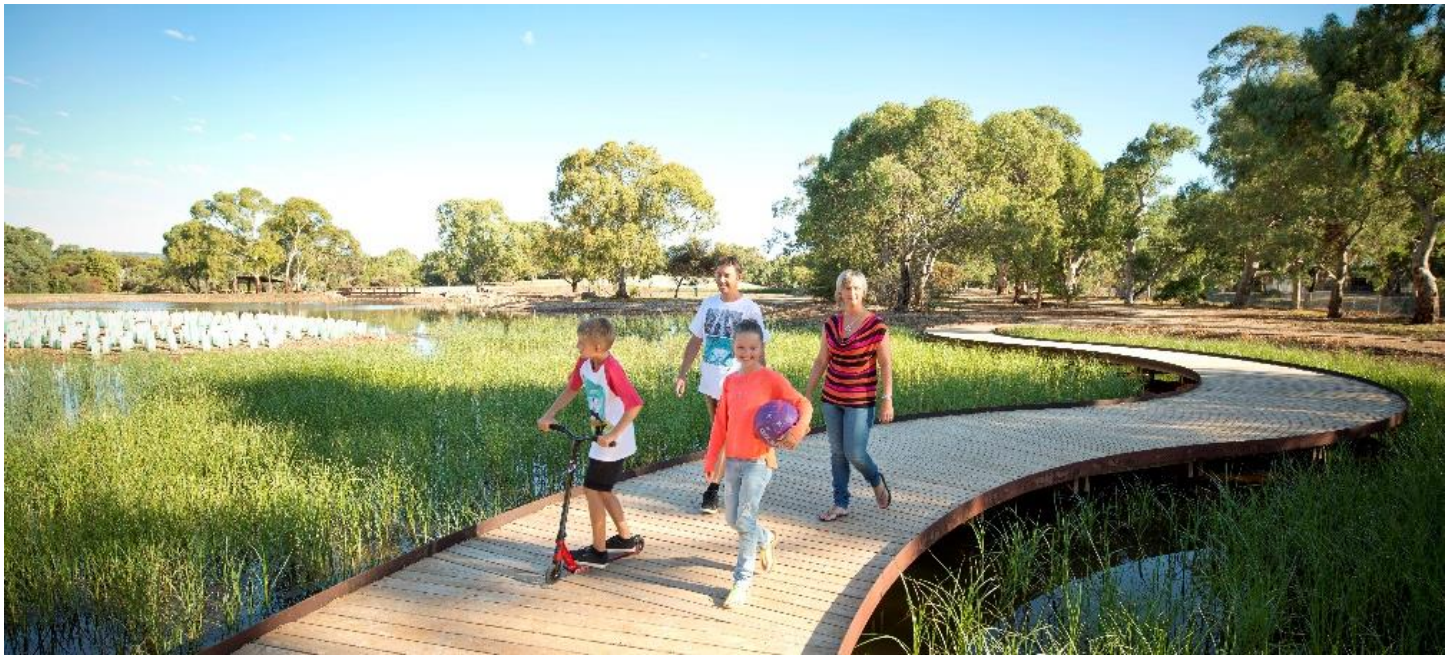
Case study – Oaklands stormwater harvest & re-use project

This is one of a series of case studies aimed at demonstrating the range of WSUD solutions being applied by practitioners in SA



Oaklands Wetland. Photo: M Mullan

Project planning & design

Oaklands Wetland has transformed the disused former driver education centre site into a beautiful new habitat where people can appreciate the year-round open water and connect directly with nature. Together, Oaklands Wetland and Oaklands Estate Reserve, extending to the south, are one of the City of Marion's most highly valued recreational and biodiverse destinations. The local community and visitors can take a walk or go for a run along the paths, relax with a picnic, have a barbecue, watch the birds, or explore the wetland.

