ACT State of the Environment Report 2011

THEME: Land and Water

Indicator cluster: Groundwater

The Groundwater indicator cluster includes four indicators that collectively report on groundwater availability, quality, use and management in the ACT:

- *Groundwater availability* (C) - the volume and distribution of available groundwater;
- *Groundwater quality* (C) - the quality of groundwater including pollution from contaminated sites;
- *Groundwater use* (P) - the amount and distribution of groundwater use; and
- *Groundwater management* (R) - the effectiveness of groundwater management responses.

Condition indicators (C) present data that tell us the state of the environment at any particular time.

Pressure indicators (P) present data for the main human activities that could potentially adversely affect the condition of the environment.

Impact indicators (I) present data on the effect that environmental changes have on environmental or human health.

Response indicators (R) present data about the main things we are doing to alleviate pressures, or to improve the condition of the environment.

Summary

ACT groundwater resources overall are relatively low in yield, but that can vary significantly between local areas. Groundwater recharge in ACT is closely related to recent rainfall history. Overall a maximum of 7458 ML is available for use annually, based on estimates of sustainable yield. ACT groundwater is relatively fresh compared to other areas of south-eastern Australia.

Groundwater extraction has increased to approximately 550 ML since the last reporting period, but is still relatively small. In 2008, an assessment report indicated that, historically, groundwater monitoring and data collection in the ACT had not been managed systematically. As a result, knowledge of the impacts of groundwater use on the aquifers in the Territory was not comprehensive, resulting in reduced ability to manage groundwater resources sustainably. Monitoring of groundwater extraction continues to expand, particularly where the resource is considered to be at risk of overuse or contamination.

Introduction

Groundwater is essential for the ongoing health and maintenance of many terrestrial ecosystems and surface water bodies such as rivers, wetlands and lakes, especially

those connected to, and dependent on, groundwater. Changes in groundwater quantity and quality have the potential to degrade these ecosystems and may cause the loss of terrestrial and aquatic species. In the ACT, groundwater typically flows through fractured rock aquifers that are relatively shallow, and connects to wells, springs and streams (ACT NRMC 2009).

Groundwater is also a valuable resource for a range of locally important domestic, agricultural and industrial uses. Changes in the availability and quality of groundwater can adversely affect these sectors.

Condition indicators

Groundwater availability

The ACT generally has low-yield fractured rock aquifers. This means that groundwater is stored in the fractures, joints, bedding planes and cavities of the rock mass, and consequently groundwater is a limited resource compared to surface water. Groundwater recharge in the fractured rock aquifers is closely related to recent rainfall history (DECCEW 2011).

The *ACT Water Resources (Water available from areas) Determination 2007 (No 1)* (ACT Government 2007) lists volumes of surface water and groundwater available for taking from each Water Management Area, and water reserved for future use. Overall, a maximum of 7248 ML of groundwater is available for use in the ACT per year (Table 1). The groundwater available has been assessed by specific investigations undertaken by the ACT Environment Protection Authority (EPA) to determine sustainable yields in particular areas.

Table 1. Groundwater available for taking from each ACT Water Management Area

Water Management Area	Maximum groundwater volume available for taking (ML)
Upper Murrumbidgee	640
Lower Murrumbidgee	189
Naas	855
Gudgenby	1170
Cotter	2050
Paddys	909
Tuggeranong	190
Upper Molonglo	24
Central Molonglo	685

Water Management Area	Maximum groundwater volume available for taking (ML)
Lower Queanbeyan	0
Jerrabomberra headwaters	0
Lower Molonglo	297
Googong catchment	0
Ginninderra catchment	239
Total	**7248**

Source: ACT Government 2007

To further improve understanding of ACT groundwater availability and potential use, in 2009, the National Water Commission (NWC) began an *ACT Aquifer Storage and Recovery Feasibility Study* (NWC 2010). The initial results from the study confirm that ACT groundwater resources have a relatively low yield that varies significantly from place to place (NWC 2010). Groundwater bores in the ACT typically yield 0.1 - 24 litres per second (L/s), with the majority of bores yielding between 1.5 and 2.5 L/s. These yields are low when compared to bores in the Great Artesian Basin, which have yields of up to 235 L/s (NWC 2010). The study is due to be completed in December 2011 and will provide important information to further assess groundwater availability and ensure appropriate groundwater management.

