BEYOND BENCHMARKING: A WATER SENSITIVE CITIES INDEX

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ABSTRACT

The CRC for Water Sensitive Cities (CRCWSC) is developing a Water Sensitive Cities Index, which is designed to benchmark and rank cities based on water sensitivity performance, set targets and inform management responses to improve water sensitive practices. It is supported by a web platform to enable visualisations of benchmarking results for a range of audiences, including policy makers and service providers. The Index will support strategic planning and decision-making; foster inter-city learning and collaboration; and enable national governments to assess their cities' urban water management trajectories in relation to other cities.

INTRODUCTION

Indicators play a significant role in the implementation and assessment of progress towards sustainability and have proliferated rapidly over the past few decades (Dunn and Bakker 2011). They play an important role in disseminating information, providing a common language for describing complex systems that necessitates effective and clear communication amongst diverse interests (McCool & Stankey, 2004). Firstly, they enable the synthesis of a wide range of intricate, dynamic system information to be translated into an accessible format that can be more easily understood (Dunn & Bakker, 2011; McCool & Stankey, 2004). Secondly, indicators are useful for assessing performance and monitoring change (Dunn & Bakker, 2009, 2011). Thirdly, indicators can used to inform policy interventions, offering insights into threatening conditions or effects and facilitating the exploration of mitigation policies (Swanson & Bhadwal, 2009). Through monitoring and assessment, indicators can facilitate the modification of policies (or even enact new ones) and practice to address specific issues to achieve more desireable outcomes (Chiras and Corson 1997).

Although a wide range of indicators to assess and measure water-related issues at multiple scales have been developed, there are few benchmarking tools to assess or inform the development of long-term policy for sustainable urban water management (Gleick 2003; Brown, Keath and Wong 2009). Moreover, despite their utility, the widespread uptake of existing indicators and translation of their results into changes in water use, governance, and policy is limited (Norman et al. 2012; Falkenmark 2007; UN WWAP 2006). Current approaches have been problematic for a number of reasons including: (1) Narrow focus of indicators (e.g., solely on drinking water quality); (2) Indicators fail to address the needs of policy and decision-makers; (3) Scalar issues, particularly the spatial mismatch between administrative boundaries and flow resources; (4) Limited data availability, making indicators difficult to calculate, and (5) Disconnect between the scientist that collect data and those that are responsible for reporting functions (Dunn and Bakker 2009, 2011; Norman et al. 2012). Best practice in the scholarly literature suggests that end-users should be engaged in the early stages of indicator development in order to achieve buy-in and success (Bond et al. 2005; Brennin 2007; Bouleau et al. 2009). However, there is often limited (or no) interaction between indicator designers and end-users of indicators resulting in indicators failing to address the information needs of decision and policy-makers (Dunn & Bakker, 2009, 2011).

Cities around the world are facing the complex challenge of designing technological, policy and institutional arrangements that are resilient to the impacts of climate change, hydrological variability and population growth, whilst ensuring sustainable management of water resources and the protection of aquatic environments (Wong and Brown 2009). An indicator / benchmarking tool is needed that will enable urban water managers, urban planners, and policy makers to identify the urban water management conditions that will create more

liveable, sustainable and resilient urban places consistent with the concept or the water sensitive city.

The CRC for Water Sensitive Cities (CRCWSC) is developing a Water Sensitive Cities Index, which is designed to benchmark and rank cities based on water sensitivity performance; set targets based on the best available research, and compare potential management responses to make the most impact with available resources. It is supported by a web platform to enable visualisations of benchmarking results for a range of audiences including policy makers and service providers. The Index supports strategic planning and decision-making; foster inter-city learning; and enable national governments to assess their cities' urban water management trajectories in relation to other cities (Brown, Keath and Wong 2009).

The development and application of the Index relies on cross-organisational knowledge sharing and collaboration that will strengthen industry relationships and commitment to a shared vision. Breaking down silos and opening up communication channels will be some of the greater benefits that come with implementing the Index framework.

