



CRC for
Water Sensitive Cities

Elizabeth Street Catchment Integrated Water Cycle Management Plan

Location:
Melbourne,
VIC



Case Study — Prepared by Cooperative Research
Centre for Water Sensitive Cities, September 2018



Business
Cooperative Research
Centres Programme

Insight

Strategically implementing storage and permeable surfaces to mitigate flood risks

Project description

The Elizabeth Street Catchment Integrated Water Cycle Management (IWCM) Plan aims to mitigate the extreme flood risks present in the 308-hectare Elizabeth Street Catchment. The plan includes a suite of targets, projects and initiatives to be implemented over a five-year period. These actions will enable the City of Melbourne to reduce its flood risk and access alternative water sources for the sustainable irrigation of parks, open spaces, and street trees.

The catchment sits entirely within the municipality of Melbourne. It starts at College Crescent in Carlton and finishes where the Elizabeth Street drain joins the Yarra River below Flinders Street Station.

The drivers

Alleviate flood risks of a highly constrained urban environment

- Reduce flood risk. The Elizabeth Street Catchment is categorised by Melbourne Water as being at Extreme Flood Risk – the highest level. The plan aims to reduce this flood risk from 'extreme' to 'high'.
- Develop alternative water supplies to irrigate the municipality's existing and future parks, gardens, trees and open spaces.



→
A map of the Elizabeth Street Catchment showing priority flood risk areas and flow directions

What does this case study demonstrate?

Each case study has been selected to demonstrate specific solutions, benefits or enabling structures that support the creation of water sensitive cities. This case study focuses on:

Flood resilience

The innovations

Utilising stormwater harvesting as a tool for mitigating floods

- **Integrated water cycle management** – The plan involves all the elements of the water cycle that the City of Melbourne can influence – water consumption, rainwater, stormwater, wastewater and groundwater management.
- **Diverse solutions** – A mixture of innovative interventions at a catchment scale were investigated for implementation. Interventions that acted to reduce runoff and downstream flood risk included permeable pavements, raingarden tree pits and stormwater harvesting using large tank storages. Green roofs were also explored as a method of reducing stormwater runoff.
- **Top of catchment** – The Carlton Squares, Royal Exhibition Building/Melbourne Museum, and Queen Victoria Market stormwater harvesting systems are key projects that will help to hold water in the top of the catchment and reduce flood risk at the bottom of the catchment.

The lessons:

- **Recognise complexity** – Complex problems require complex solutions, and patience and expertise are vital to develop them.

- **Divide and conquer** – Staging catchment scale plans and projects into manageable sections can be an effective method for achieving ambitious objectives.
- **Identify the weakest link** – Modelling the catchment’s drainage capacity identified that significant improvements could be achieved by increasing the pipe sizes in two key locations. This was an effective way for identifying drainage bottlenecks.
- **Mimic nature** – Increasing surface permeability can reduce hydraulic stress on drains and improve the replenishment of groundwater.
- **Nuisance to resource** – Stormwater harvesting can be used as a tool for addressing local drought and flood risks.
- **Top of catchment** – Increasing permeability and stormwater harvesting at the top of a catchment delivers greatest return for alleviating flood risks.
- **Effective collaboration** – Establishing a reference group that represents all internal and external stakeholders is an effective method for collaborating across a large area with a variety of land uses, owners and stakeholders.
- **Hitch-hike opportunities** – Timing projects with other works can be an effective way to explore additional possibilities and minimise disruption and construction costs.

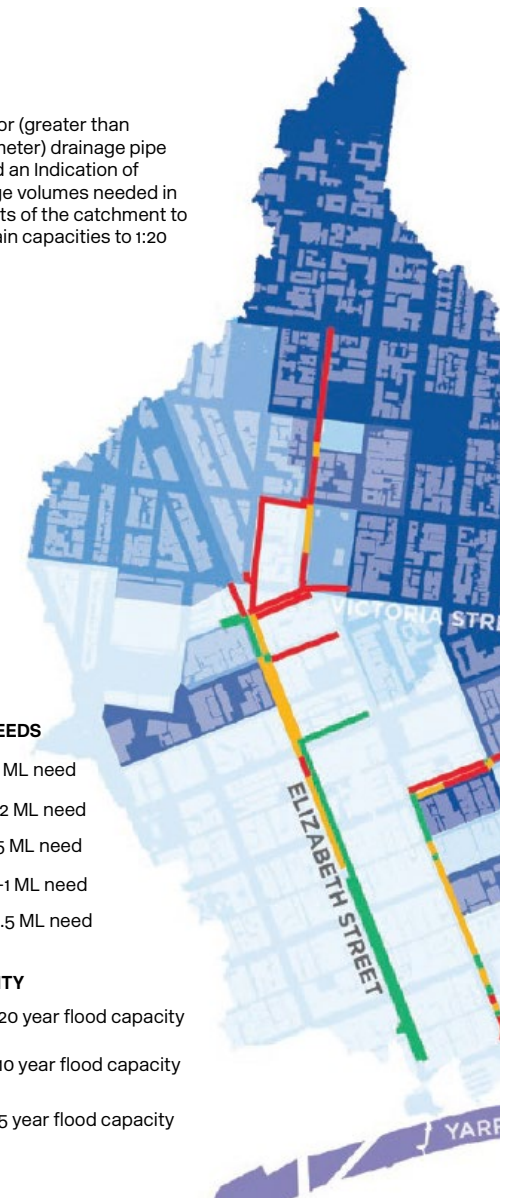
Existing major (greater than 600mm diameter) drainage pipe capacity and an indication of water storage volumes needed in different parts of the catchment to bring the drain capacities to 1:20 ARI level

