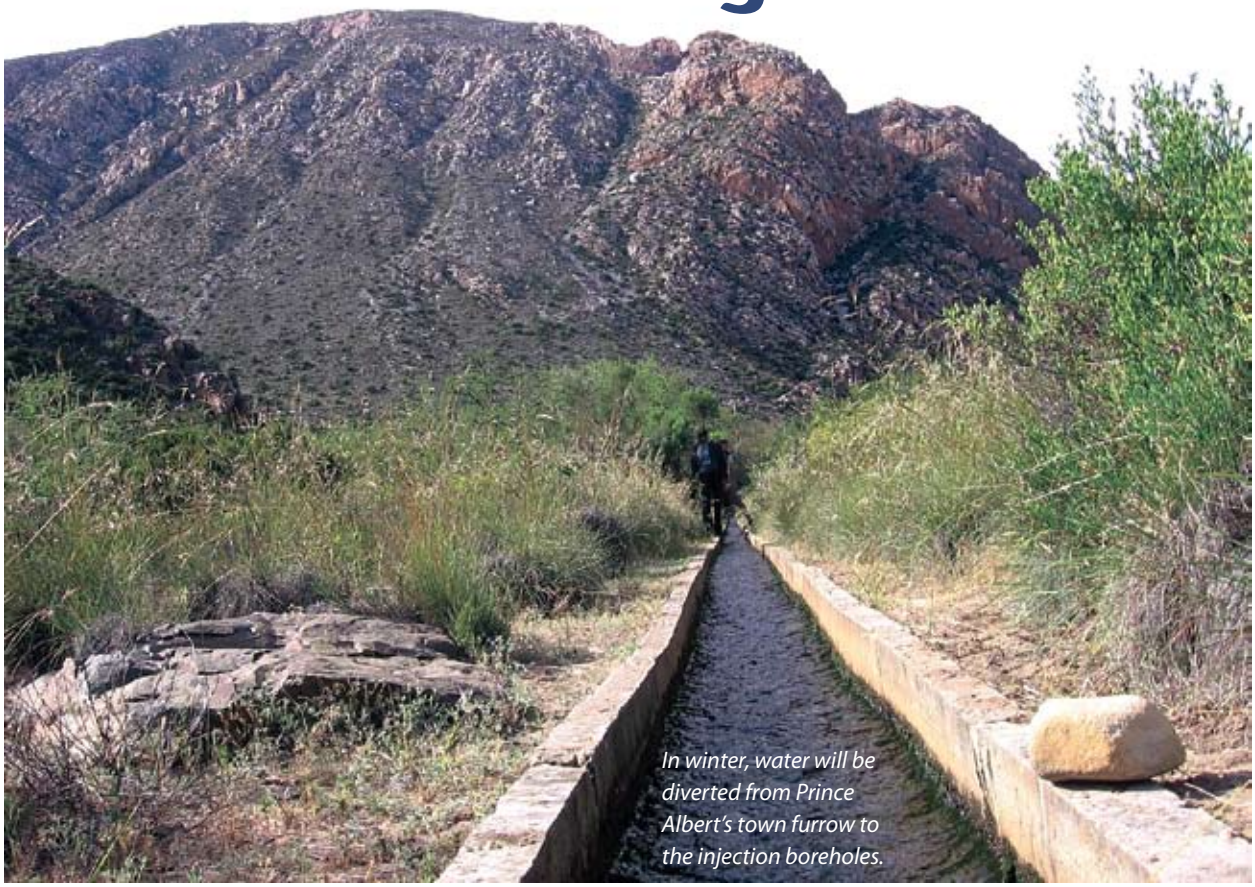
Artificial Recharge Gets Real



In winter, water will be diverted from Prince Albert's town furrow to the injection boreholes.

A new government strategy has given artificial recharge a welcome push as a conservation technique, writes Mike Wills.

Artificial recharge – transferring river or dam water underground into appropriate aquifers by means of infiltration basins or borehole injection – is finally gaining some impetus in South Africa as a water conservation and storage option for municipalities.

The Department of Water Affairs & Forestry (DWAF), with support from the Water Research Commission (WRC), has produced a detailed strategy on artificial recharge to encourage optimum usage of aquifers. This has already resulted in some action.

Borehole injection tests (where good quality surface water is injected into heavily used boreholes) are being planned for both the West Coast District as well as Prince Albert. In addition, Plettenberg Bay on the South Cape Coast, faced with a winter rainfall pattern and heavy summer holiday season demand, is also considering artificial recharge as a possible alternative to two other more expensive options, investing in an off-channel storage dam from the Keurbooms River or a desalination plant.

The West Coast District, which supplies Saldanha Bay and Langebaan, plans to inject about 4 000 m^3/day into the confined sandy aquifer that has shown a significant drop in borehole water levels over the past years. With artificial recharge, the municipality plans to restore the water levels and use the aquifer as a storage reservoir. This will increase both the water supply and its long-term security, especially in times of drought.