Groundwater quality

The quality of groundwater in the ACT is similar to the quality of nearby surface waters, except that electrical conductivity (a measure of salinity) tends to be higher because of the longer residence time within the aquifers' geology. Overall, groundwater in the ACT is fresh when compared to other areas of south-eastern Australia (Slatter et al. 2008).

As outlined in the Contaminated sites indicator (refer to the *Land health* indicator cluster), underground fuel storage at service stations and other facilities can affect groundwater quality, as also can spills at the ground surface. Groundwater can become contaminated when oils, chemicals, pathogens and other pollutants seep into the soil and enter aquifers. Monitoring of the quality of groundwater aquifers at risk of contamination is performed under authorisation by assessments at places where contamination has been identified, mainly landfill and service-station sites.

Pressure indicators

Groundwater use

Groundwater use is relatively small in the ACT compared to surface water use. However, groundwater use has increased considerably over the last decade in response to the prolonged drought and demand for additional and reliable sources of water.

The volumes licensed for extraction in ACT and the amounts of groundwater actually extracted between 2007-08 and 2009-10 are reported in Table 2. Since 2007-08, the licensed volume has increased by 135 ML (or 18%) but the amount of groundwater extracted has remained largely constant at around 550 ML per annum. This is an increase from the previous reporting period, to June 2007, when between 249 ML and 345 ML was extracted each year.

Table 2. Licensed volumes and volumes of groundwater extraction in the ACT, 2007-08 to 2009-10

Year	Licensed volume (ML)	Groundwater extraction (ML)
2007-08	741	549
2008-09	799	530
2009-10	876	550

Note: data were not available for 2010-11. Source: DECCEW

Groundwater extraction remains less than the sustainable yield as determined by the licensing framework for all water management units. It will be important to continue to monitor groundwater extraction in high-use areas, because of the increase in licensed volume and the potential for further extraction.

The number of entitlements issued in the ACT to extract groundwater is outlined in Table 3. Most groundwater licences are within the Central Molonglo water management area covering the Kowen, Fyshwick, Jerrabomberra, Lake Burley Griffin, Woolshed and Sullivans subcatchments (Table 3).

Table 3. Number of entitlements to take water, by Water Management Area and water type

Water Management Area	Number of entitlements to take water	
	Groundwater only	Surface and groundwater
Cotter	-	-
Googong	-	4
Total	**0**	**4**
Upper Murrumbidgee	17	6

Lower Murrumbidgee	0	2
Naas	1	-
Gudgenby	1	2
Paddys	3	2
Tuggeranong	3	1
Upper Molonglo	1	-
Central Molonglo	93	19
Lower Queanbeyan	-	-
Jerrabomberra Headwaters	-	-
Lower Molonglo	10	3
Ginninderra	11	5
Total	**140**	**40**

Source: DECCEW 2011.

In 2011, DECCEW recognised that there may still be bores in use without entitlements, and that existing entitlement holders may exceed their entitlement volume (DECCEW 2011). The EPA conducts groundwater compliance and enforcement monitoring programs to detect issues such as over-use of groundwater from licensed bores and unauthorised bore work, and to ensure licence/entitlement instruments are registered against active bores. There have been few instances of enforcing groundwater offence provisions in the ACT during the reporting period. In one example, unlicensed groundwater use was detected on a property, and using the provisions of the *Water Resources Act 2007* the use was stopped.

Monitoring has identified that around 5% of groundwater licensees were using more than their entitlements. Where over-use was identified the use was reduced back to appropriate volumes within a year, suggesting existing education efforts and penalties are effective.