But the award-winning Oaklands Wetland is so much more than this – the wetland itself is part of an integrated water recycling system helping to keep reserves green across the City of Marion, reducing the use of mains water, and protecting natural groundwater reserves. A small portion of the water flowing in the adjacent Sturt River is diverted into the wetland where natural processes clean it. Cleaned water is injected into the deep aquifer under the wetland for storage over winter. In summer, the stored, treated water is pumped out to irrigate council reserves through a dedicated underground pipe network.

The wetland design retained as many mature trees as possible, and more than 85,000 new plants were planted within and adjacent to the wetland. This means the 12-hectare site is a significant green space that is cooler than the surrounding urban area in hot weather while also providing habitat for native plants and animals.

Financial partners

About the site

Organisation
City of Marion
Development type
Public
WSUD feature type
Stormwater harvest and re-use
Total area of wetland
2.2 hectares
Cost
$9 million
Date completed
December 2013

Annual benefits

- ✓ Reuse of up to 200ML p.a. of stormwater for irrigation of up to 31 Council reserves replacing mains or groundwater use, or creating new irrigated areas
- ✓ Expected total treatment of 400-500 ML of stormwater p.a.

Project features

Stormwater harvesting

Flow collects in a grated trench in the base of the Sturt River concrete channel. A pipe transfers flows to a pump station that delivers flows to a forced vortex gross pollutant trap (GPT) and then to an inlet pond at a maximum rate of 50 L/s.

Pretreatment

The GPT removes sediment and debris carried in stormwater. Flow then continues (by gravity) to the inlet pond of the wetland that collects any coarse sediments that pass through the GPT.

The inlet pond consists of open water with edge vegetation and regulates flows into the macrophyte (or vegetated) area of the wetland via two equal length weirs that divide flows into two 'arms' of the wetland evenly. This design feature preserves existing significant trees as flow is split around the trees and then rejoins.

Wetland

Stormwater carries a range of pollutants, and the wetlands are proving to be very effective in the removal of nutrients, suspended solids, hydrocarbons, pesticides and herbicides.

The main macrophyte zone is divided into two levels to work with the site topography. This zone includes various species of local provenance reeds and rushes that act like filters removing pollutants and pathogens. Biofilms on the stems of the vegetation break down nitrogen, reducing nutrient loads in the treated stormwater.

The wetland has a series of connected deeper pools, which allow the system to be drained for maintenance purposes.

The wetland is designed to have a 2-3 day detention time and provides sufficient treatment for flows to be of a suitable quality for ASR injection. The system has capacity to treat 400-500ML of stormwater every year.

Outflows from the wetland pass through an outlet pit that has a screen to prevent vegetation or other material reaching the pump station. The outflow pit also includes a high level weir to prevent the site flooding, spilling treated stormwater back into the Sturt River.

ASR system

The stormwater quality is monitored by auto sampling with data loggers to ensure the water is of a suitable quality for injection into the aquifer. Filtered outflows pass from the pit into an underground pump chamber from where a submersible pump delivers flows to the wells, if water quality meets the required standard for aquifer injection. Otherwise the water is either recirculated or returned to the Sturt River.

Four ASR wells are spaced approximately 150 m apart and are between 100 m and 120 m deep. Pressure increases when sediments or biofilms build up around the well casing. The resulting scour water can be delivered to the inlet pond of the wetland to be recirculated through the system. Alarms will alert of breakdowns.

