Department of Planning and Environment

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Guidance on strategic planning outcome – Promote integrated water cycle management

Regulatory and assurance framework for local water utilities

December 2022

Acknowledgement of Country

The Department of Planning and Environment acknowledges that it stands on Aboriginal land. We acknowledge the Traditional Custodians of the land and we show our respect for Elders past, present and emerging through thoughtful and collaborative approaches to our work, seeking to demonstrate our ongoing commitment to providing places in which Aboriginal people are included socially, culturally and economically.

Published by NSW Department of Planning and Environment

dpie.nsw.gov.au

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First published: December 2022

Department reference number: PUB22/1047

Acknowledgements

This guidance was developed in partnership with the local water utilities sector. We particularly acknowledge the contribution of members of the Town Water Risk Reduction Program's working group on local water utility strategic planning of this guidance.

Contents

1.Introduction

Local water utilities can best meet the needs of their customers, and manage key risks, when their decisions and activities are based on effective, evidence-based strategic planning.

The NSW Department of Planning and Environment is committed that all local water utilities should have in place effective, evidence-based strategic planning. This will ensure utilities deliver safe, secure, accessible, and affordable water supply and sewerage services to customers. It will also ensure they can manage keys risks now and into the future, and in the event of significant shocks. Local water utilities remain responsible for conducting strategic planning.

The department gives assurance of effective, evidence-based strategic planning. Local water utilities not making dividend payments[1] are encouraged, but not compelled, to use the department's assurance framework, experience and capacity to support effective strategic planning.

Through the department's assurance role under section 3 of the Regulatory and assurance framework for local water utilities (PDF, 1613.11 KB) - Regulatory and Assurance Framework - we establish what outcomes we expect effective, evidence-based strategic planning to achieve (see section 3.2 of the Regulatory and Assurance Framework) and assess if a utility's strategic planning achieves these outcomes to a reasonable standard (see sections 3.3 and 3.4 of the Regulatory and Assurance Framework).

We give separate, optional guidance in the department's guidance Using the Integrated Planning and Reporting framework for local water utility strategic planning (PDF, 573.33 KB) to explain how utilities can achieve the strategic planning outcomes to a reasonable standard using the *Integrated Planning and Reporting Framework* for councils under the *Local Government Act 1993*.

1.1. Purpose of this document

This document supplements the Regulatory and Assurance Framework and gives guidance on achieving the outcome of promote integrated water cycle management to a reasonable standard.

This guidance is consistent with the objectives and principles established under the Regulatory and Assurance Framework, including being outcomes focused and risk-based.

This document sets out good practice **for all local water utilities** to apply when doing strategic planning to achieve the outcome of promote integrated water cycle management.

[1] Sections 3 and 4 of the Regulatory and Assurance Framework, are also the Guidelines for council dividend payments for water supply or sewerage services, under section 409(6) of the *Local Government Act 1993*. Before taking a dividend payment from a surplus of the council's water supply and/or sewerage business, a council must have in place effective, evidence-based strategic planning in accordance with section 3 of the Regulatory and Assurance Framework.

1.2. Structure of this document

This guidance is structured providing:

- the expectations for achieving this outcome to a reasonable standard
- an appendix with optional guidance for incorporating local water utility strategic planning into the Integrated Planning and Reporting Framework
- an appendix with optional 'how to' guidance that helps utilities achieve assurance expectations
- an appendix providing templates, case studies and tools useful for utilities to achieve assurance expectations.

1.3. Review of this draft guidance

As part of our commitment to continuous improvement, we will review the performance of the Regulatory and Assurance Framework within 2 years from finalisation. There will also be periodic reviews of the full suite of relevant regulatory and assurance documents, which will happen at least every 5 years.

The NSW Water Strategy 2022-24 Implementation Plan includes an action to develop a state-wide integrated water cycle management (IWCM) framework by December 2023. This guidance may be updated to align with the state-wide framework.

We welcome feedback on this guidance and will update it when needed based on feedback or a 'lessons learned' review following our assessment of strategic planning by local water utilities.

2. Oversight of local water utility strategic planning

Under section 3 of the Regulatory and assurance framework for local water utilities (PDF, 1613.11 KB), the department establishes what outcomes it expects effective, evidence-based strategic planning to achieve (see section 3.2) and assesses whether a local water utility's strategic planning achieves these outcomes to a reasonable standard (see sections 3.3 and 3.4).

Councils making a dividend payment from a surplus of their water and/or sewerage business must meet the expectations set out in section 3 and section 4 of the Regulatory and Assurance Framework.[2] Local water utilities not making dividend payments are encouraged, but not compelled, to utilise the department's assurance framework, experience and capacity to support effective strategic planning.

For effective, evidence-based strategic planning to occur, the department expects strategic planning to achieve the following outcomes to a reasonable standard:

- Understanding service needs
- Understanding water security
- Understanding water quality
- Understanding environmental impacts
- Understanding system capacity, capability and efficiency
- Understanding other key risks and challenges
- Understanding solutions to deliver services
- Understanding resourcing needs
- Understanding revenue sources
- Make and implement sound strategic decisions
- Implement sound pricing and prudent financial management
- Promote integrated water cycle management **(this guidance)**

A **reasonable standard** is met if the utility considers and addresses an outcome in a way that is:

- **sufficient:** underpinned by evidence-based analysis that supports the conclusions reached
- **appropriate:** underpinned by relevant departmental guidance and industry standard approaches to conduct planning and reach conclusions

[2] Sections 3 and 4 of the Regulatory and Assurance Framework, are also the Guidelines for council dividend payments for water supply or sewerage services, under section 409(6) of the *Local Government Act 1993*. Before taking a dividend payment from a surplus of the council's water supply and/or sewerage business, a council must have in place effective, evidence-based strategic planning in accordance with section 3 of the Regulatory and Assurance Framework.

- **robust:** underpinned by evidence that draws on appropriate sources and recognises and rebuts potential alternative interpretations.

The assessment considerations the department will apply and how these may be addressed are set out in more detail in the Regulatory and Assurance Framework.

3. Guidance on promoting integrated water cycle management

Under section 3.2 of the Regulatory and Assurance Framework, the department expects utilities to achieve the strategic planning outcome **promote integrated water cycle management** to a reasonable standard. This includes considering:

- How are urban water cycle outcomes including water security, public health, environmental and urban amenity, and liveability identified, achieved and funded?
- How does the utility consider opportunities and methods to increase resource efficiency and recovery in urban water management?
- How is the local water utility supporting customers to increase water literacy and support water efficiency measures?

3.1. Promote integrated water cycle management

In general, the department's expectations are that a local water utility promotes integrated water cycle management by:

- developing an understanding of the broader outcomes of water management characteristic of integrated water cycle management
- developing practices to enable the identification, achievement, and funding of these broader outcomes, including considering resource efficiency and water efficiency opportunities.

In the following sections we set out **what** the department's expectations are for **promoting integrated water cycle management** to a reasonable standard. In Appendix A we provide guidance on how utilities could address this outcome using the Integrated Planning and Reporting Framework.[3] In Appendices B and C, we provide optional guidance and case-studies and tools on **how** some of these expectations could be met.

When considering the outcome of promote integrated water cycle management (IWCM), it is important to first establish what IWCM means. IWCM is a strategic planning approach that brings all elements of water management together within a co-ordinated framework that integrates water planning with urban planning. To promote integrated water cycle management, a utility needs to extend its understanding beyond its core responsibilities for water supply and sewerage service provision to consider broader urban planning issues. A robust application of IWCM requires utilities to undertake additional activities, and to develop new methods and practices.

[3] We also give separate, optional guidance for all strategic planning outcomes in the department's guidance Using the Integrated Planning and Reporting framework for local water utility strategic planning (PDF, 573.33 KB), to explain how utilities can achieve the strategic planning outcomes to a reasonable standard using the *Integrated Planning and Reporting Framework* for councils under the *Local Government Act 1993*.

Promoting integrated water cycle management is important because it encourages utilities to expand their existing strategic planning approach. It enables them to:

- identify the full range of values and uses of water within the urban water cycle
- engage more broadly and deeply with their community to understand these values and uses
- set service levels and outcomes to achieve the multiple urban water cycle outcomes the community values, including sustainability and liveability
- consider a broad range of supply-side and demand-side water management solutions
- take a more collaborative approach that integrates water planning with land planning and with the management of other natural resources
- apply an adaptive planning approach that can help manage risk and uncertainty
- investigate new sources of funding and design new cost-recovery mechanisms.

A well-implemented IWCM approach can ultimately lead to better decisions, lower cost solutions, more optimal use of water, and to the delivery of water services that respond to the multiple and competing needs of the service community.

The extent to which a local water utility promotes IWCM will elevate the utility's level of achievement of the other 11 strategic planning outcomes in the Regulatory and Assurance Framework. It will also show how a utility is progressing along the urban water transition framework towards becoming a water sensitive urban area (see Figure 8).

The department recognises that the urban water sector in Australia is at an early stage of IWCM maturity. We include promoting integrated water cycle management as a strategic planning outcome in section 3 of the Regulation and Assurance Framework. This should encourage local water utilities to develop their understanding and implementation of IWCM in line with the uptake of IWCM in NSW, nationally, and internationally.

The department will apply a flexible, risk-based, and proportionate approach to assess the achievement of the outcome of promote integrated water cycle management to a reasonable standard. The department's assessment will recognise the early stage of IWCM maturity across the urban water sector and consider the unique circumstances of each local water utility.

The department is available to give advice and support to local water utilities to help them meet expectations for this strategic planning outcome.

3.2. How are urban water cycle outcomes including water security, public health, environmental and urban amenity and liveability identified, achieved and funded?

The local water utility should identify the full range of urban water cycle outcomes and the community values from all uses of water across the urban water cycle

People and the environment use water across the urban water cycle in numerous ways. The uses of water provide multiple direct and indirect benefits, and a range of outcomes, that customers and the broader community value. These urban water cycle outcomes contribute to the physical and mental wellbeing of customers and the community by enhancing 'liveability' aspects (see Figure 1 and a definition of liveability in the glossary).

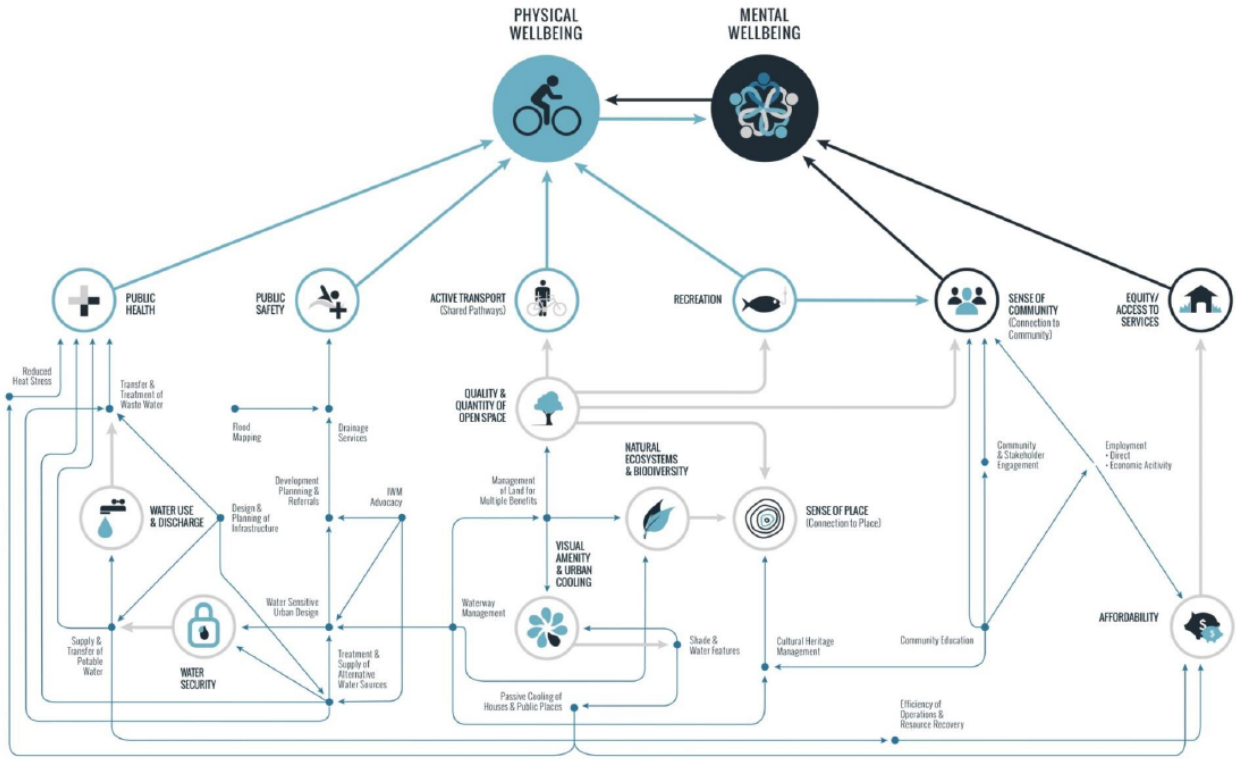


Figure 1. Interactions between water and aspects of liveability

Source: Water Services Association of Australia 2016.

The guidance on the outcome of understanding service needs provides relevant information on understanding customers' needs, values and preferences and how to identify the outcomes customers value. The guidance on the outcome of make and implement sound strategic decisions discusses relevant issues, including that a utility should identify optimal service levels based on understanding customers' needs, values, and preferences and develop efficient solutions that consider the full range of urban water cycle outcomes. It notes the decision-making framework should be holistic and as much as possible risk-based and outcomes-focused to align with a fully integrated approach to water management.

This guidance focuses on how to ensure the full range of urban water cycle outcomes are identified, including the additional outcomes or elements of outcomes characteristic of IWCM: water security, public health, environmental sustainability, urban amenity, and liveability.

A utility should, at a minimum, deliver its services consistent with the requirements and expectations of regulators. In so doing, a utility will comply with water security, public health, and environmental regulatory requirements.

A utility can extend its service delivery effort to achieve higher service levels and additional outcomes above regulatory expectations. Understanding of customers' needs, values, and preferences should determine such water service delivery decisions as revealed through engagement with customers, that considers their ability and willingness to pay.

We give further guidance on considering customers' needs, values, and preferences in the guidance on the outcome of understanding service needs. This includes that a local water utility should:

- develop a sound understanding of the key characteristics of its customer base by engaging with an adequate representation and cross-section of its customer base, including Aboriginal stakeholders
- establish an ongoing understanding of its customers' needs, values, and preferences informed by corporate tools and management systems that allow customers to provide ongoing feedback, and the utility to provide ongoing review
- conduct extensive customer engagement on a periodic basis that seeks to understand what customers may be willing to pay to achieve higher service levels and additional outcomes informed by a realistic understanding of the costs and trade-offs
- conduct broad and deep customer engagement, and start it early
- conduct objective, representative, proportionate, meaningful customer engagement that is clearly communicated and accurate
- report on the process and outcomes of its customer engagement, including to explain any customer expectations that the utility will not or cannot meet.

In addition to the above, to promote integrated water cycle management and ensure the full range of urban water cycle outcomes that the utility's customers and communities[4] value are identified, a local water utility should:

- deepen its understanding of its customers and communities, on an ongoing basis, by ensuring its community engagement activities involve a diverse range of customer and community groups
- ensure community engagement informs customers of the range of uses of water across the water cycle and elicits any added uses that customers value
- ensure community engagement seeks to fully understand customers' values and preferences for the full range of outcomes that result from their direct and indirect water use

4 The term 'communities' is used in plural to emphasise that many different types of communities may live in a local government area and these communities, and the individuals in them, may each use and value water in different ways.

- apply scenario analysis as part of the community engagement activities that can evaluate different urban futures with the community (see further description in the guidance for the outcome of understanding other key risks and challenges)
- explore their customers' and communities' perceptions of risk associated with their needs, values, and preferences for the full range of urban water cycle outcomes.

Local water utilities should periodically conduct an extensive customer engagement process to identify the uses of water and the water-related outcomes the community values.

Council local water utilities could do this as part of the community consultation required under the Integrated Planning and Reporting (IP&R) framework process. For example, a local water utility can draw on the water-related objectives identified through community engagement processes to develop the Community Strategic Plan, adapt these into urban water cycle outcomes, and can choose to test these further in community engagement exercises targeted at better understanding water values. During the community engagement, utilities should seek to understand their customer and communities' attitude to risk and how this might influence their receptivity to IWCM-related solutions. Often a community's perception of risk can be significantly different from a utility and council's perception of risk.

Improving liveability outcomes

The term liveability encompasses the outcomes characteristic of IWCM, including the aspects of water security, public health, and environmental and urban amenity additional to a local water utility's core water supply and sewerage service provision responsibilities. We discuss these aspects of liveability in more detail under separate headings below.

Other aspects of liveability include public safety, active transport, recreation, community cohesion, equitable access to services, affordability, visual amenity, urban cooling, healthy waterways, natural ecosystems, biodiversity, and a sense of place (see Figures 1 and 2).

