Building a Healthier Tomorrow with Passively Irrigated Street Trees and Open Space

Mrs Sally Boer[1], Dr Peter Breen[2], Dr Dale Browne[2], Mr Dylan Cain[1], Mr Steve Buck[2], Mr Glenn Browning[3]
[1]E2Designlab, Brisbane, Australia, [2]E2Designlab, Melbourne, Australia, [3]Healthy Land and Water, Brisbane, Australia

OVERVIEW

There are genuine opportunities and untapped potential to achieve a range of benefits through the passive watering of street trees and open space with stormwater. Stormwater, when viewed as a locally available low-cost water source, can open up many opportunities for creating cooler, healthier and more liveable communities, as well as improving the quality and reducing the volume of stormwater flowing to receiving environments. A growing body of research is demonstrating the linkages between human health and creating cooler urban environments by retaining water in the landscape and increasing shade. This is where street trees and wicking beds (subsurface irrigation techniques) can play a major role.

This project, a joint initiative between State Government (DES), Healthy Land and Water and Townsville, Cairns, Rockhampton, Mackay, Sunshine Coast and Ipswich City Councils, has undertaken soil moisture and water quality modelling to inform the design of street trees and wicking beds in the different rainfall regimes of Queensland. This provides more options for ensuring water quality objectives can be met, while also helping to ensure the viability of street trees and other public open space all with using less potable water. The outcomes of this modelling provides confidence to decision makers, designers and implementers that these solutions are viable in each of the rainfall regions.

This investigation has enabled appropriate design parameters to be defined to assist in the broader implementation of these technologies for water quality, landscape and microclimate benefits.

OBJECTIVES

The drivers and objectives for passively watered solutions include:

- Provide a healthy growing environment for the targeted species, be that street trees or turf, this includes adequate soil volume and soil moisture (being not too wet or too dry)
- Support landscapes with alternative water sources to increase landscape resilience (and thus amenity) and reduce reliance on potable water supplies
- Achieve local microclimate benefits
- Provide at-source treatment and reuse of stormwater to reduce stormwater volumes and loads delivered to receiving environments
- Provide an alternative stormwater treatment solution to bioretention basins, constructed wetlands and proprietary filters

METHODS

Detailed modelling was undertaken to inform the design of passively watered street trees which included:

- Rainfall Analysis - to confirm the most appropriate rainfall data set for each region
- Soil Moisture Modelling - evapotranspiration modelling and soil moisture data analysis including analysis of soil moisture saturation levels using cumulative frequency plots to determine overly saturated conditions and identification of dry spells below wilting point
- MUSIC Modelling - water quality modelling to demonstrate stormwater pollutant removal performance

Scenarios Modelled - for each climatic zone, the following scenarios we're modelled:

- 3 x water use levels (high and low water use trees; and turf)
- 2 x soil types (sandy loam 50mm/hr and loamy sand 100mm/hr)
- 3 x design configurations (tree pits with and without a saturated wicking zone; turf wicking beds)
- Treatment-catchment area ratios of 1% to 10%

RESULTS

The outcomes have enabled appropriate design parameters to be defined giving confidence that these systems can be successfully delivered in each of the climatic zones to achieve multiple beneficial outcomes. Design guidance materials have been developed for each climatic region including a sizing guide, based on treatment/catchment ratio to achieve suitable soil moisture conditions and pollutant load reduction objectives; MUSIC modelling parameters and typical sections of passively irrigated tree pits and turf wicking beds.

CONCLUSIONS

This investigation has provided the scientific rigor behind the proposed systems to ensure the designs are robust and achieve the intended objectives across the different rainfall regions. The next phase is the development of a design guideline to assist in the successful design and delivery of passively watered systems, including typologies for different urban settings (e.g. residential streets, city streets, plazas, podium landscapes, sports fields, parklands); construction and maintenance; and guidance materials to inform policy positions and planning schemes.