: 23.1 mAHD or 0.5 m below lake base, whichever is the higher (24.5 mAHD).</p> <p>Not to dry before end of January.</p> <p>Water levels should not decline at rate greater than 0.1 m/year.</p>	<p>2011–12: non-compliant with absolute summer minimum water levels. Minimum levels were <24.5 mAHD in all years (staff gauge dries at 25 mAHD).</p> <p>2011–12: the swamp dried before the end of January.</p>	<p>Shirley Balla Swamp is in the Jandakot suite of wetlands located on the crest of the Jandakot Mound. The wetland is in the Jandakot groundwater area.</p> <p>Public water supply abstraction from environmentally sensitive bores was reduced in 2011–12 (see section 6.2).</p> <p>The department is currently reviewing allocation limits in the Jandakot groundwater area, considering compliance, water level trends and ecological health at the lake (see section 6.2).</p> <p>The department is working to ensure future licensing decisions support compliance at Ministerial sites on the Jandakot Mound.</p>

5.1.1 Predicted non-compliance with water level criteria

The department uses previous water levels and average summer weather conditions (rainfall and temperature) to predict the number of sites that may be non-compliant with absolute minimum water level criteria in the next reporting period.

These predictions help to inform negotiations with the Water Corporation regarding distribution of licensing for public water supply abstraction. The department informs the OEPA of predicted non-compliance with water level and other criteria as required. We predict that six sites may be non-compliant with absolute summer minimum water level criteria in 2012–13 (Table 6).

Table 6 Predictions and actual numbers of sites non-compliant with absolute summer minimum water level criteria on the Jandakot Mound

Year	Predicted non-compliant sites					
	Predicted non-compliance with absolute minimum water level criteria			Actual non-compliance with absolute minimum water level criteria		
	Wetland sites	Terrestrial and rare flora vegetation	Total	Wetland sites	Terrestrial and rare flora vegetation	Total
2009–10	North Lake Bibra Lake Shirley Balla Swamp		3/23	North Lake Bibra Lake Shirley Balla Swamp		3/23
2010–11	North Lake Bibra Lake Lake Forrestdale Banganup Lake Shirley Balla Swamp	JM19 JM39	7/23	North Lake Bibra Lake Lake Forrestdale Lake Banganup Shirley Balla Swamp	JM14 JM19	7/23
2011–12	North Lake Bibra Lake Banganup Lake Shirley Balla Swamp		4/23	North Lake Bibra Lake Lake Forrestdale Lake Banganup Shirley Balla Swamp		5/23
2012–13	North Lake Bibra Lake Lake Forrestdale Banganup Lake Shirley Balla Swamp	JM19	6/23			

6 Environmental monitoring, management actions, research initiatives and consultation

6.1 Environmental monitoring

The Department of Water engages expert environmental consultants to undertake an environmental monitoring program in line with the commitments in *Ministerial Statement No. 688*. The monitoring program was reviewed in 2009 (see Appendix D) and includes monitoring of wetland vegetation, wetland aquatic macroinvertebrates and water quality.

Ecological condition is affected by a number of factors that influence water levels, including abstraction. The department uses environmental monitoring to manage abstraction at priority locations where it is identified that reduced abstraction can have a positive effect on ecological condition. A summary of compliance with Ministerial water level criteria and changes in ecological condition for the reporting period is given in Table 7.

Wetland vegetation

Wetland vegetation condition was monitored in spring at six wetland sites in 2011 (Wilson and Froend 2012). Four wetlands within the Bibra wetland suite (Banganup Lake, North Lake, Thomsons Lake, Bibra Lake) and one within the Jandakot suite (Twin Bartram Swamp) were highlighted as wetlands of concern. At these sites monitoring indicated a moderate negative change in vegetation and hydrological condition compared with 2010. These sites have all been repeatedly non-compliant with water level criteria in recent years.

Wetland aquatic macroinvertebrates and water quality

Five wetlands were monitored for macroinvertebrate family richness and assemblages and water quality in 2011 (Strehlow et al. 2012). Monitoring was undertaken to coincide with peak water levels.

In 2011, species richness composition was below average at Yangebup Lake, Warton Road Swamp, Gibbs Road Swamp and the Spectacles and above average at Thomsons Lake and Lake Kogolup. Nutrient concentrations and water levels were identified to be effecting species richness composition. Long-term trends indicate that at most sites when sufficient water is present (maximum spring depth of greater than 0.5 m) aquatic plant and macroinvertebrate communities remain stable. The monitoring recommended that reducing nutrient inputs to wetlands would limit the risk of further changes to community composition.

Water quality at all wetlands monitored either improved or remained unchanged from 2010. However all wetlands still had nutrients concentrations exceeding ANZECC/ARMCANZ (2001) triggers.

Table 7 Summary of compliance and ecological condition at Ministerial sites where monitoring occurred across the reporting period, and in previous years

Site	Compliance (absolute minimum water level criteria)			Wetland vegetation (canopy vigour / exotic cover / species composition)			Macroinvertebrate (species richness / species composition)			Water quality (pH / turbidity / nutrients)		
	2009–10	2010–11	2011–12	2009–10	2010–11	2011–12	2009–10	2010–11	2011–12	2009–10	2010–11	2011–12
North Lake	X	X	X	+ / = / =	# - / + / -	+ / -	NM			NM		
Bibra Lake	X	X	X	NM 09–10	NM 10–11	= / -	NM			NM		
Kogolup Lake South	✓	✓	✓	NM 09–10	+ / - / =	NM 11–12	NM (Kogolup Lake North is monitored)			NM 09–10	= / + / =	NM 11–12
Thomsons Lake	✓	✓	✓	- / - / -	- / - / =	+ / =	- / =	- / -	+ / =	- / + / =	+ / - / -	= / + / +
Lake Forrestdale	✓	X	X	- / - / -	NM 10–11	NM 11–12	- / -	NM 10–11	NM 11–12	= / + / =	NM 10–11	NM 11–12
Yangebup Lake	✓	✓	✓	NM	NM	NM	= / =	- / -	= / =	- / + / -	= / + / -	- / - / +
Banganup Lake	✓	X	X	+ / = / =	# - / = / -	+ / -	NM 09–10	# / -	NM 11–12	NM 09–10	#	NM 11–12
Twin Bartram Swamp	✓	✓	✓	NM 09–10	NM 10–11	= / =	NM			NM		
Shirley Balla Swamp	X	X	X	- / = / -	NM 10–11	NM 11–12	+ / =	NM 10–11	NM 11–12	= / - / +	NM 10–11	NM 11–12
Beenyup Road Swamp	✓	✓	✓	+ / - / =	+ / - / =	+ / =	NM			NM		

✓ compliant

x non-compliant

= no change from previous years

+ slight improvement in condition from previous years

- decline in condition from previous years

NM not monitored

lake dry at time of monitoring

6.2 Management actions

The department's primary focus is to manage abstraction in environmentally sensitive areas where this would lead to an improvement in compliance and ecological condition at Ministerial sites.

6.2.1 Jandakot groundwater area allocation limit review

The department is reviewing the allocation limits for the Jandakot groundwater area. The updated allocation limits will be based on current recharge and align with the environmental objectives of the Jandakot Mound. The new limits will reduce the risk of increased abstraction affecting compliance and ecological condition at Ministerial sites. The allocation limit review will be finalised in 2013.

6.2.2 Managing public water supply

In response to the increased number of Ministerial sites that were non-compliant in 2010–11, the department reduced entitlements for public water supply from more environmentally sensitive bores in the Jandakot groundwater area by 1.59 GL in 2011–12.

The proportion of groundwater licensed for public water supply from the deeper aquifers has increased in the last ten years. This is in line with the strategy developed by the department and the Water Corporation to reduce abstraction from environmentally sensitive areas of the Superficial aquifer and minimise impacts of abstraction on groundwater-dependent ecosystems.

As outlined in the *Gnangara groundwater areas allocation plan*, the addition of the Southern Seawater Desalination Plant to the scheme triggered a change in how groundwater for public water supply is allocated. In line with the plan, from 2012–13, the Water Corporation's baseline annual groundwater allocation from Gnangara and Jandakot for the Integrated Water Supply Scheme has been reduced from 145 GL to 120 GL (from existing infrastructure). Under the 120 GL baseline allocation, the licensed volume from the Superficial aquifer in the Jandakot groundwater area has been reduced from 3.20 GL to 2.90 GL. This reduction was targeted to bores near environmentally sensitive areas where it would benefit compliance and ecological condition at Ministerial sites.

