water SMART

PRACTICE NOTE 10

Groundwater

Installing a groundwater bore

WaterSmart development involves simple design and management practices that take advantage of natural site features and minimise impacts on the water cycle. It is part of the contemporary trend towards more 'sustainable' solutions that protect the environment and cost less.

This WaterSmart Practice Note gives a general introduction to groundwater utilisation measures.

- **Bores**
- **Groundwater extraction**
- **Aquifer storage & recovery**

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Groundwater

Introduction

Groundwater extracted from bores can be an important water source for domestic use. Many urban areas occur over a suitable aquifer. Indeed, the use of groundwater in Australia for outdoor purposes is commonplace.

Groundwater quality varies from place to place, and may be unsuitable for domestic purposes. For example, groundwater can be saline or be contaminated by human activity. Where groundwater quality is unsuitable, artificial recharge of stormwater into the aquifer can often be used to produce suitable water supplies. This process is known as aquifer storage and recovery. Many authors have described successful aquifer storage and recovery projects (see references).

As well as positive benefits, groundwater utilisation schemes have the potential to cause adverse impacts on local groundwater levels and quality. Consequently, specialist advice is required from qualified personnel. In addition, approvals from relevant authorities are also required.

Bores

A groundwater bore comprises a well driven into the ground to a depth exceeding the water table (the uppermost level of strata that is saturated by groundwater). Water-bearing strata beneath this level (such as rock or sand) is termed an aquifer. The depth of the water table and aquifers varies considerably from place to place in response to geological and climatic conditions, and can also vary seasonally.

A pump system is required to extract groundwater from the aquifer. Bores are installed by specialist drilling contractors. The principal components of a bore are illustrated in Figure 1.

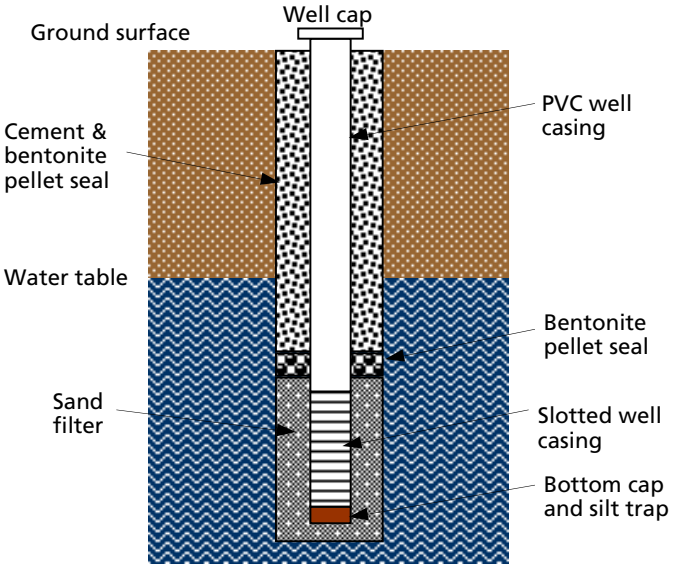

Fig 1: Components of a groundwater bore

Groundwater extraction

A conceptual groundwater extraction scheme is shown in Figure 2. Groundwater is extracted from an aquifer using a submerged pump placed in the bore. It is subsequently passed through a filter to remove sediments or contaminants. The extracted water is used for outdoor uses and toilet flushing.

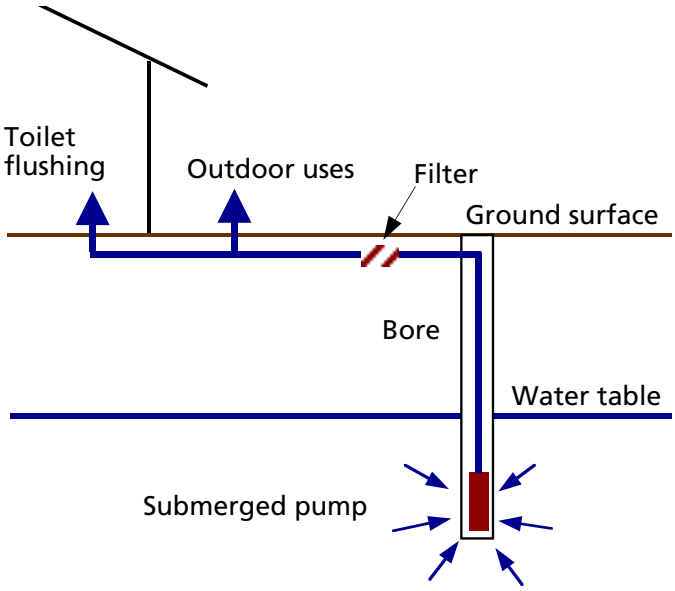

Fig 2: Conceptual groundwater extraction scheme

Groundwater

Aquifer storage & recovery

Aquifer storage and recovery involves the injection of treated stormwater into a suitable aquifer. This water is stored in the aquifer for extraction and reuse at a later time. A conceptual aquifer storage and recovery scheme is shown in Figure 3.

