University of
South Australia

Expanding CWMS Capacity using Constructed Floating Wetlands – Yorke Peninsula Council

Associate Professor Ke Xing

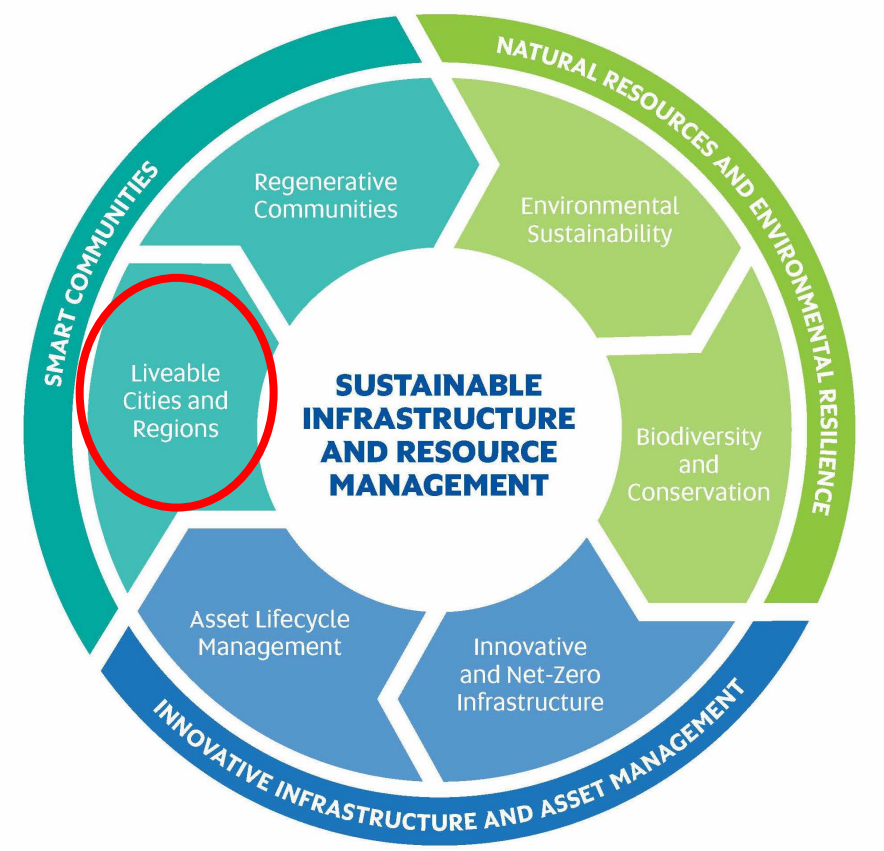
8th June 2023, **SA CWMS Conference, UniSA Enterprise Hub, Adelaide**

Outline

- Our Research Concentration – Sustainable Infrastructure and Resource Management (SIRM) and Our Links with CWMS
- Constructed Floating Wetland
- Yorke Peninsula Council WWTP Upgrade – Ardrossan Golf Club CFW Trial

University of South Australia

Our Research



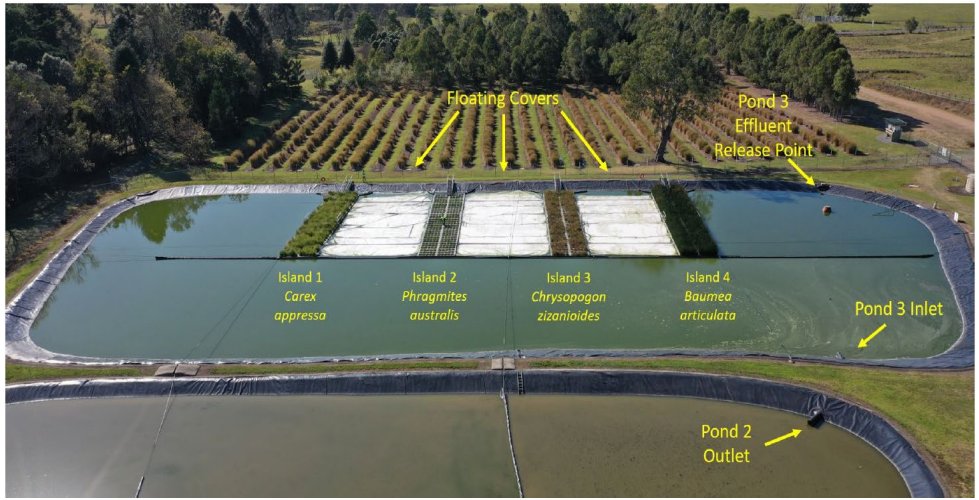
- **Sustainable Infrastructure and Resource Management (SIRM)**
- Natural Resources and Environmental Resilience
- Innovative Infrastructure and Asset Management
- Smart Communities

