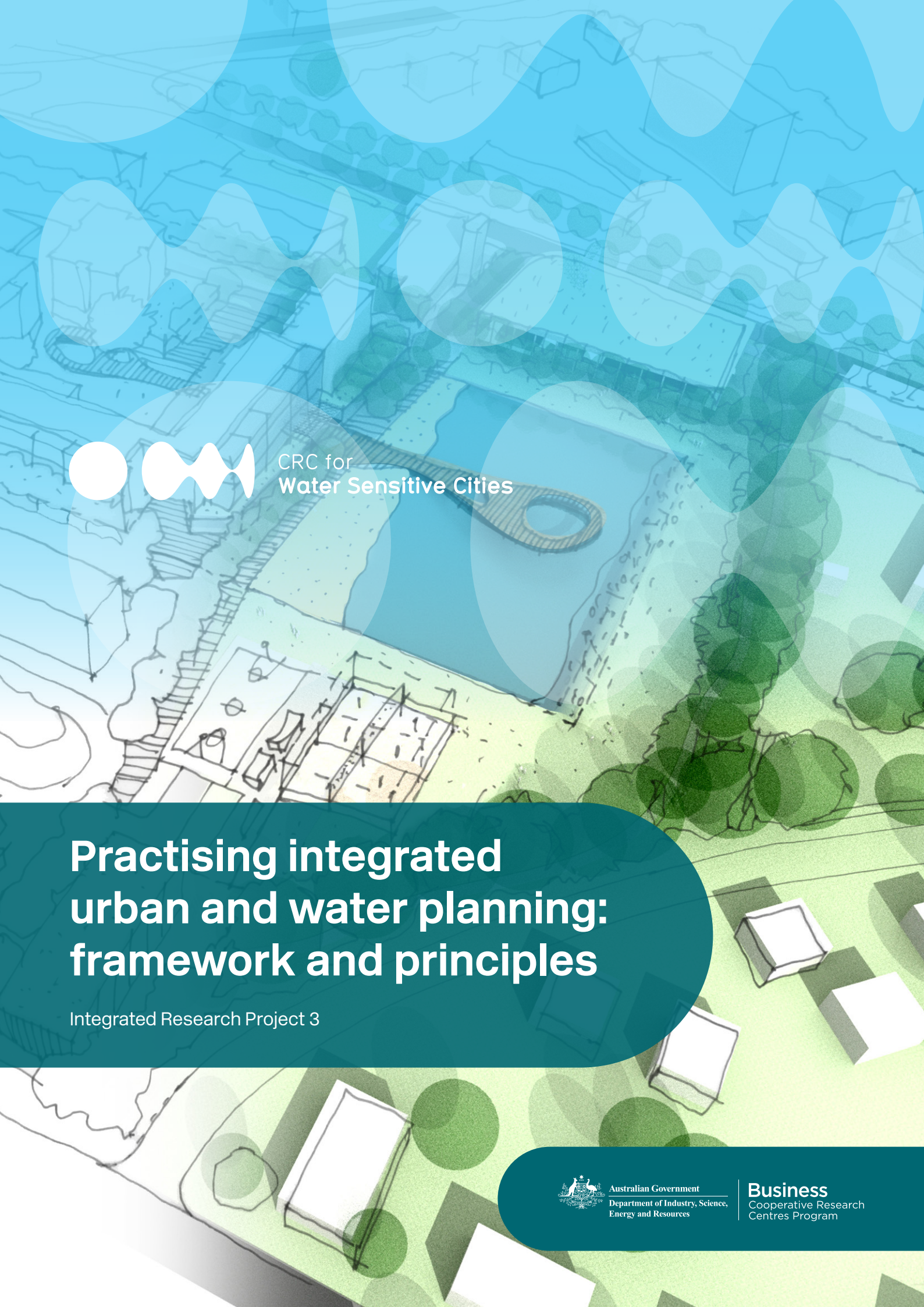

CRC for
Water Sensitive Cities

# Practising integrated urban and water planning: framework and principles

Integrated Research Project 3

Australian Government
Department of Industry, Science, Energy and Resources

Business
Cooperative Research
Centres Program

**Practising integrated urban and water planning: framework and principles**
*Guiding integrated urban and water planning* (IRP3)
IRP3-2-2021

**Authors**

Chris Chesterfield[1,4], Sylvia Tawfik[1,2,4], Shirin Malekpour[3,4], Catherine Murphy[1,4], Nigel Bertram[1,4] and Casey Furlong[5]

Illustrations and drawings by David Mason, Oscar Sainsbury and Dharmishta Painter[1]

[1]Monash Art, Design and Architecture, Monash University
[2]School of Social Sciences, Monash University
[3]Monash Sustainable Development Institute, Monash University
[4]Cooperative Research Centre for Water Sensitive Cities
[5]GHD



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Cooperative Research Centre for Water Sensitive Cities
PO Box 8000
Monash University LPO
Clayton, VIC 3800

**e**. admin@crcwsc.org.au
**w**. www.watersensitivecities.org.au

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# Introduction

Urban planning in Australia's major cities has struggled to accommodate population growth in a way that promotes water sensitivity. Conventional development practices—increasing urban sprawl and piecemeal densification—place pressure on existing infrastructure and the environment, and commonly lead to more impervious surfaces, urban heat, degraded waterways, as well as a loss of biodiversity and green open space. Under this trajectory, cities will not be able to meet policy aspirations for sustainability, liveability, resilience and productivity, highlighting a significant gap between strategic city-shaping goals and on-ground practices. This poses a challenge for the planning of cities as they continue to accommodate a growing population in the context of increasing resource scarcity, climatic shifts and economic change.