As part of the move to the new baseline allocation the department updated the environmental sensitivity classifications of public water supply production bores. The update was based on recent groundwater level trends and compliance at Ministerial sites. A significant number of production bores have been reclassified to a more sensitive classification as a result of the update. The update will help distribute abstraction for the public water supply to limit impacts at Ministerial sites.

6.2.3 Managing private licensed use

Most of the groundwater currently licensed from the Superficial aquifer is to private users. Activities in progress or scheduled to manage private licensed use include on-ground compliance inspections, meter audits and water use surveys. This work checks that water use is within entitlements and that site activities are authorised.

The department's compliance and enforcement activities have been prioritised to consider water level criteria and ecological condition at Ministerial sites. This included expanding the scope of the *State Compliance Monitoring Plan* to consider conditions and commitments at Ministerial sites, and forms part of the department's work to reduce levels of non-compliance.

Other ways the department is working to optimise the use of water by private licensees include:

- Work with local governments and other licensees using large volumes to improve water use efficiency.
- The department updated the water trading policy and listed a web-based register of licensees in 2010 to facilitate water trades as a way to optimise water use.

6.2.4 Managing garden bore use

The efficient use of groundwater from garden bores reduces demand on scheme water and is suitable in some areas. A new garden bore use guideline was developed in 2011, emphasising water conservation and efficiency and an updated garden bore suitability map is now accessible on the Perth Groundwater Atlas (accessed through the department's website). Garden bores are not encouraged in areas that are unsuitable due to the risk of acid sulphate soils, poor water quality or low yields. These areas are identified in the Atlas.

The government updated the 2007 water efficiency measures legislation for garden bores in November 2011 under the Water Agencies (Water use) by-laws 2010. This limits their use to three days per week over summer and applies a total use-ban during winter.

6.3 Research initiatives

6.3.1 Hydrogeological investigations and modelling

The department, with research partners, is completing a number of major projects to focus management effort on environmentally sensitive areas which are likely to benefit from changes to abstraction. This work is informing the review of allocation limits for the Jandakot groundwater area.

- The Perth regional aquifer modelling system (PRAMS) is currently being updated. The system will be used for detailed modelling studies, including modelling of scenarios to examine interactions between climate, land use and groundwater abstraction.

- Investigations to determine whether additional abstraction from the Leederville and/or Yarragadee aquifers could be a viable source option for public water supply.
- The Perth shallow groundwater system investigation includes studies at North Lake, Lake Forrestdale and Thomsons Lake. These studies are improving our understanding of the interrelationships between wetlands and the Superficial aquifer, and the complex, superimposed impacts of climate change, land use and abstraction. The department is using outcomes and recommendations from the investigations to better relate water levels to ecological condition and local abstraction.
- The department commissioned Edith Cowan University to develop a model to determine ecological risk to groundwater-dependent vegetation in a drying climate. The model is based on 30 years of ecological and hydrological monitoring data. It will be an important management tool for assessing risk to groundwater-dependent vegetation under different climate and abstraction regimes.

6.4 Consultation

The department engages with the community through public seminars, conferences, workshops and Jandakot Community Consultative Committee (JCCC) meetings. JCCC meetings are held annually to discuss the state of groundwater-dependent ecosystems supported by the Jandakot Mound in relation to abstraction and other influences. JCCC meetings are attended by representatives from the department, the Water Corporation, the Department of Environment and Conservation, local government and community groups.

The department provides advice to local government and other agencies that refer development proposals to us for review. For example, the department recently provided a detailed submission on the *Roe Highway Extension - Public Environmental Review* and is providing ongoing advice on this proposal to the OPEA.

The department uses the *Better urban water management framework* to provide advice on water management in urban areas to local government authorities and other land development agencies, aiming to minimise the effects of drainage and stormwater on shallow groundwater. The department also provides specific advice to local and state government agencies on water supply, including for public open space, for development proposals as required.

Appendices

Appendix A – Water level monitoring results for Ministerial sites on the Jandakot Mound, 2000–2012

Sites non-compliant with water level criteria and other criteria are highlighted in **RED**. See also Table 5 for further information about the circumstances of non-compliance and mitigation actions.

Criteria wetlands

Wetland	AWRC Ref.	Water level criteria (mAHD)		Other criteria	Water level (mAHD)												Comments on compliance in 2011–12	
		Preferred	Absolute			2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11		2011-12
North Lake	Staff 424 6142521	13.29	12.68	<0.1 m decline per year	Max	13.67	13.56	13.42	13.50	13.24	13.79	13.18	13.07	13.22	12.93	12.68	12.93	<p>Non-compliant with absolute summer minimum.</p> <p>The lake has been non-compliant since 2006-07. Groundwater levels recorded at the bore declined from 2005 to 2010 but improved in 2011-12.</p> <p>The EPA did not support the Department of Water's recommendation (Strategen 2004) to revise the absolute minimum to 12.32 mAHD.</p> <p>A shallow groundwater investigation is currently being completed to improve our understanding of the lake's hydrogeology in relation to its ecological health.</p> <p>Public water supply abstraction from environmentally sensitive bores was reduced in 2011–12 (see section 6.2).</p> <p>The department is currently reviewing allocation limits in the Jandakot groundwater area, considering compliance, water level trends and ecological health at the lake.</p>
					Min	12.38	12.48	12.38	12.38	12.38	12.97	12.38	12.38	12.38	12.38	12.38	12.38	
	Bore 61410726	Min	12.01		12.10	11.91	11.79	11.72	12.45	11.74	11.81	11.74	11.59	11.48	11.60			
Bibra Lake	Staff 6142520	13.6 – 14.2 <15.0 peak	13.6	Not to dry more than 2 in 3 years, and preferably less than 1 in 3 years.	Max	15.0	14.9	14.7	14.7	14.5	14.8	14.5	14.3	14.3	14.2	13.7	14.0	<p>Non-compliant with absolute summer minimum.</p> <p>The lake has been non-compliant since 2006-07. Lake levels declined from 2005 to 2010 but improved marginally in 2011-12.</p> <p>Non-compliant with other criterion.</p> <p>The lake has dried every summer since 2006-07.</p> <p>Public water supply abstraction from environmentally sensitive bores was reduced in 2011–12 (see section 6.2).</p> <p>The department is currently reviewing allocation limits in the Jandakot groundwater area, considering compliance, water level trends and ecological health at the lake.</p>
					Min	14.0	14.0	13.7	13.5	13.5	14.1	13.5 dry 15/03	13.5 dry 19/03	13.5 dry 12/03	13.5 dry 19/02	13.5 dry 07/12	13.5 dry 01/02	
	Bore BM7C 61410177	Min																
Kogolup Lake (South)	Staff 6142522	13.1 – 14.0 <14.8 peak	13.1		Max										15.2	14.5	14.8	Compliant.
					Min										14.0	14.0	14.0	
	Bore 6015 61410727	Max			15.4	14.9	14.8	14.9	14.7	15.2	14.6	14.5	14.9	14.5	14.5	14.8		
		Min			14.0	13.7	13.7	13.8	13.7	14.2	13.6	13.6	13.8	14.0	13.6	13.9		