STORAGE NEEDS

- 2-3 ML need
- 1.5-2 ML need
- 1-1.5 ML need
- 0.5-1 ML need
- 0-0.5 ML need




PIPE CAPACITY

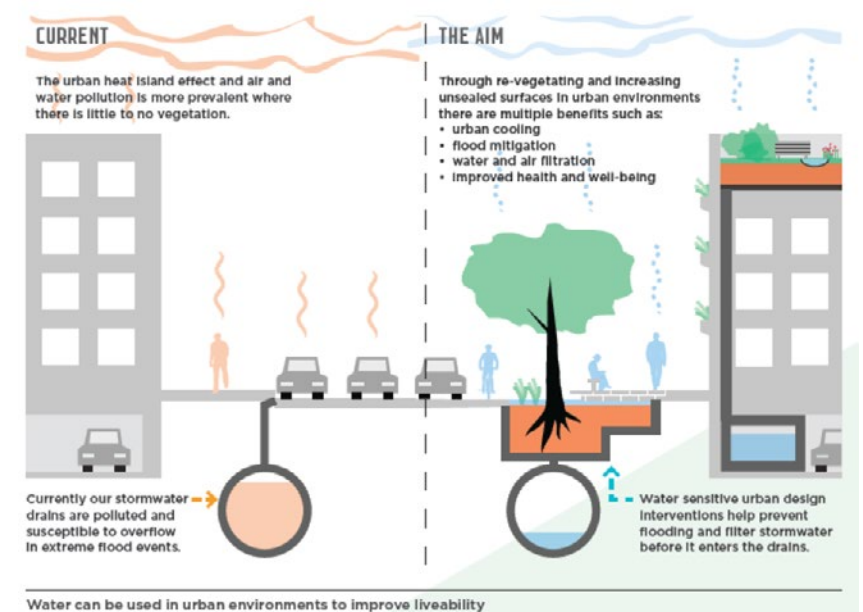
- = > 20 year flood capacity
- = < 10 year flood capacity
- = < 5 year flood capacity



Catchment map showing priority areas for the introduction of storage and expanded pipe capacity

The outcomes

 Cities providing ecosystem services	 Cities as water supply catchments	 Cities comprising water sensitive communities
<ul style="list-style-type: none"> • Reduce flood risks – Mimic the natural water cycle by retaining more rainwater in the upper section of the catchment and reducing stormwater runoff. • Improve vegetation health – Through irrigation from alternative water sources • Thermal comfort – Passive irrigation contributes to the target to increase canopy cover to 40% on public land across the catchment by 2040. • Increase soil moisture – The plan aims to have 40% of the Elizabeth Street Catchment’s soil surface unsealed by 2030. • Healthy waterways and bay – The initiatives reduce stormwater volumes entering the waterway and its associated impacts. 	<ul style="list-style-type: none"> • City as a catchment – The solutions harness large impervious surfaces in urban environments to generate stormwater as a local water supply. City of Melbourne has a target for 50% of all council water use to be sourced from alternative water sources by 2030. • Passive irrigation – Direct stormwater flows into streetscape vegetation to supplement irrigation. 	<ul style="list-style-type: none"> • Informed and supportive community – Community engagement programs build confidence and support of stormwater harvesting schemes to supply non-potable demands (i.e. irrigation and toilet flushing). • Public signage – Signage is included in key infrastructure associated with the stormwater harvesting scheme to inform residents and visitors.