If cities are to protect and enhance their particular environmental, cultural, social and economic values, the role of water in shaping city form and function needs to be more clearly recognised and advanced in the planning and management of urban growth, as emphasised in the concept of a 'water sensitive city'. To date, the water sector has largely focused on ways to optimise community benefits through an integrated, total water cycle approach to the planning and management of all water services (i.e. water supply, wastewater, drainage, waterway health). Despite these efforts, it has become evident that such benefits cannot be realised by the water sector working in isolation. There is a need to strengthen connections with other sectors, like urban planning, to advance synergies between water systems and other features of urban environments, such as built form, streetscapes and open space networks.

The CRC for Water Sensitive Cities' (CRCWSC) Integrated Research Project 3 (IRP3), *Guiding integrated urban and water planning*, recognises that achieving water sensitive outcomes requires water considerations to be elevated and better integrated within the urban development process. The project has, through stakeholder consultation and case study research, developed a simple planning framework to guide a more holistic and place-based approach to planning.

This document describes this framework. It highlights five key activities for integrating urban and water planning, illustrated with case examples from across Australia. The framework seeks to guide practitioners, particularly those involved in planning urban development or water services, in designing collaborative, context-sensitive and integrated approaches to urban and water planning.

## The framework

While planning systems and practices vary across Australian jurisdictions, the proposed framework can be applied in a wide range of contexts. It provides a conceptual representation of the urban development process and highlights five distinct but interrelated planning activities for advancing water sensitive outcomes (Figure 1).

1. **Establish a fit-for-purpose collaboration** – Explicitly design appropriate collaborative arrangements that bring together relevant stakeholders from different sectors to define and advance a shared agenda for the development and ongoing custodianship of place. This activity is a central component of the framework, providing the forum/s for carrying out all other planning activities.
2. **Investigate the development context** – Undertake a holistic investigation to understand the biophysical and socio-institutional attributes of a place in order to identify distinct local opportunities and challenges. This activity provides the data and information inputs needed to undertake all other planning activities.
3. **Create a place-based vision and alternative development scenarios** – Create a shared vision that captures and articulates the desired quality (e.g. look, feel and function) of a place, aligns stakeholder aspirations, and builds collective momentum towards its realisation. The vision also serves as a guidepost for preparing more specific development scenarios that depict alternative development pathways.
4. **Analyse development scenarios and servicing options** – Undertake iterative processes of testing, comparing and refining development scenarios and underpinning servicing options to identify the ideal scenario and options that optimise performance across all desired outcomes (e.g. water quality, public amenity, thermal comfort, connectivity, economic viability) and delivers maximum benefit to the community.
5. **Facilitate implementation** – Embed the optimised development scenario and servicing options within policies and plans, funding and financing, and service delivery arrangements to ensure they are delivered on the ground as envisioned. Since urban development may take a considerable period of time, it is important to put in place coherently designed planning instruments and clear governance arrangements that enable desired outcomes.

The following core principles guide the framework. These are critical to understanding how the framework should be interpreted and applied:

- **Different entry points** – The planning activities represented in the framework will rarely occur in a strictly linear fashion. They are more likely to be undertaken iteratively, with potential overlaps in the processes and timing of different activities. This creates different entry points for integrated urban and water planning that can each effectively facilitate water sensitive outcomes.
- **Contextual awareness** – There is no one-size-fits-all approach to integrated urban and water planning. The unique enabling and constraining features of a particular context need to strongly inform the planning, design and implementation of urban development.
- **Multi-scalar perspective** – The focus of planning activities should not be confined to the site or precinct under investigation; a place should also be understood within its broader catchment and regional context. This requires a multi-scalar perspective that considers how local or place-based outcomes are linked to larger environmental and infrastructural networks or affected by other planning scales, such as metropolitan or state.
- **Varying levels of practice** – Different 'levels of practice', from conventional to highly advanced, are possible, and will depend on the ambitions, aspirations, and complexity of the development context. Practices striving for 'tactical' impact focused on discrete project outcomes will differ from practices seeking sector-wide, transformational change. More ambitious projects are likely to exhibit higher degrees of interactivity, interdependency, comprehensiveness, formality, scale and resourcing of planning activities.
- **Influence of change agents** – Individuals and organisations can determine the success of any planning activity. They can play an incredibly influential and important enabling role, or severely constrain desired outcomes. Accordingly, planning activities need to explicitly consider and build on the personal qualities and skills of individuals involved, as well as their networks across multiple organisations and communities of practice to achieve optimal processes.