Wetland	AWRC Ref.	Water level criteria (mAHD)		Other criteria	Water level (mAHD)											Comment					
		Preferred	Absolute			2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10		2010-11	2011-12			
Thomsons Lake	Staff 609 6142517	11.3-11.8	10.8	For 30 % of time water levels > 11.8 mAHD (wet year – 10 %) 11.3-11.8 mAHD (medium year – 80 %) 10.8-11.3 mAHD (dry year – 10 %)	Max							12.9	11.5	12.4	12.7	12.7	12.1	12.3	<p>Non-compliant with other criterion.</p> <p>2011–12 was classed as a dry year with 828.4 mm of rainfall received at Perth Airport (BOM station no. 9021). Clarification is required from OEPA over which BOM station should be used for rainfall data.</p> <p>The lake dries at 11.5 mAHD. Absolute minimum water levels are measured at the bore. As part of the Jandakot Drainage Scheme, the Water Corporation monitors water levels at this site.</p> <p>A supplementation and sampling analysis plan was completed in 2004–05. The DEC supervises the ongoing supplementation program.</p> <p>A shallow groundwater investigation is currently being completed to improve our understanding of the lake's hydrogeology in relation to its ecological health.</p> <p>Public water supply abstraction from environmentally sensitive bores was reduced in 2011–12 (see section 6.2).</p> <p>The department is currently reviewing allocation limits in the Jandakot groundwater area, considering compliance, water level trends and ecological health at the lake.</p>		
	Min										11.5 dry	11.5 dry	11.5 dry								
	Max				12.3	12.0	12.0	12.0	12.0	12.4	11.3	12.0	12.2	12.2	11.8	12.1					
	Min				11.3	11.3	11.2	11.2	11.2	11.6	11.1	11.3	11.2	11.3	11.0	11.2					
Lake Forrestdale	Staff 6162557	21.2-21.6	21.1	Preferred earliest drying by April (wet year), February – March (medium year) or January (in a dry year). At least 0.9 m water at peaks levels (22.6 mAHD)	Max	22.4	22.0	22.0	22.3	22.1	22.4	21.7	21.9	22.1	22.0	21.7	21.9		<p>Non-compliant with absolute summer minimum.</p> <p>The lake dries at 21.6 mAHD.</p> <p>Absolute minimum water levels are measured at the bore. Compared to 2010-11, the minimum level improved in 2011-12 and was close to the absolute minimum criteria.</p> <p>Non-compliant with other criterion.</p> <p>The lake did not achieve a minimum depth of 0.9 m (22.6 mAHD) in 2011-12, though lake levels did improve from 2010-11.</p> <p>2011–12 was classed as a dry year with 828.4 mm of rainfall received at Perth Airport (BOM station no. 9021). Clarification is required from EPA over which BOM station should be used for rainfall data.</p> <p>The EPA did not support the Department of Water's recommendation (Strategen 2004) to revise the absolute minimum to 20.2 mAHD.</p> <p>A shallow groundwater investigation is currently being completed to improve our understanding of the lake's hydrogeology in relation to its ecological health.</p> <p>Public water supply abstraction from environmentally sensitive bores was reduced in 2011–12 (see section 6.2).</p> <p>The department is currently reviewing allocation limits in the Jandakot groundwater area, considering compliance, water level trends and ecological health at the lake.</p>		
	Min				dry 30/01	dry 30/01	dry 30/12	dry 28/01	dry 16/05	dry 28/03	dry 25/10	dry 05/12	dry 13/01	dry 09/12	dry 07/12	dry 11/01					
	Max				23.4	23.2	23.3	23.3	23.3	23.3	22.9	23.2	23.2	23.2	23.0	23.2					
	Min				21.0	20.9	20.9	20.8	20.8	21.4	20.7	21.2	21.0	21.2	20.6	21.0					
Yangebup Lake	Staff 605 6142523	<16.5 peak 13.9-15.5	13.8	Either Bibra or Yangebup Lake must contain 0.3 m water, preferably 0.5 m.	Max	16.5	16.6	16.1	16.5	15.6	16.7	16.1	16.0	16.6	16.6	15.9	15.9	<p>Compliant.</p> <p>As part of the Jandakot Drainage Scheme, the Water Corporation monitors water levels at the site and lowers water levels if the peak is exceeded</p>			
	Min				15.5	15.6	15.4	15.3	15.3	15.7	15.0	15.0	15.6	15.4	14.5	15.1					
	Max				16.1	16.2	16.1	16.1	15.6	16.1	15.6	15.9	15.9	16.1	15.3	15.3					
	Min				15.1	15.1	14.9	14.8	14.7	15.2	14.6	14.8	15.1	15.0	14.1	14.6					

Wetland	AWRC Ref.	Water level criteria (mAHD)		Other criteria	Water level (mAHD)												Comment	
		Preferred	Absolute			2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11		2011-12
Banganup Lake	Staff 5719 6142516		11.5		Max			12.5	12.7	12.7	12.8	12.7	12.7	12.7	12.7	12.7	12.7	<p>Non-compliant with absolute summer minimum. The lake dries at 12.7 mAHD.</p> <p>Absolute minimum water levels are measured at the bore. Though non-compliant in 2011-12, the minimum level improved from 2010-11.</p> <p>Public water supply abstraction from environmentally sensitive bores was reduced in 2011-12 (see section 6.2).</p> <p>The department is currently reviewing allocation limits in the Jandakot groundwater area, considering compliance, water level trends and ecological health at the lake.</p>
	Min									12.7	12.7	12.7	12.7	12.7	12.7	12.7		
	Max									12.7	12.4	12.6	12.6	12.5	12.0	12.3		
	Min				11.6	11.6	11.5	11.5	11.5	11.8	11.5	11.7	11.5	11.6	11.2	11.4		
Twin Bartram Swamp	Staff JE7C 6142544	22.8	22.5	Not to dry before end of January. Must be above preferred minimum 4 in every 6 years.	Max			24.1	24.4	24.5	24.4	23.8	23.8	24.4	24.4	23.7	23.8	<p>Compliant. The lake dries at 23.0 mAHD.</p>
	Min				23.0 dry 07/03	23.0 dry 03/02	23.0 dry 26/02	23.0 dry 25/03	23.0 dry 22/03	23.6	23.0 dry 12/01	23.0 dry 09/01	23.5	23.2	23.0 dry 04/01	23.1		
	Max									24.5	23.9	24.4	24.5	24.5	23.8	23.9		
	Min				23.0	23.1	23.0	23.2	23.2	23.6	23.0	23.1	23.5	23.4	22.7	23.1		
Shirley Balla Swamp	Staff 6142576	23.1 or 0.5 m below lake base, whichever is the higher	24.5	Not to dry before end of January. Must be above preferred minimum 4 in every 6 years. Water levels should not decline at rate greater than 0.1 m/year. Monitor staff gauge.	Max			25.2		25.2	25.6	25.1	25.0	25.0	25.0	25.1	25.1	<p>Non-compliant with absolute summer minimum. Swamp levels are consistently non-compliant with the absolute minimum criteria. Minimum levels improved in 2011-12 compared to 2010-11.</p> <p>Non-compliant with other criterion. The swamp dries every year.</p> <p>EPA endorsed new absolute minimum water level criterion in 2004. However, no preferred minimum was established. The 4 in 6 year criteria cannot be applied.</p> <p>Further review of criteria is required.</p> <p>The department is currently reviewing allocation limits in the Jandakot groundwater area, considering compliance, water level trends and ecological health at the lake.</p>
	Min				dry 02/01	dry 03/12	dry 03/12	dry 27/11	dry 27/11	dry 21/02	dry 27/09	dry	dry	dry	dry	dry 01/09	dry 01/12	
	Max							25.4	25.2	25.7	24.9	25.0	25.4	25.3	24.6	24.6		
	Min				24.3	24.3	24.2	24.2	24.1	24.5	24.0	24.3	24.2	24.2	23.8	24.3		
Beenyup Road Swamp	Staff 6142547	24.0	23.6	Bore must be above preferred minimum 4 in every 6 years.	Max			24.7	24.9	24.8	25.2	24.6	24.7	25.1	25.1	24.7	25.1	<p>Compliant.</p>
	Min									24.6	24.6 dry	24.6 dry	24.6 dry	24.6 dry	24.6 dry	24.6 dry		
	Max				25.0	24.7	24.3	24.8	24.6	25.2	24.5	24.9	25.1	25.2	24.7	25.2		
	Min				23.7	23.7	23.5	23.7	23.8	24.2	23.8	24.1	24.2	24.2	23.9	24.3		