Liveability outcomes improve when customers' and the communities' physical and mental wellbeing improves.

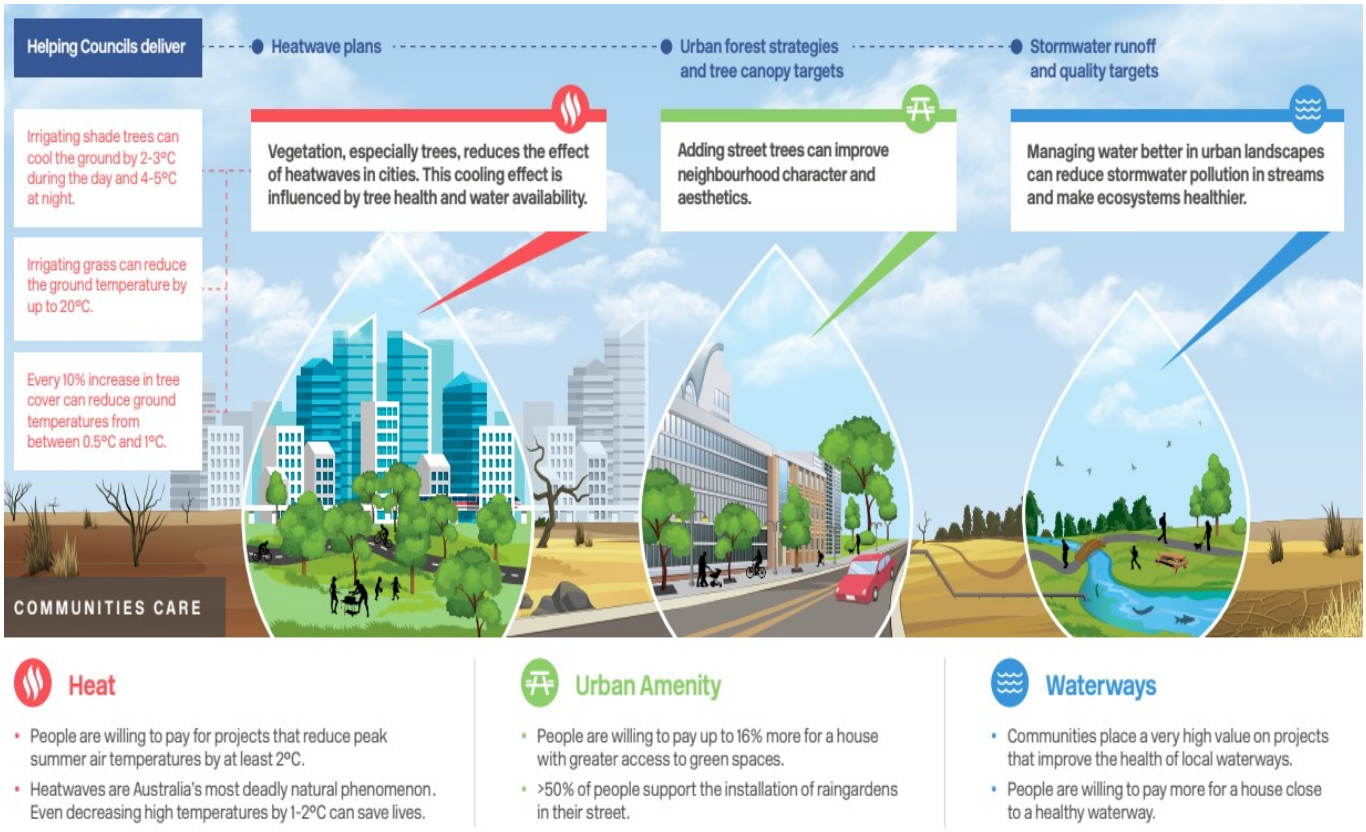


Figure 2. Water's role in liveability
Source: CRC for Water Sensitive Cities 2018b.

Addressing water security challenges and improving water security outcomes

IWCM can improve water security outcomes by encouraging innovative solutions that are more economically efficient and environmentally and financially sustainable, and more resilient to shocks, such as emergency events.

Under an IWCM approach, a utility may choose to reconsider its existing water security planning approach based on an improved understanding of how its customers and its communities value the full range of urban water cycle outcomes. By doing so, it could achieve higher value water-related outcomes for its customers and communities.

As noted in the NSW Water Strategy, every person in NSW has a right to expect access to safe drinking water for use at home and water security in their communities to sustain job-creating businesses and healthy natural environments. This is particularly important for regional NSW, where economies are often built on water-essential industries such as agriculture, food processing and manufacturing, resources, and tourism.

The Australian Department of Climate Change, Energy, the Environment and Water recently commissioned a project to develop a clear, nationally agreed definition of what town and city water security means and to build a diagnostic tool to support nationally consistent reporting on water security issues and outcomes. Extensive water sector consultation informed the project (see Figure 3).

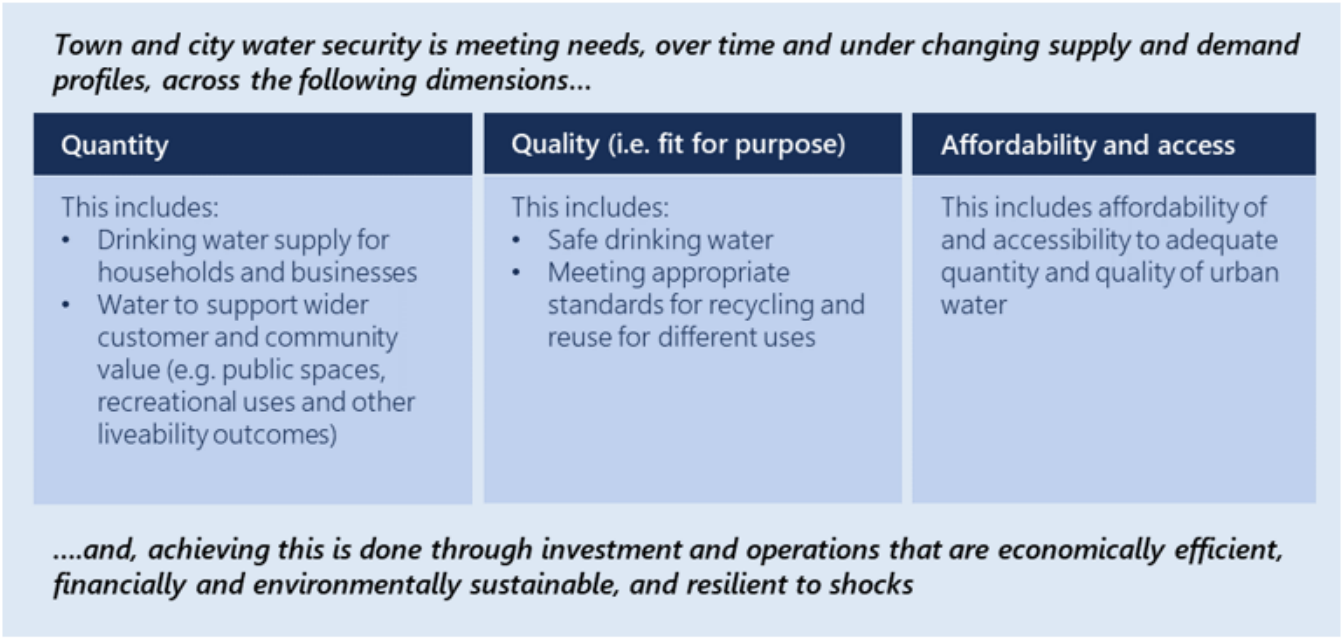


Figure 3. Definition of town and city water security in Australia

Source: Aither 2021.

This definition captures a range of urban water cycle outcomes. A utility may choose to consider this definition and diagnostic tool to inform its planning, analysis, and collaborative efforts to improve urban water security outcomes for its customers and communities.[5]

Addressing public health challenges and improving public health outcomes

IWCM can deliver public health outcomes by providing the opportunity for people to experience a range of benefits, including improvements in physical and mental wellbeing resulting from more exposure to open green space, more active recreation, reduced urban heat, and lower air pollution.

A local water utility should meet the public health regulatory requirements that apply to its water supply and sewerage service provision. It can extend its service delivery and promote integrated water cycle management by seeking to improve public health outcomes that align with its customer and communities' values and preferences.

Addressing environmental health challenges and improving environmental sustainability outcomes

IWCM can deliver environmental outcomes by reducing the negative impacts of stormwater runoff and by increasing infiltration. Benefits include reductions in diffuse source pollutants, stream erosion, turbidity, and increased soil moisture that help to sustain ecological systems and enhance environmental values.

A local water utility should meet the environmental regulatory requirements that apply to its water supply and sewerage service provision. It can extend its service delivery and promote integrated water cycle management by seeking to improve environmental outcomes that align with its customer and communities' values and preferences.

5 Available from the Australian Government Department of Climate Change, Energy, the Environment and Water website at: https://www.dcceew.gov.au/water/policy/urban/policy-reform-urban-water

Improving urban amenity outcomes

IWCM can deliver urban amenity outcomes beyond those provided by its water supply and sewerage service provision. It can improve the quality and quantity of open space and the ecological health and accessibility of waterways. Street trees, sports grounds, open spaces, and clean, accessible, and swimmable waterways have significant visual amenity, thermal cooling properties, and recreational value for water customers and communities.

Water demand measures that restrict the watering of open spaces can reduce urban amenity outcomes and, in turn, community wellbeing. Water sensitive urban designs (WSUD) and green infrastructure design approaches, improve visual amenity and waterway health and deliver urban amenity and environmental outcomes.

A local water utility can extend its service delivery and promote integrated water cycle management by seeking to improve urban amenity outcomes that align with its customer and communities' values and preferences.

The local water utility should identify all parts of the urban water cycle relevant to their area of operations

To promote integrated water cycle management, a local water utility should develop an improved understanding of the urban water cycle, or urban water balance, in its area of operations. This involves understanding the natural water cycle and the changes made to this natural cycle by urban water infrastructure.

Figure 4 presents a simplified picture of the water cycle under natural, conventional management, and more sustainable management conditions. In the conventional urban water cycle, infiltration decreases, and stormwater runoff increases as rain hits impervious surfaces such as concrete and pavements and is collected in stormwater drainage systems and discharged into waterways. Water supply is distributed through pipes and once used, is collected by sewerage pipes and discharges into waterways. The sustainable urban water cycle introduces fit-for-purpose water solutions that recycle sewage, harvest stormwater, and reduce stormwater runoff and wastewater discharges to waterways. The sustainable urban water cycle approach returns water flows to more natural water cycle conditions.

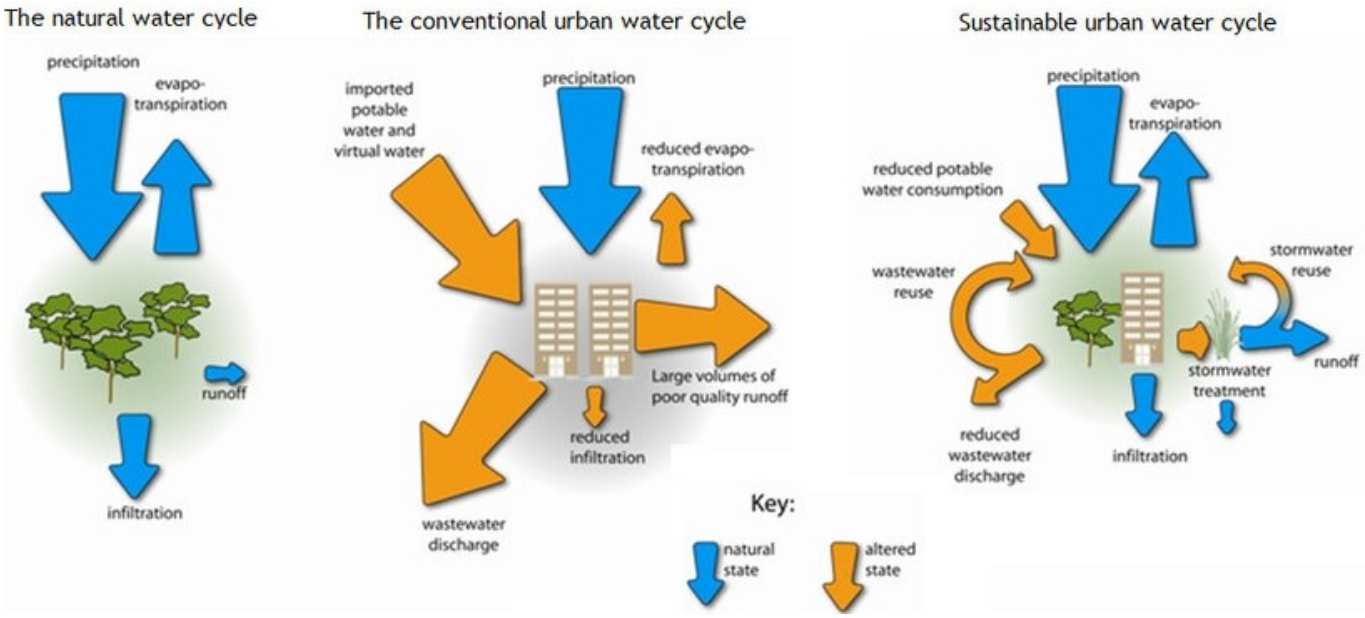


Figure 4. The natural water cycle and the urban water cycle

Source: Healthy Waterways 2011.

Thinking about urban water flows as interrelated parts of a connected system encourages utilities to:

- appreciate the physical connections between water, land, and other natural resources
- consider water planning within an integrated urban planning framework
- consider stormwater together with water supply and sewerage services
- consider the environmental impacts of water in the urban environment, including stream erosion and waterway health impacts
- identify governance and management issues as it highlights that a range of parties are responsible for parts of the urban water cycle
- establish collaborative governance arrangements with all parties responsible for the urban water cycle
- align decision-making with catchment-scale boundaries
- formalise frameworks for integrating water planning with land-use planning, and with strategic urban planning and economic development processes
- identify opportunities for using, or reusing, available water and for using water more efficiently.

Overall, a comprehensive understanding of how water flows into, through, and discharges across all parts of the urban water cycle, in both natural systems and through a utility's water supply and sewerage infrastructure network, will enable a local water utility to make more effective, evidence-based strategic planning decisions. Appendix B provides additional information and suggestions, and Appendix C introduces an urban water mass balance tool.

The local water utility should have collaborative governance arrangements in place with all those responsible for parts of the urban water cycle

It is important for a local water utility to identify all those responsible for each part of the urban water cycle and ensure it has collaborative governance arrangements in place with them. Where there are gaps in existing governance arrangements, a utility should establish new arrangements to fill these gaps.

For local water utilities responsible for water supply and sewerage services, this should include regular collaboration with the teams responsible for all strategic decision-making and operational decision-making that has an influence on the urban water cycle, including urban planning, economic development, environmental management, stormwater management, and flood management teams in council. For utilities responsible for only water supply or sewerage services, it requires close collaboration with the organisation responsible for the other service to ensure effective decision-making across these services. For county councils, it requires collaborative arrangements with multiple councils.

To support collaboration with other organisations and teams, a utility should develop its understanding of regional strategies, economic development plans, Local Strategic Planning Statements, council urban growth plans, and other relevant initiatives that influence urban planning in its area. A utility should consider how its service delivery interacts and how it might adapt its management actions to contribute to the goals of these policies and plans. Figure 5 shows co-benefits that can be generated by integrating water planning and urban planning.

Figure 5. Integrating water planning and urban planning
Source: CRC for Water Sensitive Cities 2022.

IWCM requires organisations to have a clear understanding of their roles and responsibilities. This clarity helps those involved to understand their own accountabilities, facilitates, the allocation of costs, benefits and risks, and guides funding and financing decisions. Collaborative governance arrangements provide a forum to resolve issues where roles and responsibilities may not be clear. They also provide an opportunity to identify and collectively resolve any barriers to achieving efficient solutions.

A key element of IWCM is the integration of stormwater management with water supply and sewage management. Local water utilities manage stormwater as a supply source and the general-purpose council manages stormwater in terms of waterway management, water quality, and flood control. Collaborative governance arrangements between those responsible for stormwater, flood control, water supply and sewage management need to be particularly effective to ensure integrated and optimal decision-making. To promote integrated water cycle management, these governance forums should identify where stormwater, floodwater, water, and sewage management issues interact, investigate where roles and responsibilities might not be clear, and seek to proactively resolve these issues.

The local water utility should extend its corporate tools and management systems to enable more collaborative governance and to foster a deeper understanding of the urban planning context

A local water utility collects data and information and monitors its performance in relation to the services it delivers, in most cases for water supply and sewerage services. To promote integrated water cycle management a utility should extend its understanding beyond that required to deliver its core responsibilities for water supply and sewerage service provision, and consider broader water planning and urban planning issues. As noted above, this requires a utility to develop a more comprehensive qualitative and quantitative knowledge of all water flows across the urban water cycle and a deeper understanding of the water planning and urban planning context in which it operates.