[Sustainable Infrastructure and Resource Management - University of South Australia - Research - (unisa.edu.au)]

University of South Australia

Constructed Floating Wetland

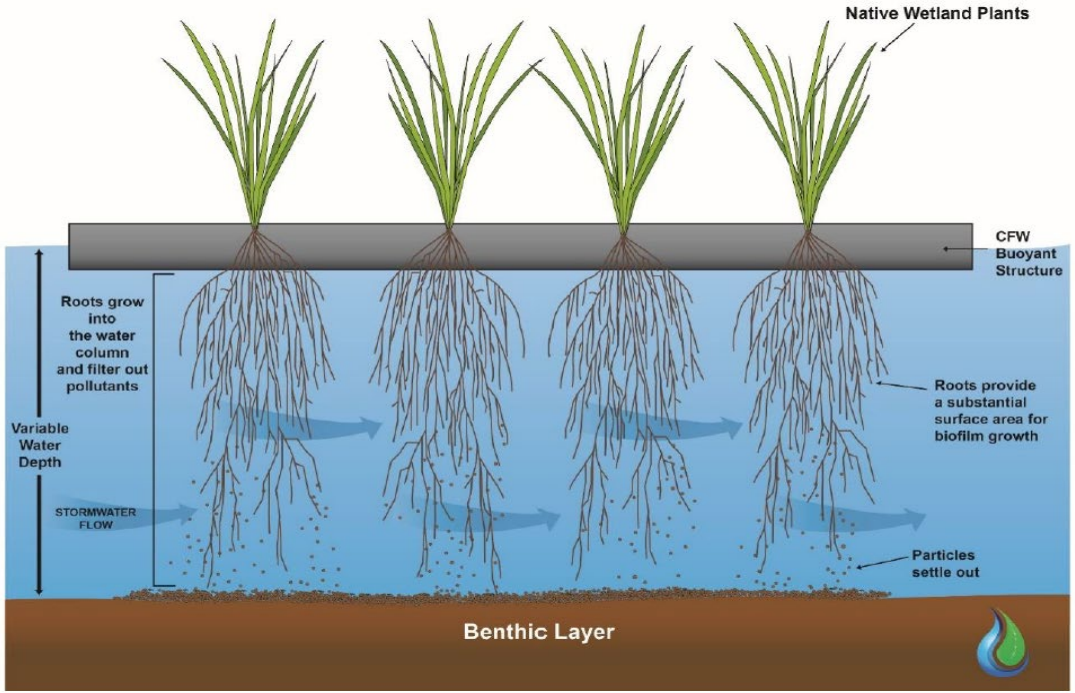
- Designed and constructed to mimic natural floating wetland systems and their water treatment capabilities
- Flexible to be incorporated into existing urban water bodies
- Setup and act as a hydroponic system
- Soil-less planting innovation by coordination biological and building efficient in a feasible manner



