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Water Sensitive Cities Australia

Lifecycle costs database: Needs analysis

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Authors
Chris Manning

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Water Sensitive Cities Australia
Level 1, 8 Scenic Blvd, Clayton Campus
Monash University
Clayton, VIC 3800

e. info@wscaustralia.org.au
w. www.watersensitivecities.org.au

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Introduction

Water Sensitive Cities Australia (WSCA) partners identified the need to better understand the lifecycle costs associated with 'decentralised' water management systems in Australia. This information can help practitioners better evaluate water management options, develop business cases, and implement these systems and approaches. To help meet this need, WSCA and partners have scoped the development of a database of lifecycle costs for appropriately designed, constructed and maintained decentralised systems and approaches.

Decentralised systems include water sensitive urban design (WSUD) assets, other green infrastructure, smart infrastructure and associated systems, non-potable substitution systems, on-site wastewater and permeable pavements for example. Centralised systems are large water infrastructure servicing significant parts of a city, including examples such as large desalination plants, dams, water or wastewater treatment plants, and traditional drainage networks. Out of scope in this project are stormwater quality improvement proprietary devices because they are better addressed through other industry led processes.

The first phase of the project will scope the strategic need and intended audience for a database and then recommend specific requirements and next steps. Once this scope is agreed with stakeholders, subsequent stages will collect and curate the data and build the database.

In conducting this needs assessment, we consulted several key stakeholders including organisations from the national water sensitive cities capacity building network (i.e. Clearwater, Water Sensitive SA, New WAter Ways and Healthy Land and Water), water utilities (i.e. Melbourne Water, Water Corporation), policy organisations (i.e. WA Department of Water and Environmental Regulation) and selected consultants (i.e. DesignFlow, Andre Taylor Consulting, E2 Designlab, and Urbaqua). A key stakeholder engagement activity was an online workshop held in June 2022. Several stakeholders also provided links to relevant reports produced over the past decade.

Context

Research and industry experience from across Australia consistently identifies the need to evaluate the full range of costs and benefits of water cycle investments as an enabler for adopting integrated water management. To address one specific knowledge gap, the former CRC for Water Sensitive Cities (CRCWSC) led a project to categorise and value the benefits of integrated water management. Industry partners have also called for more comprehensive and accurate lifecycle cost information and associated tools (see Taylor et.al., 2010). In part, this call for better information on costs is to counter the persistent perception that maintenance costs for water sensitive solutions are a significant barrier to their widespread adoption (see Urbaqua, 2021), while also addressing the need for better information to support business cases for water sensitive solutions.

More recent consultation with industry indicated maintenance cost is no longer seen as a significant barrier, mainly because many public utilities and local governments are increasingly allocating adequate annual budgets for maintenance activities. However, challenges still exist in determining the actual costs across a range of assets and locations with suitable accuracy and reliability to inform annual maintenance budgets (including materials, plant and labour). Further, collecting appropriate cost data to inform budgets and business cases, along with other persistent issues such as skills, capacity and capability are seen as more significant barriers than just the cost of maintenance alone. This is seen as a process improvement opportunity as opposed to just a cost data collection process or problem.

Industry stakeholders identified the need to improve business cases for water sensitive solutions to allow planners and decision makers to confidently compare all water sensitive options (both centralised and decentralised) within in a robust, consistent, and agreed benefit costs analysis framework. This is a significant step towards meeting the objective of 'putting all options on the table', as argued by Water Services Association of Australia, the Productivity Commission, and others (e.g., WSAA, 2019; PC, 2021).

Stakeholders also noted the maintenance perspective is often underrepresented at this strategic planning and optioneering stage, leading to sub-optimal outcomes for assets, and maintenance teams. Once again, this was seen as a process improvement opportunity to ensure maintenance costs, capacity and capability are included upfront in the optioneering stage.

The benefits component of business cases has been the subject of significant work in recent times by the former CRCWSC through the development of the Value Tool and Benefit Cost Analysis Tool to monetise non-market costs and benefits relating to water sensitive solutions. A significant gap exists in the cost components for most water sensitive solutions, across all asset delivery stages across Australia. In addition, cost information that is available is often patchy with unknown or questionable QA/QC and is often not contemporary or up to date.

Several notable attempts have been made to overcome this and other barriers (see Taylor et al., 2010), although many have not realised expected outcomes leading many to speculate why? One reason suggested is that the collected costing information does not keep up with industry developments, business management systems improvements or decision support tool updates (see Taylor et al., 2010). Further, it was noted models such as MUSIC are typically used in the conceptual design phase of the process that delivers on-ground WSUD assets, meaning solutions do not adequately cover construction, establishment and maintenance costs and stakeholders. Recent industry consultation confirmed these risks still exist and are in fact still persistent and widespread.

In conclusion, Taylor et.al, 2010 found the need for:

- improved identification of different stakeholders' needs across all stages of asset delivery
- easily accessible, reliable, up-to-date cost data for decision support or business management tools.