A local water utility should collaborate with others internal and external to their organisation to collate available data and information, to identify any information gaps, and to discuss how to best address these gaps.

Readily available data and information may include:

- annual water supply and sewerage service performance monitoring data as reported annually to the department, the Bureau of Meteorology, and the Australian Bureau of Statistics
- regional water strategies
- land-use planning instruments
- local strategic planning statements
- economic development plans
- regional development plans
- strategic asset management plans.

Information gaps may include:

- stormwater flow data and stormwater management information
- flood management plans
- local stream flow data that incorporates agreed climate change projections
- agreed long-term population projections
- agreed long-term future urban growth plans
- agreed conversion of population projections and future urban growth plan into spatially located dwelling projections
- knowledge of emerging risks and challenges that influence the urban planning context.

In some cases, data and information gaps may be difficult to address in the short-term. In such instances, having effective collaborative governance arrangements where issues and risks can be collectively discussed becomes even more important. In cases where decisions need to be made based on incomplete data and knowledge, all relevant parties should be involved in assessing the risks. They should then take a flexible approach to making water management and urban planning decisions based on a shared understanding of the risks of their decisions.

The parties may agree to implement measures to reduce risks, such as staging decisions on major investments, scenario testing, and trying to avoid locking in or locking out solutions. The guidance on the outcomes of understanding other key risks and challenges and make and Implement sound strategic decisions give more detail on making risk-based decisions where there is significant uncertainty, and better information may be available in future.

A utility should also develop an ongoing system for collecting, managing, sharing, and reporting data amongst all those responsible for parts of the urban water cycle.

The local water utility should establish agreed funding arrangements and cost-recovery mechanisms to achieve urban water cycle outcomes

The utility should consider the following steps to identify outcomes and then put in place actions to achieve and fund them:

First, a utility should understand its customers' and communities' values and preferences for the full range of outcomes that result from both their direct use of water as well as from water use by natural systems that they can also enjoy and from which they benefit.

Second, these outcomes should be valued, ideally in monetary terms applying appropriate methods to understand the customers' and communities' willingness to pay for these outcomes, and by testing this willingness based on an appreciation of cost and benefit trade-offs. This involves considering who the outcomes impact and benefit, and who should pay to achieve them. If the actions involve project-based solutions that require significant investment, the case for the project should be tested by economic analysis that compares options against a base case and identifies the optimal solution that customers and communities are willing and able to pay for.

Third, where willingness to pay is demonstrated by customer and community support, the utility, in collaboration with relevant others, should design management actions and determine accountabilities that would achieve the desired outcomes.

Finally, funding options then should be identified, and a funding mechanism designed by relevant decision-makers based on an agreed understanding of accountabilities.

The utility and other involved parties then move on to implementation, together with monitoring, evaluating, and reporting the actual benefits, costs, and risks.

In practice, each step should be considered iteratively as part of an adaptive planning process and urban planning framework that draws on new information as it becomes available.

Funding IWCM-related urban water cycle outcomes can be challenging because:

- they often involve non-market benefits that accrue to broader society, are not readily quantified in monetary terms, and cannot be clearly allocated to a particular party
- they provide multiple private and public benefits and shared outcomes that are attributable to multiple organisations and divisions within organisations
- the ownership of the assets involved in delivering outcomes may be unclear, or not aligned with asset owner responsibilities
- funding sources and cost-recovery mechanisms are often not readily available
- they often require new co-funding arrangements to be established between multiple organisations and parts of organisations.

The guidance material on other strategic planning outcomes provides relevant detail, in particular the following.

- The guidance on the outcome of understanding service needs notes that a local water utility should establish a deep understanding of its customers' needs, values and preferences through community engagement. This informs an adaptive planning process and tests customers' willingness to pay to achieve IWCM-related outcomes informed based on a realistic understanding of service level and cost trade-offs.
- The guidance on the outcome of understanding revenue sources notes that a utility's revenue sources should reflect appropriate cost allocation and funding principles. It sets out a funding hierarchy of impactor pays, beneficiary pays, and government pays, and notes that water and sewerage prices are consistent with the impactor-pays principle. It notes that willingness to pay analysis should be proportionate to the scale of costs and benefits and to a utility's circumstances. At a minimum, willingness to pay estimates should be informed by clear, detailed, and credible qualitative information relevant to the local context.
- The guidance on the outcome of make and implement sound strategic decisions notes that sound strategic decision-making should:
    - apply an iterative and adaptive process that recognises the needs and expectations of customers may change in response to changes in climate and other risks; changes in population and/or demographics; changes in customer preferences for urban water

cycle outcomes; and changes in resource recovery and water efficiency-related actions

    - consider all viable options
    - consider key risks and develop risk mitigation strategies
    - value solutions that build in optionality.

- The guidance on the outcome of implement sound pricing and prudent financial management notes that a utility should establish and maintain accounting separation between the local water utility and the rest of council's operations. This includes separate record and account costs and revenue sources within a utility's water and sewerage business systems and council business systems, supported by a cost allocation manual. The manual should establish best-practice principles and transparent methods for allocating direct and indirect or common costs that will support consistent attribution to relevant parts of the utility and of council. Such practices will support a utility to establish agreed funding arrangements and cost-recovery mechanisms.

Estimating the costs and benefits of achieving urban water cycle outcomes and choosing optimal solutions

Costs and benefits should be estimated in monetary terms, wherever possible.

Total costs should include estimates of upfront costs, ongoing maintenance and operating costs, and renewal costs.

Total benefits should include estimates of avoided costs (such as from deferring water infrastructure investments and avoiding water restrictions) and estimates of increases in values (such as increases in recreation, public health, visual amenity, waterway health), including noting the values that accrue to broader society. This information should be supported by demonstrating willingness to pay for these benefits. The process should also distinguish the benefits that have a financial basis (avoided costs) and those that are non-financial (visual amenity).

Where benefits cannot be estimated in monetary terms, the nature of benefits, and their expected scale, should be clearly described and recognised in decision-making. Total unquantified benefits should be assessed in relation to the gap between total costs and total quantified benefits. If unquantified benefits are regarded as exceeding the gap based on a logical and common-sense qualitative assessment, this should change the decision on the optimal solution. That is, choose the solution where total quantified benefits + total qualitative benefits > total cost, rather than the solution where total quantified benefits < total costs.

There is an increasing body of work on how to best monetise urban water cycle outcomes, including economic evaluation tools developed by the Cooperative Research Centre for Water Sensitive Cities (CRC for Water Sensitive Cities) (see Appendix C) and WSAA work led by Frontier Economics to quantify the health benefits of water industry investments.[6]

[6] Water Services Association of Australia 2019b.

Allocating the costs, benefits, and risks of urban water cycle outcomes to the relevant parties

This involves analysing the distribution of costs, benefits, and risks of urban water cycle outcomes and allocating them to relevant organisations or parts of organisations. The allocation should be based on an agreed understanding of the roles, responsibilities, and expertise of the relevant parties, and align with the impactors and/or beneficiaries pay principle.

This process results in a 'net position' for each organisation or part of an organisation, based on their total share of the cost, benefits and risks. This net position should serve as the basis for determining funding and cost-recovery arrangements. The net position also provides the basis for identifying where financial transfers between parties might be appropriate. Such information should be discussed in a utility's cost allocation manual and be based on best-practice cost allocation principles.

Funding sources, financial transfers, and cost-recovery arrangements

Funding sources available to local water utilities include water charges, sewerage charges, recycled water charges, trade waste charges, water and sewerage developer charges, revenue from other service charges such as from selling sewage biosolids, grants from NSW Government, grants from the Australian government, and financial transfers from council/s drawn from various council revenue sources.

IWCM solutions encourage the development of new and innovative funding arrangements, such as public and private partnership models and joint funding models where government, developers and industry contribute funds. For example, there may be a case for developers to contribute to IWCM solutions that provide public health benefits and increase biodiversity values and property values in a greenfield or infill development.

A logical funding arrangement is for parties to contribute funds proportionate to the scale of their impact and/or benefit, or their 'net position' as described above. For example, for IWCM projects where a utility has net costs and its general-purpose council has net benefits, a financial transfer could be made from council to the utility to allocate funding appropriately. Such transfers should apply the principle of competitive neutrality and adhere to the requirements to ring-fence local water utility and general-purpose council accounts. The transfer amounts should reflect the utility's costs to deliver the services/outcomes and ensure there is no cross-subsidisation between the council and its local water utility, or vice versa. Financial transfers would need to comply with section 409(3) of the *Local Government Act 1993*.

For council-owned local water utilities, funding arrangements for IWCM-related urban water cycle outcomes could involve several teams within the general-purpose council each making proportionate contributions from their allocated budgets, and the local water utility also contributing funds. Costs could be recovered through a mix of council rate revenue, other council charges, local water utility water supply and sewerage service charges, and/or its other revenue source. Where urban water cycle outcomes are delivered by stormwater management actions, there may be a case for funding to be sourced from council stormwater management service charges.

Evaluating funding mechanisms

Criteria for evaluating funding mechanisms includes efficiency, equity, adequacy, and dependability, simplicity, and transparency. The guidance on the outcome of understanding revenue sources gives further information. In general, water and sewerage charges should be the primary source of funding for utilities. Transfers from council and NSW government grants are justified on efficiency and equity grounds for management actions and projects that deliver additional private benefits (for example, to the residents of new urban growth developments) and broader public benefits.

The guidance on the outcome of implement sound pricing and prudent financial management discusses when differential or location-specific charging may be appropriate, rather than postage stamp pricing (where all customers of the same type who receive the same service, pay the same prices). The guidance notes that utilities should differentiate prices by the cost of servicing different customers (for example, based on location and/or service standards) where the benefits of doing so outweigh the costs of identifying differences and the equity advantages of alternatives. Refer to this guidance for further information.

Evaluating the effectiveness of IWCM investments

It is important to monitor, evaluate, and report how well the pre-implementation or 'ex-ante' estimates of IWCM solutions compare with the actual costs, realised benefits and risks, and the level of urban water cycle outcomes achieved after the project has been implemented. Post-evaluation is important to ensure funding mechanisms were appropriately designed and that they funded the most highly valued and affordable solution.

Over time, the post-evaluations will build an evidence base of insights on the effectiveness, barriers, and shortcomings of IWCM solutions, and in turn build the case for promoting integrated water cycle management. Post-evaluation will also enable the utility and relevant parties to develop a body of knowledge and increasing expertise in IWCM-related methods and practices.

In practice, this could simply involve a local water utility organising a meeting with all relevant parties of an IWCM-related project, including community representatives, after the project has been implemented and has been up and running for a while. The group could discuss and reflect on the planning, design, and delivery stages of the project; evaluate how actual costs and the realised benefits and risks compare with the ex-ante project estimates; identify discrepancies between actuals and estimates and discuss the possible reasons (unforeseen cost increases, underestimated operational and maintenance costs); identify any other barriers and issues experienced (poor installation of assets that means they do not operate as well as they should, lack of monitoring processes, data gaps, governance challenges); and document these observations and learnings so that they can be drawn on in future. Such practices will provide the utility, and those with whom it collaborates, with a process of continuous learning.

Building IWCM capacity and improving funding arrangements

Over time, with more collaboration, more effective governance arrangements, and improved data and knowledge-sharing arrangements; the local water utility sector, collaborators, and regional communities will build their knowledge of IWCM and establish new and improved mechanisms to

fund IWCM solutions. The sector can draw on this evidence to increasingly apply IWCM-related methods and practices in water planning and urban planning in regional NSW towns.

This will increase the uptake of IWCM solutions in regional NSW towns and deliver solutions that provide the highest net public benefit to regional NSW communities. Over time, this body of knowledge of evidence will be supported by the lived experience of regional NSW communities who can enjoy IWCM's sustainability and liveability advantages.

Such effort and experience will accelerate the transition of regional NSW towns to be more water sensitive, more sustainable, and more enjoyable places to live.

3.3. How does the utility consider opportunities and methods to increase resource efficiency and recovery in urban water management?

The local water utility should develop an understanding of how water resources interact with other resources in their area of operations

Local water utilities make design, operational, and procurement decisions that impact multiple natural resources, not just water. Every decision about the source, treatment, and distribution of water and sewage has implications for energy and chemical requirements, and the waste streams generated. Utilities are also for managing the waste stream of sewage treatment plants.

Pumping and treating water and sewage is very energy intensive. Therefore, actions to optimise the efficiency of water and sewage distribution and treatment systems can have a significant impact on a local water utility's operating costs. Actions that reduce energy demand and the volume of waste streams will also reduce a local water utility's overall carbon footprint (see Figure 6).

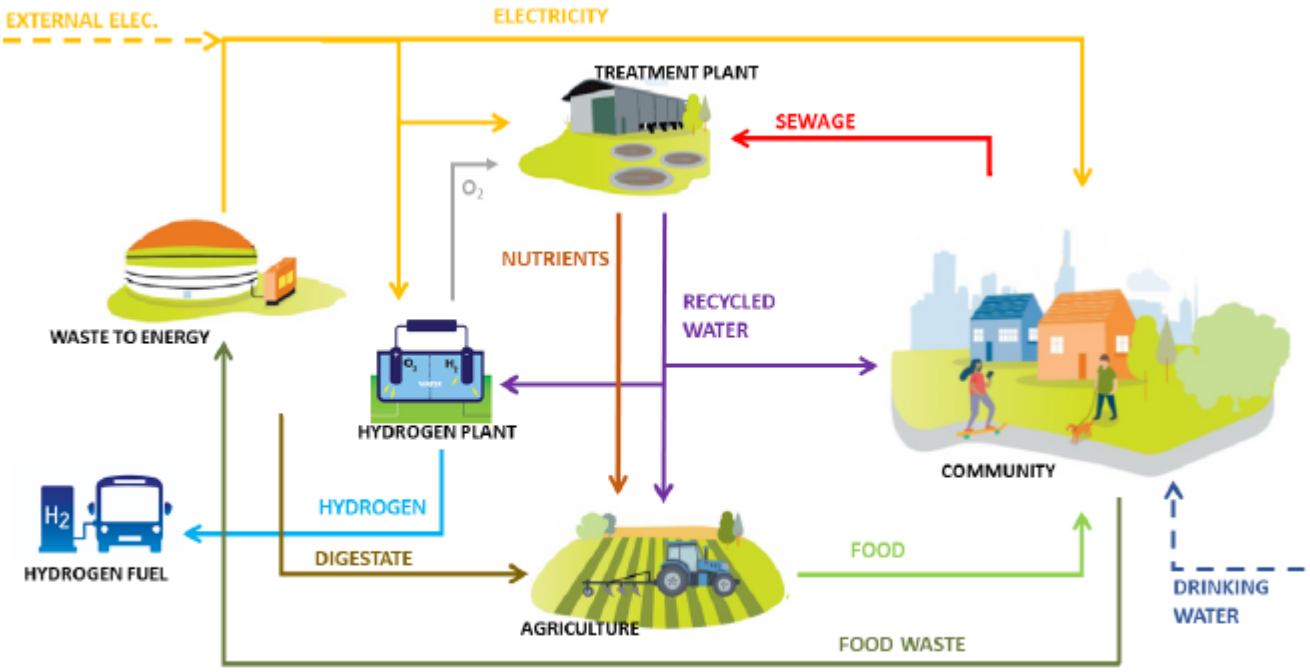


Figure 6. Resource use and recovery pathways
Source: Yarra Valley Water in Skinner R and Satur P 2020.

The local water utility should consider opportunities and methods to increase energy and waste efficiency and resource recovery

Urban water management presents significant opportunities for energy and resource recovery – for the water utility itself and for the communities it services. A utility should consider opportunities and methods to reduce energy use and methane emissions through energy efficiency initiatives, low emissions technology, and circular design principles.

In addition to providing recycled water, sewage can be treated in a way that creates heat or methane, while nutrients and carbon can be recovered for use as fertiliser and other more advanced purposes. Cities and major regional centres have an increasing interest in the co-digestion of sewage with other food and organic waste streams. This creates renewable energy and reduces the amount of food waste going to landfill. Reservoir and treatment plant sites are often highly suitable for solar energy capture, while the hydraulics of water supply and sewerage systems provide opportunities for mini hydro power generation.

Commitments to net zero emissions, resource scarcity, and increases in energy and waste management costs are driving research and investment in the 'circular economy' as it applies to the water industry. Communities also support and expect water utilities to innovate and invest in optimising their energy use and resource recovery.

A utility should consider opportunities and methods to increase waste efficiency and resource recovery, including by reducing waste sent to landfill through improved design solutions and more resource efficient operating and maintenance practices.

A utility should also consider opportunities and methods to reduce carbon and methane emissions through waste and materials management, low emissions technology, and circular design principles.

See Appendix B for more background information and policy context.

3.4. How is the local water utility supporting customers to increase water literacy and support water efficiency measures?

