Project Summary

W15: At-source infiltration: irrigating the urban forest with stormwater.

Objective(s)

We want to understand whether streetscapes can be designed to promote infiltration of stormwater and achieve the dual benefits of protecting urban streams and increasing tree canopy cover.

Why this research is important

Urban streams are severely degraded by the large volumes of stormwater runoff created and conveyed by road networks. Harvesting and infiltrating this stormwater using existing Water Sensitive Urban Design (WSUD) techniques is challenging, as demonstrated by the limited progress towards the infiltration targets in the Healthy Waterways strategy.

Streetscape-scale stormwater control measures incorporating street trees (street tree SCMs) have significant potential to create storage for stormwater in streetscapes and restore pre-development hydrological processes; specifically: infiltration and evapotranspiration. Established trees can transpire significant volumes of infiltrated water, providing one of the few mechanisms to reduce runoff volumes. Streetscapes therefore provide the opportunity to make use of runoff to rapidly increase tree canopy cover for urban cooling and amenity benefits, as well as benefit urban streams by substantially reducing stormwater runoff volumes.

Contribution to Melbourne Water research priorities

- MWRPP 10 (SW7, SW11, SW12, SW13, SW17) Optimum combination of centralised and decentralised stormwater control measures (SCMs) to achieve Healthy Waterways Strategy stormwater harvesting and infiltration targets and protect headwater streams.

Approach

Our previous work has demonstrated that:

- Irrigating newly planted trees with stormwater can double tree growth rates (Grey et al., 2018a, 2018b; Thom et al., 2022a),
- Stormwater runoff volumes can be reduced with appropriately designed systems by up to 90% when integrated at the design stage (Grey et al, 2018b) and we have measured in retrofit experiments to reduce runoff volumes by up to 46% (18% on average) (Szota et al., 2019),
- Established trees have the ability to transpire up to 70% of the volume of runoff generated (Thom et al., 2020) and
- Species selection impacts growth, water use and survival outcomes (Hanley et al., 2023; Szota et al., 2018; Thom et al., 2022b)

We assume large-scale systems designed to irrigate street trees have significant potential to achieve stormwater infiltration targets in new developments. *However, we have yet to convert this understanding to changes in current practice.*

Our proposal is simple:

- Collate the data we have collected through multiple projects over the last 10 years
- Create a generic water balance model to demonstrate to what extent street tree systems can achieve infiltration targets in new developments in stormwater priority areas
- Create new modules, or modify existing modules, in MUSIC, SWMM and potentially STORM, to translate the generic water balance model into industry standard tools, with the aim of facilitating widespread uptake by councils and the development industry

Key Outputs

- Demonstrated ability of street tree systems to achieve infiltration targets in new developments
- Delivery of modules for industry standard tools to facilitate conceptual design of large-scale street tree infiltration systems

Expected benefits

- Increased infiltration of stormwater in priority areas to protect urban streams
- Increased tree growth and canopy cover to provide cooling benefits to communities

Project teams

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