Rare flora and phreatophytic flora criteria monitoring bores

Monitoring bore	AWRC Ref.	Water level criteria (mAHD)		Other criterion	Water level (mAHD)												Comments	
		Preferred	Absolute			2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11		2011-12
Vegetation wells																		
JM14	61610247	24.39	23.89		Max			25.67	25.72	25.74	26.27	25.33	25.08	25.65	25.64	25.08	25.30	Compliant.
					Min	24.71	24.53	24.47	24.59	24.34	24.91	24.05	24.39	24.63	24.64	23.82	24.59	
JM16	61610445	23.90	23.40		Max			25.47	25.73	25.37	25.95	25.02	25.19	25.51	25.50	24.95	25.27	Compliant.
					Min	24.59	24.31	24.29	24.30	24.28	24.59	24.09	24.30	24.26	24.38	23.98	24.31	
JM19	61610177	25.26	24.76		Max			26.16	26.02	25.95	26.57	25.77	25.68	26.51	26.27	25.59	25.90	Compliant.
					Min	25.08	25.16	24.76	24.90	24.90	25.33	24.41	24.90	25.16	25.26	24.29	25.12	
JM35	61610333	21.25	20.75		Max			25.58	26.03	25.83	26.24	25.43	25.64	25.95	25.82	24.33	25.68	Compliant.
					Min	23.44	23.47	23.32	23.41	24.44	24.86	24.23	24.63	23.60	23.11	21.22	21.74	
JM39	61410142	21.20	20.70		Max			24.10	24.49	24.20	24.48	23.06	23.12	23.87	24.27	22.66	23.86	Compliant.
					Min	21.56	21.65	21.49	21.67	21.66	22.06	21.30	21.56	21.56	21.62	21.16	21.86	
JM49	61410111	22.34	21.84		Max	23.65	23.78	23.69	23.81	23.88	24.04	23.71	23.76	23.80	23.81	23.49	23.86	Compliant.
					Min	23.09	23.10	23.04	23.15	23.12	23.29	22.92	23.15	23.12	23.19	22.75	23.25	
8284	61610178	24.82	24.32		Max			25.90	25.80	25.90	26.30	25.60	25.80	25.80	25.70	25.35	25.62	Compliant with absolute summer minimum. Unable to monitor compliance with absolute summer minimum when levels fall below 25 mAHD as the current Ministerial criteria bore is not deep enough to measure levels below this. A new bore (8284B) was installed adjacent to the existing bore in early 2009 and the department has been monitoring water levels at this bore. The department recommends changing the Ministerial criteria bore to 8284B (AWRC ref. 61611864) as water levels at this bore correspond with water levels at 8284. Compliance with absolute minimum water levels can be determined, even when levels fall below 25 m AHD.
					Min	25.40	25.30	25.00	25.10	25.10	25.30	25.00	25.00	25.00	25.00	25.00	25.03	
JE4C	61610234	24.00	23.50		Max			24.93	25.54	25.32	26.06	25.19	25.18	25.85	25.70	24.83	25.63	Compliant.
					Min	24.10	24.05	23.95	24.14	24.21	24.76	24.00	24.41	24.49	24.43	24.00	24.78	
JE10C	61410250	21.80	21.30		Max		26.09	26.14	23.25	26.10	26.32	25.21	25.39	25.79	25.98	24.86	25.28	Compliant.
					Min	23.08	23.86	23.67	23.83	23.68	23.86	22.66	23.70	23.46	23.25	22.46	23.81	
Rare Flora Wells																		
JM7	61610180		22.06	< 0.1 m decline per year	Max			23.65	23.73	23.42	24.01	23.29	23.38	23.86	23.84	23.27	23.84	Compliant.
					Min	23.06	22.97	22.80	22.79	22.71	23.06	22.52	22.82	22.90	22.97	22.30	23.13	
JM8	61610248		23.38	< 0.1 m decline per year	Max			25.08	25.21	24.98	25.51	24.63	24.57	25.00	25.12	24.49	24.88	Compliant.
					Min	24.34	24.24	24.10	24.11	24.05	24.34	23.77	24.02	24.09	24.19	23.67	24.15	
JM45	61610179		22.71	< 0.1 m decline per year	Max			24.34	24.22	24.12	24.70	23.88	23.57	24.12	24.12	23.62	23.91	Compliant.
					Min	23.68	23.69	23.42	23.43	23.34	23.67	23.03	23.17	23.38	23.38	22.71	23.45	
JE17C	61419703		16.35	< 0.1 m decline per year	Max			18.08	18.12	18.10	18.19	18.01	18.12	18.15	18.13	18.06	18.05	Compliant.
					Min	17.31	17.44	17.38	17.50	17.63	17.67	17.37	17.46	17.53	17.68	16.97	17.48	

Note: Water levels are permitted to fall between the preferred and absolute criteria levels. Non-compliances exist when groundwater levels fall below the absolute minimum criteria.

Appendix B – Audit table. Environmental conditions, procedures and commitments, Jandakot Mound Groundwater Resources

Proponent: Department of Water

Period: 1 July 2008 to 30 June 2012

[Text in blue represents Conditions/Proponent Commitments for which the Department of Water seeks 'Clearance' from DEC/EPA](#)

Note: Ministerial Statement 688 refers to the Water and Rivers Commission (now Department of Water) responsibilities to the EPA. In some cases, although referred below as EPA, some responsibilities now lie with the Department of Environment and Conservation (DEC).

Ministerial conditions and procedures

Audit code	Subject	Action	How	Evidence	Requirement of	On advice from	Phase	When/Where	Status
688: M 1-1	Implementation	The proponent shall implement the proposals as documented in "Section 46 Review of Environmental Conditions on Management of the Gngara and Jandakot Mounds – Stage 1 Proposal for Changes to Conditions" (August 2004), as modified and documented in Environmental Protection Authority Bulletin 1155.	Implement proposals (Conditions, Procedures) given in EPA Bulletin 1155 and Ministerial Statement No. 688.	Compliance report.	Minister for the Environment		Overall		Partly compliant. Compliant with majority of Ministerial conditions – refer to 'Status' column Appendix A.
688: M 2-1	Proponent Commitments	The proponent shall implement the environmental management commitments, as revised in December 2004, and documented in schedule 1 of Statement 688, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.	Implement environmental management commitments given in EPA Bulletin 1155 and Ministerial Statement No. 688.	Compliance report	Minister for the Environment	EPA	Overall		Partly compliant. Compliant with majority of Proponent Commitments – refer to 'Status' column Appendix B.
688: M 3-1	Proponent Nomination & Contact Details	The proponent for the time being nominated by the Minister for the Environment under section 38(6) or (7) of the <i>Environmental Protection Act 1986</i> is responsible for the implementation of the proposal until such time as the Minister for the Environment has exercised the Minister's power under section 38(7) of the Act to revoke the nomination of that proponent and nominate another person as the proponent for the proposal.	Adhere to Conditions, Procedures and Commitments given in EPA Bulletin 1155 and Ministerial Statement No. 688.	Letter notifying the Chief Executive Officer of the Department of Environment and Conservation of any change in proponent details.	Minister for the Environment	EPA	Overall		N/A at this time.
688: M 3-2	Proponent Nomination & Contact Details	If the proponent wishes to relinquish the nomination, the proponent shall apply for the transfer of proponent and provide a letter with a copy of this statement endorsed by the proposed replacement proponent that the proposal will be carried out in accordance with this statement. Contact details and appropriate documentation on the capability of the proposed replacement proponent to carry out the proposal shall also be provided.	Follow procedure given in 'Action'.	Letter notifying the Chief Executive Officer of the Department of Environment and Conservation of any change in proponent details.	Minister for the Environment		Overall		N/A at this time.
688: M 3-3	Proponent Nomination & Contact details	The nominated proponent shall notify the Environmental Protection Authority of any change of contact name and address within 60 days of such change.	Follow procedure given in 'Action'.	Letter notifying the Chief Executive Officer of the Department of Environment and Conservation of any change in proponent details.	CEO		Overall	60 days of change	N/A at this time.