This paper outlines the key steps taken in the development of the Water Sensitive Cities Index and presents its preliminary framework, which is currently being pilot tested in Perth. The Index addresses key gaps identified in the literature (1) it has a broad focus; (2) it addresses the needs of end users by engaging industry, policy and decision makers throughout the indicator development process; (3) is at the right scale - indicators are at the city-scale, the frontline of water management (Dunn et al. 2014; Norman et al. 2012) and (4) data availability - cities or regions are the primary collectors of water-related data (ibid) and as such will be the most suitable scale for the application of the indicators. Indeed, this aligns with the findings by Norman et al. (2012), which argues that assessment processes should be conducted at scales commensurate with governance and decision-making.

METHODOLOGY/ PROCESS

This research is part of a 3-year (2014-2016) CRC for Water Sensitive Cities project: *D6.2 Developing a Water Sensitive Cities Index*.

The WSC Index aims to:

- provide a communication tool for describing key attributes of a water sensitive city.
- articulate a shared set of goals of a water sensitive city.
- provide benchmarking for a city's water-sensitive performance.
- measure the progress and direction of progress (at city or municipality scale) towards achieving water sensitive city goals.
- assist decision-makers prioritise actions, define responsibility and foster accountability for water-related practices.

The Index has undergone multiple development phases such that its useability and functionality is improved through a co-designed process with industry partners. Engagement is facilitated through a staged development approach, which incorporates short feedback loops for end-user inputs (enabled through regular meetings, workshop and surveys etc). Each of the three phases (the development phase; reconceptualisation phase and finalisation phase) is summarised in Figure 1 and described in detail below.

Development phase

The first step in the development phase was to undertake an inventory and analysis of existing indicators. Consideration was given to sustainability indicators (environmental, social and economic), water-related indicators (including water accounting), urban design indicators, vulnerability indicators, and governance indicators. It was found that the majority of water related indicators were directed at characterising the current state of water management practices and infrastructure (predominantly associated with essential services), and water quality of receiving environments.

WSC Index indicators were developed based on characteristics identified in the literature as important, including timeliness, relevance, workability along with indicators being easy to understand, comparable, credible and transparent. Best practice also recommends that indicators be developed with the end-user in mind. In particular, the following ISO standards and principles were adopted (United Nations (2003) and Sustainable Development Solutions Network, (2014)):

- Clear and straightforward to interpret.
- Consensus based.
- Broadly consistent with system-based information (ie national accounting, global reporting).
- Disaggregated (household, spatial -metro area - rural, economic activity).
- Universal (applicable in developed and developing countries).

- Managed by a designated organisation (different indicators can be assigned the responsibility of different organisations).

Drawing on considerable knowledge of the key attributes of a water sensitive city, established through CRCWSC research and stakeholder visioning forums, a prototype for the WSC Index was developed. A total of 54 indicators related to 9 themes covering governance, community capital, equity, productivity, ecological health, human wellbeing, quality urban space, adaptive infrastructure and resource efficiency were developed.

Input data for the Index is derived from locally relevant information to provide an evidence base for the assignment of a rating for each indicator. This may include the analysis of publicly available documents, key data sourced from Australian Bureau of Statistics and other government databases, calculations undertaken using GIS layers and methods to collect, and input data through consultation and engagement with key industry stakeholders.

The prototype was tested with two councils located in Melbourne, Australia, which provided detailed feedback on the usability, functionality, benefits and reliability of the Index was documented.

Key findings from this prototyping included the need to harmonise indicators to reduce the reporting burden and increase applicability. This was the underlying driver for the reconceptualisation of the index described in the following section. This streamlining process made clear the difference between indicators that could be used to benchmark a city, and those that could also be used for measuring the processes and outputs that underpin progress toward a water sensitive city.

The feedback also included key usability elements, such as the need for reporting outputs that could support business case development and strategic planning.

Reconceptualisation phase

A project steering committee and internal working group (with CRCWSC researchers and industry practitioners) was established to oversee the reconceptualisation phase which involved the consolidation of existing indicators, the writing of 6 new indicators to address gaps and rewording to simplify language.

This resulted in a revised Index with the number of goals reduced from 9 to 7 and the total number of indicators reduced from 54 to 34. The final 7 WSC Index goals are; ensure good water sensitive governance, increase community capital, achieve equity of essential services, improve productivity and resource efficiency, promote adaptive infrastructure, improve ecological health and ensure quality urban spaces.

