City of Salisbury

STORMWATER RECYCLING THROUGH WETLANDS

IN THE

CITY OF SALISBURY SOUTH AUSTRALIA

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Achieving sustainable development requires clear vision, an inventive search for solutions in a cooperative organisational environment, and not a little good fortune. These qualities have all been present in the experience of the City of Salisbury, Adelaide, South Australia, through the progressive development of its wetlands program.

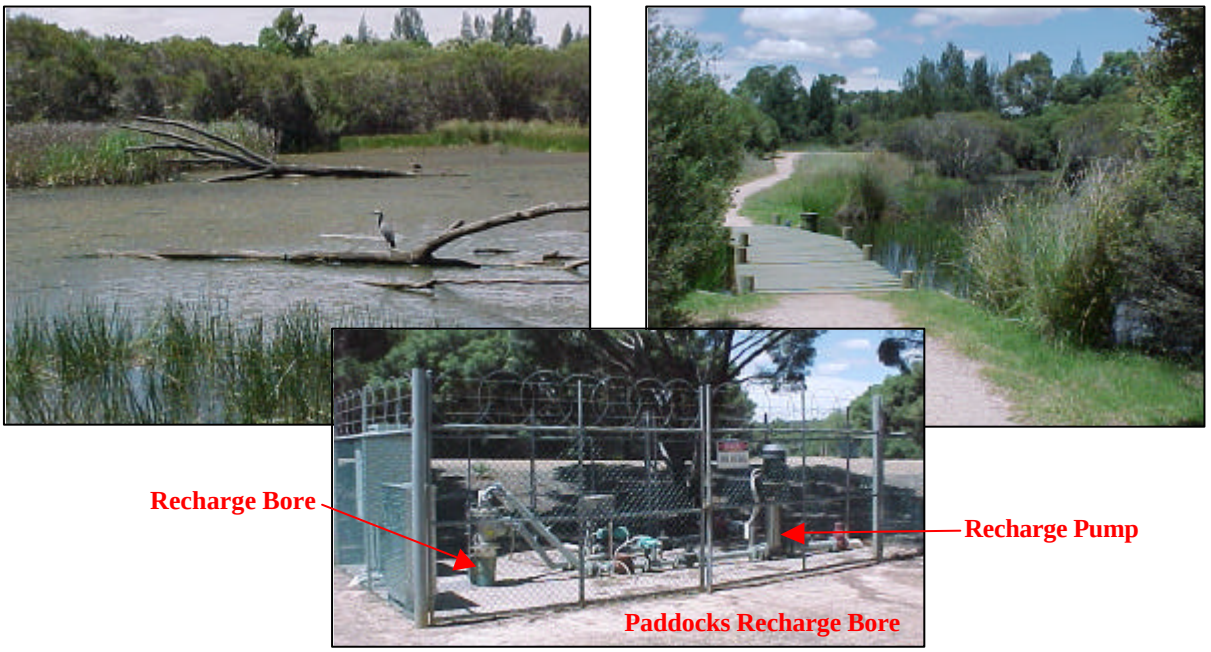
The Genesis of the Salisbury Wetlands

Located 25km north of Adelaide, the City of Salisbury occupies an area of 161 square kilometres extending from escarpment and foothills of the Mt Lofty Ranges to the shores of Gulf St Vincent. The flat coastal plain was, before European settlement, poorly drained and marshy in character. So it was not surprising that early residential subdivision took place on the rising land in the foothills.

Noting that the stormwater from one such development at Para Hills was pooling in an area of under-utilised land, the City Council in the late 'sixties decided to sculpt the area and turn it into a recreational asset. This became the City's first wetland, known as The Paddocks. It was soon found that the area attracted a host of bird life and a number of other fauna, thought to no longer exist in the area, and it did indeed become a wonderful recreation asset.

But, importantly, it was also found that the slow-moving water allowed most of the heavy metals picked up from the streets to settle as sediment; reed beds planted along the banks very effectively filtered the nutrients; aquatic micro organisms decomposed organic matter and the action of sunlight and oxygen through the shallow water effectively removed much of the biotic pollutants. Within just a few days, it was found that the stormwater had been substantially cleansed.

Paddocks Wetland



Paddocks Wetland

South Australia is the driest state in Australia – in the driest continent on earth – and access to cheap, quality water is one of the most critical issues facing the development of the State. Yet it is ironic to note that enough water falls on Adelaide in annual precipitation to satisfy its annual consumption. Yet, at great expense, we have always channelled storm water and sewerage effluent to the coast, where it has debilitated the marine environment, while pumping our water from the River Murray, a river that is undergoing something of an ecological crisis through over use and mismanagement.