Audit code	Subject	Action	How	Evidence	Requirement of	On advice from	Phase	When/Where	Status
688: M 4-1	Commencement and Time Limit of Approval	The proponent shall provide evidence to the Minister for the Environment within five years of the date of this statement that the proposals have been substantially commenced or the approvals granted in the statements of 8 March 1988 and 17 February 1999 shall lapse and be void.	Provide evidence in annual/triennial reports.	Compliance report.			Overall	Condition complete	The Department of Water seeks 'Clearance' of this condition. The 'status of implementation of the proposals' is 'completed' as Jandakot Scheme Stage 1 and 2 are fully commissioned.
688: M 5-1 1	Compliance Audit and Performance Review	The proponent shall prepare an audit program and submit compliance reports to the Environmental Protection Authority which address: 1. the status of implementation of the proposals	Detail in Annual/Triennial reports. Compliance report will include: 1. the status of implementation of the proposals	Compliance report.	CEO		Overall	Condition complete	The Department of Water seeks 'Clearance' of this condition. Audit program prepared (see 688: P 14) and submitted to EPA 25 November 2005. The 'status of implementation of the proposals' is 'completed' as Jandakot Scheme Stage 1 and 2 are fully commissioned.
688: M 5-1 2	Compliance audit and performance review	The proponent shall prepare an audit program and submit compliance reports to the Environmental Protection Authority which address: 2. evidence of compliance with the conditions and commitments	Detail in Annual/Triennial reports. Compliance report will include: 2. evidence of compliance with the conditions and commitments	Compliance report.	CEO			Annually	Compliant. Detailed in Annual report and 'Status' column of this Audit Table (Appendix B).
688: M 5-1 3	Compliance audit and performance review	The proponent shall prepare an audit program and submit compliance reports to the Environmental Protection Authority which address: 3. the performance of the environmental management plans and programs. Note: Under delegation No. 54 issued on 18 June 2004 and section 48(1) of the <i>Environmental Protection Act 1986</i> , the Environmental Protection Authority is empowered to monitor the compliance of the proponent with the statement and should directly receive the compliance documentation, including environmental management plans, related to the conditions, procedures and commitments contained in this statement.	Detail in Annual/Triennial reports. Compliance report will include: 3. the performance of the environmental management plans and programs.	Compliance report.	CEO			Annually	Compliant. Detailed in Annual report and 'Status' column of this Audit Table (Appendix B). Also refer to results given in Appendix A and Tables 4 and 5.
688: M 5-2 1	Compliance audit and performance review	The proponent shall submit a performance review report by 1 December each year and more detailed reports by 1 February every three years, to the requirements of the Environmental Protection Authority, which address: 1. compliance with the conditions	The performance review will address: 1. compliance with the conditions	Compliance report.	CEO		Overall	By 1 December each year and more detailed reports by 1 February every three years.	Compliant. Detailed in Annual report and 'Status' column of this Audit Table (Appendix B). Also refer to results given in Appendix A and Tables 4 and 5.
688: M 5-2 2	Compliance audit and performance review	The proponent shall submit a performance review report by 1 December each year and more detailed reports by 1 February every three years, to the requirements of the Environmental Protection Authority, which address: 2. the achievement of environmental objectives set for the proposal	The performance review will address: 2. the achievement of environmental objectives set for the proposal	Compliance report.	CEO		Overall	By 1 December each year and more detailed reports by 1 February every three years.	Compliant. Detailed in Annual report. Evidence of achievement of 'Objectives' are given in 'Evidence' & 'Status' columns of Audit table (Appendix B).

Audit code	Subject	Action	How	Evidence	Requirement of	On advice from	Phase	When/Where	Status
688: M 5-2 3	Compliance audit and performance review	The proponent shall submit a performance review report by 1 December each year and more detailed reports by 1 February every three years, to the requirements of the Environmental Protection Authority, which address: 3. stakeholder and community consultation about environmental performance and the outcomes of that consultation, including a report of any on-going concerns being expressed	The performance review will address: 3. stakeholder and community consultation about environmental performance and the outcomes of that consultation, including a report of any on-going concerns being expressed. Comply with Commitments 688: P 7, 9, 10, 11, 16, 17.	Compliance report.	CEO		Overall	By 1 December each year and more detailed reports by 1 February every three years.	Compliant. Detailed in Annual report. The Jandakot Community Consultative Committee (JCCC) met on 23 August 2012 and discussed the environmental management of abstraction from the Jandakot groundwater system.
688: M 5-2 4	Compliance audit and performance review	The proponent shall submit a performance review report by 1 December each year and more detailed reports by 1 February every three years, to the requirements of the Environmental Protection Authority, which address: 4. proposed environmental management over the next three years to comply with conditions and environmental objectives set for the proposal.	The performance review will address: 4. proposed environmental management over the next three years to comply with conditions and environmental objectives set for the proposal.	Compliance report.	CEO		Overall	By 1 December each year and more detailed reports by 1 February every three years.	Compliant. The department is continuing to review and refine its environmental management of Jandakot groundwater resources using results from: <ul style="list-style-type: none"> environmental monitoring (see section 6.1) hydrogeological investigations including the Perth shallow groundwater systems investigation (see section 6.3.1) Outcomes from environmental monitoring and hydrogeological investigations are being incorporated into a review of allocation limits for the Jandakot groundwater area and are used in licence assessments.
688: M 5-3	Compliance audit and performance review	The proponent shall make the reports required by condition 5-2 publicly available, to the requirements of the Environmental Protection Authority.	Available on Department of Water website: <www.water.wa.gov.au>	Reports made available on the Department of Water website: <www.water.wa.gov.au>	CEO		Overall	After OEPA acknowledgement letter being received. Department of Water website.	Compliant. The following Jandakot compliance reports can be found on the department's website <www.water.wa.gov.au>: <ul style="list-style-type: none"> 2006–07 annual (DoW 2007a) 2005–08 triennial (DoW 2008) 2008–09 annual (DoW 2009a) 2009–10 annual (DoW 2010) 2008–11 triennial (DoW 2012)
688: M 5-4	Compliance audit and performance review	The proponent shall report any breach or anticipated breach of the environmental criteria set out in Tables 1 and 2 (attached to statement 688) or environmental objectives to the Environmental Protection Authority immediately it becomes evident to the proponent.	Report in regular summaries sent to the Chief Executive Officer of the Department of Environment and Conservation.	Letter to the Chief Executive Officer of the Office of the Environmental Protection Authority reporting non-compliances with water level and other criteria as required. Compliance report.	CEO		Overall	Immediately as it becomes evident.	Compliant. The department reports regularly to the DEC (now the Office of the EPA) over the reporting period to inform non-compliance with criteria water levels and other criteria. <ul style="list-style-type: none"> DG DoW to GM OEPA 2011–12 Q2 CEOW36/12

Audit code	Subject	Action	How	Evidence	Requirement of	On advice from	Phase	When/Where	Status
688: M 6-1	Management plan	The proponent shall implement the Environmental Management Plan prepared by the Water Authority of Western Australia (1992) to the requirements of the Environmental Protection Authority.	Comply with environmental objectives and criteria listed in WAWA EMP (1992).	Compliance report	EPA		Overall		The Department of Water seeks 'Clearance' of this condition. The condition to implement the requirements set out in the Environmental Management Plan are covered and met by water level, environmental monitoring and management commitments in <i>Ministerial statement No. 688</i> . The Environmental Management Plan was submitted to the OEPA in 1992 and since then there have been a number of amendments to Ministerial conditions relating to the plan. The department considers the implementation of the Environmental Management Plan an ongoing commitment. From 2005 onwards the Department of Environment, now Department of Water has been demonstrating its implementation through annual/triennial compliance reports to the OEPA. Implementation is reported as: <ul style="list-style-type: none"> compliance with water level and other criteria predictions of non-compliance with water level criteria reporting on proponent and Ministerial conditions/commitments (audit tables) implementation of the environmental monitoring program (required under other conditions)
688: M 7-1	Groundwater allocations	The proponent shall inform the Environmental Protection Authority immediately of any proposed changes to allocations, abstraction limits and licence or allocation periods.	Detail limits on availability on the Department of Water website. <www.water.wa.gov.au> Detailed in Annual/Triennial reports.	Reports made available on the Department of Water website: <www.water.wa.gov.au>	Minister for the Environment		Overall		Compliant. Documented in annual and triennial compliance reports. There has limited change (mostly reductions in abstraction) over the last 5 years. The department's current management focus is an allocation limit review for the Jandakot groundwater area (see section 6.2.1). The OEPA and DEC will be consulted regarding possible changes that result from the allocation limit review.
688: M 8-1	Water conservation	The proponent shall actively encourage further reduction in public and private water demand in accordance with the State Water Strategy (2003) and other water conservation initiatives.	Engage in activity that supports water conservation.	Compliance reports	Minister for the Environment		Overall		Compliant. Section 6 outlines management actions the department is undertaking to encourage further reduction in public and private water demand. Following extensive consultation with the mining and irrigation industries as well as local government, the Department of Water developed and implements <i>Operational policy no. 1.2 – Policy on water conservation/efficiency plans</i> (DoW 2009b). The department's Water Recycling and Efficiency Branch undertakes projects (see section 6.2.3) to reduce water demand and achieve water conservation initiatives. This includes implementing <i>Operational policy no. 1.2 – 'Policy on water conservation/efficiency plans'</i> and implementing the permanent winter sprinkler ban.
688: M Procedure 1		Where a condition states 'to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority', the Environmental Protection Authority will prepare the written notice to the proponent.	The Environmental Protection Authority to provide written notice to the proponent (Department of Water).		Minister for the Environment		Overall		The Department of Water seeks 'Clearance' of this condition. It is not responsibility of Proponent.
688: M Procedure 2		The Environmental Protection Authority may seek advice from other agencies or organisations, as required, in order to provide its advice.	The Environmental Protection Authority to seek advice as required.		EPA	Other agencies as required	Overall		The Department of Water seeks 'Clearance' of this condition. It is not responsibility of Proponent.
688: M Procedure 3		Where a condition lists advisory bodies, it is expected that the proponent will obtain the advice of those listed as part of its compliance reporting to the Environmental Protection Authority.	Department of Water liaises with advisory body as required.	Liaison with advisory body in compliance report	EPA	Agencies listed as part of compliance reporting	Overall		Compliant.