University of South Australia

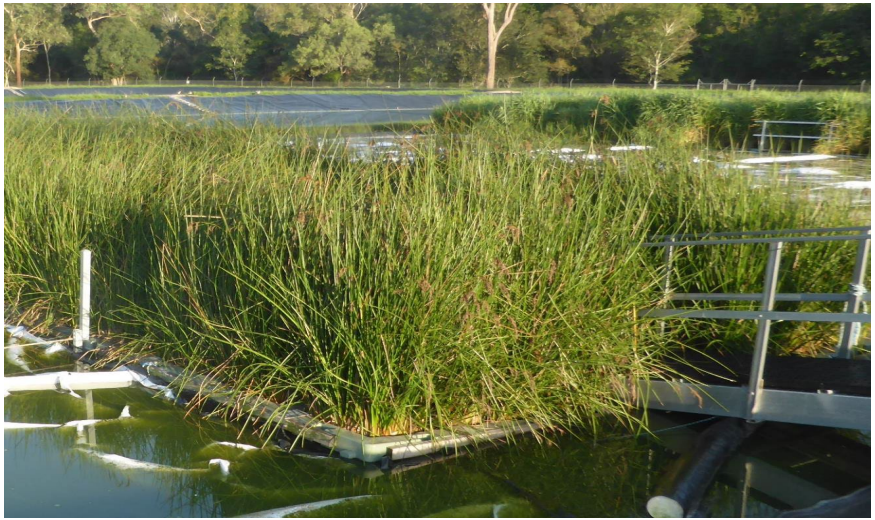
How Does CFW System Work?

- Plant roots system grows directly into the water column
- Provides substantial surface area for the growth of microbial biofilm
- Constructed and operated to remove nutrients and other contaminates from the water



University of South Australia

How the CFWs System Works?



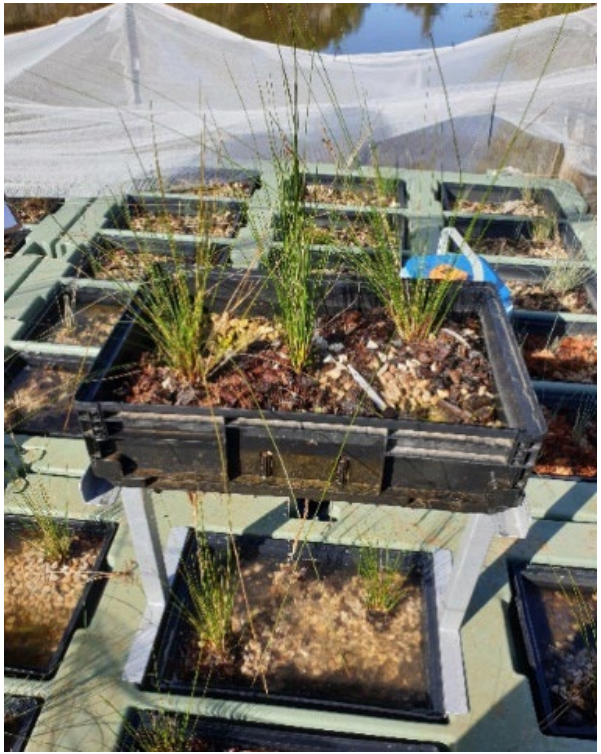
University of South Australia

CLARITY AQUATIC

Large scale application example: ACT Healthy Waterways Yerrabi Pond – Stormwater Cleansing

University of South Australia

Clarity Aquatic CFW modules come with a 10-year structural warranty, have an expected lifespan of > 30 years, are fully recyclable at the end of their lifespan and do not add to landfill burden.



