



# Groundwater BRIEFING



## Managing aquifer recharge for sustainable groundwater use



Existing wells and boreholes can be used to recover recharged water. These may become perennial sources where previously they failed. Rajasthan, India.



A recharge dam in Kenya in the dry season



Under some conditions reclaimed water can be injected into a confined brackish aquifer and stored for subsequent irrigation supplies. An example in Australia.

### The issue

Storage of water is becoming increasingly important as climate variability impacts on balancing demand with supply. Groundwater is by far the largest store of freshwater on the earth. However, when more water is pumped from an aquifer than is replenished periodically by natural recharge (rainfall), the groundwater level falls and storage is depleted. Recharge occurs only in the wet season when much water can be lost to runoff and evaporation.

Managed Aquifer Recharge (MAR) has the potential to be a key component in many integrated water management systems; providing storage, and in some cases, water treatment. Treated wastewater and storm water are increasingly being used as sources for MAR. Demand for water also needs to be managed to balance the recharge to the aquifer, be it natural, managed or incidental. Demand management can take many forms including more efficient use, limiting the depth of wells, education, moves to a lower water use economy (i.e. away from irrigated agriculture) as well as fiscal controls.

### What the groundwater community is doing about it

The IAH formed a Commission on Management of Aquifer Recharge in 2002. IAH-MAR aims to expand water resources and improve water quality in ways that are appropriate, environmentally sustainable, technically and economically viable and socially acceptable. This will be achieved by increasing awareness of MAR among professionals, decision-makers and the community, by facilitating exchange of information (e.g. [www.iah.org/recharge](http://www.iah.org/recharge) and e-mail list), and results of research and practical experience, and by undertaking joint projects and activities. IAH-MAR has established four working groups who will develop and report on 'Training', 'Regulations', 'Inventory' and produce a document entitled "Wise strategies for recharge enhancement".

UNESCO IHP-VI (2002-2007) <http://www.unesco.org/water/ihp/> comprises five Themes, components of each being addressed through the IAH-MAR agenda. Aquifer recharge is also a topic identified in the UNESCO master programme for 2004-05. Contributions are also made by, amongst others, WHO, GW-MATE, AwwaRF, FAO, IAEA and national departments for international development.

### What else needs to be done?

Adoption by governments of groundwater management policies, regulations (eg. groundwater protection, property rights, environmental flows), and practices to conserve, protect and enhance groundwater resources.

Raise awareness of governments, NGOs, water utilities and the public through dissemination of information and guidelines based on sound understanding of the technical, operational and livelihoods issues, relating to;



Large spreading basins are used to recharge water near Phoenix, Arizona. The water is imported by aquaduct.



Many small structures in a catchment can add significantly to aquifer recharge. A recharge dam near Pune, India.

- Wise strategies for recharge enhancement in arid and semi-arid areas as part of water management strategies;
- Public health and environmental issues associated with enhancing recharge with storm water and reclaimed water;
- Climate change and water storage needs for water security.

Build national capacities in the management and protection of water resources, including aquifer recharge, through provision of training and education at all levels

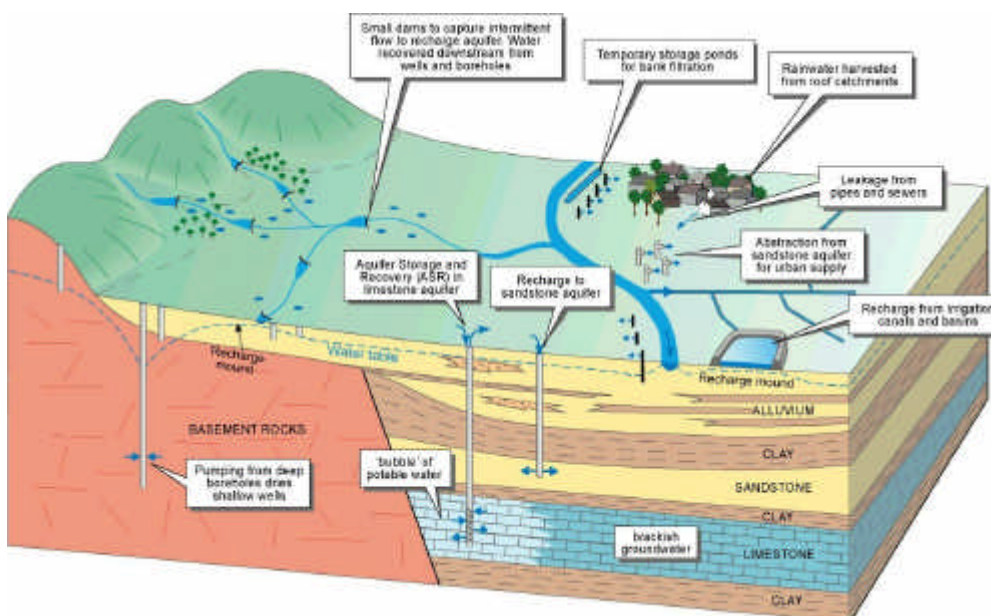
Co-ordinate activities of international and national agencies to promote improved understanding and sharing of knowledge, as well as training programmes.

### Key facts

- Over 95% of the Earth's useable fresh water resources are stored in aquifers as groundwater;
- In water-scarce areas, groundwater is the most common source of water supplies, and its continued use is threatened by over-exploitation;
- Recharge enhancement and demand reduction need to go hand in hand to sustain supplies, and MAR can be used to facilitate demand management;
- Good planning, investigations, design, operating practices, maintenance and monitoring are needed to be successful, and techniques need to be adapted to local conditions.

### Further reading

- Managing Aquifer Recharge. Information leaflet. UNESCO, 2002;
- Recharge enhancement & sub-surface water storage. Dialogue on water and climate. Netherlands Committee IAH. April 2003;
- Groundwater and Society: Resources, Tensions and Opportunities. 2000. Burke, J J and Moench, M H. United Nations Publications;
- Management of Aquifer Recharge for Sustainability. Proceedings of ISAR-4, Adelaide, 2002. A A Balkema;
- GW-Mate Briefing Note 12. Urban Wastewater as Groundwater Recharge, World Bank, 2003 [www.worldbank.org/gwmate](http://www.worldbank.org/gwmate).



### Techniques for managed aquifer recharge

Some of the methods used to enhance recharge to aquifers are shown in the diagram below. In addition to managed aquifer recharge, excess irrigation and leakage from water mains and sewers can also make a large (unintentional) contribution to groundwater recharge. This needs to be better understood and managed.