Proponent environmental management conditions

Audit code	Subject	Objective	Action	How	Evidence	Requirement of	On advice from	When/ Where	Status
688: P 1	Groundwater-dependent ecosystems	To protect significant environmental values.	Ensure that groundwater abstraction satisfies the environmental criteria presented in Tables 1 and 2 (Ministerial Statement 688).	Meet objectives and Environmental Water Provisions criteria presented in Tables 1 and 2 (Ministerial Statement 688).	Compliance report.	Minister for the Environment		Overall	Partly compliant. Detailed in Annual report, refer to results given in Appendix A .
688: P 2 1	Environmental management and monitoring	To minimise environmental and/or significant impact.	In the event that monitoring indicates that there will be significant impacts of a nature not predicted or indicates that a breach of the specified criteria has occurred or is likely to occur, then one or more of the following actions will be undertaken: 1. demonstrate to the satisfaction of the EPA that the breach of criteria is not a result of groundwater abstraction; or	Review of monitoring results, advice from expert hydrogeologists, groundwater modelling.	Compliance report. See Condition 688: M 5-4	EPA		Overall	Compliant. The department predicts the sites that are likely to be non-compliant with water level criteria during the coming summer (see Table 6). The department uses these predictions to distribute public water supply abstraction to limit impacts at Ministerial sites.
688: P 2 2	Environmental management and monitoring	To minimise environmental and/or significant impact.	2. satisfy the EPA that the breach of a criterion is transient and not of permanent significance; or	Review of similar occurrence in the past and consequences from environmental monitoring results Advice from expert hydrogeologists.	Compliance report	EPA		Overall	Partly compliant. Water levels at a number of Ministerial sites, including North Lake, Bibra Lake and Shirley Balla Swamp are consistently non-compliant with water level and other criteria. The department is considering non-compliance and ecological condition at these in the current review of allocation limits for the Jandakot groundwater area. The non –compliance at these sites is also considered in distributing public supply abstraction and in licensing decisions for private use.
688: P 2 3	Environmental management and monitoring	To minimise environmental and/or significant impact.	3. take the following actions: a. modify pumping from any bore where such changes can have a measurable effect (say raise water levels 1 centimetre or more), except in extenuating circumstances such as where significant economic hardship would occur, or CALM declare that the low water levels would be beneficial b. in the case of a wetland, artificially maintain the 'action minima' water level c. implement a short-term detailed monitoring program to establish the condition of agreed species in the affected area.	Implement actions as outlined.	Compliance report	EPA		Overall	Compliant. No new actions were required in the reporting period. As described in previous compliance reports, the department restricts Water Corporation abstraction from bores that impact on Ministerial sites and other groundwater dependent ecosystems.
688: P 3	Water allocation	To minimise environmental and/or significant impact and manage the resource sustainability.	Regularly review the bulk allocations for private abstraction, as part of the total water abstraction allocation for the Jandakot PWSA, with regard to the sustainable yield of the superficial aquifer, including consideration of the environmental impacts of that abstraction.	Make part of Department of Water, water allocation planning program.	Compliance report	EPA		Overall	Compliant. The department's current management focus is an allocation limit review for the Jandakot groundwater area (see section 6.2.1). This review is considering allocations both private and public abstraction.

Audit code	Subject	Objective	Action	How	Evidence	Requirement of	On advice from	When/Where	Status
688: P 4	Water allocation	To minimise environmental and/or significant impact and manage the groundwater resource sustainability.	Restrict the issuing of licences for private abstraction to the limits set by the bulk allocations for both the Jandakot PWSA in its entirety and the licensing sub-areas.	Set sub-area groundwater allocation limits to values equal to or less than those set for the Jandakot PWSA.	Compliance report	EPA			Compliant. Total private licensed entitlements are below allocation limits originally set for subareas of the Jandakot groundwater area (see Table 3). The department's current management focus is an allocation limit review for the Jandakot groundwater area (see section 6.2.1).
688: P 5	Water allocation	Provide up-to-date mechanisms for groundwater allocation.	Investigate and implement efficient mechanisms for groundwater allocation.	Incorporate in regular Department of Water (ground)water allocation work program.	Compliance report	EPA			Compliant. The department's current management focus is an allocation limit review for the Jandakot groundwater area (see section 6.2.1). This review is using contemporary methods for determining sustainable limits.
688: P 6	Groundwater protection	To minimise environmental and/or significant impact and manage the groundwater resource sustainability.	Assist the EPA in the development of environmental protection policies to protect groundwater.	Liaise with the EPA as required	Compliance report	EPA			N/A at this time.
688: P 7	Groundwater protection	Integrated land and water resource planning to minimise environmental and/or significant impact.	Participate in the review of regional plans proposed by the Department for Planning and Infrastructure, local government town planning schemes, and rezoning and development applications.	Liaise with local government, the Department for Planning and Infrastructure, and other relevant land-use planning agencies.	Compliance report	EPA			Compliant. The department assesses land use proposals with potential water resource issues referred from local and state government agencies. In partnership with the Department of Planning and Infrastructure (and other agencies), the department produced the <i>Better Urban Water Management</i> publication (WAPC 2008). The department also recently produced the <i>Jandakot drainage and water management plan</i> (DoW 2009c) which aims to assist land developers and local government to better manage groundwater quantity and quality. The department recently provided advice on the <i>South Metropolitan and Peel Regional Structure Plan - Regional Water Management Strategy</i> which identifies water related constraints and opportunities associated with proposed urban/industrial areas.
688: P 8	Groundwater protection	Integrated land and water resource planning to minimise environmental and/or significant impact.	Participate in the review of development submissions to the EPA.	Provide advice to the EPA as requested.	Compliance report. See 688: P 7	EPA			Compliant. See 688: P 7
688: P 9	Groundwater protection	Integrated land and water resource planning to minimise environmental and/or significant impact.	Work with the Department for Planning and Infrastructure to prepare an integrated Land Use and Water Management Strategy for the Jandakot Mound.	Liaise with the Department of Planning and Infrastructure to prepare an integrated Land Use and Water Management Strategy for the Jandakot Mound.	Compliance report	EPA			Compliant. The department recently produced the <i>Jandakot drainage and water management plan</i> (DoW 2009c) which aims to assist land developers and local government to better manage groundwater quantity and quality. With the Department of Planning and Infrastructure (and other agencies) the department has produced the <i>Better Urban Water Management</i> publication (WAPC 2008). The department recently provided advice on the <i>South Metropolitan and Peel Regional Structure Plan - Regional Water Management Strategy</i> which identifies water related constraints and opportunities associated with proposed urban/industrial areas.
688: P 10	Water conservation	Water conservation.	Actively pursue programs in both supply and demand management. This includes ongoing public information programs and, where appropriate, regulation for design changes and regular reviews of pricing to conserve water. Improvements in the Water Corporation's supply system will also be pursued.	Engage in activity that supports water conservation. Development of a policy on water conservation plans.	Compliance report	EPA			Compliant. Section 6 outlines actions the department is undertaking to pursue supply and demand management and support water conservation. The department required that the Water Corporation continue its 'Target 60' campaign in 2011-12 as a condition of the exceptional circumstances allocation for public water supply.

