Responding to the challenges and complexities of urban water management in the Sydney Metro – SSTOM

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Abstract: The Sydney Metro – Western Sydney Airport project's Stations, Systems, Trains, Operations, and Maintenance (SSTOM) works package is classified as State Significant Infrastructure (SSI). As part of its obligations, the project must achieve an Infrastructure Sustainability (IS) Rating, which includes exceeding standard water quality requirements. A key innovation is the submerged zone/passive irrigation system, which uses surface water to irrigate landscapes, reducing reliance on potable water. This pioneering approach in New South Wales integrates stormwater management with landscape design. It improves water efficiency, reduces pollutant load, and enhances vegetation growth. It also increases climate resilience while advances the principles of water nexus.

Traditional stormwater management relies on pit-and-pipe networks, end-of-pipe water quality basins, and rainwater tanks and expensive proprietary devices which are costly and require extensive maintenance. The SSTOM works, being delivered by the Parklife Metro consortium, adopts a proactive strategy by embedding stormwater quality measures within landscape design. Given New South Wales relatively high rainfall, stormwater runoff from roads, rail tracks, and hardstand areas presents an untapped resource. The submerged zone technique enhances passive irrigation by storing and gradually releasing stormwater, reducing excess infiltration while maximising water efficiency. This minimises direct irrigation needs, conserves potable water, and delivers environmental benefits such as lower surface temperatures, improved air quality, and expanded urban greenery.

The project follows a structured methodology to implement submerged zones and passive irrigation. A literature review established the benefits of submerged zone techniques, including increased tree growth and ecosystem advantages. Site selection and assessment considered key constraints such as dispersive and reactive soils associated with Bringelly Shale, high groundwater levels, and the presence of dense underground utilities. Suitable locations were identified within the project sites where stormwater could be effectively captured and utilised. Stormwater is conveyed to vegetated areas via kerb entry and stormwater diversion techniques before entering the drainage network. Submerged zones are designed with impermeable liners, storage media, and passive irrigation systems like perforated pipes to optimise storage and ensure controlled water release to vegetation. The Model for Urban Stormwater Improvement Conceptualisation (MUSIC) assessed system performance, guiding optimal design.

Collaboration among hydrology, sustainability, and design teams ensured alignment with IS rating requirements.

The adoption of submerged zones and passive irrigation provides significant benefits. Environmentally, it reduces potable water consumption, lowers pollutant loads, supports vegetation growth, and mitigates urban heat island effects. Economically, the system supports achievement of the project's very high water quality targets and contributes to the Infrastructure Sustainability (IS) Rating by minimising reliance on potable water and avoiding the need for costly end-of-pipe treatments. It also reduces long-term irrigation costs, minimises pavement maintenance, and prevents damage from root intrusion damage. Socially, it enhances public health and wellbeing by expanding green spaces and improving urban aesthetics. The system integrates seamlessly with civil and architectural designs, requiring minimal modifications.

The SSTOM project's use of submerged zones and passive irrigation represents a major step forward in sustainable water management. This approach meets rigorous IS rating requirements while advancing the water nexus and resource efficiency goals. By utilising locally available stormwater for irrigation, the project sets a benchmark for sustainable infrastructure, offering long-term environmental, economic, and social benefits. The success of this initiative paves the way for its application in other large-scale infrastructure projects, reinforcing the value of integrated, nature-based solutions in urban water management.

REFERENCES

Sally B, Peter B, Dale B, Dylan C, Steve B (2018) Building a Healthier Tomorrow with Passively Irrigated Street Trees & Open Space, Stormwater Conference, NSW Australia

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