

# THE PARRAMATTA RIVER WATERWAY IMPROVEMENT PLAN

## IMPLEMENTING INTEGRATED WATER-SENSITIVE URBAN DESIGN (WSUD) STORMWATER MANAGEMENT SYSTEMS TO IMPROVE THE HEALTH OF THE PARRAMATTA RIVER

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### ABSTRACT

The *Parramatta River Waterway Improvement Plan* is a collaboration between local councils, community groups and NSW Government agencies, led by Sydney Water, to implement integrated Water-Sensitive Urban Design (WSUD) stormwater management systems to improve the health of the Parramatta River. Improvements include, but are not limited to, better water quality and enhanced liveability. After consultation with stakeholders, Sydney Water and consultant group Alluvium developed 10 project options. If implemented, the *Parramatta River Waterway Improvement Plan* will contribute to Sydney's transition from a 'drained city', focused on flood protection, to a 'waterways city' focused on social amenity and environmental protection.

### INTRODUCTION

Sydney Water owns wastewater infrastructure and 447km of stormwater trunk drainage assets that collect, contribute to and convey flows to receiving waters in the Parramatta River catchment (Cunningham *et al.*, 2015). Because of this it has a significant influence over the river's health and its tributaries along with other land management authorities. The Parramatta River Catchment Group (PRCG) is a group of local councils, community groups and State Government agencies, including Sydney Water, collaborating to improve the urban waterway.

Wastewater pollution is governed under an Environment Protection Licence issued by the Environment Protection Authority; however, stormwater remains unregulated. No single authority currently leads waterway management in Sydney, with responsibilities shared by local councils, State Government agencies and private landowners. The Waterway Improvement Plan involved the collaboration of Sydney Water with stakeholders to agree on project locations and to gain the best-value outcomes for the community.

### Current Waterway Health

Waterways in Sydney include small upland freshwater streams, lowland freshwater creeks, rivers, estuaries, lakes, lagoons, wetlands, harbours and the ocean. The health of these waterways will depend on the level of development in the catchment and the extent and condition of riparian zones. Rivers with urban catchments have more polluted waterways in comparison to upland creeks with natural catchments (Walsh *et al.*, 2001). Pollution tends to accumulate on impervious surfaces and runs off into receiving waters during periods of rainfall. Examples of pollutants are included in Table 1.

### Towards A Water-Sensitive City

A water-sensitive city is the commonly adopted vision for the water industry in Australia. Figure 1 shows the continuum from 'water

supply city' towards a 'water-sensitive city' and the key socio-political drivers and service delivery functions associated with each phase. Sydney is currently transitioning from a 'drained city' into a 'waterways city' (Cunningham *et al.*, 2015).

Traditionally, water quality has been seen as the major indicator of waterway health. However, as indicated by Figure 1, urban water management is now shifting its focus to social and environmental benefits as well, hence the need for plans such as the *Parramatta River Waterway Improvement Plan*.

Recently, Sydney Water has taken steps to improve waterway health and liveability through waterway restoration (or naturalisation) in areas where waterway assets required renewal.

In Sydney Water's 2016–2020 capital program, stormwater quality improvement has been proposed in accordance with the Parramatta River Coastal Zone Management Strategy. Sydney Water's corporate values: 'to care for one another, the environment and the community; to create new and better ways of doing things; and having the customer at the heart' have been another key driver for the Waterway Improvement Plan.

Other key drivers include the *Sydney Water Act*, Operating Licence and

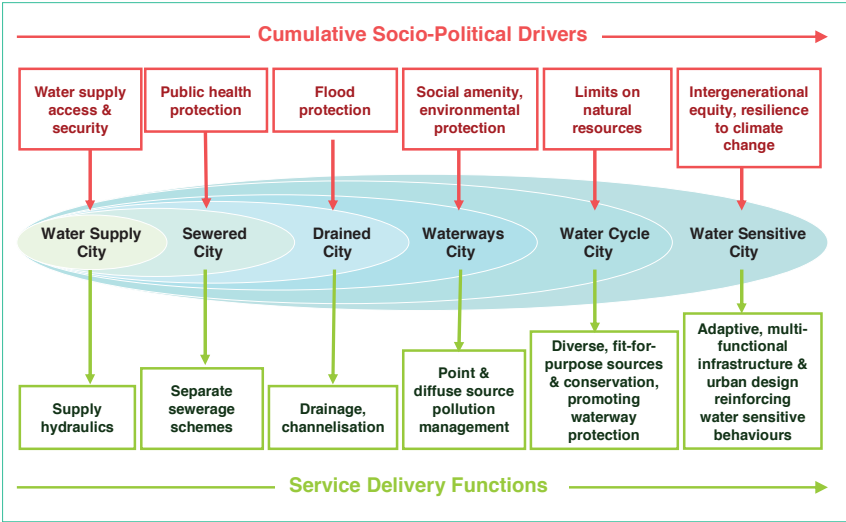


Figure 1. Urban Water Management Transition Framework (Brown et al., 2008).