The local water utility should support its customers to increase their water literacy

Water literacy will encourage customers to investigate and reach out to their local water utility to find out where their water comes from, how it is used, and where it goes after being used. Water literacy has an important role in ensuring customers have the information to understand the challenges facing water resources. It will equip customers to be involved in the water management planning process and make well-informed decisions. A local water utility can increase water literacy internally, within council, and of customers and the community by:

- delivering community engagement programs that educate customers on water saving opportunities, such as changing water use behaviour
- targeting water efficiency awareness building engagement activities at key members of the community, such as teachers, who in turn can educate the community
- providing water efficiency education information and materials on its website, and include weblinks to useful resources
- leveraging content provided in the Water Conservancy's Smart Water Advice subscription (see further information in Appendices B and C) – more than 50% of local water utilities in NSW have an active subscription
- supporting uptake of water efficient fixtures and fittings, particularly in showers, toilets and washing machines
- supporting uptake of emerging technologies that use digital control to reduce water use, particularly for cooling and irrigating gardens and lawns
- using content and tools available through the department's water efficiency program, such as the NSW Water Efficiency Framework.

The local water utility should evaluate water efficiency measures on an equal basis with other supply and demand options and implement them where it is cost effective to do so

The efficient use of water contributes to the sustainability of long-term supplies as population increases, builds resilience to drought, and supports readiness to respond to future extremes in weather. Increased investment in water system efficiency, water conservation and demand

management can delay the timing and reduce the scale of investment in new supply infrastructure and maximise the value gained through the use and reuse of water resources.

Utilities should identify all the potential water efficiency options to achieve water security and evaluate them on an equal basis with other water supply and demand management measures. Utilities should consider the full range of costs, benefits and risks to customers and the broader community when evaluating water efficiency measures. If there are any costs and benefits of water efficiency options that are difficult to estimate in monetary terms, such as liveability benefits, they should be described and analysed qualitatively. The utility should apply an appropriate economic evaluation method (cost-benefit analysis, cost-effectiveness analysis) to identify and rank viable solutions, and then also analyse the influence any non-monetised benefits may have on the highest ranked solutions qualitatively. A gap analysis would check whether the non-monetised benefits are likely to be greater than the difference between the total quantitative costs versus the total quantitative benefits, and therefore whether they could change the preferred solution.

The utility should also evaluate water efficiency initiatives using post-evaluation processes to assess whether estimated benefits were realised and, if not, consider the potential reasons why and aim to address barriers and constraints in future. Post-evaluation encourages knowledge sharing and continuous improvement and advances risk mitigation strategies.

See Appendix B for more background information and policy context on the NSW Water Efficiency Program.

The local water utility should use the guidance in the NSW Water Efficiency Framework to work towards best-practice water efficiency

The department recently developed a water efficiency framework in consultation with local water utilities and the wider water sector. The framework enables utilities to proactively develop a water efficiency plan or program before an extreme event happens rather than react in times of drought. It covers improving water conservation, end-use efficiency, and reducing leakage or non-revenue water.

Appendix A: Optional guidance on using the Integrated Planning and Reporting Framework

The Integrated Planning and Reporting (IP&R) Framework is administered by the Office of Local Government under the *Local Government Act 1993*. It sets out a comprehensive, mandatory framework for councils to plan for, deliver, and report on all activities, including urban water functions.

Table 1 gives optional how-to guidance to support utilities in achieving the strategic planning outcome **promote integrated water cycle management** to a reasonable standard by using the Integrated Planning and Reporting (IP&R) Framework.

Using IP&R

Table 1. Promoting integrated water cycle management and how it links to relevant IP&R framework components

Outcome	Description (sub-outcomes)	IP&R framework components
Promote Integrated Water Cycle Management	How are urban water cycle outcomes including water security, public health, environmental and urban amenity, and liveability identified, achieved, and funded? How does the utility consider opportunities and methods to increase resource efficiency and recovery in urban water management? How is the local water utility supporting customers to increase water literacy and support water efficiency measures?	The **Community Strategic Plan** (CSP) identifies the vision and strategic objectives of the local community. A utility should identify the water-related objectives set in the CSP, align them to IWCM outcomes, and establish collaborative arrangements to establish and evaluate potential solutions to achieve the water-related CSP objectives in their strategic planning. The **Community Engagement Strategy** should include engagement activities that seek to understand the community's values, uses, and preferences for water-related CSP objectives, including for the IWCM-related improved outcomes of water security, public health, environmental, urban amenity, and liveability. The **Resourcing Strategy** should identify the funding and staffing resources required for the delivery of IWCM outcomes. This should be detailed in the Strategic Asset Management Plan, Asset Management Strategy (AMP), Workforce Management Planning and Long-term Financial Planning. It is important to the utility's asset management planning processes for its asset classes to link appropriately with council's AMP, and accurately reflect any joint funding of assets. The utility and council need to financially account for green and blue infrastructure, and the ecosystem services such infrastructure provides, as accurately as possible. A utility should develop its technical expertise to account for IWCM-related assets more accurately over time with its increasing knowledge and experience in IWCM. The **Delivery Program** should detail the water-related actions to support achievement of the water-related strategic objectives set in the Community Strategic Plan and their corresponding IWCM outcomes, and detail how implementation will be measured, evaluated, and reported. The **Operational Plan** should detail the IWCM-related actions and projects a utility and council will undertake each year and detail any funding risks. The **Annual Report** should report back to the community on the IWCM-related work undertaken by the utility and council each year, to ensure accountability between council, the local water utility, and the community.

Appendix B: Optional how-to guidance for promoting integrated water cycle management

To support utilities in achieving the strategic planning outcome of **promote integrated water cycle management** to a reasonable standard, we offer the following optional how-to guidance.

The optional how-to guidance in this section covers a variety of areas that may help address one or more of the expectations set out in section 3 of this guidance document. The areas are also interrelated and complementary.

Defining integrated water cycle management

The NSW Water Strategy states that an IWCM approach:

> 'Promotes the co-ordinated development and management of water with land, other infrastructure, and related resources to facilitate protection of the water resource and vital ecosystems, and deliver place-based, community-centred outcomes that maximise the resilience and liveability of cities and towns.'

And further, that IWCM:

- fosters consideration of the urban water cycle early in the urban planning process
- recognises the role water plays in creating places that contribute to communities' physical and mental wellbeing
- allows a greater range of options to be identified and evaluated
- requires robust evidence-based and place-based economic and engineering analysis
- delivers solutions that enhance urban amenity and achieve better economic (financial, social, and environmental) value for the community.

As mentioned above, IWCM encompasses all the strategic planning outcomes in the *Regulation and assurance framework for local water utilities* (see section 2 and section 3 preamble) within a co-ordinated strategic planning framework that integrates water planning with urban planning.

IWCM recognises the fundamental interconnected nature of hydrological resources and that the many different uses of water are interdependent and connected to other vital natural resources (soil, air, forests, coal, oil, gas, minerals).[7] As well as integration of natural systems, IWCM regards water management as requiring integration of human systems, that bridge the water sector with

[7] Global Water Partnership 2020.

other service sectors in the economy (energy, waste, food services), and across spatial and temporal scales and levels of decision-making.

IWCM regards water as a limited resource with multiple values and conflicting and competing demands. The fundamental goal of a utility that promotes IWCM is to provide **secure water system services** that achieve the community's **shared vision** in a way that maximises their **social equity**, **environmental sustainability,** and **economic efficiency** outcomes.

This is delivered through an **integrated approach** supported by four essential enablers: effective corporate tools and management systems; broad and deep community engagement; collaborative governance; and adaptive planning (see Table 2).

IWCM is facilitated by **effective corporate tools and management systems** that provide a robust and transparent evidence base. This requires the utility and all relevant parties to share data and information effectively, and for relevant parties to have effective monitoring, evaluation and reporting methods and practices.

IWCM requires **deep engagement with a broad range of community stakeholders** to consider the local context and account for the multiple environmental, social, cultural, and economic perspectives held by the community. Community engagement enables the utility and council to establish a shared vision for its water-related future. Community engagement enables the community's multiple values and uses of water across the urban water cycle to be identified and considered in planning decisions. The overall aim is to deliver water management solutions that maximise the financial, social, and environmental benefits for the community. Broad and deep community engagement unlocks the potential to maximise the community's water-related outcomes.

IWCM requires **collaborative governance**. For council-run local water utilities, this involves local water utility staff collaborating with other council teams and creating governance arrangements that ensure the co-ordinated development and management of water with land, other infrastructure, and related resources. For county councils and joint organisations, this involves designing governance arrangements that include all the parties responsible for all elements of the urban water cycle, including for drinking water, sewerage, stormwater, and floodwater management. Collaborative governance enables place-based urban planning and helps to ensure informed and integrated water planning.

IWCM approach requires an **adaptive planning** approach. Adaptive planning is an iterative process that involves monitoring, evaluating, and reporting throughout the strategic planning cycle to enable continual learning and improvement. Adaptive planning responds well to uncertainty as it ensures decision making is based on sound and current knowledge and that decisions can adjust as information changes. This flexible approach is well-suited to tackling the challenges facing the urban water sector, such as climate change, population growth, and the increasing incidence of extreme events, including drought, bushfires, floods, and heatwaves.

An IWCM approach is inherently **risk-based** and **outcome-focused**. The department takes a risk-based approach to regulation and assurance of local water utilities that aligns with and promotes the principles of IWCM. IWCM's focus on local context enables effort to be targeted at key risks, with fit-for-purpose solutions developed to address them. These deliver on the water-related

outcomes that communities value and are willing and able to pay for. Table 2 sets out key principles and elements of an IWCM approach.

Table 2. Key principles and elements of an IWCM approach

IWCM Principles	Key elements of an IWCM approach
Shared vision	Strategic direction
	Inclusive and co-owned
Collaborative governance	Evidence-based
	Secure resourcing
	Enabling authorising environment
	Clearly assigned roles and responsibilities
	IWM leadership and champions
	Governance mechanisms
	Delivery assurance
Integrated and adaptive planning	Water and land planning alignment
	Place-based outcomes
	Adaptive planning
	Whole of urban water cycle approach
	Stormwater integration
	Systems approach
Secure water system services	Secure yield and demand analysis
	Agreed levels of service
	All options considered
	Fit-for-purpose services, solutions, and water use
	Risks and future trends considered with contingency planning
Environmental sustainability	Water quality monitoring
	Management of ecological health impacts
	Sustainable ecological health systems
Social equity	Equitable access
	All values of water considered
Economic efficiency	Economic evaluation
	Total asset management planning
	Cost-reflective water pricing
	Maximise public benefit
Community engagement	Public participation
	Aboriginal partnerships
	Community preparedness

Sources: Informed by Skinner R and Satur P 2020, Australian Government Department of Climate Change, Energy, the Environment and Water 2019, Baldwin CL & Hamstead M 2015; International Water Association 2016.

Concepts and principles related to IWCM

IWCM is often used interchangeably with similar, related terms, including integrated water resource management (IWRM), integrated urban water management (IUWM) and integrated water management (IWM), and is closely linked to the concept of a 'water sensitive city/ town'.

The key common feature of each concept is the need for an integrated approach to help address the inherent, emerging, and future challenges that face the water sector.

IWRM is the first term created to describe the concept of an alternative, integrated approach to water management. It was developed by international water and development experts and institutions such as the United Nations. In 2000, the Global Water Partnership defined IWRM as:

'a process which promotes the coordinated development and management of water, land and related resources in order to maximise economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.'[8]

IWM can be regarded as a broader concept than IWRM. IWRM places more onus on water's use as a resource, whereas IWM and IWCM also promote consideration of the non-use values of water, such as urban amenity, cultural and aesthetic values. IUWM focuses specifically on water in the urban environment and highlights the need to integrate urban development and water management.

The distinction between IWM and IWCM is unclear in the water management literature and the terms sems interchangeable. IWCM can be interpreted as focusing more on the whole-of-water cycle aspects of water management and IWM can be regarded as a more all-encompassing term that encapsulates all types of sustainable urban water management approaches that promote integration, and to more strongly consider ethical issues.

This guidance adopts the NSW Water Strategy's definition of IWCM, which is consistent with the Productivity Commission's (2020) definition of IWCM[9], as follows:

'Integrated water cycle management is the integrated management of water resources in the urban environment in a way that achieves the full suite of water security, public health, environmental and amenity outcomes that the community seeks. It encompasses all urban water, regardless of its source, and the provision of the full range of water services and water infrastructure, regardless of scale or ownership.'

Figure 7 shows that an IWCM approach contributes to water outcomes, public health outcomes, environmental outcomes, and urban amenity outcomes. Contributing to these outcomes requires integration of the water cycle and consideration of reliability, affordability, water quality, environmental impacts, and the provision of green space and water in the landscape.

[8] Global Water Partnership 2020.

[9] Productivity Commission 2020.

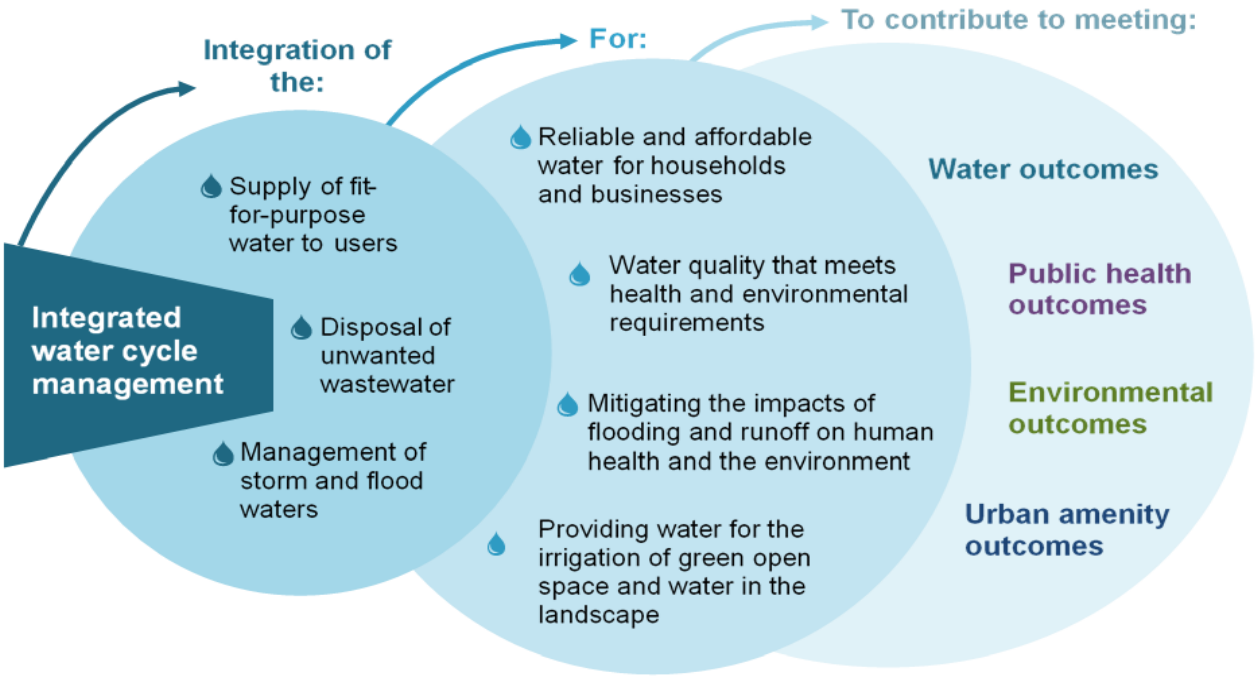


Figure 7. An integrated approach to urban water management

Source: Productivity Commission, 2020.

An IWCM approach is a key enabler of the transition to a water sensitive city. As with IWCM, a water sensitive city is achieved through consideration of the whole of urban water cycle and the identification and realisation of a broad range of water-related community-centred outcomes. Its enablers are community engagement, collaborative governance, and adaptive planning.

Water sensitive cities or 'water sensitive urban areas' or 'water sensitive towns' are generally regarded as resilient, liveable, productive, and sustainable urban environments. Water sensitive city objectives include water security, water conservation, fit-for-purpose water use, flood protection, urban amenity, diffuse source and point-source pollution minimisation.[10] Achieving these multiple objectives requires strong collaboration between organisations, disciplines, sectors and the community.

'A water sensitive city may be characterised by three key attributes (i) access to a diversity of water sources underpinned by a diversity of centralised and decentralised infrastructure; (ii) provision of ecosystem services for the built and natural environment; and (iii) socio-political capital for sustainability and water sensitive behaviours.' [11]

Local water utility transitions to IWCM and water sensitivity

Each water utility will operate from a different starting point and will have a different rate of transition to a water sensitive urban area. The starting point and rate of transition will depend on its

[10] Ferguson et al. 2012.

[11] Wong and Brown 2009.

individual circumstances and capability, and on its level of commitment to applying an IWCM approach and to improving IWCM outcomes.