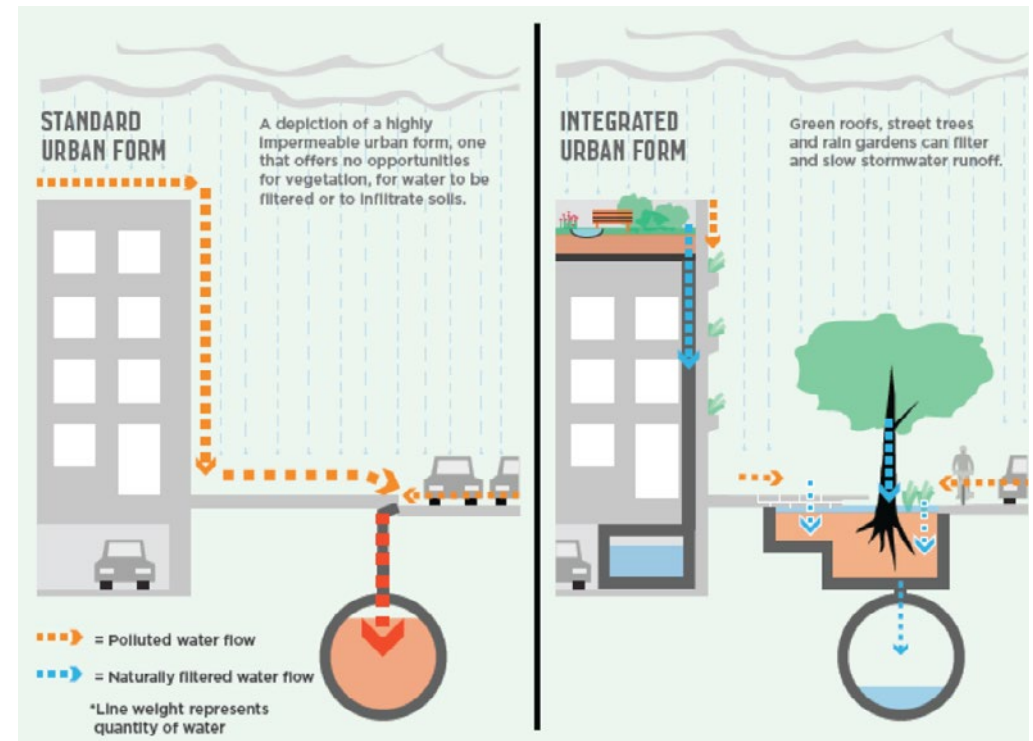


Current conditions compared with the preferred outcome with integrated water management



Business case

Costs	Benefits
<ul style="list-style-type: none"> The total retention volume required throughout the catchment is 25.4 million litres. Based on previous cost figures and a 50:50 split of the retention between council and private, this volume of retention would require a \$20.5 million investment by council and \$12.7 million by private land owners. Increasing the pipe sizes in two key locations will make a significant improvement to the conveyance of stormwater. A cost estimate, using 2015 rates, to conduct these works is \$7 million. Council's permeability target equates to an additional 306,955 square metres of council managed land being unsealed by 2030, and 380,780 square metres of private areas. For council, this will require a signification investment (\$81 million) to convert roads to green open space and the conversion of footpaths, bike paths and parking lanes to permeable paving. 	<ul style="list-style-type: none"> The impacts of flooding can have significant economic implications. In the late 2000s, the average direct annual damage cost of all forms of flooding across Victoria – excluding potential climate change impacts – was estimated to be approximately \$450 million. The extreme heat experienced in Melbourne between 14 and 17 January in 2013 is estimated to have cost businesses in the municipality \$37 million in lost revenue. Through the establishment of more open, permeable, vegetated spaces and greater canopy cover, these losses could be mitigated.



Integrated water cycle management transforms the urban landscape and results in less water entering the storm water drainage network during the peak of the storm runoff.

Transferability

The initiatives included in the plan are relevant and transferable to other urban areas with high imperviousness in the upper catchment and downstream flood risk.

Project collaborators

- City of Melbourne
- Department of Environment, Land, Water and Planning (DELWP)
- Melbourne Water
- City West Water
- University of Melbourne
- RMIT
- GHD
- Broader community and the business sector

Awards

- 2015 Stormwater Victoria Excellence Award for Strategic and Master Planning



View of central Melbourne with the top of the Elizabeth Street catchment in the foreground

Additional information

More information about Elizabeth Street Catchment IWCM can be found at:

- [Urban Water: Elizabeth Street Catchment IWCM Plan](#)
- [Urban Water: Carlton Square stormwater harvesting project](#)
- [Urban Water: Interactive map of water projects](#)
- [University of Melbourne: actions for the Elizabeth Street Catchment IWCM Plan](#)
- [CBD News article](#)