The reconceptualisation phase also included the development of a web-based platform. The highly visual and user friendly interface has been specifically designed to clearly communicable the performance of a city relative to the goals of the Index (refer to Figure 2). It offers the ability to benchmark the performance of a city against others, and to clearly show areas of high and low performance for prioritisation and management attention.

The basis of benchmarking and assessment of a city's water sensitive performance is underpinned by a number of conceptual frameworks developed as part of CRCWSC research activities. Each conceptual framework provides an organising structure to generalise research observations and findings. They create a simple means to communicate and discuss the interrelated breadth of societal, governance, environmental and urban design factors of a water sensitive city.

The reconceptualisation phase also linked indicators to a series of potential management actions that can collectively help to transition a city to become more water sensitive.

Finalisation phase

This reconceptualised WSC Index is being further pilot tested during 2016 in Perth, Australia at the city and municipality scale of application. In addition it is also being tested in 3 cities located in developing countries across the Asia-Pacific region (Suva, Fiji; Mandalay, Myanmar; Ho Chi Minh, Vietnam). The outcomes of this testing and validation will be used to further refine the user interface and materials provided to the user from which a regional transition strategy for a city is produced.

RESULTS AND DISCUSSION

WSC Index framework

Table 1 presents the framework of the reconceptualised WSC Index that is currently being pilot tested. It provides a summary of the goals and indicators that are used for assessing the water sensitivity of a city or municipality.

Benchmarking

The WSC Index uses the City State Continuum (Brown, Keith and Wong (2009), Wong and Brown (2009)) framework to benchmark the performance of a city and compare it to the performance of other cities (see Figure 3). The benchmarking shows the progress of a city or municipality according to the key attributes of a (1) water supply city, (2) sewered city, (3) drained city, (4) waterway city, (5) water cycle city, and (6) water sensitive city. The first three city states are aligned to the provision of essential services. The remaining three city states represent various stages of water sensitivity, recognising the interaction of the urban water cycle with ecological functioning of natural and built systems, as well as

human wellbeing. Transitioning to a water sensitive city is not necessarily a linear process and CRCWSC researchers are gaining insight into how a city can 'leapfrog' from their current state to become more water sensitive.

Figure 2 provides an example of the benchmarking graphical output. The greater percentage achieved for each city state the more progressed a city or municipality is in term of their water sensitive practices and their alignment with the fundamental elements that underpin each city state

Filtering and prioritisation

The web-based platform allows the user to filter results using a number of options (as shown in Figure 2).

The Water Sensitive Cities Pillars framework (Wong and Brown, 2009) provides a filtering mechanism for the analysis of the results. Each of the 34 indicators is assigned to one of the three key pillars of practice that provide the foundation for a water sensitive city. They are:

- Cities as Water Supply Catchments: meaning access to water through a diversity of sources at a diversity of supply scales;
- Cities Providing Ecosystem Services: meaning the built environment functions to supplement and support the function of the natural environment; and
- Cities Comprising Water Sensitive Communities: meaning socio-political capital for sustainability exists and citizens' decision-making.

If a city or region wants to invest in water sensitive practices with a focus on water resources and alternative water supplies, ecosystem services for the built and natural environments, or social and institutional capital then results can be sorted and management actions prioritised using the three pillars of practice.

Similarly, each of the 34 indicators are aligned to one or more of the four lenses of sustainability, resilience, liveability and productivity. This enables the user to filter results and align management actions with emphasis on delivery of key water sensitive city outcomes:

- Sustainability, in relation to water, is the carrying capacity of the social, ecological and economic environment to meet water-related needs.
- Liveability, in relation to water, is the capacity to meet the expressed societal needs of a community in the urban water context (de Haan et al., 2014). These could include, for example, potable water, public health, environmental health, human thermal comfort and urban aesthetics.
- Resilience, in relation to water, is the capacity to maintain the function of a service under a wide range of conditions, including shocks and surprises, through recovery or adaptation.
- Productivity, in relation to water, is the capacity to generate economic value, directly or indirectly, from water related actions.