Environment Plan, which require Sydney Water to sustainably operate, maintain and manage its stormwater infrastructure.

Furthermore, the PRCG currently has an initiative called *Our Living River* to plan for the regular use of natural swimming locations throughout the river in the future.

Water-Sensitive Urban Design

WSUD is the integration of urban water cycle management with urban planning (Melbourne Water, 2005). It can be implemented in existing or new developments and has three key principles:

- Protect waterways so that they continue to be beneficial for the

- community, improve liveability and provide for a healthy ecosystem in the waterway;
- Manage stormwater so that the volume and frequency of stormwater runoff is reduced and runoff quality is improved;
- Add benefits such as improved amenities and minimised development costs.

Examples of WSUD include bio-retention systems such as raingardens (Figure 2) and constructed wetlands (Figure 3), which allow for the extended detention time of stormwater runoff. Pollutants such as total nitrogen and phosphorus are removed to an extent through biological uptake. Lastly, stormwater infiltrates through the soil over time as cleaner runoff as well.

As outlined in Table 2, combinations of primary, secondary and tertiary treatments are able to capture more of the pollutants from stormwater runoff.

Table 1. Common pollutants in stormwater runoff (Cunningham, 2015).		
Pollutants	Sources	What Are Their Impacts?
Organic matter	Leaves, grass clippings, human and animal faeces	Biogeochemical processes (cycling of substances)
Gross pollutants	Litter, coarse sediments, organic matter	Impact on visual amenity Impact on water quality indicators such as oxygen demand, hydrocarbons and heavy metal levels Contributes to blockages of the conventional drainage system
Total nitrogen Total phosphorus	Atmospheric deposition, soil particles, human and animal faeces, plant matter, fertilisers	Algal blooms on the water surface Toxic algal blooms cause the closure of fisheries, water farming industries and public beaches
Suspended solids	Soil particles, airborne particles, sediment from erosion	Reduce the penetration of light through water impacting on the respiration of aquatic plants Sedimentation of receiving waterways Can contribute to blockages of the conventional drainage system
Trace amounts of heavy metals: lead, zinc	Petrol additives, hydrocarbons, old paint (prior to 1970), lead acid batteries, vehicle wear (tyres), herbicides, building materials used on roofs and pavements	Impacts are affected by complex interactions with biophysical parameters such as pH, dissolved oxygen and temperature Bio-accumulation of heavy metals in soils and in various species
Hydrocarbons	Mineral oils, automotive oils, diesel fuel	Impact on visual amenity Can be highly toxic to aquatic life in low to moderate concentrations
Pathogens	Sewage cross-connections and overflows, animals	Human and animal health

Table 2. Examples of WSUD used in primary, secondary and tertiary treatment (Melbourne Water, 2015).			
Treatment	Processes	Pollutants	Typical Treatment Application
Primary treatment	Physical screening and rapid sedimentation	Gross pollutants and coarse sediment	Grassed swales, litter traps and sediment ponds
Secondary treatment	Fine particle sedimentation and filtration techniques	Fine sediment and attached pollutants	Swales, infiltration trenches, porous paving and bio-retention systems
Tertiary treatment	Enhanced sedimentation and filtration, biological uptake and adsorption onto sediments	Nutrients and dissolved heavy metals	Bio-retention/bio-infiltration systems and wetlands

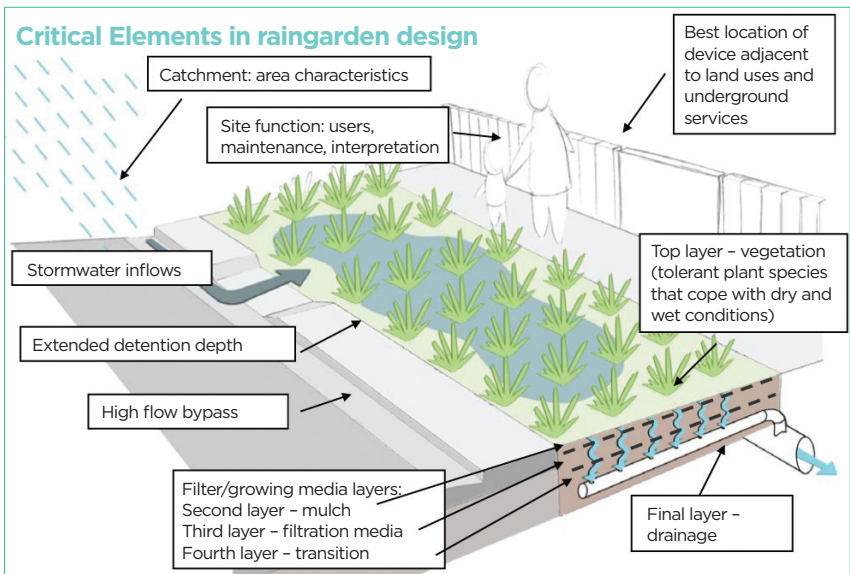


Figure 2. A raingarden design example (Clearwater, 2012).

