

## Royal Botanic Gardens – Working Wetlands

Royal Botanic Gardens  
Birdwood Avenue, Melbourne, Victoria

### Overview

The Royal Botanic Gardens Melbourne extends over 38 hectares and is located South-East of the city centre on the edge of the Yarra River. In 2007, the Gardens adopted a Strategic Water Plan, which provides strategies and actions to encourage a more sustainable use of water resources under a drying climate. The 'Working Wetlands' project, aiming to revitalise the landscapes and water bodies of Melbourne's Royal Botanic Gardens, is one of the outcomes of the Strategy. The project involves harvesting of stormwater run-off from external residential catchments and treating the stormwater through a series of wetlands and the implementation of a water circulation system. The additional water supply will also reduce the Garden's reliance on potable water for irrigation.

Stormwater is diverted from Anderson St and Domain Rd drains, with a predicted annual volume of 63ML/yr. The stormwater flows through gross pollutant traps before it is gravity fed to two lakes situated in the Gardens (Ornamental Lake and Nymphaea Lake). Wetlands with sediment ponds, situated at the inlet into each lake, treat the water via physical and chemical processes. For additional treatment, the lake water is circulated through a system of connected water bodies within the Gardens: Pumps located in Ornamental Lake allow circulation within the lake and also pump water through underground pipes to Guilfoyle's Volcano. In turn, Guilfoyle's Volcano gravity feeds to Nymphaea Lily Lake. From there, the water flows via Fern Gully Creek through Central Lake before returning to Ornamental Lake.

In addition to the 'regular' wetlands, there are floating wetlands in two of the water bodies. These are made from recycled PET plastic injected with polyurethane to provide sufficient buoyancy. They are then covered in coconut fibre and planted with an assortment of semi-aquatic plants. The roots of these plants, suspended in the water, allow fine particles to be trapped and nutrients to be adsorbed. The microorganisms present in the biofilm covering the roots increase the efficiency of this process. A total of 14 floating wetlands were installed in the Gardens (5 in Guilfoyle's Volcano and 9 in Ornamental Lake), making up a total surface area of 1020m<sup>2</sup>. To increase nutrient uptake, two of the floating wetlands are irrigated with lake water.

The lakes and the volcano act as storage for the water and can provide approximately 52ML/yr for irrigation. A predicted overflow amount of 11ML/yr is released into the Yarra River. Assuming the Garden's annual irrigation volume is 130ML, this project could allow up to 40% potable water savings. The water is pumped out of the main lake and the water undergoes further treatment before being stored in four large water tanks, which have a total storage capacity of 500kL. The treatment consists of (1) disk filters, as a pre-treatment for (2) the UV disinfection unit, which is followed by (3) pH adjustment and (4) chlorination. The water can be circulated via underground pumps and pipes into the existing irrigation system. A potable water back-up system allows top-up of the water storage tanks when the irrigation demand is greater than storage capacity during programmed irrigation.



*Floating wetlands in Guilfoyle's Volcano*

## Organisations

**Responsible Organisation:** Royal Botanic Gardens Melbourne

**Funding Partners:** Australian Government, Victorian Government, Myer Foundation - Sydney Myer Fund 2009 Commemorative Grants Program, Melbourne Water, South East Water Corporation, Friends of the Royal Botanic Gardens, Melbourne Inc., Royal Botanic Gardens Foundation Victoria, The Calvert-Jones Foundation, Ken and Jill Harrison, P.J. Jopling QC and many generous individual donors

**Design Consultants:** GHD (stormwater diversion and wetlands), The Water Group (advanced treatment and irrigation – sub-contracted)

**Construction:** Entracon

## Cost

Overall budget (excluding maintenance): \$6.5M

Approx. \$1M for design, project management, marketing and education activities

Expected maintenance budget: \$75k/year (out of which \$35k for electricity)

## Timeframe

**Stage 1** of the Garden's Water Management Plan – rehabilitation of Guilfoyle's Volcano: May 2009 - Oct 2010

**Stage 2** of the Garden's Water Management Plan – stormwater diversion, wetlands and circulation system:

- Construction works: September 2010 – Dec 2012 (includes diversion weirs, underground pipes, pumping wells, embankment works, rock riffles in Fern Gully and installation of floating wetlands)
- Planting of floating wetlands: Dec 2011 – Jan 2012

