Bolivar recycled water ASR

Research project overview

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Bolivar ASR original concept

- Waste water flows to the Treatment Plant, which includes Stabilisation Lagoons.
- Post-treatment (DAF/F) process precedes the storage and recovery (ASR) in the aquifer.
- Aquifer Storage & Recovery (ASR) involves injecting post-treated water into the aquifer during winter, which can be withdrawn during summer for irrigation.

Inset graph shows seasonality of water volume.
Objectives of Bolivar ASR research project

• To determine –
  • technical feasibility,
  • environmental sustainability, and
  • economic viability

• To improve knowledge of subsurface (aquifer) processes and develop sound operating practices and ability to predict changes

• To define operation and maintenance procedures, and produce manuals for reclaimed water ASR
SA Water’s Bolivar DAFF water reclamation plant

Bolivar ASR research project

WRSV’s pipeline pumping station

ASR Injection well
Bolivar recycled water ASR overview

ASR trial site

Virginia Triangle Horticultural Area

output channel

Bolivar wastewater treatment plant

Gulf St Vincent

ADELAIDE

BOLIVAR SEWAGE TREATMENT WORKS

ADELAIDE ZOO FODDER FARM

Two Wells

Virginia Pipeline

Gawler

ASR

4m

50m n

75m

50m s
Hydrogeological section

Depth below ground surface (m)

<table>
<thead>
<tr>
<th>Layer</th>
<th>Depth Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0 - 50 m</td>
</tr>
<tr>
<td>2</td>
<td>50 - 100 m</td>
</tr>
<tr>
<td>3</td>
<td>100 - 150 m</td>
</tr>
<tr>
<td>4</td>
<td>150 m</td>
</tr>
</tbody>
</table>

Kinterval / Kavg (4m well)

Aquifers:
- Layer 1
- Layer 2
- Layer 3
- Layer 4

ASR well:
- 18777

Overlying aquifers:
- T2

Hydrogeological section diagram with depth and aquifer layers indicated.
Bolivar recycled water ASR research

**Stage I**
Viability Tests
drilling & lab studies

**Stage II**
Demonstration model development

**Stage III**
Packaged Methods design tools

- clogging processes
- biogeochemical reactions
- pathogen survival and growth
- characterise aquifer hydraulics
- solute transport modelling
- aquitard structural stability
- regional groundwater flow modelling
- additional research objectives e.g. trace organic fate, aquifer ecology, risk management, economic viability, operational management
Bolivar ASR research – Stage 1 steps

**Concept**
- CSIRO and DWLBC successful at Andrews Farm stormwater ASR and put joint proposal to Premier and Cabinet through DAIS as adjunct to Virginia Pipeline Scheme for winter storage
- Draft experimental plan and budget established

**Prove Concept**
- Drilled one well – with coring, geophysics, pumping test and sampling
- Lab tests on cores, for clogging, geochemistry
- Preliminary groundwater flow and solute transport modelling
- Revised experimental plan and budget, and set management structure

**Approvals**
- EPA – Health – approved trial and invited onto advisory committee
- Inform and seek feedback from local community, local council and NAP-CWMB
- Funding approved by P&C via DAIS
- Project commences with Steering Committee, Chaired by DWLBC with CSIRO, SA Water, United Water & DAIS to run project. Also Advisory Committee and Technical Committee
Community information

Aquifer Storage and Recovery Trials in the North Adelaide Plains

Meetings with groundwater users, catchment board and local government

Brochures

Multilingual interactive display
## Community Consultation

<table>
<thead>
<tr>
<th>Feedback – desires &amp; concerns</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Project governance and credibility</strong></td>
<td></td>
</tr>
<tr>
<td>State government to manage the injection trial</td>
<td>Agreed – DWLBC to manage the trial, even though it was on SA Water land</td>
</tr>
<tr>
<td>CSIRO to undertake independent research and report publically</td>
<td>Agreed – CSIRO led and did most of the research and involved universities and international partners. Published extensively.</td>
</tr>
<tr>
<td><strong>Aquifer and groundwater protection</strong></td>
<td></td>
</tr>
<tr>
<td>Potential for leakage from T2 to T1 aquifer through unknown improperly completed or abandoned wells</td>
<td>FEFLOW modelling of an abandoned well interconnecting aquifers between ASR well and nearest T1 well showed undetectable impact</td>
</tr>
<tr>
<td>Wanted baseline monitoring of all local water supply wells in T1 aquifer</td>
<td>Baseline monitoring implemented and reported back to owners</td>
</tr>
<tr>
<td>You could cause damage to the aquifer or our wells that you will not be able to fix</td>
<td>Investigation undertaken to assess potential risks</td>
</tr>
</tbody>
</table>
Project progression 1996-2010

Series of projects (est budget $5M)

- DAIS – original 3 year project to support capital costs and CSIRO and DWLBC costs
- CSIRO, SA Water, United Water – all contributed substantial in-kind
- NHT – supported DWLBC costs
- PRF – to support supplemental costs
- AWWARF – 2618 Water quality improvements during ASR
- AWWARF – 2968 Water quality changes during ASR
- WateReuse Foundation – trace organic fate
- NWC – AGWR- MAR Guidelines
- NWC – Facilitating recycling of stormwater and reclaimed water via aquifers in Australia
- EU- AquaRec – water quality risk assessment and management
- EU- Reclaim Water – water quality risk assessment and management
- AWRCoE- MAR and Recycling options 2012-2015

Research Outcomes:

- Bolivar Publications: 23 journal papers, 40 conference papers, 15 reports, 7 PhDs, 1 Hons.
- Major input to Australian MAR Guidelines
- Major input to establishment of Perth Groundwater Replenishment Program
- Some SA Water input into Southern Vales recycled water ASR

Practical Outcomes at Bolivar:

- Proven viable at pilot scale and 134 ML supplied for irrigation Sept 2009-Mar 2010
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