The urban water transitions framework illustrated in Figure 8 depicts an urban water utility's transition from a water supply city to a water sensitive city. This figure is widely referenced in IWCM-related literature.

Transformation from a drained city to a waterways city, a water cycle city, and ultimately to a water sensitive city requires changes in the way individuals, utilities, institutions, and governments think about, use, and value water, and in the way water utilities plan, regulate, and manage water.

A utility can apply this concept to investigate the degree to which it has achieved each city state. The concept identifies the socio-political drivers and service delivery functions that a water utility can apply to help it transition to an increasingly flexible, integrated, and complex operating environment.

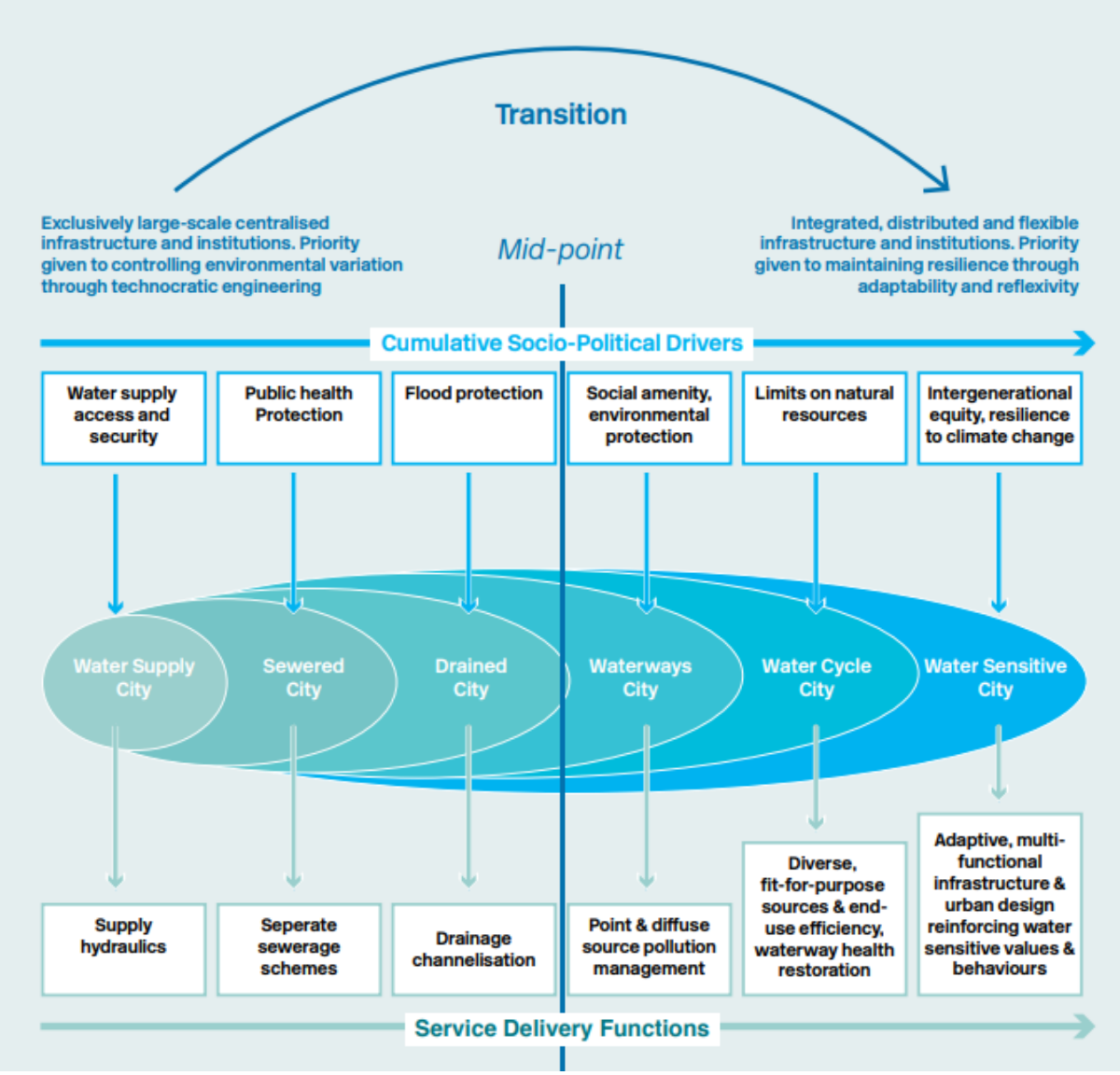


Figure 8. Urban water transitions framework.
Source: Water Sensitive Cities Australia 2022, adapted from Brown et al, 2009.

IWCM is an effective, evidence-based approach

The integrated management of water resources, through IWCM or its related terms, has become the accepted alternative to water management approaches of the past that were characterised by sector-by-sector, top-down and fragmented decision-making. Past approaches often failed to appreciate water's role in sustaining the ecological functions of the natural environment, as well as its key role in driving economic and social development.

IWCM provides a holistic and integrated planning process and decision framework that can address the risks, trade-offs, uncertainty, and variability issues characteristic of water management.

IWCM's adaptive and iterative approach is well-suited for tackling the inherent challenges and the increasing pressures that face the water sector. The inherent challenges are due to the long life of water and sewerage assets, their often large and irreversible investment profile, and the fact that, once constructed, water infrastructure solutions drive service levels, water prices, and community outcomes for decades to come. Emerging pressures include rapid population growth (in urban and regional centres), as well as fluctuating and declining populations (in regional areas); urban densification; increasing climate risks; and rising community expectations for environmental, urban amenity, and liveability outcomes. These pressures increase the demand for water services at the same time as climate change reduces rainfall and makes water sources less reliable. This all amounts to a need for substantial new investment in water infrastructure and non-infrastructure solutions.

The Productivity Commission equates IWCM with 'best practice system planning', which it defines as 'planning that integrates water supply, wastewater and stormwater planning and management – and enables utilities to efficiently pursue the full suite of water security, public health, environmental, and amenity outcomes sought by the communities they serve.'[12]

An IWCM approach has the potential to achieve greater value for communities. It is regarded as best practice system planning and enables utilities to extend past 'business-as-usual' service delivery to meet a broader suite of community outcomes (see Figure 9) through a greater range of service options, with potential solutions identified and evaluated at the outset and throughout the planning process.

[12] Productivity Commission 2021.

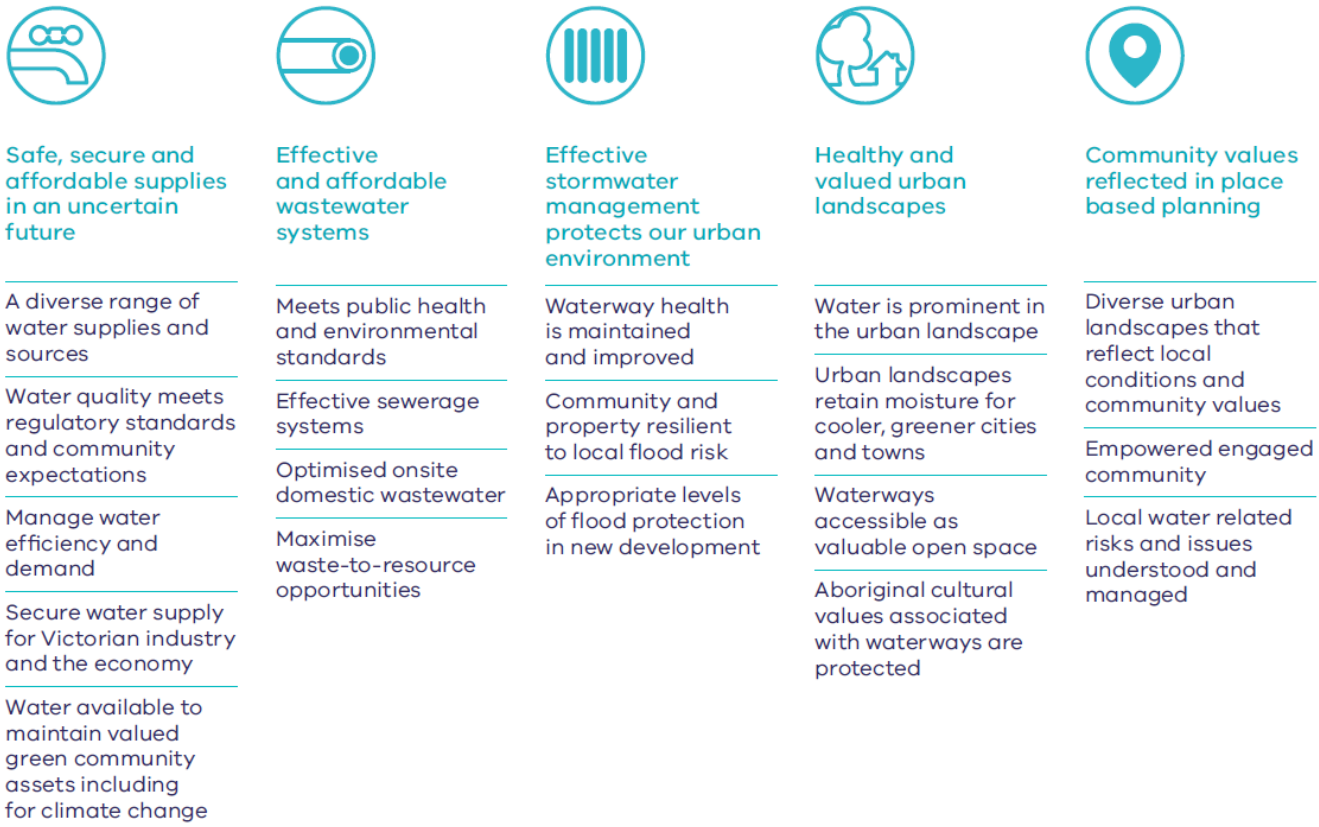


Figure 9. Water-related outcomes to deliver resilient and liveable cities and towns
Source: DELWP 2017, Integrated Water Management Framework for Victoria

An IWCM approach can realise significant monetary and non-monetary **benefits** by developing lower-cost and higher-value solutions that repurpose stranded assets, defer major infrastructure investments, adapt existing infrastructure to use new technologies, and service a broader range of community preferences.

However, the **costs** and effort required to enable IWCM can be significant. Key barriers that limit the adoption of IWCM include:[13]

- a lack of clear objectives for water-related aspects of liveability
- unclear roles and responsibilities for providing enhanced liveability
- a lack of effective collaboration arrangements
- a lack of transparent and economically robust assessments of IWCM solutions
- poor levels of integration of
    - stormwater planning with water supply and wastewater planning
    - local-scale and system-wide water planning
- a lack of environmental regulation of diffuse sources of pollution, such as stormwater.

[13] See Productivity Commission 2021, which sets out ten key impediments to the adoption of IWCM in the current policy, water service planning and delivery, and regulatory environment.

Establishing an enabling environment for IWCM that can overcome these multiple barriers requires significant changes to current policy, planning, and operating practices. The enabling activities of IWCM, such as community engagement and collaborative governance mechanisms, often require additional staffing and financial resources. Also, establishing governance mechanisms where 'everyone knows what everyone else is doing' is administratively complex, especially in water management and urban planning where existing institutional arrangements assign responsibility to multiple parties.

In some cases, the estimated costs of an IWCM solution may outweigh its estimated benefits.

For these reasons, the department will apply a flexible approach when assessing a local water utility's achievement of the outcome of promote integrated water cycle management. This flexible approach considers each local water utility's unique circumstances, capacity and capability, including its available sources of funding, the receptivity of its community, and the effectiveness of its corporate tools such as asset management systems and staff capacity.

The NSW Government is committed to IWCM

The NSW Water Strategy: Towards 2050 commits to taking an integrated water cycle management approach for urban planning, consistent with the National Water Initiative.

This commitment is detailed in NSW Water Strategy Action 6.9.

> **NSW Water Strategy Action 6.9 Promote Integrated Water Cycle Management**
>
> The Government will promote integrated water cycle management through the NSW planning system and through water management arrangements. All regional and metropolitan water strategies are developed based on an integrated water cycle management approach.

The NSW Water Strategy notes that local water utilities currently undertake integrated water cycle management planning. However, as noted above, IWCM planning is currently at a low-level of maturity across the urban water sector, including in the local water utility sector.

NSW Water Strategy implementation plans outline the key actions to deliver on the strategy for the year ahead. The 2021-22 Implementation Plan includes an action to *'make system improvements to the regulatory framework and support to enable local water utilities to implement a comprehensive IWCM approach'. The Regulation and assurance framework for local water utilities* and the suite of strategic planning and other guidance materials, including this strategic planning guidance, deliver on this action.

The 2022-24 Implementation Plan includes an action to develop a state-wide integrated water cycle management framework by December 2023. This guidance material will be updated, as necessary, to align with the state-wide framework.

The NSW Government is committed to delivering a better environment through the NSW planning system that will help make NSW more liveable and resilient, including by providing greener public spaces that improve urban amenity.

The NSW Water Strategy recognises that IWCM captures opportunities to improve all aspects of water management and provide urban amenity as part of the design and establishment of new urban precincts, urban infill, and urban redevelopment.

The urban water sector's commitment to IWCM

Water utilities, industry bodies, government, research centres, and water networks increasingly advocate for the key principles of IWCM, including the Water Services Association of Australia (IWM), the Victorian Government (IWM), the Australian Government, the Productivity Commission (IWCM and IUWM), Water Sensitive Cities Australia and Monash University's Sustainable Development Institute and the Global Water Partnership (IWRM).

An integrated approach is promoted internationally to help deliver the United Nations Sustainable Development Goals (SDGs), in particular Goal 6: Clean Water and Sanitation, and Goal 11: Sustainable Cities and Communities. The SDGs were developed in 2015 as part of the 2030 Agenda for Sustainable Development. They represent an agreed set of international priorities to address global economic, social, and environmental issues (see Figure 10).

Figure 10. United Nations' Sustainable Development Goals

Source: United Nations website.

The Global Water Partnership co-ordinates an SDG 6 Integrated Water Resource Management Support Programme to assist governments to implement IWRM at all levels by 2030.

At a national level, creating water sensitive cities and integrated urban water cycle planning and management practices, including through water sensitive urban designs, is a key element of urban water reform in the National Water Initiative (NWI).[14] The NWI is the national blueprint for water reform agreed by the Council of Australian Governments in 2004. NSW, along with other states and

14 See the National Water Initiative paragraph 92.

territories, have made ongoing commitments to NWI urban water reforms. The Productivity Commission's National Water Reform 2020 Inquiry Report called for a renewed NWI to include updated principles for best-practice urban water system planning that equate with IWCM principles.[15]

The Water Services Association of Australia (WSAA) promotes integrated water cycle management as a planning approach that can optimise water management, liveability, and the circular economy. WSAA has published IWCM principles and agreed best-practice outcomes and numerous other publications to support the industry to deliver an IWCM approach.

The Victorian Government published an Integrated Water Management Framework in 2017 and set up IWM forums across the state to drive IWM implementation. (See the Key IWCM-related references section below for weblinks to this framework and its accompanying resources.)

Sydney Water is adopting an integrated water management approach for its areas of operation. For example, in Western Sydney, it is planning for '*a more integrated, sustainable and resilient water future, that keeps water in the landscape, contributes to the circular economy, and brings about whole-of-community benefits.*'[16]

Hunter Water actively promotes an integrated water management approach and is committed to integrating sustainability principles into the way it plans and operates, and to creating liveable communities: *'We're investing in our communities by taking an integrated water management approach and working with our partners to enable growth.'*[17]

Overall, the urban water sector in Australia is at an early stage of maturity in implementing an IWCM approach. This includes large metropolitan water utilities and smaller water utilities servicing regional towns.