Overall, the framework and associated principles offer a deliberative approach to urban and water planning that integrates typically siloed planning activities to facilitate improved development outcomes. They are designed to support practitioners set up more enabling forms of planning that are responsive to community and stakeholder aspirations, and able to deliver innovative urban form and servicing solutions that reflect the conditions, constraints and opportunities presented by their local context. They are not designed to provide step-by-step guidance on how to undertake each activity. Rather, they aim to prompt practitioners to think holistically about their context so they can design their own planning pathways to realise their aspirations for water sensitive urban development.

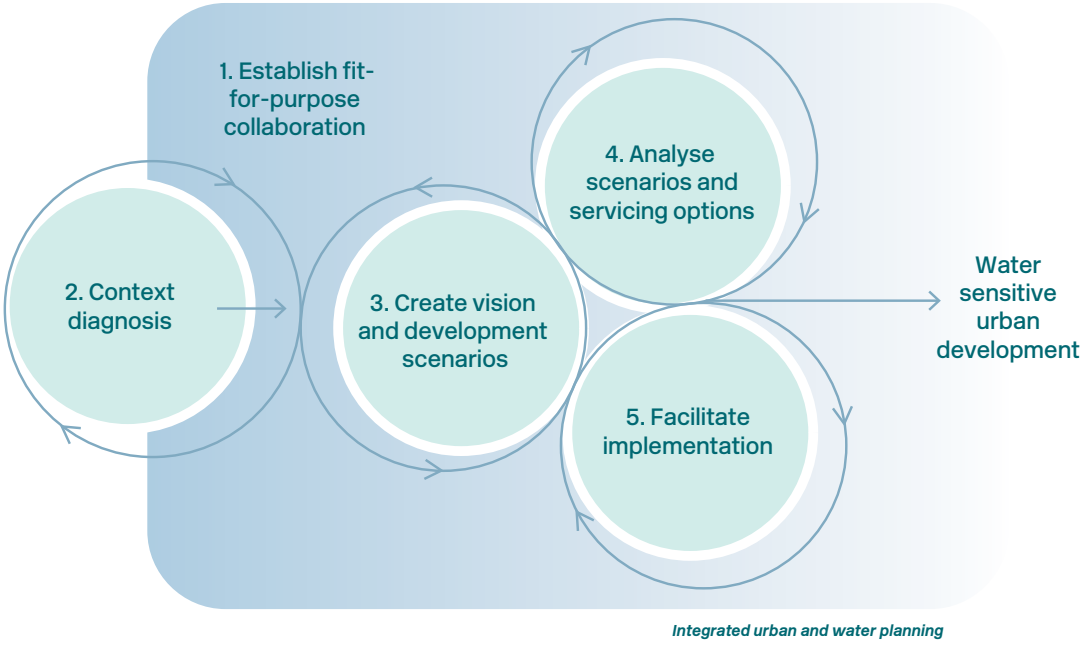



Figure 1. A conceptual representation of the framework and the five interrelated planning activities for advancing water sensitive outcomes through the urban development process.

# Applying the framework

The five planning activities that make up the framework are described in this section. Each activity is defined, and its importance briefly explained, in relation to conventional approaches. Then a number of principles and considerations are outlined to help practitioners design the planning activity in a way that suits their particular needs and aspirations. A selection of case studies that draw on CRCWSC research illustrate the principles in action. Links to resources with more information and guidance are also provided at the end of the document.

## 1. Establish a fit-for-purpose collaboration

Collaboration involves sharing information, activities, capacities, resources and decision making responsibilities among multiple stakeholders in support of a shared vision and set of outcomes that could not otherwise be achieved by individual stakeholders acting alone. These stakeholders are likely to be diverse, coming from different sectors and disciplines, but with interests broadly related to urban development and water servicing.

**Why is this important?**

Under a conventional approach to planning and delivering water infrastructure to service urban development, responsible organisations mainly interact to coordinate their activities, resolve any issues that arise and/or comply with requirements for stakeholder consultation. Unlike collaboration, coordination often occurs in response to a regulatory trigger at the implementation stage and facilitates enough cooperation between different organisations so they can each achieve their own objectives for a particular development project. This typically facilitates a standard set of development outcomes—highly impervious urban environments serviced by conventional drainage, water supply and wastewater systems.

**Box 1. Benefits of collaboration**

- Creating a shared vision for a place
- Reducing conflict through improved dialogue
- Including different perspectives
- Holistically identifying and assessing opportunities
- Building capacity from sharing knowledge
- Improving coordination between stakeholders
- Building lasting relationships and improved trust
- Improving likelihood of implementation
- Creating on-ground outcomes that support a wider range of community benefits

*Source: Malekpour et al. (2020)*

Achieving innovative, water sensitive outcomes requires a greater commitment and willingness to collaborate. Bringing together key stakeholders in a considered way can help to facilitate a place-based and interdisciplinary approach (as opposed to organisational or siloed approaches) to planning and delivering urban development. There are many benefits to be gained from collaboration (see Box 1). Stakeholders are able to combine their knowledge, expertise and values to define, assess and implement a wider set of mutually beneficial solutions. Accordingly, any integrated process should consider establishing a collaborative arrangement to guide activity.