Management actions

The 'Transition Pathways' framework identifies the key pathway elements that collectively enable a city or region to progress towards more water sensitive systems. The framework has been developed through synthesising existing CRCWSC knowledge and research on the critical elements needed for enabling transitions towards water sensitive cities and regions (Brown et al., 2013, Ferguson et al., 2013). The elements can be grouped into three 'transition pathways' to distinguish between the shifts in practices, structures and cultures required for driving sustainability transitions (Rotmans and Loorbach, 2009). The water sensitive city transition pathways are:

- On-ground practices, or the on-ground activities that deliver water related services (includes elements, such as, water system planning, cost-benefit analsyis and monitoring and evaluation).
- Enabling structures, or the formal and informal rules and frameworks (regulatory, policy and economic context) that structure urban water management and practices (includes elements, such as, vision and narrative, evaluation frameworks, policy and strategy).
- Socio-political capital, or the commitment, knowledge and skills needed from people and organisations to establish the enabling structures and implement water sensitive practices in the real world (includes elements, such as, leadership, community connection and learning cultures).

Each transition element has been assigned to one or more of the 34 indicators. This process enables key transition actions to be related to the objective(s) of each indicator for inclusion in a city's regional transition strategy (action plan).

CONCLUSION

The need has emerged among practitioners to adapt the knowledge amassed over the life of study into

water sensitive cities into a form that can support strategic planning and decision-making. The index will enable cities to identify their current status and the steps necessary to transition towards more sustainable urban conditions and possibly, the ultimate goal of becoming a water sensitive city. This research will be vital to urban water managers, urban planners, policy and decision-makers engaged in long-term planning and policy development for sustainable urban water management. In addition, the World Bank, International Water Association and UN-Habitat have also indicated that such a tool may be of use in considering global urban water strategy such as facilitating the prioritisation of investments. The findings contribute new knowledge on indicators and benchmarking as well as deepen insights and understandings of sustainable urban water management.

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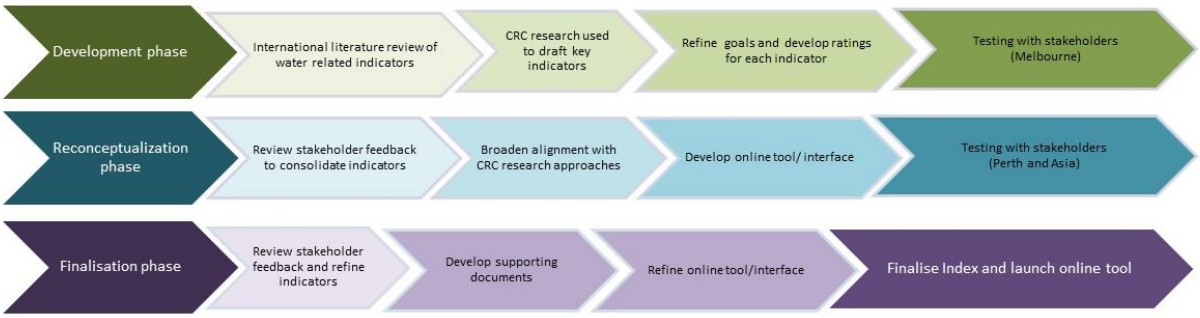