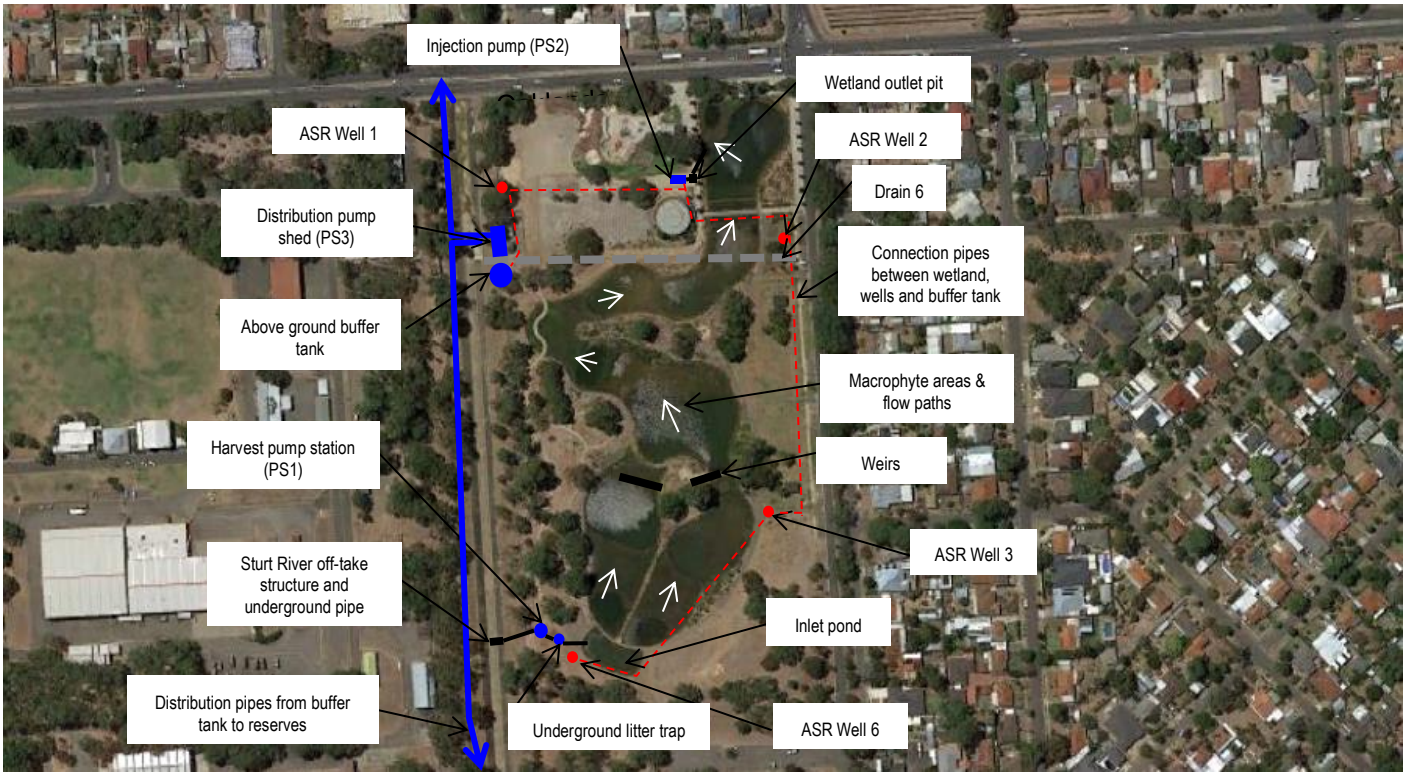


Figure 1 Oaklands stormwater harvest and re-use project

Re-use system

An extraction pump in each well transfers recovered water to a 300,000 L balance tank located adjacent to the distribution pump shed.

The balance tank supplies distribution pumps that transfer water through a network of pipes to council reserves. The control system has built in alarms to detect any breakdowns in the system.

Currently the scheme provides an alternative water supply for 11 reserves, including two large sports fields. Over the 2016-17 summer irrigation season, Council expects to deliver 75ML of recovered stormwater to these reserves.

Future expansion of the scheme will provide an 11.5km long distribution network to supply water to 31 reserves and other public open spaces for irrigation. The scheme has capacity to supply other users seeking an alternative, climate resilient water supply. Council is currently exploring potential partnerships in close proximity to the proposed distribution pipeline which may include collaborations with local schools and the Tonsley development.