Principles and considerations

Each planning context is characterised by a different set of stakeholders with different needs and drivers, and unique biophysical conditions and institutional arrangements. The setup of any collaboration needs to account for these particularities.

Four key elements to consider in designing cross-sector collaborations are:

**1. *Why collaborate?***

Articulating the 'why' establishes the rationale for collaboration, and clarifies upfront the incentives to engage in a collaborative process. The incentives could include solving an implementation challenge, reducing or sharing risk and delivering greater community benefit through considered urban design and integrated servicing approaches.

**2. *What is the scope of the collaboration?***

Understanding the context for collaboration helps with identifying and unpacking the issues that need to be addressed, the opportunities that can be leveraged, and the challenges to overcome through the collaboration (see 'Investigate the development context'). This will help inform the articulation of a clear collaborative purpose and priorities for action.

**3. *Who should be involved in the collaboration?***

Mapping all stakeholders according to their level of *interest* in and *influence* over relevant issues, processes and outcomes is helpful in identifying the individuals or organisations that should be involved in the core collaboration, and those that should be engaged selectively over the course of the collaboration. Ideally, core collaborators have interests that align with the purpose of the collaboration and are able to give effect to desired outcomes. But careful consideration needs to be given to the choice of collaborators, because the possible outcomes of the collaboration are largely determined by who is involved and their level of commitment to the process.

### 4. *How* to structure the collaboration?

A collaboration can take different forms (e.g. coalition, working group, taskforce etc.) and facilitate different levels of cross-agency integration, ranging from informal networks to highly formalised governance structures. The structure adopted should align with the collaboration's rationale (the 'why'), scope (the 'what') and the nature of collaborators (the 'who').

#### *Level of impact*

Practitioners should consider the why, what, who and how in relation to the desired level of impact. The nature of the collaboration should reflect the ambitiousness of aspirations, with *transformational impact* (sector-wide change) likely to require a different approach to collaboration than *strategic impact* (changes in some aspects of a sector) or *tactical impact* (project-level change) (see Figure 2). For example, collaborations with 'strategic impact' aspirations will require greater organisational support and commitment, and involve longer engagement processes with more iterative planning activities compared with collaborations with 'tactical impact' aspirations.

#### *Ongoing management of a collaboration*

It is important to continually revisit and reassess each element over the life of the collaboration since conditions are likely to change over time and the collaboration will need to adjust accordingly, if it is to endure. For example, the goals of the collaboration may change as new information comes to light, which may require changes to the scope of the collaboration. Similarly, as the collaboration shifts its focus from planning to implementation, the stakeholders involved (the 'who') and the type of activities undertaken (the 'what') will also need to change. These considerations highlight the importance of maintaining a flexible approach to collaboration.