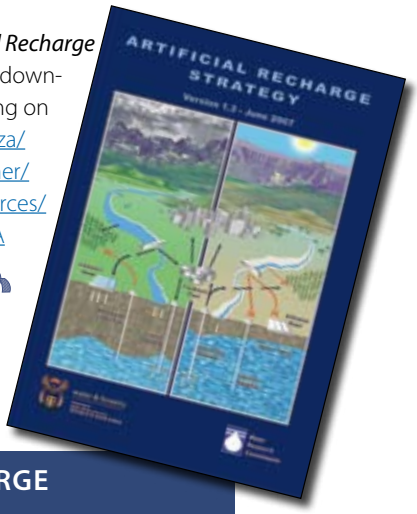
In turn, the municipality of Prince Albert plans to inject at a rate of about 20 ℓ/s into one of its groundwater compartments which has historically been over-pumped in summer months. If these tests prove that artificial recharge is a viable option for both municipalities, they will be the first examples of sizeable artificial recharge in the country using the borehole injection method.

Atlantis, near Cape Town, and the city of Polokwane have been implementing artificial recharge for decades, but they use infiltration techniques. Since most of South Africa is underlain by hard-rock formations, the borehole injection option is more appropriate for any extensive expansion of the technique.

The Prince Albert injection borehole test site.

Artificial recharge is a key weapon in conservation and storage in water-scarce regions, and DWAF believes its possibilities should be explored wherever it is technologically, economically, environmentally and socially feasible.

DWAF's Artificial Recharge Strategy can be downloaded by clicking on www.dwaf.gov.za/Documents/Other/Water%20Resources/ARStrategyForSAJun07.asp



Neighbouring Namibia has successfully implemented several artificial recharge schemes, including a large-scale injection project for Windhoek. DWAF is keen on South Africa following suit and, as part of its strategy, the department has now established a legislative framework, standard guidelines and a draft code of practice for the application of artificial recharge.

The new strategy document outlines all the environmental benefits of artificial recharge and details the global and southern African history of the technique. It also provides hydrogeological maps showing the areas with the greatest potential storage volumes. This includes the Limpopo, Crocodile West Marico, Lower Vaal and Lower Orange water management areas, although DWAF believes that smaller-scale opportunities exist in almost every region.

Clear criteria are also outlined for successful implementation, including high-quality surface water that is geochemically compatible with the existing groundwater and aquifer hydraulics which must allow for the recharged water to enter the aquifer rapidly and be contained within it.

There are several management and technical issues around artificial recharge, and good feasibility planning and testing are essential, with the correct siting of borehole injection points being an important factor. Clogging is identified as the key problem in most schemes around the world. Methods to prevent this from happening are detailed in the document along with the principles of 'safe yield' to ensure that groundwater levels are not raised or lowered beyond critical points.

TYPES OF ARTIFICIAL RECHARGE

Aquifer storage and recovery: Injection of water into a borehole for storage and recovery from the same borehole.
Aquifer storage transfer and recovery: Injection of water into a borehole for storage and recovery from a different borehole, generally to provide additional water treatment.
Bank filtration: Extraction of groundwater from a borehole, well or caisson near or under a river or lake to induce infiltration from the surface water body thereby improving and making more consistent the quality of water recovered.
Dune filtration: Infiltration of water from ponds constructed in dunes and extraction from boreholes, wells or ponds at lower elevation for water quality improvement and to balance supply and demand.
Infiltration ponds: Ponds constructed usually off-stream where surface water is diverted and allowed to infiltrate (generally through an unsaturated zone) to the underlying unconfined aquifer.
Percolation tanks: A term used in India to describe harvesting of water in storages built in ephemeral streams where water is detained and infiltrates through the base to enhance storage in unconfined aquifers and is extracted down-valley for town water supply or irrigation.
Rainwater harvesting: Roof runoff is diverted into a borehole, well or a caisson filled with sand or gravel and allowed to percolate to the water table where it is collected by pumping from a borehole or well.
Soil aquifer treatment: Treated sewage effluent, known as reclaimed water, is intermittently infiltrated through infiltration ponds to facilitate nutrient and pathogen removal in passage through the unsaturated zone for recovery by boreholes after residence in the aquifer.
Sand dams: Built in ephemeral streams in arid areas on low permeability lithology, these trap sediment when flow occurs, and following successive floods, the sand dam is raised to create an 'aquifer' which can be tapped by boreholes in dry seasons.
Underground dams: In ephemeral streams where basement highs constrict flows, a trench is constructed across the streambed keyed to the basement and backfilled with low permeability material to help retain flood flows in saturated alluvium for stock and domestic use.
Recharge releases: Dams on ephemeral streams are used to detain flood water. Uses may include slow release of water into the streambed downstream to match the capacity for infiltration into underlying aquifers, thereby significantly enhancing recharge.
Source: DWAF Artificial Recharge Strategy