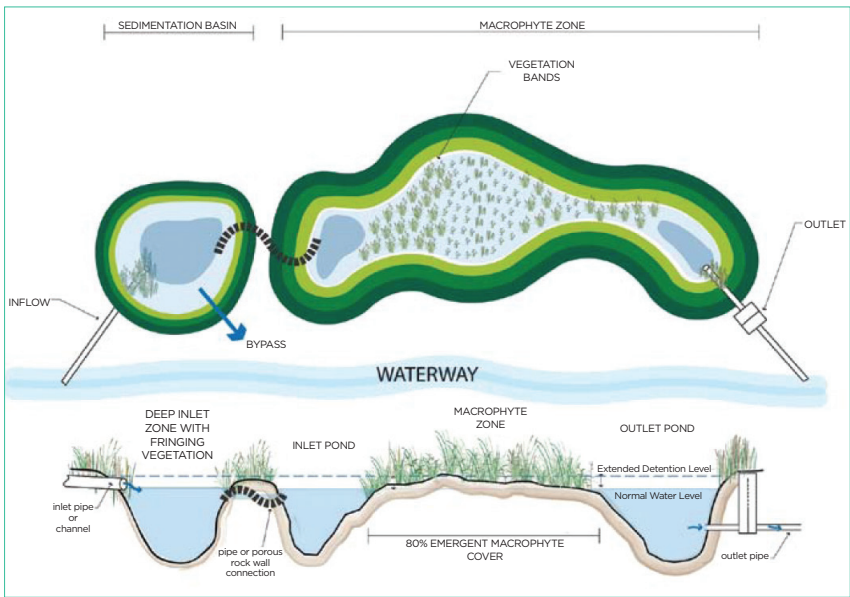


Figure 3. A constructed wetland design example (Melbourne Water, 2010).

## PROCESS AND OUTCOMES

Sydney Water and Alluvium have developed project options for the *Parramatta River Waterway*

*Improvement Plan*. Projects will involve WSUD to achieve the best possible water quality and liveability improvement for the Parramatta River (McAuley, 2014). The process involved:

1. Reviewing background information such as the Parramatta River Coastal Zone Management Strategy, and also geospatial data from local councils and utilities including Sydney Water. Sydney Water met with the PRCG to understand the river's history, current activities and the priorities of its members.
2. Meeting with council staff from across declared catchment areas to identify project opportunities and possible ongoing maintenance options in the future. Sydney Water met face-to-face with seven local councils, while another seven were contacted through conference calls. Discussions began with Sydney Water calling for collaboration with the local council and its community. Following this, potential locations such as currently polluted waterways were identified and projects tentatively proposed. The meetings also allowed Sydney Water to establish a rapport and key contacts within council.
3. Undertaking desktop analysis of the potential options, proposing and mapping out the locations and project sizes. Following field visits of the proposed projects, Alluvium determined the catchment and potential treatment area, and whether the proposed projects were feasible. Constraints such as community sentiment, or concerns from council that WSUD stormwater management systems may impede the current use of a park for sport or recreation were also considered. Preliminary costings were then established.
4. Developing 10 project options to initial concept stage and





Photo: Noel Butcher

A rain garden placed around a stormwater drain cleans stormwater runoff from the road and surrounds.

undertaking a cost, risk and benefit review. Alluvium used MUSIC (Model for Urban Stormwater Improvement Conceptualisation) modelling to estimate the proportion of suspended solids, phosphorus and nitrogen removed by each proposed treatment. Alluvium then reassessed costings based on any further risks, such as encountering contaminated soils, and benefits such as biodiversity and habitat, landscape amenity, community engagement and education.

## CONCLUSION

With continued collaboration, the *Parramatta River Waterway Improvement Plan* has the potential to create industry capacity, promote similar works elsewhere and provide a foundation of knowledge and data that will support the integration of stormwater and wastewater management in the catchment of Australia's most iconic waterway: Sydney Harbour.

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## THE AUTHOR



**Thuwaarahan**

**Warren Nadesan**

(email: THUWAARAHAN.NADESAN@sydneywater.com.au) is currently in his

second year of Sydney Water's graduate program. While completing his last year of university, Warren worked as a trainee with Sydney Water, where he planned the shutdown and recommissioning of Sydney Water assets. In his first year of the program Warren was Project Manager of the *Parramatta River Waterway Improvement Plan*. He also reviewed development applications and engaged and built rapport with stakeholders such as councils, community groups and customers to collaborate on joint projects.

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