Improving understanding of the urban water cycle

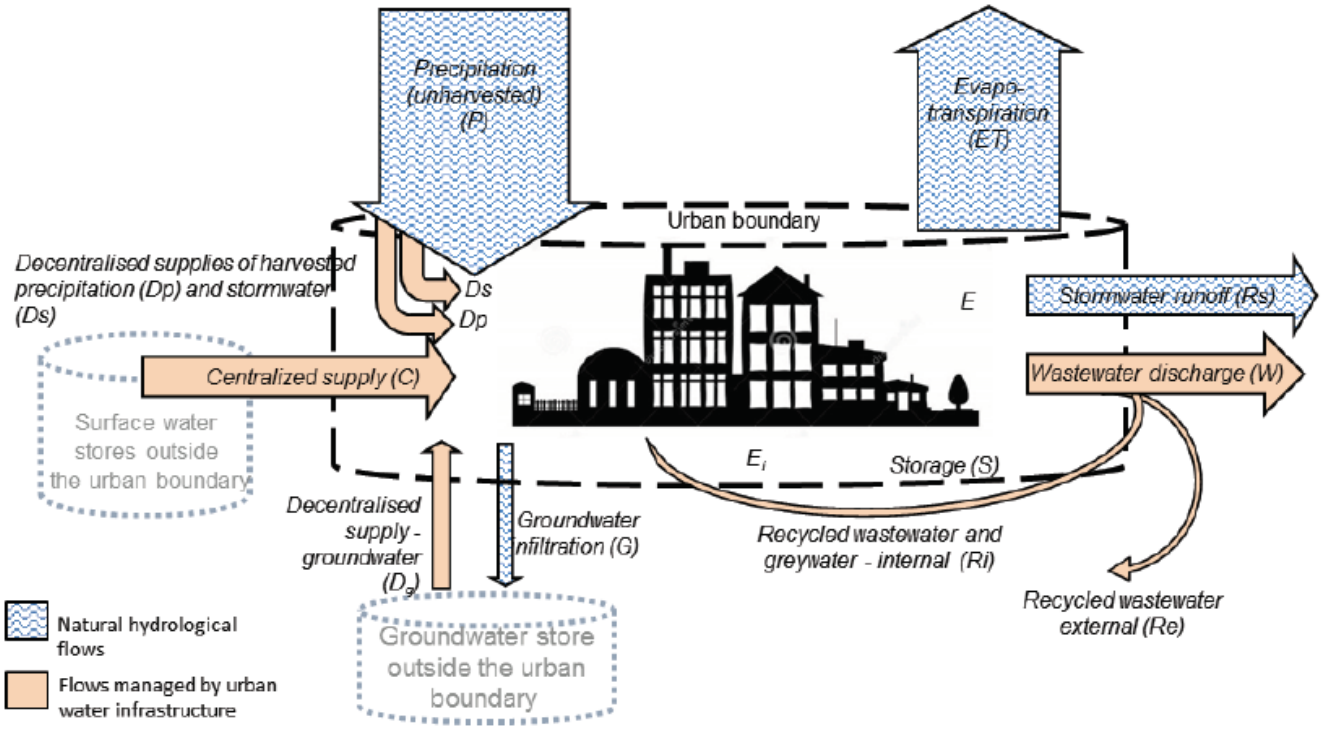
IWCM requires a utility, its community, and its collaborators to develop an improved understanding of the urban water cycle or urban water balance. Water balances help to understand the hydrological performance of cities. They account for all inputs, outputs, and storages for a given area, and recognise them as occurring within an integrated system.

To build urban water cycle literacy in the community, a local water utility may choose to develop materials to help their customers and community better understand the urban water cycle and to facilitate community engagement activities. For example, Figure 11 depicts the urban water cycle in a regional town and shows how water flows from source through to treatment processes, distribution to customers, consumption by customers, wastewater collection, wastewater treatment, and disposal.

15 Productivity Commission 2021.
16 Sydney Water 2022
17 See Hunter Water Corporation 2022

Figure 11. The urban water cycle
Source: WSAA 2021 infographic

A utility should develop a more technical understanding of how water flows through its (and relevant others') water infrastructure and the surrounding natural systems. Figure 12 depicts the flow of water into, within, and out of a defined urban system.



$$\textbf{Input (Qi)} = \textbf{Output (Qo)} + \Delta S$$

$$(P + C + D + Ri) = (ET + Rs + W + G + Ri + Re) + \Delta S \quad (1)$$

- P = Preciptation
- C = Centralised water supply
- D = Decentralised water supply
- ET = Evapotranspiration
- Rs = Stormwater runoff
- W = Wastewater discharge
- G = Groundwater infiltration
- Ri = Reuse / recycling of wastewater internally
- Re = Reuse / recycling of wastewater externally
- △S = Change in stored water volume

Figure 12. Conceptual Model and Equation for Urban Water Mass Balance

Source: Kenway et al 2011 and Farooqui et al 2016.

A utility can also use the water balance to inform where urban water cycle outcomes can be improved by modifying flows (see Appendix C for a description of the Site-scale Urban Water Mass Balance Assessment Tool that is publicly available).

A local water utility can choose to develop a progressively more detailed understanding of the urban water cycle in its area of operations by quantifying the flow of water across all inputs, outputs, and storages and breaking down these flows into meaningful sub-categories and components. Targeted analysis within these sub-categories will help a utility better understand the hydrological performance of the parts of the urban water cycle it actively manages, and to identify where it can make changes to improve its hydrological performance. It can also help a utility identify opportunities for improving urban water cycle outcomes by modifying the water balance.

For example, a local water utility could conduct a water balance analysis to monitor flows across its reticulated network (see Figure 13). The process would identify gaps and inconsistencies in monitoring data, help monitor non-revenue water and identify where real losses occur and reveal where to target water savings effort that would in turn improve water cycle outcomes. A utility could conduct similar water balance analysis across its headworks infrastructure and across its customer segments. A local water utility could also quantify water use across its council land and premises.

<table>
<tr><td rowspan="11">Source water</td><td rowspan="10">System input volume</td><td rowspan="5">Authorised consumption</td><td rowspan="3">Billed authorised consumption</td><td>Billed metered consumption</td><td rowspan="2">Revenue water</td></tr>
<tr><td>Billed unmetered consumption</td></tr>
<tr><td rowspan="3">Unbilled authorised consumption</td><td>Unbilled metered consumption</td><td rowspan="6">Non-Revenue water
(NRW)</td></tr>
<tr><td>Unbilled unmetered consumption</td></tr>
<tr><td rowspan="5">Water losses</td><td rowspan="2">Apparent losses</td><td>Unauthorised consumption</td></tr>
<tr><td>Customer metering inaccuracies</td></tr>
<tr><td rowspan="3">Current annual real losses
(CARL)</td><td>Leakage on transmission and distribution mains</td></tr>
<tr><td>Leakage and overflows at storage tanks</td></tr>
<tr><td>Leakage on service connections, up to customer meter</td></tr>
<tr><td colspan="5">Head-works losses</td></tr>
</table>

Figure 13: Reticulated network water balance dashboard

Source: Adapted from International Water Association 2020.

Establishing a good understanding of flow regimes across the urban water cycle will also enable the utility and council to allocate responsibility appropriately across its water management, stormwater management, and flood management functions, where management responses are allocated to these functions based on their different levels of flow. This will ensure the utility and council correctly allocate assets to asset classes, and that asset inventories, asset risk ratings, and asset management systems are also as accurate as possible.

It also supports accurate classification and alignment of asset levels of service and attributes (performance, condition and serviceability), asset status (quantities, replacement value, age profile, quality profile) and asset renewals and upgrades in council and utility asset management planning systems. This in turn can reveal financial sustainability issues. For example, it can reveal if there are any significant gaps between estimated asset life cycle costs and annual forecast expenditure on operation, maintenance, and renewal of assets.

For IWCM-related infrastructure solutions, such as water sensitive urban design (WSUD) stormwater control measures, accurate planning for maintenance, renewal, and upgrades is crucial to ensure these green and blue infrastructure assets continue to perform as intended and continue to provide expected urban water cycle outcomes for the community, including urban amenity and environmental outcomes. The lifecycle costs of WSUD assets can be high and therefore it is important that asset management planning systems accurately record assets and that financial planning systems adequately account for WSUD asset maintenance and renewal expenditure.

Water sensitive urban design

Water sensitive urban design (WSUD) is a planning and design approach that provides opportunities to realise the multiple objectives of IWCM and water sensitive urban areas. It integrates stormwater, potable water, and wastewater services in a holistic approach. WSUD technologies can control stormwater runoff and reduce nutrient discharges into waterways. WSUD technologies include stormwater harvesting, constructed wetlands, raingardens, swales, tree pits, permeable pavements, bioretention systems, rainwater tanks, gross pollutant traps, and green roofs and walls. Figure 14 represents an urban precinct with WSUD systems at the local and micro-scale.

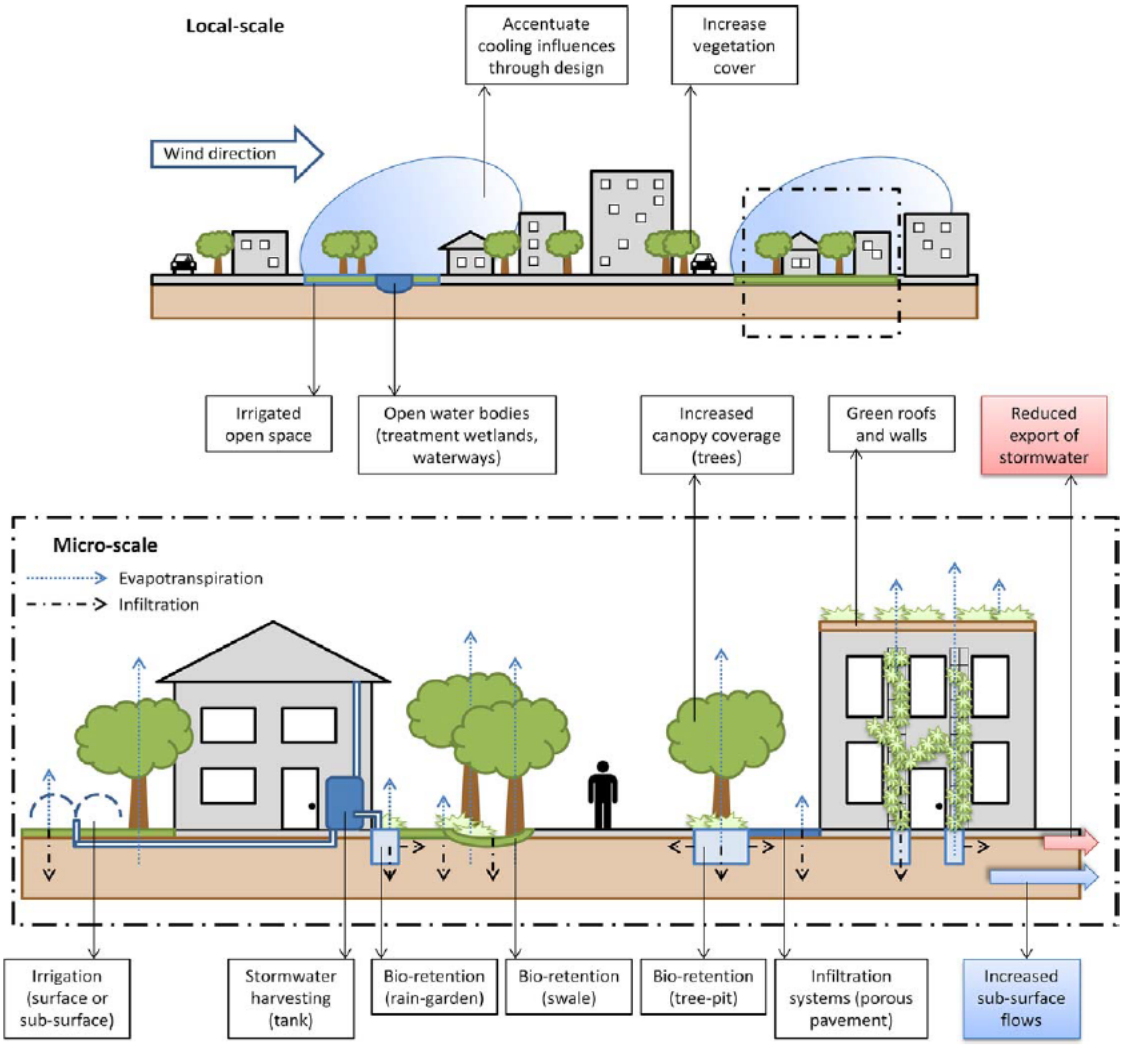


Figure 14. Illustration of a water sensitive precinct at the local and micro-scale.
Source: Coutts et al. 2013.

The main barriers to WSUD options are soil quality and space. WSUD is often constrained by clay soils with low infiltration capacity and high salinity, and by a lack of space to overlay or retrofit WSUD technologies. Permeable pavements are a WSUD system that do not require much space and are modular and compact. Where space allows, vegetated buffer zones and filtration systems in swale or basin type can be introduced (Figure 15).

Figure 15. Vegetated filtration systems in swale-type (left) and basin-type (right).
Source: Monash University 2010.

The NSW Government's commitment to resource efficiency and recovery

Under Action 6.11 of the NSW Water Strategy the NSW Government commits to foster the circular economy in our cities and towns by '*partnering with councils, water utilities, research organisations, the private sector and communities to pilot innovative urban water management that improves resource efficiency and recovery and contributes to working towards a net zero emissions future'.*

This commitment supports the NSW Government's Circular Economy Policy[18] and The NSW Waste and Sustainable Materials Strategy 2041[19], and SDG Goals 9: Thinking of innovative new ways to repurpose old materials, and Goal 12: Promoting resource and energy efficiency, reducing resource use and pollution along the whole life cycle.

NSW defines a circular economy as follows:

'A circular economy values resources by keeping products and materials in use for as long as possible. Maximising the use and value of resources brings major economic, social, and environmental benefits. It contributes to innovation, growth, and job creation, while reducing our impact on the environment.'

The NSW Waste and Sustainable Materials Strategy includes commitments to:

- reduce the amount of organic waste sent to landfill, which has implications for organic waste streams derived from the wastewater treatment process
- support circular design to reduce carbon-intensive materials and increase recycling

[18] Department of Planning and Environment (NSW) 2019.

[19] Department of Planning and Environment (NSW) 2021.

- reducing carbon emissions through better waste and materials management.

The NSW Net Zero Plan sets a goal for net zero emissions for NSW by 2050. Driving uptake of proven emissions reduction technologies and empowering consumers and businesses to make sustainable choices are priorities under the NSW Net Zero Plan that are relevant to local water utilities.

The NSW Government's commitment to water efficiency

The department has a strong commitment to water efficiency. The department established a revitalised Water Efficiency Program in 2021 under Action 6.6 of the NSW Water Strategy. Action 6.6. committed the NSW Government to implement a state-wide Water Efficiency Framework and Program for urban water following consultation with key stakeholders, including local water utilities.

Water Efficiency Framework

The department is developing the NSW Water Efficiency Framework (see Figure 16). The framework is a best-practice guide for utilities to plan, implement and review water efficiency initiatives that are relevant to the local context. It sets out a step-by-step process that utilities can use no matter their existing level of maturity.

The framework has 3 phases: plan; implement; review, and 5 key elements: establish context; analyse the situation; develop the response; design and deliver options; monitor, report; and adapt. Community engagement, secure resourcing, effective governance, and capturing and sharing knowledge are key activities to enable effective water efficiency decision-making.

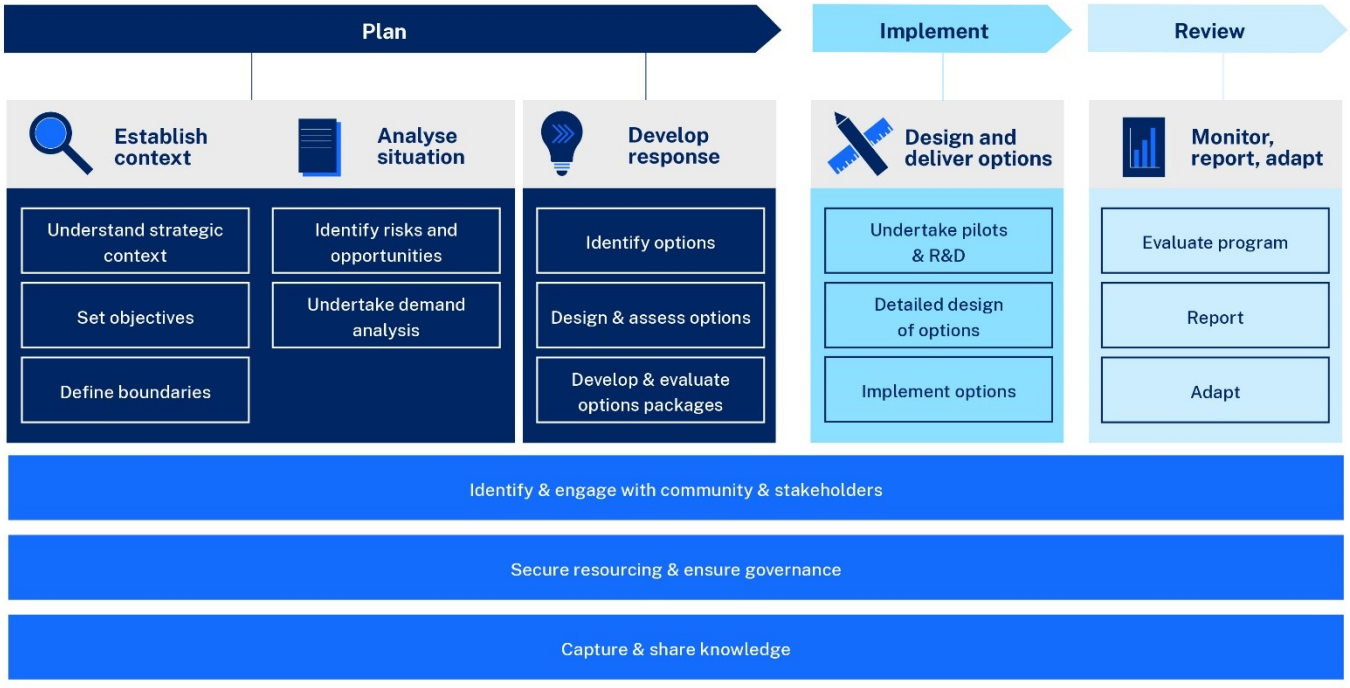


Figure 16. NSW Water Efficiency Framework
Source: DPE 2022.