At Salisbury, we began to note that the Wetlands might provide another way around the mid-nineties. Concerned at the City's huge irrigation costs, and with the fact that the water is collected during our wet winters while being required in the hot dry summers, the City's engineers needed to find a way to store large volumes of water cheaply. They found it in the underground aquifer, and the first experimental Aquifer Recharge Bore was trialled (interestingly in The Paddocks) in 1994.

These trials were very successful, and proved that the aquifer can be readily used to store large volumes of water for subsequent reuse. A side benefit is the fact that the aquifers beneath the City of Salisbury have been heavily depleted through intensive agriculture and other ground water users. Recharge bores, which combine recharge and extraction capacity within the same structure, monitor water quality and shut the injection process down if quality falls below acceptable standards.

The City of Salisbury is now recognised as a world leader in the field of wetlands technology, with over 30 wetlands totalling approximately 250 hectares in area and costing in excess of $16 million. Stormwater – traditionally regarded as a problem, and in some cases a threat – is now harnessed and utilised by Salisbury in a series of wetlands, enhancing the landscape, and creating habitat diversity.

In the mid-nineties, the City defined a vision that it would seek to eliminate completely the flow of polluted water into the marine environment of the Barker Inlet. An estuary leading off the Gulf St Vincent, the Barker Inlet is a delicate marine environment of mangroves and seagrass meadows that is the nursery for almost all of the State's fishing industry. Years of neglect and polluted inflows have left the Inlet in a delicate state. By developing an extensive series of wetlands and implementing aquifer storage and recovery technology, the City of Salisbury is contributing to the ecological rehabilitation of the Barker Inlet while providing cheaper water to local industry and other users.

The City of Salisbury now has some 36 major wetlands, covering in all several square kilometres. In addition, all new residential subdivisions in the last ten years have been required to install wetlands to contain stormwater on site as much as possible, while large industrial developments have been actively encouraged to develop wetlands for the same reason, and in order to contain potential industrial spills on site. Collectively, these initiatives have effectively eliminated flood risk in an otherwise flood-prone area, and have dramatically increased the wildlife habitat and biodiversity within the City. Importantly, they have substantially reduced the flow of polluted surface water into the fragile Barker Inlet estuary, and have opened new opportunities for the economic recycling of stormwater.

Two recent projects in particular have demonstrated the enormous potential of this new technology: the Parafield/Michells project; and the Kaurna Park/Edinburgh Parks project.

Aerial view of the construction work in progress at Parafield Airport

Parafield/ Michells Project

One of the most recent, and most challenging, of Salisbury's wetlands projects is the Parafield Partnerships Urban Storm Water Initiative, which is a landmark project to manage stormwater in the area to the north and east of Parafield Airport, a general aviation airport in the middle of Salisbury City.

It is the last remaining catchment in the City of Salisbury without treatment to filter and cleanse stormwater prior to discharge to the marine environment.

When it is completed by mid 2002, the project will be another major step in the City of Salisbury's commitment to cease the flow of pollution from its region into the ecologically fragile Barker Inlet of Gulf St Vincent.

The genesis of this project lay in a discussion between City executives and the management of G.H.Michell & Sons, Australia's largest wool processing company, some three years ago. The company's process involves the use of significant quantities of mains water to wash the wool (approximately 1 billion litres per year), and similarly large quantities of effluent and sludge waste water. The costs of fresh water and sewerage disposal were high enough to force the company to consider alternative, cheaper locations elsewhere, potentially resulting in the loss of around 700 jobs.

Following a trial developed and monitored on the Michell site, it was demonstrated that the wastewater could be readily treated through natural wetlands, and a concept was developed for a commercial alternative to mains water supplies.

The G.H. Michell & Sons project ultimately became a jointly funded venture between the City of Salisbury and G.H. Michell & Sons.

The concept presented by the City of Salisbury involved diverting stormwater from existing drains to a system of constantly flowing, bird-proofed reed bed ponds on Parafield Airport land, where it would be filtered, cleansed and supplied directly to users, with the surplus water injected into underground aquifers for extraction during dry periods.