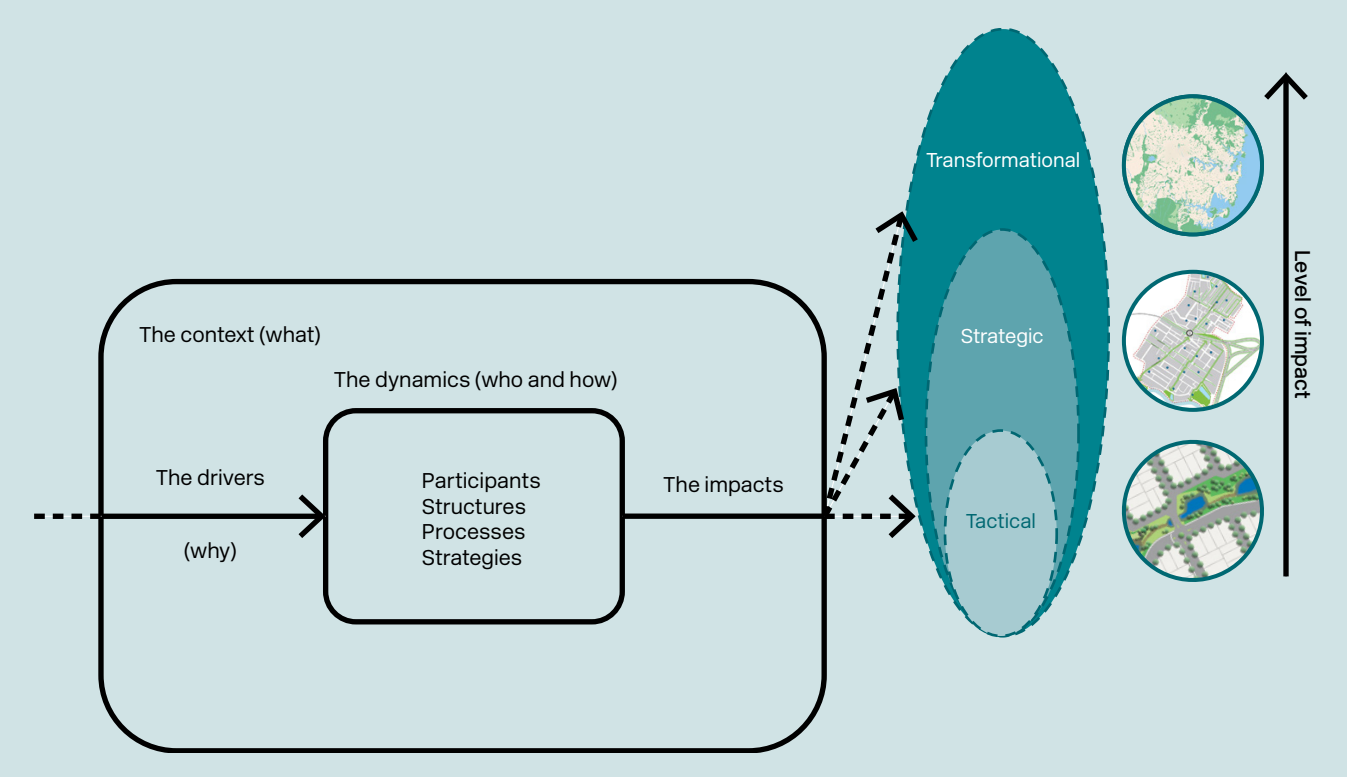



Figure 2. The design of any cross-sectoral collaboration should account for the desired outcomes (the 'why'), the issues and opportunities presented by the particular context (the 'what'), the stakeholders that need to be involved (the 'who'), and the structures and processes required to deliver (the 'how') the intended level of impact. (Malekpour et al., 2020)

## Case study 1 – Sub-catchment scale integrated water management (IWM) planning driving collaboration in Melbourne's north

The Upper Merri Creek sub-catchment in Melbourne's northern growth corridor is expected to transform over the coming decades as the largely rural and natural landscape develops and becomes more urbanised. The area features highly valued creeks and waterways, diverse remnants of native vegetation, protected species such as the Growling Grass Frog, and sites of cultural significance. As the population in the area grows, with a projection of 372,000 people by 2031 (compared with 196,000 in 2019), these valued features will come under threat from urbanisation and the ongoing effects of climate change.

This growth area was the focus of Yarra Valley Water's first trial of a collaborative, place-based approach to planning at the sub-catchment scale. Typically, water services are planned within jurisdictional or system (water supply or wastewater) boundaries. It was recognised that by focusing on the sub-catchment, different organisations (e.g. councils, water authorities) operating within a defined place could work together with Traditional Owners and evolving communities to address complex issues in ways that produce the most mutually beneficial outcomes. This enables issues to be explored holistically in the context of place rather than arbitrary administrative boundaries.

Under Yarra Valley Water's leadership, different stakeholders came together in 2018 to develop a shared, place-based IWM plan for the Upper Merri Creek sub-catchment. A partnership between Wurundjeri Woi Wurrung Cultural Heritage Aboriginal Corporation, Hume City Council, City of Whittlesea, Mitchell Shire Council, Yarra Valley Water, Melbourne Water and the Victorian Planning Authority was formed to explore a range of opportunities for IWM that could address the challenges presented by urban growth, and deliver positive outcomes for local communities and the environment. The CRCWSC supported the partnership in a number of ways (e.g. facilitated workshops, coordinated activities), and later evaluated the project as one of two instances of collaborative IWM planning in Melbourne's growth corridors.

The project began with the development of a shared vision for the sub-catchment that was co-developed with a broad range of stakeholders. The vision recognised water as an enabler of better urban outcomes, which justified a more integrated approach to planning, and a broader and more inclusive approach to collaboration. Many partners in this process had not previously planned together and so coming together in this way allowed these organisations to better understand each other's needs and priorities and identify ways to support each other in achieving a broader set of shared objectives. The process also empowered Traditional Owners, who in the past have had limited involvement in water servicing and management activities, to more effectively participate in the collaboration.

The evaluation of this collaborative planning process highlighted the importance of:

- *Designing the collaborative governance structure deliberately in response to context*, to ensure it is able to support the realisation of the defined project scope and aspirations, promotes equitable participation, and clearly establishes different roles and responsibilities, particularly in relation to leadership and coordination.
- *Collaborating effectively*, by choosing appropriate representatives to participate in the collaboration, enhancing the quality of interactions through dedicated trust and relational capacity building, and providing access to necessary data, tools and resources to undertake IWM planning. Independent and skilled facilitators play a critical role in navigating contentious issues (e.g. by mediating difficult conversations) and driving collective outcomes (e.g. by removing perceptions of organisational bias).
- *Authorising the collaboration*, by ensuring all partner organisations endorse the project and its outputs, and enable their representatives to meaningfully participate, as well as build widespread commitment to shared outcomes by capturing community and cultural values within project aspirations.