Impact indicators

There is no specific indicator for groundwater impact. However, as outlined above, over-extraction of groundwater can adversely impact on groundwater-dependent ecosystems as well as on environmental flows and limit the future availability of groundwater for human uses. The current groundwater abstraction limits for all ecosystems is 10% of the long-term recharge (ACT Government 2006).

If groundwater becomes polluted it may be unusable for many years and affect the environment and human health. Polluted groundwater can be difficult and costly to

clean up. A recent example is the remediation of groundwater at Civic, polluted by a petrol plume. For more information see the *Land health* indicator cluster.

Response indicators

Groundwater management

Groundwater management in the ACT includes assessment, water resource planning, licensing, education, monitoring, enforcement and reporting. In 2008, a groundwater data assessment report (Slatter et al. 2008) indicated that, historically, groundwater data in the ACT had not been managed systematically. Further, the ongoing monitoring program was not designed systematically and so did not provide a comprehensive picture of the impacts of groundwater use on the aquifers in the Territory. As a result, ability to manage groundwater resources sustainably was reduced.

The *Water Resources Act 2007* (the Act) provides a framework for the sustainable management of ACT water resources including groundwater. Under the Act, it is a requirement to hold a Water Access Entitlement (WAE) before a Licence to Take Water can be issued. A WAE is a right to an amount of surface water or groundwater within a Water Management Area. *The 2006 Environment Flow Guidelines* set a limit on groundwater abstraction for all ecosystems at 10% of the long-term recharge (ACT Government 2006). The current draft of the *2011 Environmental Flow Guidelines* indicates that this limit will be maintained. It would appear to be a reasonable limit. Information from the *ACT Aquifer Storage and Recovery Feasibility Study* (NWC 2010) due to be finalised late in 2011, as well as possible climate change implications, should guide future groundwater abstraction limits.

DECCEW maintains 14 dedicated monitoring bores, and additional information is supplied from another 6 monitoring sites by groundwater users (DECCEW 2011). This monitoring provides information about the movement of groundwater, and the hydraulic conductivities, potential storage capacities, chemical compositions, and recharge rates of the various aquifers within each Water Management Area. Monitoring of the recharge is important for assessing aquifer responses to climate change, for quantifying the potential effects of changing rainfall patterns, and for identifying sustainable limits for each groundwater aquifer.

In response to increasing demand for and use of groundwater since 2002, the ACT Government has been aiming to improve the accuracy of groundwater assessments and expand groundwater monitoring. A risk-based approach to groundwater monitoring has been developed, whereby the amount of monitoring of an area is proportional to the risk posed to the groundwater by abstraction, contamination or

land use change. In 2010, three additional monitoring bores were proposed for construction in Weston, Wanniassa and Kambah in recognition that these areas were coming under pressure from current levels of extraction (DECCEW 2011).

Monitoring of groundwater recharge will improve understanding and quantification of potential effects and implications of changed rainfall patterns from climate change, for determining future groundwater extraction limits. The groundwater data assessment report (Slatter et al. 2008) provided a number of recommendations to improve data collection, management and analysis. These should guide improved monitoring of groundwater in the ACT.

Education and information programs are also important for groundwater management. In 2009, the Upper Murrumbidgee Catchment Coordinating Committee (UMCCC) released a fact sheet for rural landholders titled *Groundwater in the Upper Murrumbidgee*. The purpose of the fact sheet was to increase local knowledge and awareness of groundwater, its sustainable use, and impacts of land use in the catchment (UMCCC 2009).

The ACT Government is participating in a national framework during 2011 to 2016 to improve compliance and enforcement systems for water resources. The national framework will implement:

- consistent provisions for treating water resource offences;
- strategies for best practice compliance and enforcement;
- catchment risk assessments;
- review of monitoring activity; and
- stakeholder education.

The NWC has recommended that “ultimately all surface and groundwater extractions, including for stock and domestic purposes, should be licensed and metered or otherwise measured. However, the NWC also recognises the practical constraints to universal metering of groundwater extractions.” The NWC acknowledged the need for “a risk-based approach taking into account the water management benefits of better metering, the level of risk to the groundwater resource, impacts on third parties, and cost effectiveness” (NWC 2009:37).