In the first stage alone, 1.1 billion litres (1,100 mega litres, or 1,100,000,000 litres) of water that was being pumped annually from the River Murray to supply the Michell plant and other users would stay in the river. Instead, these users would rely on the high quality harvested stormwater from the Parafield Airport catchment.[1]

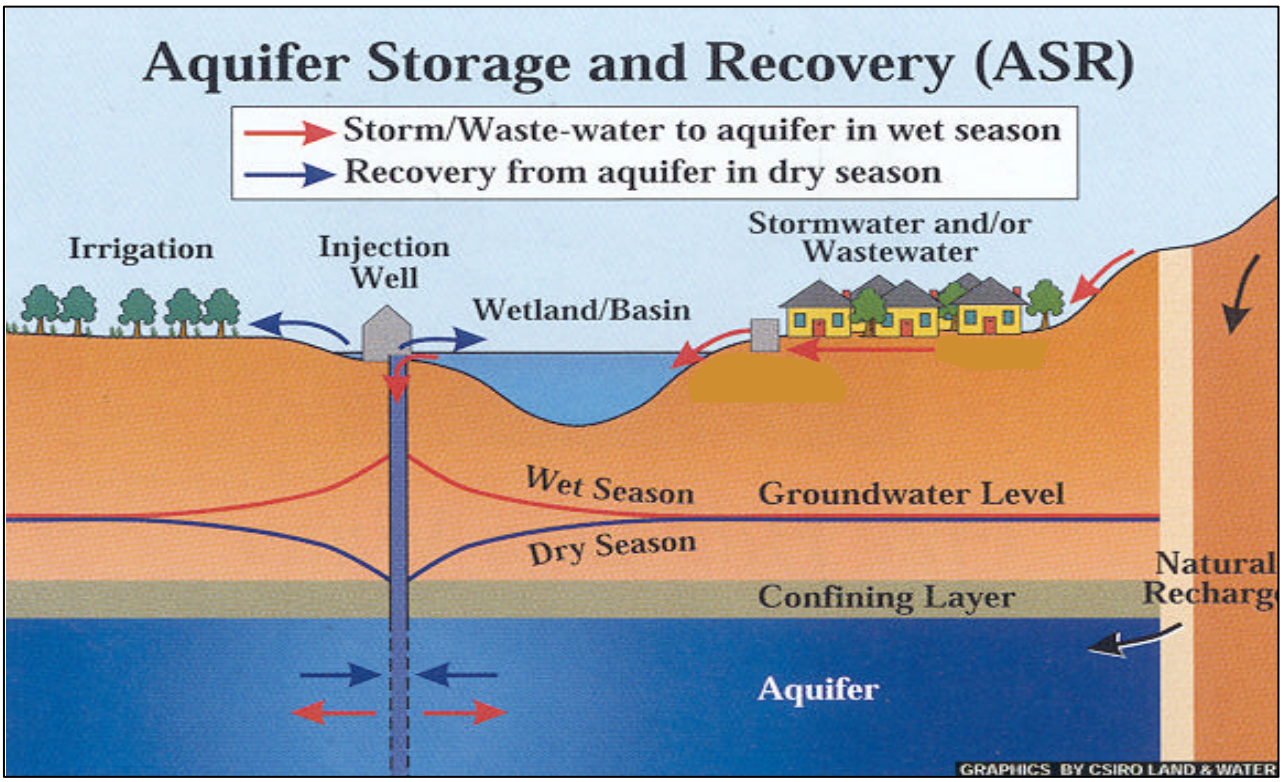
How will it work?

The Parafield Partnerships Urban Stormwater Initiative utilises proven biological processes in the treatment of stormwater. The scheme involves diversion of

[1] Interestingly, as a further by-product of this process, engineers from G.H.Michell and the City of Salisbury have discovered that sludge from the plant, which represents around 20% of all the sludge going to Adelaide's major Sewerage Plant at Bolivar, can be combined with green waste collected from residential properties to produce a high quality fertilizer grade compost for the horticultural and wine industries. A plant to produce some 55,000 tonnes per annum at very competitive costs is presently under consideration.

stormwater via a weir in the main Parafield drain to a 50 mega litre capacity “in stream” capture basin. It will be pumped to a similar capacity holding basin, from where it will gravitate to a two hectare cleansing reed bed and will then flow continuously through the densely planted reed bed to biologically cleanse the water.

Nutrient and pollutant loads will be reduced by up to 90 per cent with the treated water having salinity less then 220 mg/l. The residency period of the water in the treatment ponds prior to being pumped direct to users, or stored in the aquifer, is expected to be between seven and ten days, depending on inflow water quality.