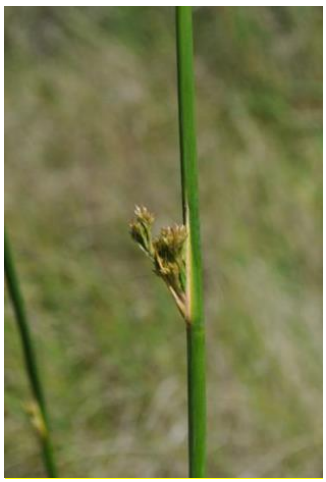
Regulation of water quality

Water is injected into the deeper aquifer, under the terms of a licence issued by the Environment Protection Authority. This protects the precious groundwater resource from adverse impacts.

Wetland vegetation species

Group A – Effective at nitrogen removal

Juncus subsecundus
Finger rush



Juncus palidus
Pale Rush

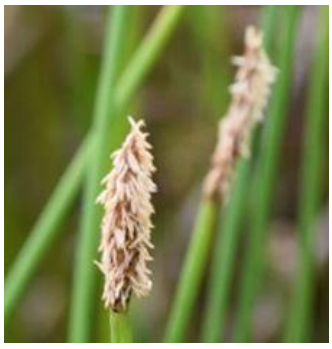
Carex tereticaulis
Rush Sedge

Carex Fascicularis
Tassle Sedge

Group B – Companion Planting

Crassula helmsii
Swamp Crassula

Mimulus repens
Creeping Monkey Flower



Eleocharis acuta
Common Spike Rush

Marselia drummondii
Common Nardoo

Plant images sourced from The Atlas of Living Australia (http://bie.ala.org.au/)

Maintenance & operation

The wetland is extensively vegetated and will require regular inspections to assess weed ingress and identify any damage to hydraulic structures. A dewatering system is incorporated into the wetland design to allow for water level manipulation as well as emptying the system if fish require removal or for other maintenance activities.

Other elements of the routine maintenance regime include the electrical and mechanical servicing and repair of pumps, valves, solenoids and actuators as well as calibration of water monitoring equipment.

Monitoring

Regular manual water sampling is required after every 50 ML of water is injected, and the water quality test results are reported to EPA to demonstrate compliance with the ASR scheme operational license.

Challenges & learnings

Harvesting the water from an adjacent river that carries a high load of sediment and debris has proven to be a challenge. Various off-take structures were considered with a grate system being selected as a preferred solution. The grate was subsequently modified under operational conditions and covered with a plate with holes ranging in diameter from 10 to 30 mm, which has proven to be effective at minimizing sediment loads across a range of flow conditions.

Other challenges encountered relate to the hydrogeology. Groundwater injection rates were based on limited well development during feasibility studies. Actual operational rates are lower than predicted but more than adequate to supply current and future Council demand. The site is future-proofed in that any additional demand for treated stormwater can be serviced by installing additional bores

Initial short circuiting of the flow path resulted in poor mixing within the lower wetland and reduced retention times. This has been resolved by ensuring both weir heights are the same as when the site was first constructed. One weir raised 20 mm during the first year of operation due to the ground swelling once the wetland was filled

Education program & community

The City of Marion uses the wetland and has an educational viewing platform. Site tours are promoted via the Council website. Local schools regularly visit the site. Flinders University students also use the wetland for water quality monitoring and ecology practicals.

Risks & uncertainties

Climate variability is always a risk when investing in ASR. However, in a drying climate, urban catchments will not be affected as much as rural catchments and the size of the upstream catchment is very large compared to the volume of water extracted meaning lower rainfall is unlikely to affect yields.

Early season flows carry higher concentrations of pollutants and the ASR system may have to allow the initial “first flush” to bypass the system until water quality improves.

Salinity of low flows in the main channel in autumn can be a problem however a salinity probe is installed at the offtake point to shut down extraction when the water in the Sturt River is too salty.

Project delivery

Civil design
FMG Engineering

Wetland design
DesignFlow

Landscape design
Taylor Cullity Lethlean

Constructed by
Bardavcol Construction

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