## Case study 2 – Design-led capacity building workshops improving collaboration in Brisbane's south

Yarrabilba is a large greenfield development south of Brisbane where the developer, Lend Lease, is seeking to implement circular economy principles, including an ambitious agenda of water sensitivity. However, shifting government priorities have resulted in an unpredictable water policy landscape, which has made it difficult to plan and engage with planning authorities. These challenges have culminated in the construction of a large stormwater harvesting scheme, encouraged by an earlier administration but not supported by the current administration. Consequently, reaching agreements about asset allocation, governance and water use have proved intractable to date.

The CRCWSC has been working with Lend Lease through a capacity building seminar series (the 'Yarrabilba Happy Street Seminar Series') as part of efforts to facilitate improved collaboration between the developer and local government. Part of this process has involved introducing and applying the CRCWSC's Scenario Tool and Economics Framework, as well as documenting modelling results into a shareable design booklet that can be used to advocate for change. The theme of 'design-led, collaborative, inspirational practice delivering liveable places' has encouraged workshop participation by a diverse mix of practitioners from state and local government, the Urban Development Institute of Australia and industry experts.

Yarrabilba demonstrates that collaboration:

- should commence early and in good faith, otherwise there is a risk that well-conceived plans generate poor outcomes, such as some IWM assets being built but never operated
- depends on good working relationships, so it is necessary to invest time and effort in building and maintaining trust and developing shared understandings
- can be effectively facilitated through workshops or seminars, and supported by appropriate modelling and evidence that is tailored to the interests of different stakeholders
- can help to change attitudes and perspectives.

Yarrabilba site tour.
Credit: Angeline Deo

# 2. Investigate the development context

Contextual analysis describes a thorough investigation of the particular attributes of a place, from both a bio-physical and socio-institutional perspective. Every place is unique, so it is important to collectively develop a full understanding of origins and influences, in order to identify distinct local opportunities and challenges. This in turn provides the foundation upon which a shared place-based vision can be built, appropriate development scenarios and servicing options generated and interrogated, and implementation pathways defined.

**Why is this important?**

Understanding context is key to delivering place-based outcomes. Conventional development practices can result in homogenous development typologies that are not responsive to local context. This can exacerbate existing vulnerabilities to, for example, urban heat, flooding, car dependency and social isolation. Designing urban areas that support healthy people and environments, celebrate local character and cultural heritage, and nurture a sense of place and collective identity requires an in-depth understanding of place across a broad spectrum of spatial and temporal scales. The following principles and considerations highlight particular aspects of place that should be understood if we are to plan and design our urban environments in a way that promotes contextually appropriate outcomes.

Principles and considerations

***A systems perspective provides a useful way of understanding place***

Thinking of urban areas as 'systems' can help to identify the various components of 'place' that need to be investigated and how they relate to one another. Each place can be thought of as a coupled human-environment system, in which stakeholders come together through various activities to shape the form and function of a physical place. Their interactions are guided by various rules and norms, often encapsulated within planning instruments such as policies and regulations. Understanding the effect of these instruments on practice is important, as is understanding how existing natural and built systems came to be, and how they function. Different development processes (greenfield, brownfield, dispersed infill) affect what these systems look like and the challenges and opportunities they present. Further, external drivers such as climate change, regional or catchment activities, politics and macro-economic trends affect how these systems operate, so understanding their influence is also important.

***Diagnosing planning instruments can highlight potential barriers and opportunities early on***

Every aspect of urban development, from the type and location of development across a city through to the design and construction of buildings at the lot-scale, is affected by a range of planning instruments. These instruments exist across different levels of governance (e.g. state, regional and local) and sectors (e.g. water, open space, energy and biodiversity).

Any contextual analysis should involve a stocktake of applicable planning instruments that considers how different instruments relate to one another (or not) and how they may collectively influence desired outcomes. Planning instruments across the following three levels of governance activity need to be considered (see Tawfik and Chesterfield, 2020):

- *Direction-setting level*, in which overarching policies and strategies articulate long-term aspirations for the future and supporting goals and objectives to guide decision making.
- *Plan-making level*, in which a variety of spatially explicit plans direct long- to medium-term changes in land use, urban form and (water) infrastructure delivery at the catchment, corridor and precinct scales.
- *Implementation level*, in which directions, plans and regulatory instruments dictate where, what and how land use and development occur and infrastructure is constructed and connected. Other non-statutory instruments guide some aspects of building and infrastructure design.

Broadly speaking, planning instruments may influence the realisation of an outcome in three ways: support, oppose or have a neutral impact (Figure 3).

Part of this stocktake should consider whether there are any gaps in the planning landscape (e.g. an inability to enforce certain types of interventions) and whether there may be any opportunity to revise existing instruments or create new ones throughout the collaboration. These opportunities may be triggered by a strategy update, a planning scheme amendment or the commencement of structure planning. Knowing what key decisions need to be made, and when is necessary to ensure enough preparatory work is undertaken in advance to successfully influence and embed desired outcomes.

***Understanding nature and ecological processes as essential infrastructure provides new ways of thinking about urban form***

The increasing use of 'blue' and 'green' infrastructure labels to describe waterways and vegetation recognises their importance in the urban realm. It also offers new ways of organising landscape elements through urban planning. These forms of infrastructure are paramount to creating places that improve human wellbeing and ecological health, as well as build landscape connectivity (e.g. habitat corridors) to deliver catchment-scale benefits such as biodiversity and flood resilience. Understanding how environments have evolved over time (e.g. how past practices have shaped their current state) is essential to identifying ways in which development can create or regenerate landscapes that support multiple social, ecological and economic functions.