University of South Australia

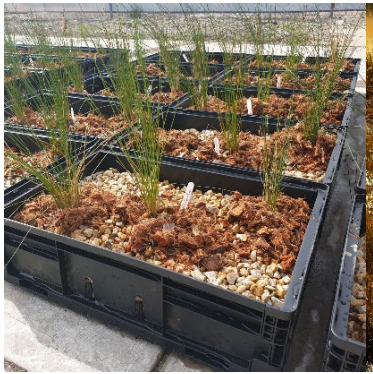
Mawson Lakes Case Study

Preparation and Installation of CFWs

- Gravel (14 mm) as a filter media
- 4 CFWs modules (30 baskets each)

CFWs Plants Selection

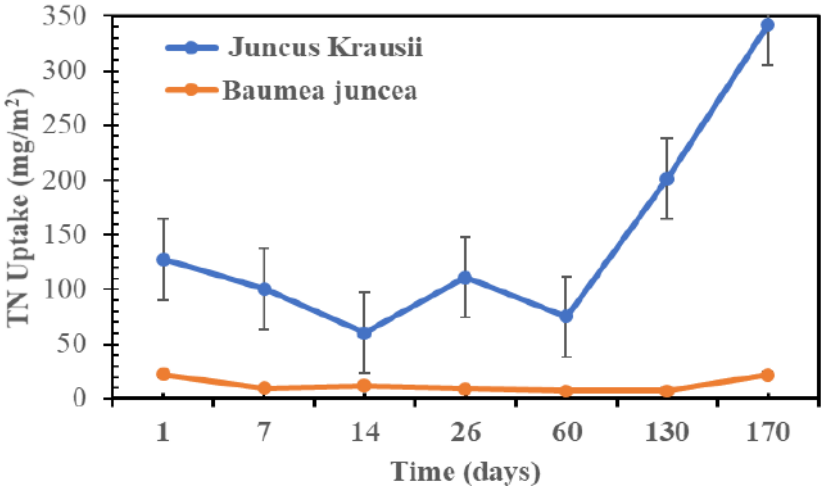
- Plants are selected for their ability to remove nutrients, pollutants and contaminants
- Assess various kind of plants and their percentage of nutrient removals
- *Baumea juncea* and *Juncus kraussii* have been selected for this project