Aquifer Storage and Recovery (ASR)

In the first instance, the Parafield Partnerships Urban Stormwater Initiative will produce a minimum yield of 1100 mega litres of water per year.

Use of the water will be facilitated by the development of an aquifer storage and recovery (ASR) borefield allowing direct supply as well as storage for supply when the system has no flow.

ASR is the process of injecting water into a suitable underground aquifer for storage and later reuse, and it can also be a means of artificially recharging depleted underground water supplies.

ASR is a modification of the natural system that has been occurring for millions of years. Natural recharge occurs by filtration of rainwater through the soil profile, past the vegetation root zone and down to permeable rocks known as aquifers.

Aquifers can store large quantities of water without losses from evaporation and with reduced risk of contamination, both of which are problems associated with surface water storage areas such as reservoirs.

Precious but extremely stressed ecosystem at Barker Inlet

Benefits for environment and industry

There are significant environmental and flood mitigation benefits through treating stormwater from the Parafield Airport catchment in terms of protecting Barker Inlet, an essential fish breeding ground and nursery for much of the State's fisheries. This inlet also supports an abundance of wildlife in its diverse range of habitats.

The harvesting and use of the stormwater resource also eases the burden on the River Murray, which is suffering from reduced flows and rising salinity.

At the same time, through the Parafield Stormwater Initiative, the quality of the captured and cleansed stormwater, which will have markedly lower salinity than that of mains water and can be supplied for around half the cost to industry, will assist in the on-going viability of industry and enhance employment opportunities. A clear objective has been to maximise the use of an available local resource – stormwater – to the benefit of Michell and other industry bodies, irrigators and the community.

Michell Factory with Parafield Project seen at top right hand corner

Kaurna Park Wetlands – Site for the Holden – Edinburgh Park Water Supply Project

Edinburgh Parks - Holden Stormwater Management Project

This project is yet another milestone in the City of Salisbury's innovative program of stormwater management. The City of Salisbury is the proponent and consortium leader in the project to collect, filter and cleanse stormwater in the catchment around the General Motors Holden car manufacturing plant in the northern suburbs of Adelaide. Holden has been part of the local community for more than four decades. Its plant covers approximately 122 hectares and employs around 4,300 people. The treated stormwater will be supplied to Holden Ltd and new industries in the nearby Edinburgh Park precinct. In terms of magnitude, this project is even larger than the Parafield project with a design supply capacity of 2,300-million litres per annum. Once again, a driving motive for the City is to proportionally reduce demand on River Murray mains water and the potential for polluted sormwater entering Barker Inlet.

This project will be constructed in stages. First stage will involve supply to General Motors Holden, Edinburgh Parks, and local irrigators. Second stage will further expand the scheme to supply to the Defence Science and Technology Organization (DSTO) and the Edinburgh Airport for the Royal Australian Air Force (RAAF). Detailed design of this scheme is currently in progress and construction of Stage 1 is expected to commence by October 2002.

General Motors Holden Car Manufacturing Plant

Conclusion

They say, “necessity is the mother of invention”. In the case of the City of Salisbury, the flat, marshy plain clearly restricted the potential development of the City, and pointed to the importance of ponding basins to detain floodwater and allow urban settlement to occur. The sculpting of these basins into recreation assets and wildlife havens was a significant early success for this program. However, the discovery that the artificial wetlands also very effectively cleaned the stormwater, and that surplus water could be stored in the underground aquifer for subsequent reuse, provided a major breakthrough of international significance.

Importantly, the City of Salisbury has now extended this technology to demonstrate, not only that such recycled water can be supplied in large volumes at very competitive prices to large water using industries, but that the waste effluent from this industries, including effluent laden with detergent, oils and paints, can be effectively and cheaply cleansed for recycling through a natural wetland.

Through this project, the City has sought to demonstrate that there is another way to continuing to deplete the threatened waters of the River Murray, or to pore pollutants into the fragile marine ecosystem of the Barker Inlet. It is a way that increases biodiversity and replenishes a heavily depleted underground aquifer. Importantly, it is also a way that provides cheap, quality, reliable water supply and effluent disposal to industry, safeguarding investment and jobs in the City.

Salisbury’s leadership in this area will hopefully act as a catalyst to achieve the paradigm shift amongst regulators, industry and community that is necessary if we are ever to fully realise the enormous potential of stormwater as a valuable and sustainable resource.