Water Efficiency Program

The Water Efficiency Program seeks new ways and approaches to working with the community to ensure we have secure, reliable water sources and build future resilience to climate change and droughts. It includes commitments for the department to provide a clear statement of government policy; collaborate with government and across the water sector; focus on building water efficiency capacity, gaining a greater understanding of water use, improving the evaluation of water efficiency initiatives and increasing private sector involvement; and to evaluate the effectiveness of BASIX (the Building Sustainability Index).

Key aspects of the Water Efficiency Program to date have been:

- establishing the Regional Leakage Reduction Program
- rolling out a washing machine replacement trial
- partnering with the Water Conservancy in support of local water utilities and councils providing Smart Water Advice resources
- partnering with NABERS to support buildings to achieve a first-time water rating.[20]

The Regional Leakage Reduction Program addresses network leakage and water loss as a priority. The need to focus on local water utilities' network leakage and water losses became apparent during the drought and has been reinforced during consultation with Councils and the wider sector.

The department is undertaking the program in collaboration with the NSW Water Directorate and local water utilities. The program targets areas where the NSW Government can provide the most value to local water utilities, enhancing their ability to identify and fix leaks as part of their asset management planning. The first stage of the program aims to save up to 7.5 billion litres of water by the end of 2024.

Part of the program involves the department providing specialist leak detectors who use technology such as high-powered listening devices to pinpoint leaks in pipes, meters, and valves. This then allows local water utilities to act quickly to fix leaks. As of 30 September 2022, more than 2750 kilometres of water mains had been surveyed and more than 930 leaks detected. Repairs by local water utilities to date have saved more than 800 million litres of water per year. A further 7500km of pipeline is to be surveyed by the end of 2023. Other department and local water utility co-funded projects are under way across 24 council areas to improve water supply infrastructure, such as bulk water meters and network pressure reduction valves.

The NSW Government is also encouraging utilities to increase water literacy. The department partnered with the Water Conservancy to support local water utilities and councils provide Smart Water Advice resources. The Water Conservancy's Smart Water Advice is a resource designed to help water utilities, businesses, and councils provide professional water efficiency information to their customers. This improves community awareness and understanding and influences communities' water efficiency and water waste behaviour.

20 NABERS is a national rating system that measures the energy, water and waste performance, and the indoor environmental quality, of Australian buildings and tenancies.

The department is making water efficiency-related school education content available on its website and sending teacher resource packs to regional primary schools. This initiative is aimed at improving the water literacy of teachers so they can educate their communities. These resources encourage the community to investigate and reach out to their local water utility to find out where their water comes from, how it is used, and where it goes after being used.

A range of other initiatives are under development.

Key IWCM-related references

There is an extensive literature on integrated water cycle management and its related concepts. Key reference materials related to promoting integrated water cycle management and referred to in this guidance are listed below.

NSW Government publications

The New South Wales Water Strategy August 2021

The New South Wales Water Strategy Implementation Plan 2021-2022

The New South Wales Water Strategy Implementation Plan 2022-2024

Productivity Commission publications

Productivity Commission 2020, Integrated Urban Water Management – Why a good idea seems hard to implement, Commission Research Paper, Canberra

Productivity Commission, National Water Reform 2020, Inquiry Report

Water Services Association of Australia (WSAA) publications

Skinner, R and Satur, P, 2020. Integrated Water Management: Principles and best practice for water utilities, prepared for WSAA

WSAA 2019, Blue+Green=Liveability

Victorian Government publications

Integrated Water Management Framework for Victoria

Technical resources and guidelines to support integrated water management in Victoria

International Water Association (IWA) publications

The IWA Principles for Water Wise Cities, 2016

Global Water Partnership publications

IWRM toolbox

CRC for Water Sensitive Cities publications

Water Sensitive Cities Australia publications

Academic publications

Ferguson, B. C., Frantzeskaki, N., & Brown, R. R. 2013, A strategic program for transitioning to a Water Sensitive City. Landscape and Urban Planning, 117, 32 – 45

Brown, RR, Keath, N, Wong, THF 2009, 'Urban water management in cities: historical, current and future regimes', Water Science & Technology, 59(5), 847-855

Appendix C: Templates, case studies and tools

To support utilities in achieving the strategic planning outcome **promote integrated water cycle management** to a reasonable standard, we give the following optional how-to tools, frameworks, and processes.

Urban WaterGuide: Building Sustainable and Resilient Cities

The Urban WaterGuide provides practical guidance to water planners and urban planners on how to operationalise an IUWM approach. It provides an introduction to IUWM and then sets out a 5-step approach to help cities achieve multiple water-related outcomes. The guide was developed in partnership by the Australian Government, Australian Water Partnership and the Cooperative Research Centre for Water Sensitive Cities. It has an international development focus and draws on Australian case studies to demonstrate its application.

1	• Define the boundary • Gather stakeholders • Understand your context • Build a shared vision
2	• Water cycle strategy • Urban strategy • Leapfrogging as a strategy
3	• Design for multiple functions and multiple benefits • Connect centralised and decentralised solutions • Co-design solutions • Evaluate for value, not just least cost
4	• Convert planning solutions into actions and an implementation plan • Foster community support • Agree who is paying for it • Build delivery partnerships • Accelerate innovation
5	• Thinking politically • Working politically • Building influencing skills

Figure 17. Urban WaterGuide steps and objectives
Source: CRC for Water Sensitive Cities 2022.

Weblinks:

- Guide summary
- Full version:

CRC for Water Sensitive Cities and Water Sensitive Cities Australia

The CRC for Water Sensitive Cities produced a body of research and tools from 2012 to 2021 to benchmark, envisage, and develop strategies to transition to a water sensitive city; to plan and assess water sensitive city solutions; and to design, evaluate and implement water sensitive city practices.

The CRC for Water Sensitive Cities has now transitioned to Water Sensitive Cities Australia (WSCA), which operates in partnership with the Monash Sustainable Development Institute. The CRC for Water Sensitive Cities outputs are available through WSCA. WSCA will work to improve, build on and disseminate CRC for Water Sensitive Cities research and tools.

The CRC for Water Sensitive Cities has published a webinar that introduces its research and tools and explains how the tools might be applied in metropolitan and regional contexts in NSW.

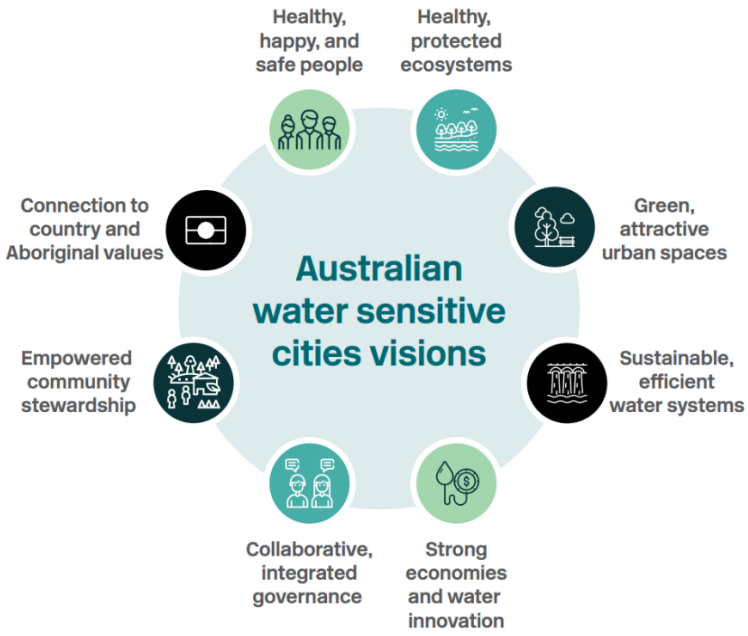


Figure 18. Themes from Australian water sensitive cities visions

Source: Hammer et al 2020.

Weblinks:

https://watersensitivecities.org.au/

https://watersensitivecities.org.au/tools/

https://watersensitivecities.org.au/content/nsw-webinar-series-webinar-1-planning-for-a-water-sensitive-city-why-its-important-for-metro-and-regional-councils/

Water Sensitive Cities integrated urban and water planning framework

The Water Sensitive Cities integrated urban and water planning framework aims to help practitioners design collaborative, context-sensitive, and integrated approaches to urban and water planning. The framework aims to prompt practitioners to think holistically about their context and design their own planning pathways for delivering water sensitive urban development. It identifies 5 planning activities as represented in Figure 19.

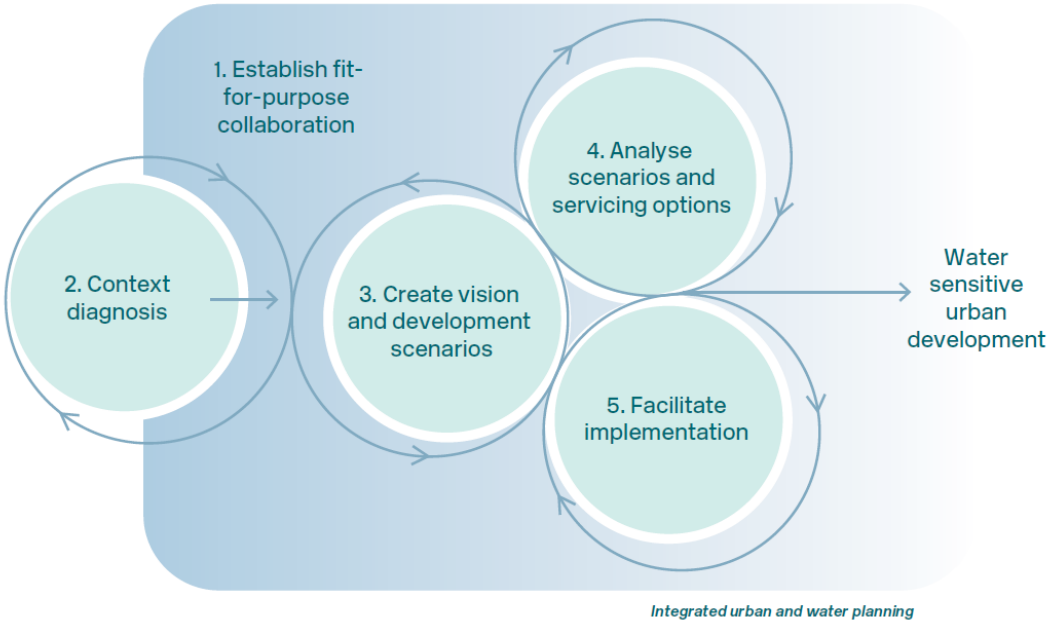


Figure 19. The five interrelated planning activities for advancing water sensitive outcomes through the urban development process

Source: Chesterfield et al 2021.

Weblinks:

https://watersensitivecities.org.au/guiding-integrated-urban-and-water-planning-framework/

Water Sensitive Cities transition phases

The CRC for Water Sensitive Cities identifies 6 phases of transition to a water sensitive city. Three phases have an associated tool: the Water Sensitive Cities Index; the Transition Dynamics Framework (detailed below); and the Management Actions Tool.

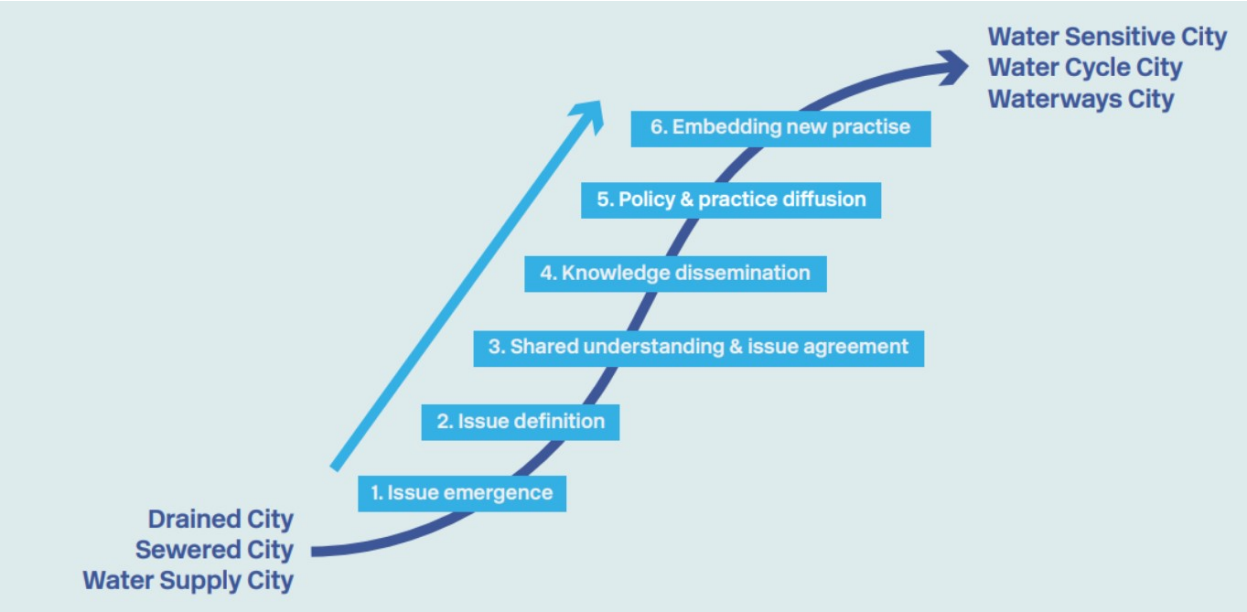


Figure 20. The six transition phases to a water sensitive city
Source: Brown et al 2016.

Weblinks:

https://watersensitivecities.org.au/wp-content/uploads/2022/08/WSC-Transition-Tools-Provider-Manual.pdf

Water Sensitive Cities Index

The Water Sensitive Cities Index is a benchmarking tool developed by the CRC for Water Sensitive Cities to assess the overall urban water system performance of a city or urban area. It evaluates performance against 34 indicators and 7 goals using a quantitative measure approach to determine its status as a water sensitive city.

The benchmarking process helps establish a shared understanding of a city's existing management arrangements; gain insight into the range of outcomes a water sensitive city can provide and of the available solutions; identify the strengths, weaknesses, and gaps in current arrangements; and to develop a transition strategy towards a water sensitive city. A number of research reports and case studies are publicly available, and the index tool can be purchased through Monash University.

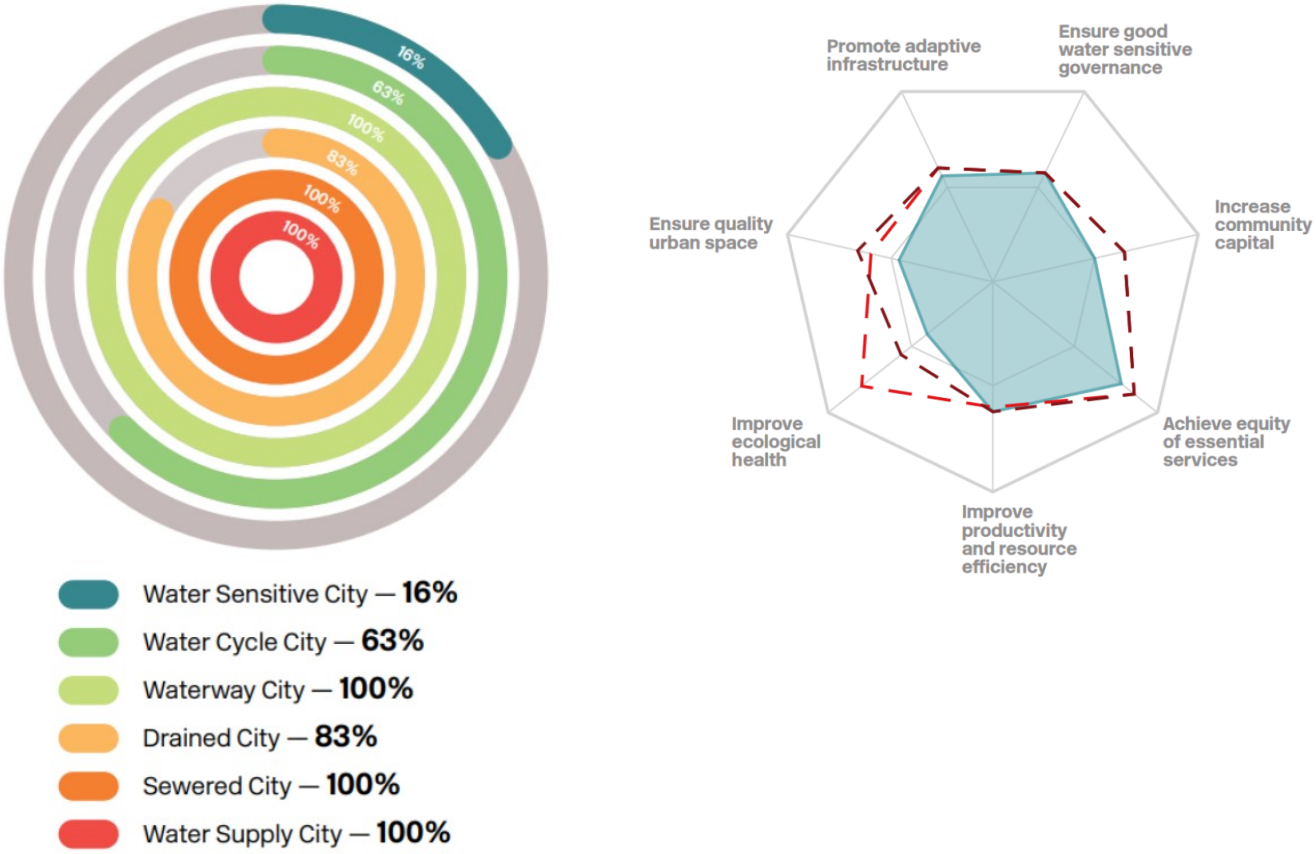


Figure 21. Examples of Water Sensitive City Index results
Source: CRCWSC 2018a & CRCWSC 2019.