Figure 1: Index Development Process

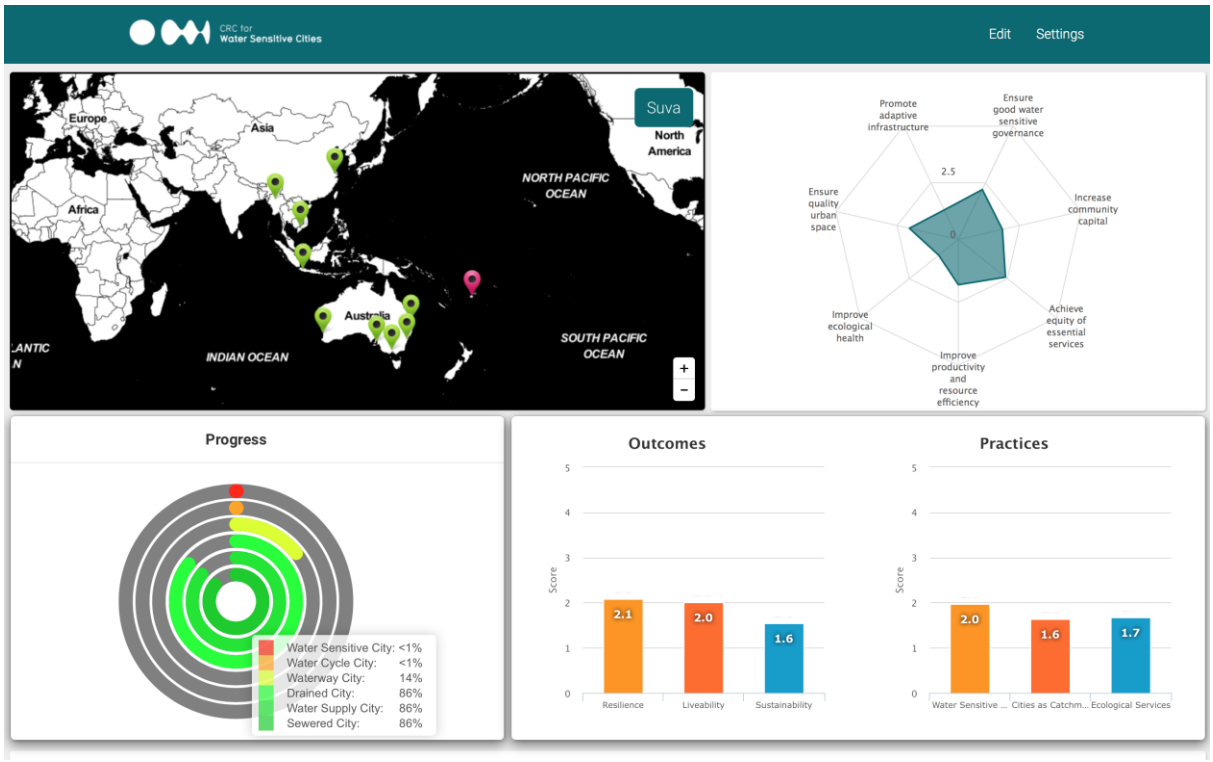

Figure 2: Example of web interface

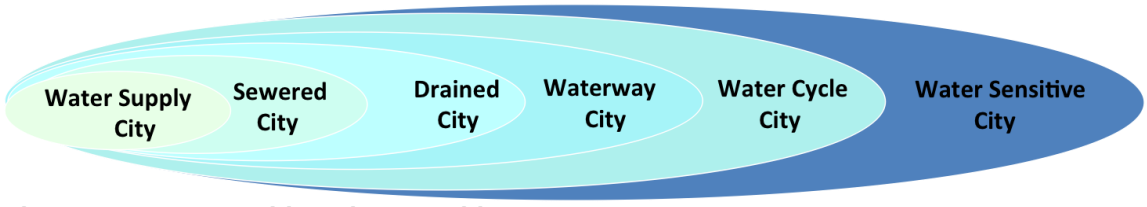

Figure 3: Water Sensitive City Transitions

Table 1: Summary of the WSC Index goals and indicators

Ensure good water sensitive governance	Increase community capital	Achieve equity of essential services	Improve productivity & resource efficiency	Promote adaptive infrastructure	Improve ecological health	Ensure quality urban space
Knowledge, skills and organisational capacity	Water literacy	Equitable access to safe and secure water supply	Maximised resource recovery	Diversify self-sufficient fit-for-purpose water supply	Healthy and biodiverse habitat	Activating connected green - blue space
Water is key element in city planning and design	Connection with water	Equitable access to safe and reliable sanitation	Low GHG emission in water sector	Multi-functional water infrastructure	Surface water quality and flows	Urban elements functioning to mitigate heat impacts
Cross-sector institutional arrangements and processes	Shared ownership, management & responsibility	Equitable access to flood protection	Water-related business opportunities	Integration and intelligent control	Groundwater quality and replenishment	Vegetation coverage
Public engagement, participation and transparency	Community preparedness and response to extreme events	Equitable and affordable access to amenity values of water-related assets	Low end-user potable water demand	Robust infrastructure	Protect existing areas of high ecological value	
Leadership, long-term vision and commitment	Indigenous involvement in water planning		Benefits across other sectors	Infrastructure and ownership at multiple scales		
Water resourcing and funding to deliver broad societal value				Adequate maintenance		
Equitable representation of perspectives						