**Stage 3** of the Garden's Water Management Plan – advanced treatment, storage and irrigation system upgrade: Dec 2011 – Aug 2012

**Launch** of the project: August 2012

## Objectives

- Increase the amenity and public use of the Gardens:
  - Return flows to Fern Gully Creek to enhance the landscape features
  - Avoid exposure of the mud flats in the lakes
  - Minimise algal blooms in the lake (this will also minimise human health risks)
- Improve stormwater quality in the Gardens' lakes and Yarra River
- Reduce the Gardens' reliance on potable water for irrigation
- Attract new and improve existing wildlife population (e.g. water birds and aquatic fauna)
- Develop community awareness through education activities around Guilfoyle's Volcano

“ Our vision is to be less reliant on potable water while sustaining high-quality landscapes and water bodies ”



Floating wetlands being installed at Ornamental Lake (Photo Courtesy of RBG Melbourne)



Educational sign at Guilfoyle's Volcano – Floating wetlands working principles

### Outcomes

- The visual appeal of the Gardens and the lake systems was greatly improved through a combination of
  - Increased volumes of water in the lake system (achieved via harvesting)
  - Lake water treatment via water circulation and a series of in-situ and floating wetlands
  - Constant flow of water through Fern Gully
  - Planting of over 20,000 wetlands plants
- It is expected that up to 40% of irrigation water can be supplied by the stormwater harvesting system, thereby greatly reducing the Gardens' dependence on potable water supply.
- The water quality in the lake system has greatly improved: Grab sampling in the lakes showed that nutrient concentrations (both Nitrogen and Phosphorus) had dropped in average by about 30-40% between 2011 and 2012.
- Anecdotal observations point to an increase of the waterbird population, and therefore an increase in habitat.
- Irrigation efficiencies were improved through the installation of more underground irrigation pipes.
- A horizontal direct drilling method called 'pipe-jacking' allowed the installation of long lengths of pipe without the need to dig trenches throughout the Gardens.
- The project achieved community and student awareness and education:
  - Educational signs are placed in various locations throughout the Gardens. During construction, signs were also placed at the visitor centre and attached to temporary fencing.
  - Guilfoyle's volcano provides multiple education opportunities. Visitors are able to discover more about water conservation principles, sustainable gardening and the functioning of floating wetlands. At the same time, the Gardens hold regular primary and secondary school education programs at this location. It is also a common destination for industry tours.

### Additional figures:

- The irrigation system can convey up to 85L/s at 750kPa
- 1.6ML of lake water could be treated and pumped to irrigate the gardens in one night only