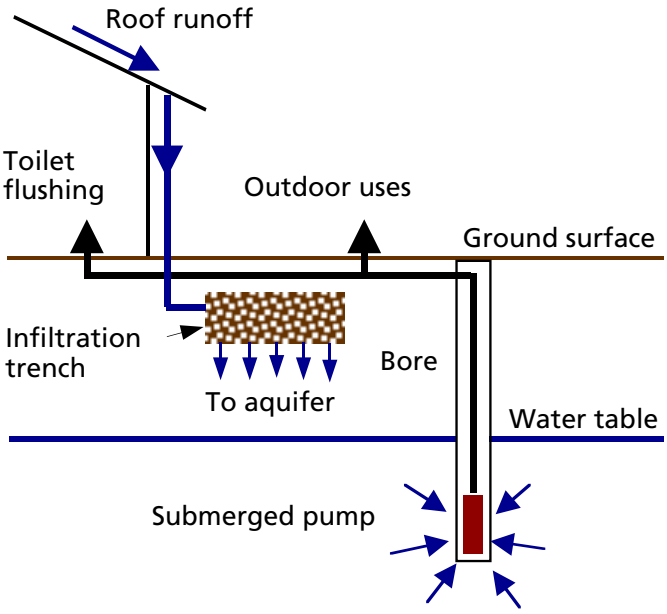

Fig 3: Conceptual aquifer storage & recovery scheme

There are three essential criteria that must be satisfied by an aquifer storage and recovery scheme.

- *Pre-treatment*: rainwater must be suitably treated prior to aquifer injection in order to prevent groundwater contamination. Domestic roof water is generally of acceptable quality provided that it is passed through a sand-gravel filter.
- *Water balance*: aquifer extraction and recharge must be balanced on an annual basis. This will ensure that long-term ground water levels are maintained.
- *Suitability for use*: the quality of water extracted from the aquifer must be suitable for the proposed use.

Satisfying each of the above requires specialist investigation, advice and management.

Consequently, aquifer storage and recovery will generally only be appropriate for larger housing developments. However, where installed, it can produce significant water management benefits including:

- reduced groundwater salinity
- flood mitigation
- reduced mains water demand and costs
- restoration of groundwater levels
- improved stormwater quality.

Approvals

An access licence under the *Water Management Act 2000* is required to extract groundwater from an aquifer. Such licences are administered by the Department of Land and Water Conservation.

Because of the need for an access licence, a development application for housing or other development involving groundwater extraction or aquifer storage and recovery is classed as 'integrated development'. This means that the application is required to be referred by the local council to the Department of Land and Water Conservation for its 'general terms of approval' regarding the access licence.

Consultation with the Environment Protection Authority is advised regarding aquifer injection and the need for an environment protection licence under the *Protection of the Environment Operations Act 1997*.

Development applications should be supported by detailed documentation that addresses relevant hydrological, hydrogeological, soil contamination and public health issues. This must be prepared by personnel having appropriate qualifications, expertise and experience.

Groundwater

Useful websites

Peter Coombes, University of Newcastle: www.eng.newcastle.edu.au/~cegak/Coombes

Royal Australian Institute of Architects: BDP Environment Design Guide

CSIRO Urban Water Program: www.dbce.csiro.au/urbanwater

CRC for Catchment Hydrology: www.catchment.crc.org.au

Atlantis Corp.: www.atlantiscorp.com.au

Rocla Concrete Products: www.rocla.com.au

James Hardie Industries: www.jameshardie.com.au

University South Australia: www.unisa.edu.au

References

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Dillon, P., Pavelic, P., Gerges, N., Martin R. & Barnett, S. (1998). 'Aquifer storage and recovery of stormwater, treated effluent and mains water', in *Proc. HydraStorm98 Symposium*, Adelaide, 189-194. Institution of Engineers Australia, Canberra.

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