Audit code	Subject	Objective	Action	How	Evidence	Requirement of	On advice from	When/Where	Status
688: P 11	Groundwater protection	Integrated land and water resource management to minimise environmental and/or significant impact.	Actively participate in integrated management of the Jandakot catchment.	Liaise with other water and land-use agencies.	Compliance report	EPA			Compliant. The department liaise with other water and land-use agencies in integrated management of the Jandakot catchment including the Water Corporation, DEC and the Western Australian Planning Commission. For example, the department, with some modelling assistance from the Water Corporation, prepared the <i>Jandakot drainage and water management plan</i> for the (WAPC) Jandakot structure plan area (see 688: P 9).
688: P 12	Environmental management and monitoring	Environmental management of groundwater abstraction is based on best available scientific knowledge.	Review and revise the management criteria and strategies, with the agreement of the EPA, as knowledge of the Jandakot environment and its interaction with groundwater improves.	Stage 1 and 2 Section 46 review supported by scientific research results.	Compliance report	EPA	EPA		Compliant. <i>Stage I Section 46</i> completed and a number of changes were supported by the OEPA (refer Bulletin 1155). <i>Stage II Section 46</i> work has concentrated on the Gnangara Mound area due to priorities (refer 2007–08 Gnangara compliance report, December 2008). The department's current management focus is an allocation limit review for the Jandakot groundwater area (see section 6.2.1).
688: P 13	Environmental management and monitoring	Monitor compliance with Ministerial water level criteria. Management of groundwater levels to protect environmental values of select wetlands.	Monitor water levels in groundwater monitoring bores and North, Bibra, Yangebup, Kogolup, Thomsons and Forrestdale Lakes, and The Spectacles and Twin Bartram Swamp, as well as some other small wetlands.	Include in Department of Water regional groundwater monitoring program.	Compliance report. Hydrographs available on the Department of Water website: <www.water.wa.gov.au> See 688: P 14	EPA			Compliant. Detailed in Annual report, refer to results given in Appendix A . Wetlands were included in the department's Jandakot Environmental Monitoring Program referred to the EPA in December 2005 (see 688: P 14). Hydrographs of Ministerial criteria wetland and terrestrial vegetation sites are available on the department's website.
688: P 14 1	Environmental management and monitoring	Provide a means for the assessment of compliance with Ministerial environmental criteria for the Jandakot Mound.	1. Prepare an environmental monitoring program for submission to the EPA for review and subsequent finalisation of the program to the satisfaction of the EPA. The monitoring program will include: <ul style="list-style-type: none"> monitoring of groundwater levels in all relevant aquifer systems relevant wetland water levels and water quality condition of vegetation and fauna associated with groundwater-dependent ecosystems. 	Prepare an environmental monitoring program.	Submit monitoring program to the EPA for approval. Compliance report.	EPA	DEC	Within four months of a revised statement being issued following the 2004 Stage 1 section 46 review	Compliant. The department's monitoring program includes: <ul style="list-style-type: none"> monitoring of groundwater levels in all relevant aquifer systems relevant wetland water levels and water quality condition of vegetation and fauna associated with groundwater-dependent ecosystems. The previous environmental monitoring program was produced and submitted to the EPA on 21 December 2005. It was detailed in Appendix 7 of Gnangara Triennial report 2003-06 (DoW 2007b). The audit of 2006–07 compliance report agreed commitment could be 'cleared' upon confirmation from the DEC. A review of the environmental monitoring program was undertaken in June 2009 in collaboration with the ecologists who undertake the monitoring (see Appendix D). A number of amendments were made. A letter was sent to Director General of the DEC in December 2009, seeking advice and input on the amendments. Further revisions may result from recommendations from the Perth shallow groundwater systems investigations and the eco-hydrological states investigation (see section 6.3.1).
688: P 14 2	Environmental management and monitoring	To enable assessment of compliance with Ministerial environmental criteria for the Jandakot Mound.	2. Implement the approved environmental monitoring plan	Make part of annual Departmental work program	Compliance report	EPA	DEC		Compliant. A summary of the results of the environmental monitoring conducted in 2011-12 is reported in section 6.1. These results are used to distribute public supply abstraction to limit environmental impacts and inform licensing decisions for private use. The results are also being considered in the current review of allocation limits in the Jandakot groundwater area.

Audit code	Subject	Objective	Action	How	Evidence	Requirement of	On advice from	When/ Where	Status
688: P 14 3	Environmental management and monitoring	Monitoring program is a reflection of the best available knowledge of groundwater/ environment interaction.	3. Review and revise the program every six years (coinciding with triennial reports), to the satisfaction of the EPA.	Incorporate review in Triennial reporting in 6 year intervals.	Triennial compliance report	EPA	DEC	Every six years (coincide with Triennial report)	Compliant. A review of the environmental monitoring program was undertaken in June 2009 in collaboration with the ecologists who undertake the monitoring (see Appendix D). A number of amendments were made. A letter was sent to Director General of the DEC in December 2009, seeking advice and input on the amendments. Further revisions may result from recommendations from the Perth shallow groundwater systems investigations and the eco-hydrological states investigation (see section 6.3.1).
688: P 15	Environmental management and monitoring	Monitor habitat shifts in conjunction with the assessment of potential impacts on environmental values from groundwater abstraction on the Jandakot Mound.	Use aerial photographs or equivalent on a triennial basis to detect habitat shifts in North Lake, Yangebup, Kogolup, Thomsons and Forrestdale Lakes.	Aerial photographs not an effective method. Instead the department focuses on field surveys of vegetation transects.	Triennial compliance report	EPA		Every three years (coincide with Triennial report)	Partly-compliant. There may be limited value for use of aerial photos solely as a diagnostic tool. This was recognised and the Commitment modified in Bulletin 1155. The department undertakes monitoring at established transects annually at each of these wetland sites. This monitoring identifies shifts in habitat. The department commissioned Edith Cowan University to develop a model for determining ecological risk to groundwater dependent vegetation in a drying climate. The model is based on 30 years of ecological and hydrological monitoring data from the Gnangara mound. It will be an important management tool for assessing risk to groundwater dependent vegetation (including likely habitat shifts) under different climate and abstraction regimes.
688: P 16	Community consultation	Inform major stakeholders of Department of Water and Water Corporation activities on the Jandakot Mound. Provide mechanism for feed-back.	Hold meetings at least annually with the Jandakot Community Consultative Committee (JCCC) established in consultation with the EPA. This committee will be informed on the groundwater scheme's operation and will provide feed-back to the proponent.	Department of Water to organise JCCC meetings.	Compliance report	EPA			Compliant. The Jandakot Community Consultative Committee (JCCC) met on 23 August 2012 and discussed environmental management of abstraction from the Jandakot groundwater system. A wide range of major stakeholders were represented at the meeting.
688: P 17	Community information	Maintain good public image and up-to-date knowledge of community concerns of water resource issues.	Continue to monitor community response to relevant water resource issues as reported by the media and maintain the current practice of public accessibility of WRC staff. Upon request and adequate notice, staff will address community groups on issues associated with groundwater management.	Monitor media for relevant issues. Address community groups as requested.	Compliance report	EPA			Compliant. The department subscribes to the 'Media Watch' service, which forwards newspaper articles relating to water resource issues to department employees. The department's staff are involved in conferences, meetings, and workshops that include community group representation (for example JCCC meetings).
688: P 18	Environmental management and monitoring	Improved environmental monitoring facility at this significant wetland.	Install monitoring wells and improved wetland water level monitoring facilities for Forrestdale Lake, and evaluate monitoring data to determine groundwater/wetland water level relationship. Subject to CALM/WRC installing permanent vegetation monitoring transect and undertaking flora and fauna studies to establish environmental values, the proponent will review available information to propose revised management criteria, if appropriate.	Being addressed as part of the Department of Water project 'Perth shallow groundwater systems investigation'.	Compliance report	EPA			Compliant. Groundwater monitoring bores were installed at Lake Forrestdale (see Bourke 2008; Bourke and Paton (in prep)) and North Lake (see Searle 2009; Bourke and Hammond (in prep)) as part of the Perth shallow groundwater systems investigation. The Spectacles and Thomsons Lake were also included (Searle 2009) with sampling undertaken at existing bores (see section 6.3.1). Monitoring data at these wetlands is being evaluated to determine groundwater/wetland water level relationship.