***Social and cultural values can enhance water sensitive urban development***

Local values, traditions, character and cultural heritage make a place distinctive, creating a unique identity and sense of place. Understanding this context, including Indigenous ways of knowing, can inform a more meaningful approach to the way a place looks, feels and functions. It enables considered design that can strengthen local connections between people, water and the natural environment.

Inclusive forms of stakeholder engagement to capture the diversity of voices and perspectives is key to understanding the past, present and future significance of a place. This is a particularly important input to defining a place-based vision that guides more specific planning activities, such as the investigation of development scenarios and servicing options (see 'Create a place-based vision and alternative development scenarios').

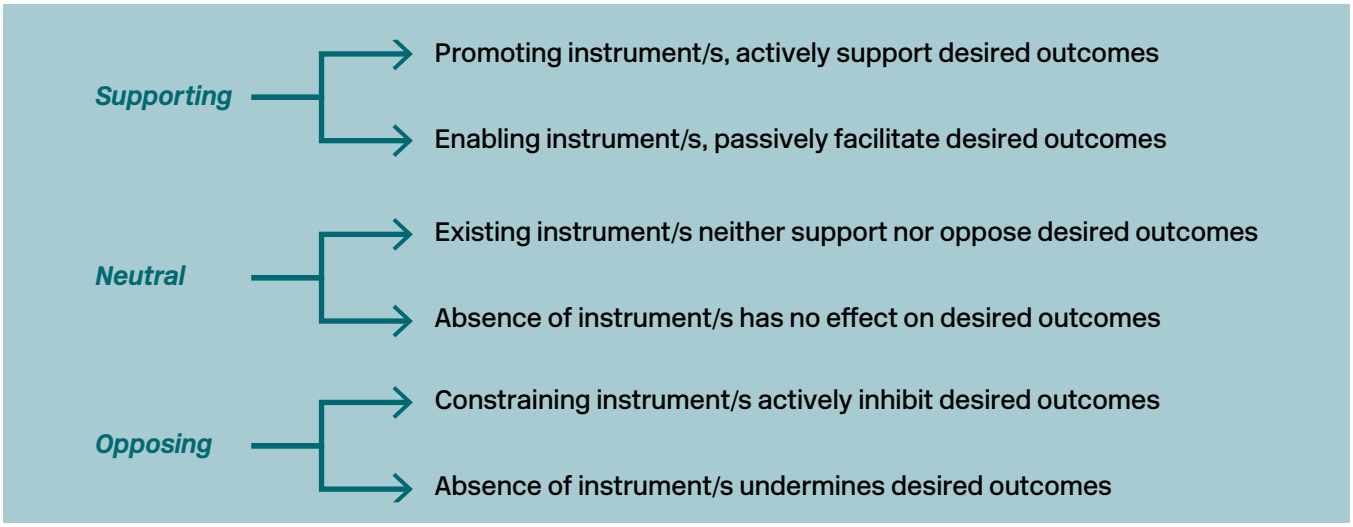



Figure 3. The types of influence that planning instruments may have on the realisation of an outcome.

## Case study 3 – Understanding local context to deliver water sensitive outcomes in Townsville

Townsville City Council first partnered with the CRCWSC in 2017 to develop a Water Sensitive Vision and Transition Strategy for Townsville. This process involved benchmarking the city's current performance against a broad range of water sensitive cities goals and indicators, to understand key areas of strength and weakness.

Townsville's unique dry tropical climate and proximity to the Great Barrier Reef present a different set of challenges and opportunities for water servicing and urban development. Its climate is characterised by extremes, such as droughts and cyclones. The people of Townsville understand water and water-related issues, and highly regard the active lifestyles that surrounding marine and terrestrial environments support. Due to the uniqueness of this landscape and the values of its community, it was necessary to define what a water sensitive city means in this local context.

Following the articulation of a place-based, water sensitive vision for Townsville, council recognised that to advance towards this aspirational state, further diagnosis of institutional arrangements was required. So they worked with CRCWSC experts to firstly define what water sensitive greenfield development in Townsville could look like, before exploring the potential issues and opportunities they would create in relation to governance and implementation. The analysis revealed a number of planning and service delivery needs related to:

- prioritising water at the strategic level, through clear state policy water directives and council strategies that adopt the Water Sensitive Townsville agenda
- bridging organisational silos through more coordinated approaches to activity (e.g. integrated water services planning at the 'corridor' or growth area scale)
- moving beyond a stormwater focus within the local planning scheme by embedding integrated water management outcomes at all levels.

These activities have helped raise awareness among council staff about the connections between water and liveability. For example, land use planners have a better understanding of their role in planning for water and are starting to look at urban greening more holistically, with an understanding of cooling benefits, and implications for potable water demand. As a result of these collaborative efforts, a cross-council working group of senior and middle management was established to advance the water sensitive agenda within council. This has been set up to encourage a long-term and proactive approach to water in all council activities.