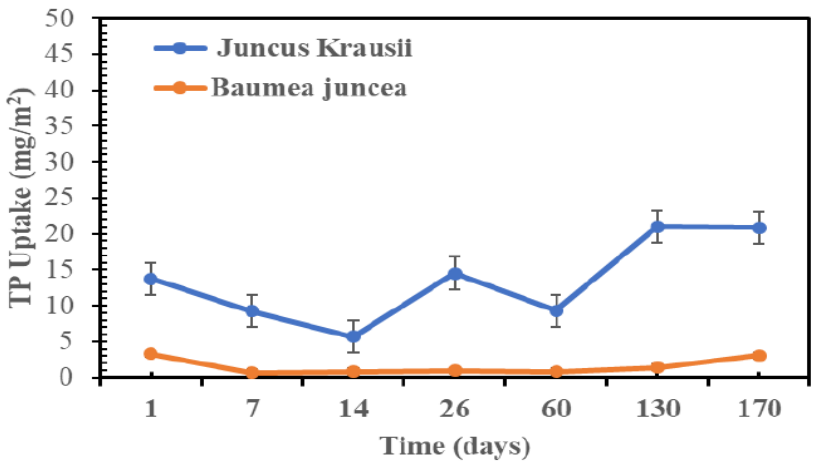
University of South Australia

Mawson Lakes Case Study – Nutrient Removal/Uptake Results

Total Nitrogen



Total Phosphorus

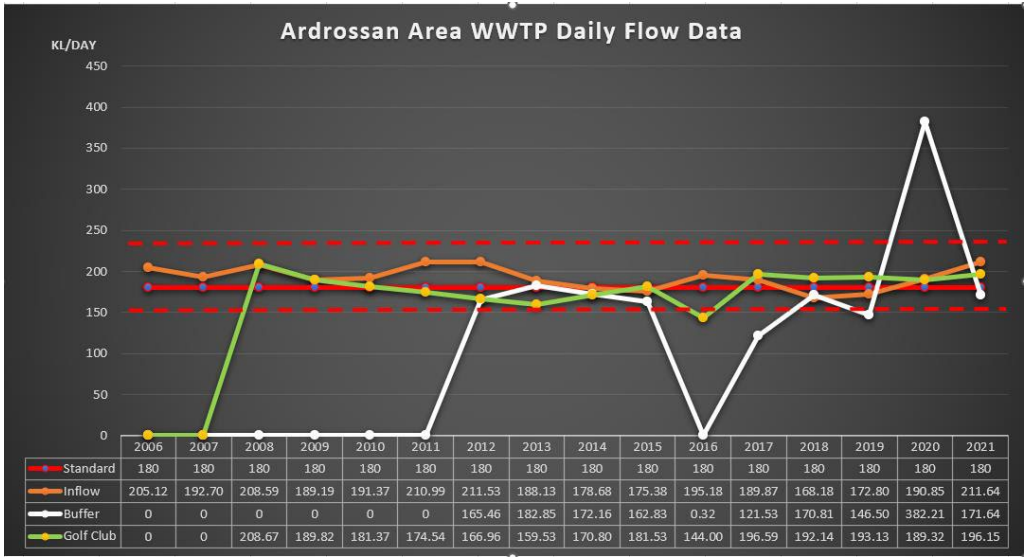


University of South Australia

Yorke Peninsula Council WWTP Upgrade

- Build and upgrade the WWTP at the Ardrossan Golf Club
- Current capacity is 180KL per day
- Feasibility study of using constructed floating wetland (CFW)
- Increase the capacity of the existing wastewater treatment system by at least 25%
- Upgraded system has a daily wastewater treatment capacity of 225 KL/day

University of South Australia



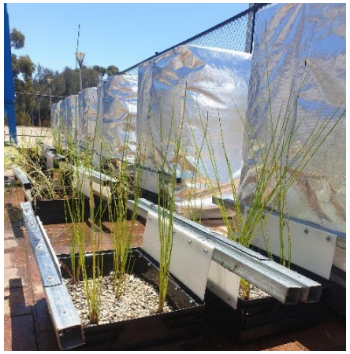
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Standard	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180
Inflow	205.12	192.70	208.59	189.19	191.37	210.99	211.53	188.13	178.68	175.38	195.18	189.87	168.18	172.80	190.85	211.64
Buffer	0	0	0	0	0	0	165.46	182.85	172.16	162.83	0.32	121.53	170.81	146.50	382.21	171.64
Golf Club	0	0	208.67	189.82	181.37	174.54	166.96	159.53	170.80	181.53	144.00	196.59	192.14	193.13	189.32	196.15

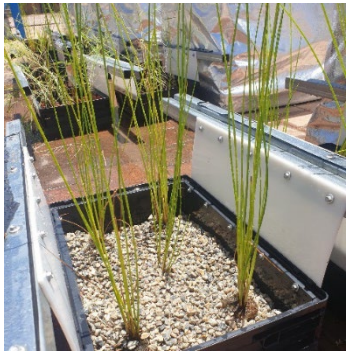
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Daily Flow %	17.52%	4.52%	-0.74%	-2.57%	8.43%	5.48%	-6.57%	-4.00%	6.03%	17.58%
Annual Flow %	14.30%	4.52%	8.18%	3.33%	38.66%	23.99%	-3.90%	-2.35%	15.28%	45.08%

		Removal Rate (%)														
Sample Data	Limits	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Biochemical Oxygen Demand [mg/l]	20	100	100	100	75	100	100	100	75	100	75	75	75	100	100	75
Suspended Solids[mg/l]	30	75	100	75	75	100	100	100	100	50	75	75	100	100	80	75
Thermotolerant Coliforms-E. coli [/100ml]	100	50	100	25	75	75	75	75	100	100	50	75	50	80	80	75