In addition, Taylor et.al, 2010 and Taylor pers comm recommended:

- creating a national lifecycle cost database website, with flexibility to service a wide range of stakeholders across Australia, and with agreement and documentation of definitions, assumptions and use limitations
- identifying a major project 'sponsor' to champion and resource the proposed lifecycle cost tool, and identifying a long-term 'owner' of the tool.

Needs analysis

The industry consultations undertaken for this report broadened discussion beyond WSUD assets, identified the need for a high-level needs analysis for lifecycle costing. The analysis presented in Table 1 is based on previous work, recent consultations, and an overall understanding of relevant issues. This analysis considers the needs at each asset delivery stage, identifies the relevant stakeholders and the intended audience, identifies cost estimate needs and a mainstreaming outcome, and then provides a high-level summary.

The analysis clearly identifies lifecycle costs as an information gap in the strategic planning and optioneering stages. Further, addressing this gap will improve business cases, enhance awareness and acceptance of water sensitive city solutions, and therefore lead to more widespread adoption. This is likely to represent the best intersection of the needs of WSCA partners/stakeholders, WSCA's mainstreaming agenda[1] and where WSCA can add value. We acknowledge more detailed construction, establishment and maintenance costs are also important, but we consider this data is best delivered through other industry-specific mechanisms.

[1] Mainstreaming aims to accelerate the take up of water sensitive knowledge and tools developed through the CRCWSC.

Table 1: Water sensitive solutions costs: needs analysis (partly adapted from Taylor et.al., 2010, New WAter Ways and Urbaqua, 2021 and recent industry consultations)

Asset delivery stage		Stakeholders/audience		Cost estimate needs	Mainstreaming outcome	Summary
Strategic planning	• Land-use plan • Infrastructure plan • Capital plan / annual budget • Optioneering • Concept design • Project plan	• State govt • Local govt • Water utilities • Industry (developers, consultants)	• Planners • Environmental officers • Landscape architects • Planning engineers • Community engagement	**Lifecycle costs** • Suitable for decision support tools, incl. BCA • Assumptions and uncertainty clearly articulated • Mix of opex/capex costs	• Better understanding of whole-of-lifecycle costs (what is included, sensitivities, dollar ranges) • Improved business cases across costs and benefits • Enhanced collaboration • Water sensitive options identified / assessed early in asset delivery cycle • Budget allocations for water sensitive solutions • Opportunity to enhance existing tools including INFFEWS and Scenario Tool • Building city-to-city learning and data sharing to enhance take up of water sensitive practices nationally and stimulate research opportunities using the metadata	**Key influence outcome** • Identification, assessment and approval of water sensitive options **Lifecycle cost information** • Priority – High • Data accuracy – Medium • Data completeness – High • Data comprehensiveness – High • Who – WSCA (others?) • Tools – Scenario Tool, INFFEWS, eWater (MUSIC)
Financing and approvals	• Business case • Development approval • Regulator approval • Capex/opex budget approval	• Industry (developers) • State govt • Local govt • Water utilities	• Project managers • Decision makers • Finance	**Lifecycle costs** • Suitable for business cases and decision support tools • Assumptions and uncertainty articulated • Mix of opex/capex costs		
Design and procurement	• Detailed design • Procurement plan • Detailed project plan	• Industry (developers) • Local govt • Water utilities	• Multidisciplinary design team • Project managers • Consultants	**Construction costs** • Unit rates or bill of quantities • Suitable for informing procurement decisions • Capex cost	• Better understanding of construction and establishment costs • Improved accuracy in cost estimation of projects • Improved standard of construction and establishment of water sensitive assets	**Key influence outcome** • Provision of accurate budget allocations for C&E works for water sensitive assets **Construction cost information** • Priority – Medium • Data accuracy – High • Data completeness – NA • Data comprehensiveness – Medium • Who – Industry (TBD) • Tools – Models, spreadsheets
Construction and establishment	• Construction plan • Establishment plan • On-maintenance plan	• Industry (developers) • Local govt • Water utilities	• Project managers • Site foreman / staff • Contractors	**Construction costs** • Unit rates or bills of quantities • Suitable for informing C&E plan including plant and labour provision • Capex cost		
Asset handover	• Asset performance • Maintenance plan • Defect rectification	• Industry (developers) • Local govt • Water utilities	• Developers • Project managers • Asset inspectors • Contractors	**Maintenance costs** • Unit rates or bills of quantities • Suitable for informing maintenance plan including plant, labour or parts provision	• Better understanding of ongoing maintenance and rectification costs, including for donated assets • Improved accuracy in cost estimation of ongoing operation, maintenance and rectification requirements • Adequate and sustainable budget allocations leading to improved operation and maintenance of water sensitive assets	**Key influence outcome** • Increased acceptance among industry of water sensitive assets and their operations and maintenance needs **Maintenance cost information** • Priority – Medium / High • Data accuracy – High • Data completeness – NA • Data comprehensiveness – Medium • Who – Industry (TBD) • Tools – TechOne, Assetic, spreadsheets
Asset management, operations and maintenance	• Asset management plan • Asset operations manual • Asset performance • Asset maintenance • Annual budget	• Local govt • Water utilities	• Asset managers/operators • Maintenance staff • Decision makers	**Operations and maintenance costs** • Unit rates or bill of quantities • Suitable for informing asset management plan, updates of maintenance plan including plant, labour or parts provision, and annual budget allocations • Opex cost		
Asset renewals	Return to Strategic planning stage above					