### Lessons learnt

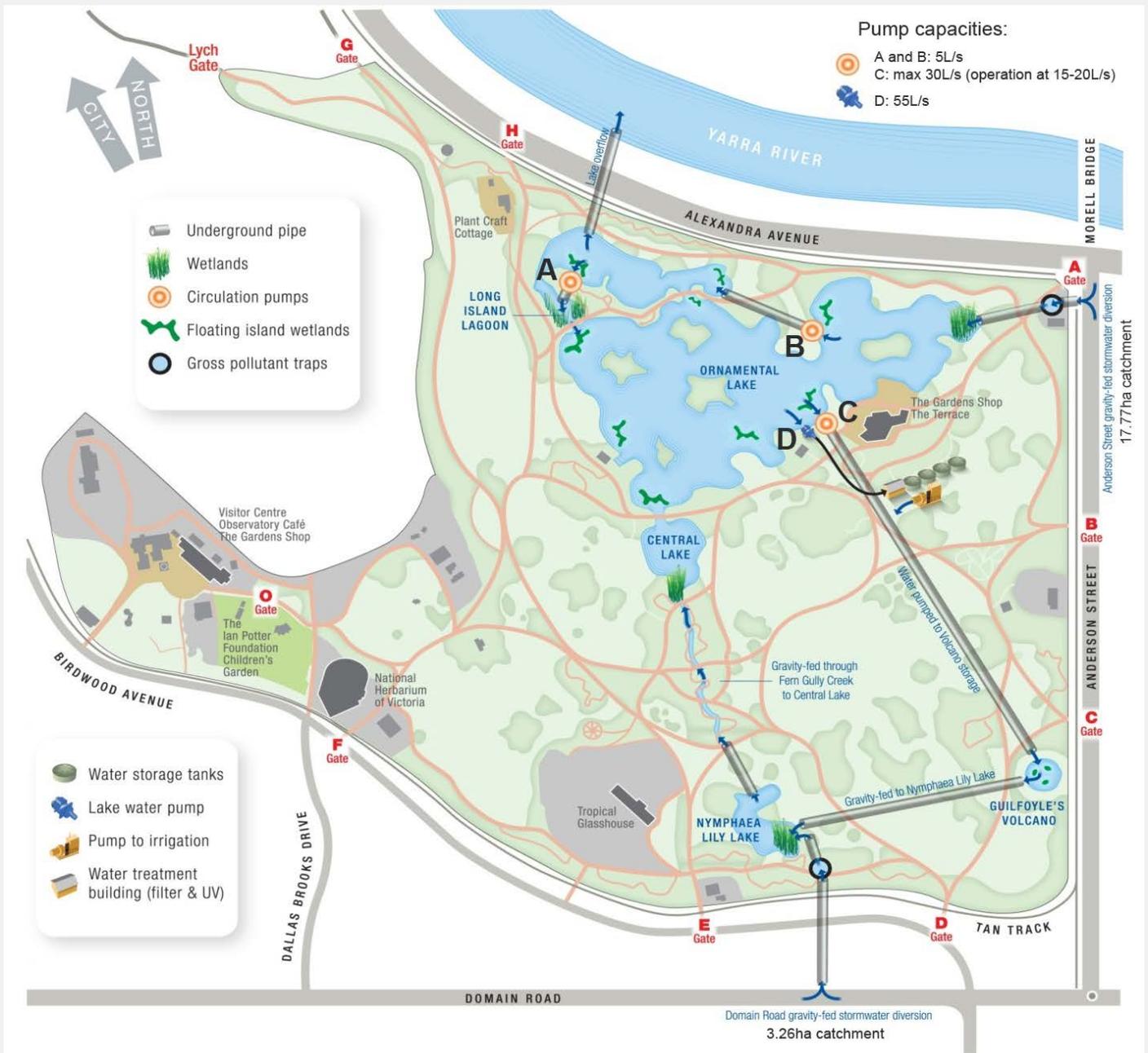
- For habitat rich sites, it is essential to choose the right type of plants and to install efficient netting until vegetation has matured. In this instance, the frame of the initial netting was too heavy and swamp hens were able to get onto the floating islands. They destroyed most of the vegetation for nesting and fed on the seedlings. Most islands had to be replanted and new netting installed. Plants in the constructed wetlands suffered similarly and additional areas were netted to improve plant establishment.
- Installation of the constructed wetlands in Ornamental Lake proved to be more difficult and time consuming than originally planned: the presence of Coode Island silt in the bottom of the lake made the ground very sloppy, hindering construction activities of the earth banks. The design of the earth bank itself met performance requirements, however there was limited detail to account for construction on Coode Island silt. The presence of the silt was known and ideally, the design process would have taken this into account. For similar projects, it is therefore recommended for the design consultant to liaise with the building contractor early on in the project to develop alternative construction solutions. Due to these difficulties, the construction of the second wetland in the same lake was cancelled and additional floating wetlands were installed to make up for the loss of water quality treatment.
- Due to buoyancy issues with the first floating wetlands installed in the volcano, a new prototype was tested in the main lake. The buoyancy needed to be sufficient to allow a person to walk on the island comfortably for maintenance purposes. Following the successful testing of the prototype, the original wetlands in Guilfoyle's volcano were replaced with the new design.



*Constant flows in Fern Gully contribute to the Gardens' amenity*

- Staggering an important project into several stages might be time consuming, but it could allow you to attract financial support by demonstrating the potential benefits of your proposed work. Stage one of the Working Wetlands project, the rehabilitation of Guilfoyle's Volcano, included building community awareness and education. Demonstrating successful construction and the educational benefits that would be achieved by this project allowed the Gardens to secure Government funding for the second and third stages.

Royal Botanic Gardens – Working Wetlands Site Plan



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