University of South Australia

Trial Design – Intermediate Bulk Container (IBC) Setup

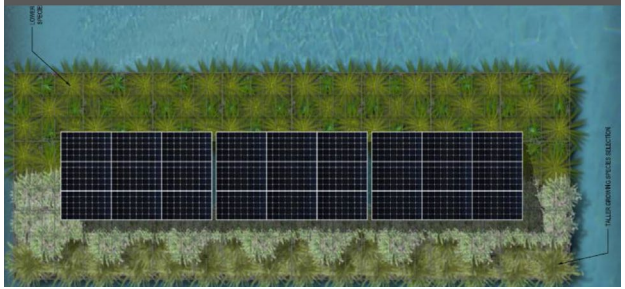




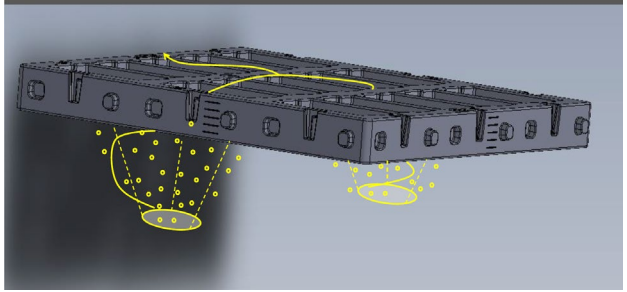
- 10 IBC tanks
- 5 plants per basket, for 2 baskets per IBC tank
- Phragmites australis
  - 3 IBC with lower salinity
  - 3 IBC with higher salinity
- Baumea rubiginosa
  - 3 IBC with higher salinity
- Evaporation measurement
  - 1 IBC