Notes:
- Priority – relative measure of priority across the 3 main stages of the asset delivery cycle
- Data accuracy – accuracy of data required to achieve desired outcome (High, Medium, Low)
- Data completeness – data required for all stages of asset delivery cycle for a given asset (High, Medium, Low)
- Data comprehensiveness – data required for different asset classes (High, Medium, Low)

Summary – what problem needs to be solved?

The aim of this needs assessment is to identify a clear problem statement to guide the development of the national mainstreaming project on lifecycle costs. By extension, this problem statement should adequately reflect industry needs and trends.

The needs assessment analysis points to 3 different industry problems:

1. Lack of confidence in lifecycle costs information for proprietary WSUD devices. This is primarily a governance issue.
2. Lack of data to support option assessment when initially planning infrastructure solutions. This is both a systems problem (i.e., how might we structure data to support decision making) and an information gap (e.g., do we have comparable data for all the options being assessed). A consequence is that decentralised options are often dismissed as 'too risky' from a cost perspective, mostly before any evaluation.
3. Problems with maintenance activities undertaken by councils and utilities, created by gaps in skills and information about true maintenance costs. This can be simplified as a capacity building and budgeting issue. Improved collection of cost data and greater transparency around the 'normal' ranges of operations and maintenance costs might also generate innovation and efficiencies.

At a more detailed level, the sub-problems consistently identified in the lifecycle costs space are:

a. Information gaps for some ***types of infrastructure*** solutions (i.e., we know less about WSUD assets than other infrastructure; we tend to focus on the assets we already have without considering the assets we might want to create in the future).
b. Gaps in ***spatial coverage*** of data. A national perspective would greatly increase the utility of the data, allowing a user to access and adapt data from another jurisdiction or climate context.
c. Where data already exists. It is ***often orphaned*** and out of date.
d. There is no consistent ***standard for collecting and managing*** data. Even consistent definitions and a common framework of what is considered would assist.
e. Data that exists is ***underutilised in benefit–cost analysis***. Existing data is typically used in concept and detailed design stages and accessed through tools such as MUSIC. The data may not be available (or in a useful form) to those undertaking benefit–cost analysis.

When these problems/needs are considered through an asset delivery stages framework (Table1), the key influence outcome that most closely aligns with the objectives and existing IP of WSCA and its partners is collecting lifecycle costs to support the "identification, assessment, and approval of water sensitive options".

Recommendations

Given WSCA's purpose is to change the way we design, build and manage our cities and towns by valuing the contribution water makes, and the previous research to develop benefit–cost analysis tools used at the planning stage, it appears the greatest value WSCA can add is to help resolve industry problem number 2, and to initially focus on all 5 sub-problems (a–e).

On this basis, the 'problem to be solved' might look like this (draft wording only):

> *How can we create a national tool to transform our approach to understanding lifecycle costs so that we can better support an 'all options in the table' approach to decision making, and the goal of creating water sensitive cities?*

The national mainstreaming project may achieve this by:

1. focusing on overall lifecycle cost as distinct to the construction, establishment and maintenance cost components, and then focus on 1 or 2 asset types such as permeable paving, bioretention or natural channels, to provide a proof of concept
2. identifying and confirming the project 'sponsor' to champion and resource and subsequent stages, and importantly identifying and confirming the long-term custodian of the product
3. undertaking a detailed risk analysis to identify risks and mitigation strategies for project, implementation and governance risks.

References

Taylor A, Leinster S and Allison R (2010). *National needs analysis: life cycle costing data and tools for WSUD assets*. Report for the WSUD Program, Sydney Metropolitan Catchment Management Authority, Sydney.

New WAter Ways and Urbaqua (2021). *Maintenance of WSUD assets by local governments in Perth*. Prepared for the Water Sensitive Transition Network, Perth.

Productivity Commission (2021). *National Water Reform 2020.* Inquiry report. Productivity Commission, Canberra.

Water Services Association of Australia (2019). *All options on the table: urban water supply options for Australia*. WSAA, Sydney.

Water Sensitive Cities Australia

PO BOX 8000 Monash University LPO,
Clayton, VIC 3800, Australia

watersensitivecities.org.au

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