Groundwater management in the ACT is largely effective given current levels of use and ongoing improvements in monitoring of groundwater extraction compared to sustainable yield. It is important to continue to improve understanding of aquifers at

risk of over-use and contamination, and to identify and manage impacts on groundwater quality.

Glossary

Aquifer: a geological formation that contains and transmits groundwater

Bedding planes: the surfaces between the different layers in sedimentary rock

Confined aquifer: an aquifer that is covered (confined) by a layer of impermeable rock and not recharged by vertical infiltration

Groundwater-dependent ecosystems: ecosystems that are dependent on groundwater for their existence and health

Sustainable yield: the amount of water extraction from a particular system which, if exceeded would compromise key environmental assets, or ecosystem functions and the productive value of the resource

Unconfined aquifer: an aquifer that is covered by permeable rock and that is recharged from vertical infiltration; its upper surface is the water table

Upper Murrumbidgee Catchment Coordinating Committee (UMCCC): a community-based organisation made up of agencies and groups that are responsible for, or contribute to, natural resource management in the upper Murrumbidgee catchment

References

ACT Government 2006. *2006 Environmental Flow Guidelines.* Environment ACT, Canberra http://www.environment.act.gov.au/__data/assets/pdf_file/0010/151948/Environmental_Flow_Guidelines_Jan2006.pdf (accessed 14/9/11)

ACT Government 2007. *Water Resources (Water available from areas) Determination 2007 (No 1).* ACT Government, Canberra. http://www.legislation.act.gov.au/di/2007-191/default.asp (accessed 26/11/11)

ACT NRMC 2009. *Bush Capital Legacy - Plan for Managing the Natural Resources of the Act*. ACT Natural Resource Management Council, Canberra. http://www.actnrmcouncil.org.au/files/NRMplan.pdf (accessed 19/6/11)

DECCEW 2008. *ACT Water Report 2007-2008.* ACT Department of the Environment, Climate Change, Energy and Water, Canberra. http://www.environment.act.gov.au/__data/assets/pdf_file/0005/152159/Annual_Report_2007-2008_Pdf.pdf (accessed 23/5/11)

DECCEW 2009. *ACT Water Report 2008-2009.* ACT Department of the Environment, Climate Change, Energy and Water, Canberra. http://www.environment.act.gov.au/__data/assets/pdf_file/0003/175206/DECCEW_Water_Report_FINAL_FINAL.pdf (accessed 23/5/11)

DECCEW 2011. *Draft ACT Water Report 2009-2010.* ACT Department of the Environment, Climate Change, Energy and Water, Canberra

NWC 2010. *ACT Aquifer Storage and Recovery Feasibility Study.* Australian Government National Water Commission, Canberra. http://www.nwc.gov.au/www/html/639-act-aquifer-storage-and-recovery-feasibility-study.asp?intSiteID=1 (accessed 24/5/11)

Slatter, E., Mullen, I., Mansfield, D. and Evans, R. 2008. *Australian Capital Territory Groundwater Data Assessment Report 3: Final report.* Report to Australian Government Bureau of Rural Sciences, Canberra

UMCCC 2009. *Groundwater in the Upper Murrumbidgee - understanding your bore*. Topic 3 Fact Sheet for Rural Landholders. Upper Murrumbidgee Catchment Coordinating Committee, Canberra. http://umccc.org.au/files/GroundwaterFactsheet.pdf (accessed 26/11/11)

Other data sources

In addition to these published reports, data for this paper were also sourced from:

ACT water quality database, http://incp.environment.act.gov.au/water/index.aspx

ACT Department of the Environment, Climate Change, Energy and Water (DECCEW) - now Environment and Sustainable Development Directorate (ESDD)

Environment Protection Authority (EPA) – now part of Environment and Sustainable Development Directorate (ESDD)