University of South Australia

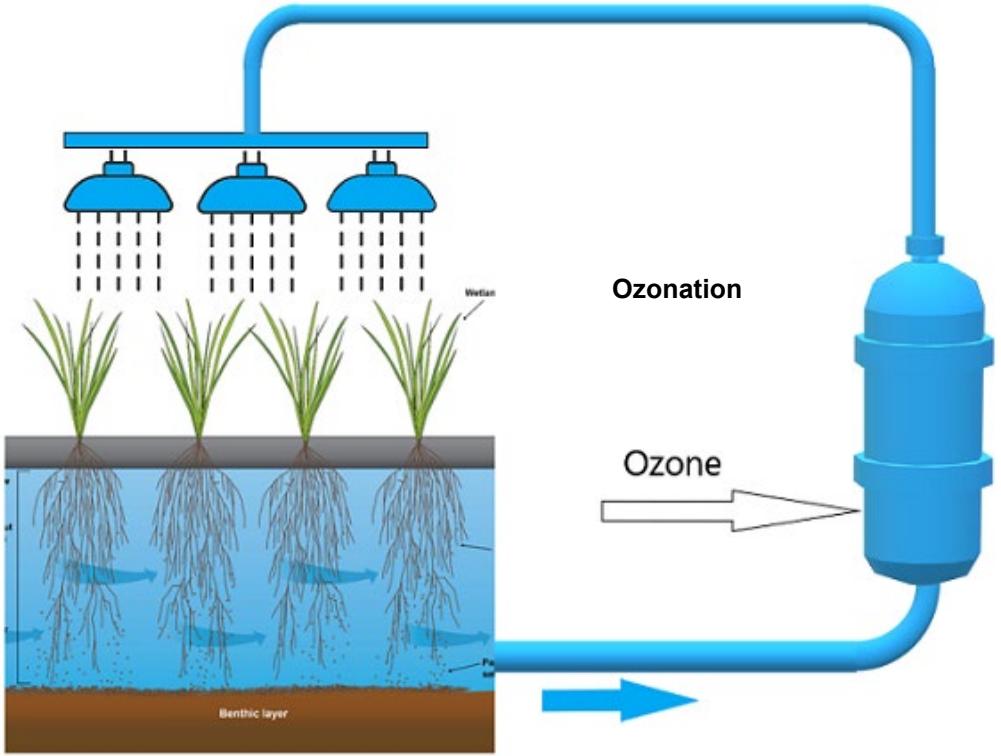
Solar Aeration



Solar Aeration

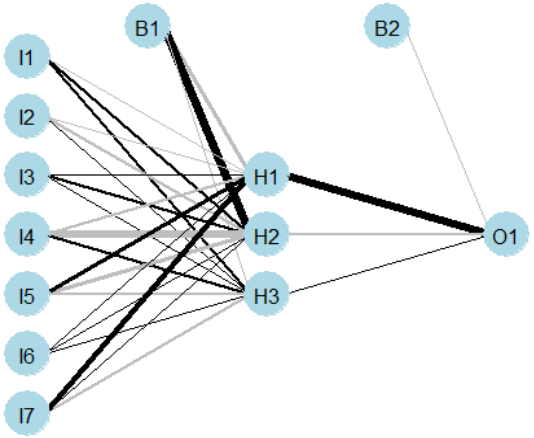


VS

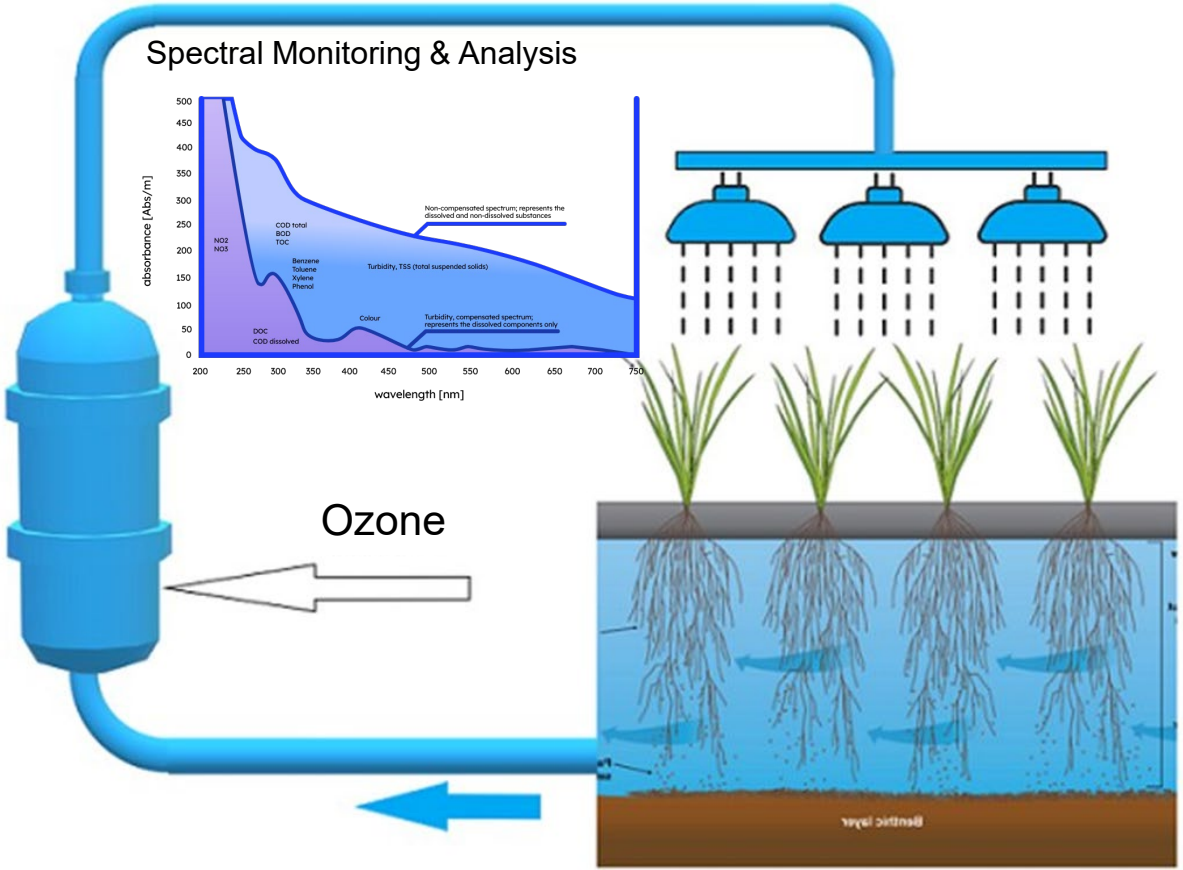


Constructed Floating Wetland

University of South Australia



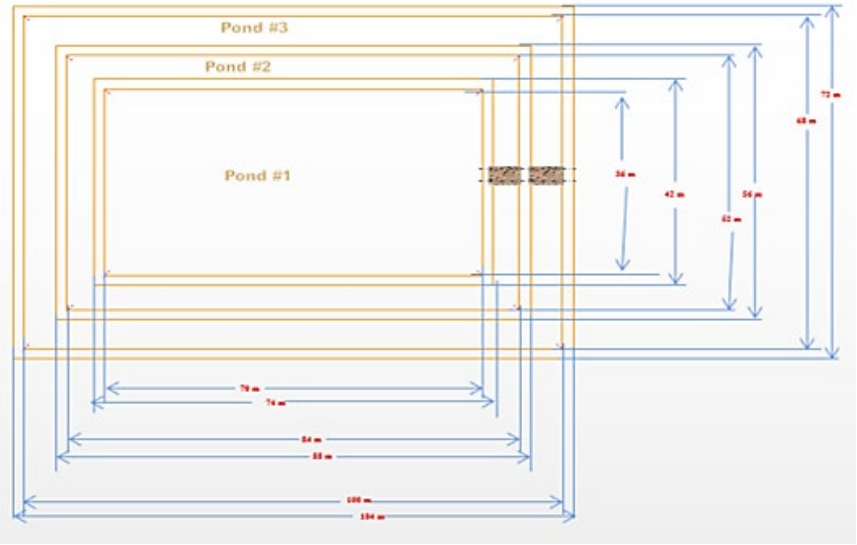
Artificial Intelligence based on Spectral Data Input to control **Ozone Ultrafine Bubble Technology for oxidation** (Hydro2020)



University of South Australia

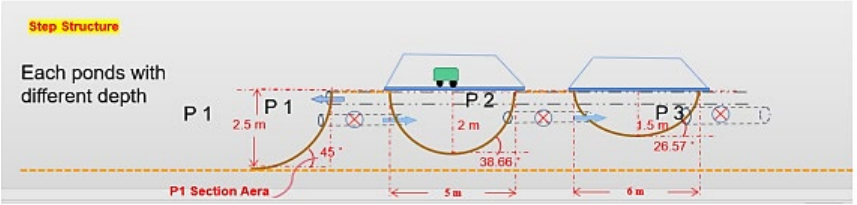
Potential Pond System Layout

VS



Floating Wetland Parameters		
		Note
Capacity	1200PE	5㎥/PE
Land Aera	6800㎡	100*68(m)
Design Average Flow	225KL/Day	
Structure	Concentric Rectangular	Step Sturcture Dam
Located	Location 4	
Plants	Phragmites australis Baumea articulata	123 Modulars 2.35*2.35(m)/EA

Ponds Parameters			
	Land Area (㎡)	Volume (m³)	Slope
Pond 1	2520	6029	45°
Pond 2	1408	2058	38.66°
Pond 3	1872	2304	26.57°
Total	5800	10391	



University of South Australia

Acknowledgements

- Mawson Lakes Case Study - Project co-funded by Clarity Aquatic and supported by City of Salisbury

- UniSA researchers


Prof Christopher Chow


Dr Christopher Walker


Dr John Awad


Mr Thanusshan Packiyarajah


Prof Rameez Rameezdeen


Dr Barbara Drigo


Dr Leslie Huang


Dr Linda Shi


Dr Soheil Aber


Mr Jiawei Zhong

University of South Australia

University of
South Australia

Thank you!