Audit code	Subject	Objective	Action	How	Evidence	Requirement of	On advice from	When/Where	Status
688: P 19	Environmental management and monitoring	Enable good water resource management including environmental protection on the Jandakot Mound.	<ol style="list-style-type: none"> 1. Prepare a Management and Monitoring Program. 2. Implement the Management and Monitoring Program. 	Prepare Management and Monitoring Program and submit to EPA.		EPA		Completed	<p>Completed. The Department of Water seeks 'Clearance' of this condition. This commitment was required prior to commissioning of the Stage 2 scheme. Stage 2 has been in operation for over 10 years and the implementation of the management and monitoring program has been described in numerous annual and triennial compliance reports. In addition, following publication of Ministerial statement 688, a revised monitoring program was developed and submitted to EPA (refer Commitment 688: P 14) in December 2005.</p>
688: P 20		Improve understanding of groundwater/wetland ecology relationships	Continue to fund the research projects 10.6.3 listed in Appendix 2 of the EPA Bulletin 587 for the duration of the studies.	Include research projects in annual business planning.		EPA		Completed	<p>Completed. The Department of Water seeks 'Clearance' of this condition. Auditor's comments in the 2003–04 Annual Report state commitment can be 'cleared'. Research projects given in Appendix B (Table A12.2) of EPA <i>Bulletin 587</i> refer to commitments given in numbers 21, 22, and 23 below.</p>
688: P 21		Improve understanding of aquatic fauna of the select Jandakot wetlands.	<p>Develop a fauna monitoring program which will focus on:</p> <ol style="list-style-type: none"> 1. waterbird species diversity and breeding success 2. the number of families of aquatic invertebrate and, at infrequent intervals, species richness. 	Develop a fauna monitoring program.		EPA	CALM	Completed	<p>Completed. The Department of Water seeks 'Clearance' of this condition. Auditor's comments in the 2003–04 Annual Report agreed such a program had been developed prior to commissioning of the Stage 2 scheme and implemented and that the commitment can be 'cleared'. Fauna monitoring program has been developed and results presented in numerous annual and triennial reports to date.</p>
688: P 22		Improve understanding of the environmental significance of this wetland and means of protecting values.	Undertake study of Banganup Lake, in conjunction with CALM and University of WA to establish management criteria and consider effectiveness of artificial maintenance of water levels.	Undertake a study of Banganup Lake as described.		EAP	CALM	Completed	<p>Completed. The Department of Water seeks 'Clearance' of this condition. Study undertaken and Auditor comments in 2003–04 annual report states that Commitment can be 'Cleared'.</p>
688: P 23		Improve understanding of the environmental significance of this wetland and means of protecting values.	Undertake a study of Twin Bartram Swamp to consider the feasibility and effectiveness of artificial maintenance of water levels.	Undertake a study of Twin Bartram Swamp as described.		EPA	CALM	Completed	<p>Completed. The Department of Water seeks 'Clearance' of this condition. Study was undertaken and Auditor's comments in 2003–04 annual report state that the commitment can be 'cleared'.</p>

Appendix C – Background information

In 1988, the Water Authority of Western Australia (WAWA), referred plans for construction of Stage 2 of the Jandakot Groundwater Scheme to the Environmental Protection Agency (EPA). The EPA applied a Public Environmental Review (PER) level of assessment to the proposal. In 1992, the Minister for the Environment issued a statement (EPA Bulletin 587, *Ministerial Statement No. 253 – Assessment 196*) advising that the proposal could be implemented subject to conditions and commitments imposed on the WAWA. The majority of these conditions and commitments relate to ensuring that groundwater and surface water levels across the Jandakot Mound are maintained at acceptable levels.

A key element of *Ministerial Statement No. 253* was confirming environmental water provisions for the maintenance of environmental values on the Jandakot Mound. These were set in the form of water level criteria to be achieved in key wetlands and other groundwater-dependent ecosystems such as areas of phreatophytic vegetation and rare flora.

Section 46 review of Ministerial conditions and commitments

In 2001, as a consequence of changes in land use and lower rainfall, the EPA endorsed a two-stage approach to a review of the Ministerial conditions and commitments for the management of the shallow groundwater resources of the Gnamara and Jandakot mounds under section 46 of the *Environmental Protection Act, 1986*. The first stage was for the department (then Department of Environment) to review Ministerial conditions and commitments on Gnamara and Jandakot based on existing knowledge (DoE 2005). This review led to *Statement No. 687* Gnamara and *Statement No. 688* for Jandakot (Government of Western Australia 2005), released in 2005.

The 2004 review confirmed the sites with ecological value. The second stage of the Section 46 review was to be a more comprehensive review to deliver improvements to management of public and private abstraction. The second stage was to have incorporated ecological information from work underway at the time, however this work has been subsequently outdated by more recent investigations into the shallow groundwater systems and ecological responses to climate. Analysis of this investigative work will be used to focus management effort on those areas which will show the most benefit from changes to abstraction.

Appendix D – Review of environmental monitoring program (688: P 14 1)

In mid 2009, the department commenced a series of monitoring review workshops in collaboration with the ecologists contracted to carry out the monitoring. The workshops aimed to improve both the effectiveness and efficiency of the monitoring program. In revising the monitoring program we:

- refocused the program on the relationships between groundwater levels, ecological condition and abstraction
- improved the efficiency of our monitoring by reducing the monitoring frequency from annually to every three years, unless annual monitoring is warranted on a management or information-needs basis
- improved the presentation and communication of monitoring data.

A second review workshop, held in late April 2010, considered the following two key issues:

- how monitoring results could be presented spatially so that they represent short-term and longer-term trends across an entire groundwater management area
- how modelling results could be used to ensure the monitoring effort is focussed on the correct areas in the longer-term.

The main outcomes and recommendations of this workshop were as follows:

- Future monitoring programs should include sites where improvements in ecological health and compliance are possible through the management of abstraction (based on modelling).
- The department can make a difference to important areas on the Gngangara Mound by managing abstraction. Management that achieves even minor benefits to groundwater levels can be significant for certain groundwater-dependent ecosystems.
- Where possible, abstraction should be reduced where it would benefit wetlands that still retain some of their key environmental values.

The following tables contain a summary of the amended environmental monitoring program for the Jandakot Mound.

Frequency	
*	Monthly
✓	Annually
◆	Triennially
◆	Episodic (when water is present)

Site	Water levels	Wetland vegetation	Rapid end of summer	Macro-invertebrate	Water quality	Terrestrial vegetation
Criteria wetlands						
North Lake	*	✓	✓			
Bibra Lake	*	◆	✓			
Kogolup Lake South	*	◆	✓	◆	◆	
Thomsons Lake	*	✓	✓	✓	✓	
Forrestdale Lake	*	◆	✓	◆	◆	
Yangebup Lake	*			✓	✓	
Banganup Lake	*	✓	✓	◆	◆	
Twin Bartram Swamp	*	◆	✓			
Shirley Balla Swamp	*	◆	✓	◆	◆	
Beenyup Road Swamp	*	✓	✓			
Criteria monitoring wells						
JM14	*					
JM16	*					
JM19	*		✓			
JM35	*					
JM39	*		✓			
JM49	*					
8284	*					
JE4C	*					
JE10C	*					
JM7	*					
JM8	*					
JM45	*					
JE17C	*					
Other sites						
Kogolup Lake North		◆	✓	✓	✓	
Gibbs Road Swamp				◆	◆	
Warton Road Swamp				◆	◆	
Perth SGS Investigation sites						
The Spectacles	*	✓		✓	✓	

Site	Water levels	Wetland vegetation	Rapid end of summer	Macro-invertebrate	Water quality	Terrestrial vegetation
Phreatophytic terrestrial vegetation sites						
Airport						◆
Liddelow						◆
Modong West						◆
Modong East						◆
Thomsons Lake						◆

* The structure of the wetland waterbird monitoring has changed. During 2009–10 an analysis of the current dataset was undertaken. This analysis involved reviewing hydrological and rainfall data across the state to determine wider influences on population structure and abundance of waterbirds. This review informed the decision to discontinue waterbird monitoring.

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