Weblinks:

https://watersensitivecities.org.au/water-sensitive-cities-index-tool/

https://www.sciencedirect.com/science/article/pii/S0043135420309465#!

https://shop.monash.edu/water-sensitive-cities-index.html

Water Sensitive Cities Transition Dynamics Framework

The Transition Dynamics Framework is a software tool developed by the CRC for Water Sensitive Cities that maps the six transition phases of change and six enabling factors that drive change into a matrix. The Transition Dynamics Framework process helps stakeholders make sense of their current institutional conditions, develop priorities, and identify strategies for accelerating their urban area's transition to a water sensitive city/town.

	Transition Phase	Champions	Platforms for connecting	Knowledge	Projects and applications	Tools and instruments
Desktop Preview	1. Issue emergence	Issue activists		Issue highlighted	Issue examined	
	2. Issue definition	Individual champions	Sharing concerns and ideas	Causes and impacts examined	Solutions explored	
Participant Review	3. Shared understanding & issue agreement	Connected champions	Developing a collective voice	Solutions developed	Solutions experimented with	Preliminary practical guidance
	4. Knowledge dissemination	Influential champions	Building broad support	Solutions advanced	Solutions demonstrated at scale	Refined guidance and early policy
Benchmarking discussion (WS1)	5. Policy and practice diffusion	Government agency champions	Expanding the community of practice	Capacity building	Widespread implementation and learing	Early regulation and targets
	6. Embedding new practice	Multi-stakeholder network	Guiding consistent application	Monitoring and evaluation	Standardisation and refinement	Comprehensive policy and regulation

Figure 22. The Traditional Dynamics Framework matrix.
Source: Hammer et al 2020.

Weblinks:

https://watersensitivecities.org.au/transition-dynamics-framework-tool/

Water Sensitive Cities Investment Framework for Economics of Water Sensitive Cities Benefit Cost Analysis and Values Tools

The Investment Framework for Economics of Water Sensitive Cities (INFFEWS) **Benefit Cost Analysis Tool** is an Excel-based economic evaluation tool developed by the CRC for Water Sensitive Cities. It enables users to compare the benefits of a water sensitive project with its costs and determine whether the project demonstrates value for money and would support an investment decision to go ahead. The Excel worksheets lead users through a structured and systematic process to define the project, identify project options, identify information requirements and gaps, and to perform the benefit cost analysis. The tool is consistent with best-practice economic evaluation frameworks and Australian and NSW Government cost benefit analysis guidelines. The tool is flexible and easy to use.

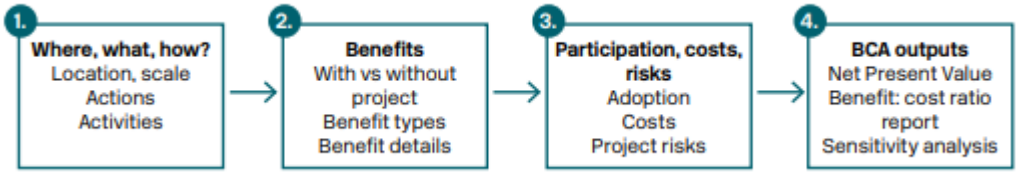


Figure 23. The Benefit Cost Analysis Tool economic assessment steps.
Source: CRC for Water Sensitive Cities 2020.

The tool can be downloaded for free at the link below.

Weblinks:

https://watersensitivecities.org.au/investment-framework-for-economics-of-water-sensitive-cities-inffews-benefit-cost-analysis-tool/

https://shop.monash.edu/benefit-cost-analysis-tool.html

The INFFEWS **Values Tool** is an Excel-based database developed by the CRC for Water Sensitive Cities of more than 2,000 non-market values relevant to water sensitive projects. It allows users to value the social and environmental benefits of projects and for these values to be incorporated into benefit cost analyses. A primary study to estimate the monetary value of non-market benefits, such as a willingness to pay (WTP) study, is the ideal method to determine the value a community would assign to the non-market benefits of a proposed water project. However, WTP studies are expensive and complex and are usually only conducted to support large investment decisions. The Values Tool can provide users with a reasonable approximation of the non-market benefits of a project based on the benefits established through previous studies. The INFFEWS **Benefit Cost Analysis Tool** allows users to compare the non-market benefits drawn from the **Values Tool** to the total benefits of the project and supports scenario testing to examine the degree to which these non-market benefits influence the investment decision.

The tool is available for purchase at the link below.

Weblinks:

https://watersensitivecities.org.au/investment-framework-for-economics-of-water-sensitive-cities-inffews-value-tool/

https://shop.monash.edu/value-tool-annual-subscription.html

Water Sensitive Cities Scenario Tool

The Water Sensitive Cities Scenario Tool is a geospatial modelling tool that can simulate real life urban development scenarios and assess the multiple benefits of these scenarios over time. Developed by the CRC for Water Sensitive Cities, the Scenario Tool integrates four analytical modules, an urban development module, land surface temperature module, air temperature response module and an urban water cycle module. Users can also upload customised data sets.

The tool allows the user to compare urban development scenarios in terms of their urban heat, density, greening and water management impacts and to create visual representations of the relative changes. Access to the tool is available through registration.

Weblinks:

https://watersensitivecities.org.au/water-sensitive-cities-scenario-tool/

The Site-scale Urban Water Mass Balance Assessment Tool

The Site-scale Urban Water Mass Balance Assessment (SUWMBA) Tool is an Excel-based tool developed by the CRC for Water Sensitive Cities that measures water flows into, through, and out of an urban area.

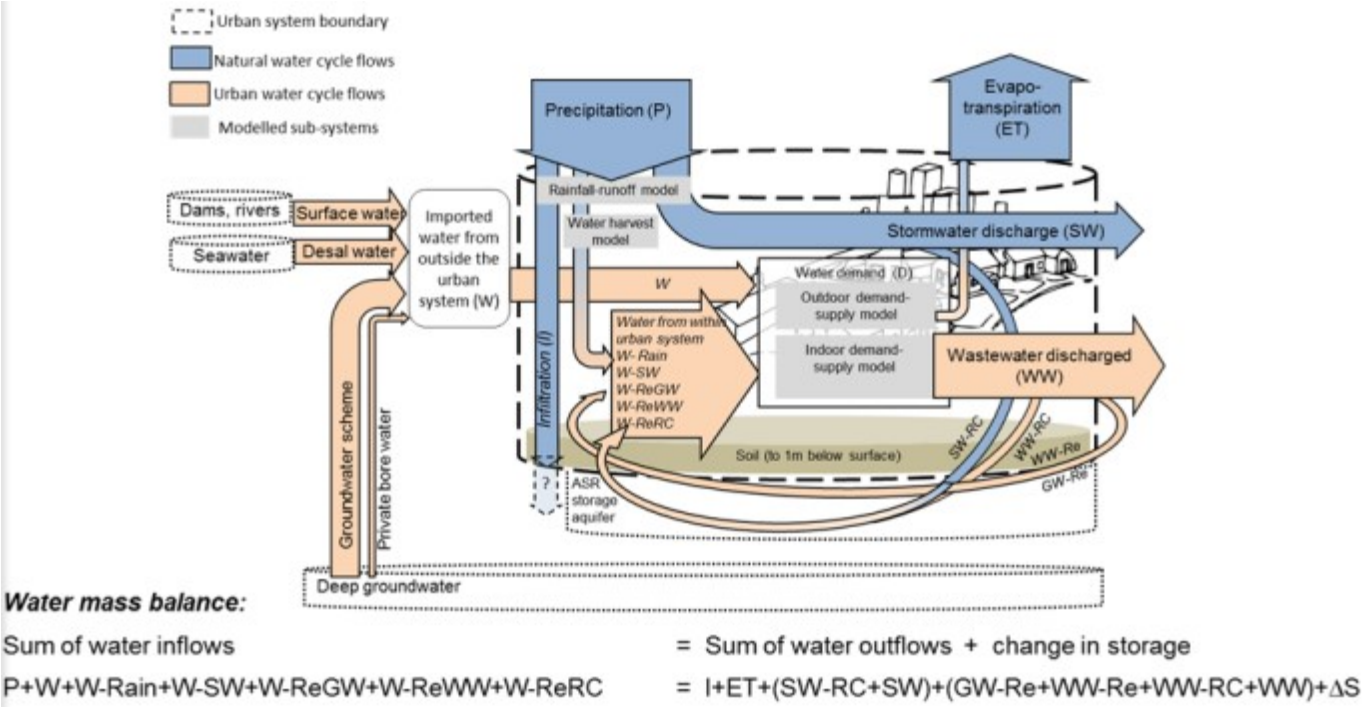


Figure 24. Urban water mass balance
Source: Moravej et al 2020.

The tool produces an urban water mass balance, which is a comprehensive account of all water flows in both the natural and human-made water cycles. The tool can be used to consider how water performance is affected by water servicing features, built form design, and environmental conditions. The tool can be downloaded for free at the link below.

Weblinks:

https://watersensitivecities.org.au/site-scale-urban-water-mass-balance-tool-suwmba/

The Water Conservancy

The Water Conservancy (previously known as Smart Approved WaterMark) is an independent water efficiency advisory and certification service provider.

Its certification program independently certifies water efficient products and services in Australia. For householders, the certification scheme is designed to provide confidence that products and services bearing the label will help save water around the home and garden. For the water industry, the scheme provides a national mechanism to identify water saving products and services.

Its Smart Water Advice program is a subscription resource that helps water utilities and councils provide professional water efficiency information to their customers.

Weblinks:

https://thewaterconservancy.org/

https://thewaterconservancy.org/smart-approved-watermark/

https://thewaterconservancy.org/smart-water-advice/

http://www.smartwateradvice.org/

Glossary

Blue infrastructure	Infrastructure Australia defines blue infrastructure as: '*Beaches and waterways, such as harbours and rivers, and the facilities that support them, including foreshores, surf lifesaving and water recreation clubs, jetties and wharves*.' (Infrastructure Australia 2019).
Diffuse pollution	Pollution that originates from many sources, such as stormwater runoff over land. Diffuse pollution, however, is more difficult to regulate and control than point source pollution given it originates from a large area. Diffuse sources now contribute approximately 75% of all pollution in the river. Diffuse pollution controls can include stormwater harvesting, constructed wetlands, raingardens, swales, tree pits, rainwater tanks, gross pollutant traps, porous asphalt, and infiltration chambers (Productivity Commission 2020).
Fit-for-purpose services and solutions	Infrastructure solutions and non-infrastructure service solutions that are designed to treat water to a standard that is appropriate for its intended purpose and/or service level.
Fit-for-purpose water	Water that is treated to a standard that is appropriate for its intended use.
Green infrastructure	Infrastructure Australia defines green infrastructure as: '*The range of natural and built landscape assets which incorporate natural vegetation. It includes areas of public and private land such as parks, fields, verges, rooftop gardens, green facades, walking and cycling tracks, street trees and backyards.*' (Infrastructure Australia 2019).
Integrated Urban Water Management (IUWM)	The Global Water Partnership defines IWRM as an approach that integrates planning for the water sector with other urban sectors, such as land, housing, energy, and transport to avoid fragmentation and duplication in policy and decision-making. IUWM brings together water supply, sanitation, stormwater, and wastewater management and integrates them with land use planning and economic development.
Integrated Water Cycle Management (IWCM)	The NSW Water Strategy states that an IWCM approach '*promotes the co-ordinated development and management of water with land, other infrastructure, and related resources to facilitate protection of the water resource and vital ecosystems, and deliver place-based, community-centred outcomes that maximise the resilience and liveability of cities and towns'.*
Integrated Water Cycle Management (IWRM)	IWRM is the first term created to describe the concept of an alternative, integrated approach to water management. It was developed by international water and development experts and institutions such as the United Nations. The Global Water Partnership defines IWRM as: '*A process which promotes the co-ordinated development and management of water, land and related resources in order to maximise economic and social welfare in an*

	equitable manner without compromising the sustainability of vital ecosystems.' (Global Water Partnership 2000)
Integrated Water Management (IWM)	The distinction between IWM and IWCM is unclear in the water management literature and the terms are interchangeable. IWCM can be interpreted as focusing more on the whole-of-water cycle aspects of water management and IWM can be regarded as a more all-encompassing term that encapsulates all types of sustainable urban water management approaches that promote integration, and to more strongly include ethical considerations.
Liveability	The term liveability is widely used but is not well defined. WSAA defines a liveable city or region as one that '*...meets the social, environmental and economic needs of its people. It also addresses community values and preferences for amenity, wellbeing and a sense of place. To be long lasting and resilient a liveable city or region must consider the needs of future generations to understand and respond to shocks and long-term change*.' (WSAA 2019a) The Urban Research Centre at RMIT University defines a liveable community as one that is '*safe, attractive, socially cohesive and inclusive, and environmentally sustainable; with affordable and diverse housing linked by convenient public transport, walking and cycling infrastructure to employment, education, public open space, local shops, health and community services, and leisure and cultural opportunities.*' (Centre for Urban Research RMIT University 2017)
National Water Initiative (NWI)	The NWI was agreed by the Council of Australian Governments (COAG) in 2004 and is Australia's national water reform blueprint. The NWI provides an overarching framework and principles for the sustainable management of water resources.
Point-source pollution	Pollution that comes from a single identifiable source, most often a pipe outlet that discharges wastewater into waterways. Environmental regulators (such as the NSW Environment Protection Authority) issue licences for point source wastewater discharges from water utilities to minimise their impact on the environment.
Sustainable Development Goals (SDGs)	The SDGs are a collection of 17 interlinked global economic, social and environmental goals designed to be a *'shared blueprint for peace and prosperity for people and the planet, now and into the future'* (United Nations 2015). The SDGs were adopted by all United Nations Member States in 2015 as part of the 2030 Agenda for Sustainable Development.
Urban amenity	The term urban amenity can be regarded as a key component of liveability. The Productivity Commission defines the term urban amenity as: *'The overall quality of the built form and natural environment impacting on the level of human enjoyment, and public and private spaces. Other elements of amenity include landscape amenity (features such as the provision of high quality green open space, trees, plantings and lawns that add to the quality of the landscape in a city environment), level of noise, air quality and sunlight. The word "amenity" is often used to describe a pleasing or agreeable environment.'* (Productivity Commission 2020)
Urban cooling	The process of reducing heat in the built environment of an urban area. Urban cooling can be achieved through natural open spaces, natural waterways, WSUD features

	that hold water, and tree coverage that absorbs heat from the surrounding environment.
Water sensitive cities, water sensitive urban areas, water sensitive towns	Water sensitive cities, water sensitive urban areas and water sensitive towns are generally regarded as urban environments that are resilient, liveable, productive and sustainable. Water sensitive city objectives include water security, water conservation, fit-for-purpose use, flood protection, pollution minimisation, urban amenity and broad stakeholder participation. '*A water sensitive city may be characterised by three key attributes (i) access to a diversity of water sources underpinned by a diversity of centralised and decentralised infrastructure; (ii) provision of ecosystem services for the built and natural environment; and (iii) socio-political capital for sustainability and water sensitive behaviours.*' (Wong and Brown 2009).
Water sensitive urban design (WSUD)	WSUD can be regarded as both a planning and design approach that involves designing buildings, landscapes and stormwater control measures to reduce or slow stormwater runoff, and as a form of design of stormwater abatement and quality control measures. WSUD measures increase the extent to which water infiltrates the soil, reduce pollution and provide opportunities for stormwater reuse. WSUD provides opportunities to realise the multiple objectives of IWCM and enables the transition to a water sensitive city.

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