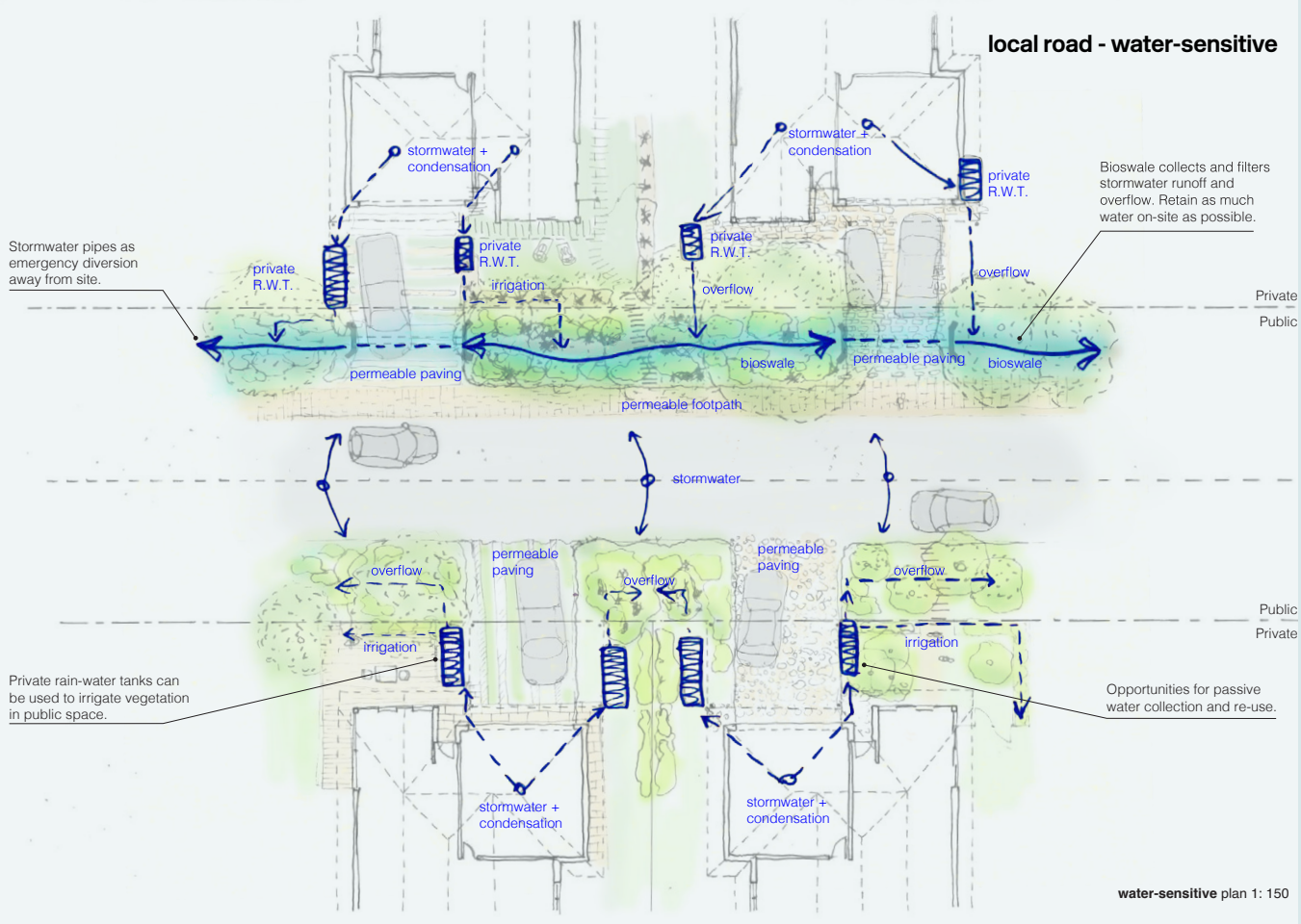
Subsequent capacity building activities have involved applying the CRCWSC's full suite of tools and products to provide the evidence base to galvanise leadership and investment in a Water Sensitive Townsville. These outputs will be translated into communications materials that are tailored to different audiences (e.g. councillors, developers) to make the case for change.

Overall, the case study has highlighted the importance of:

- understanding local context, drivers, community attitudes and values, ecologies and building traditions to deliver place-based outcomes
- a shared vision as a means of galvanising broad-based support and commitment
- generating buy-in from decision makers and politicians at all scales, to ensure a clear line of sight from policy through to implementation.

These depend on:

- collaborative processes and functions that recognise the role of people in developing and implementing plans, and seek to foster their abilities to champion change
- place-based planning that examines the total water cycle at a meaningful scale, to optimise integrated water management opportunities
- building an enabling authorising environment to effect change.




Ideas for a water sensitive local road in Townsville.
Credit: Monash Urban Laboratory

# 3. Create a place-based vision and alternative development scenarios

A vision articulates the desired look, feel and function of a place. The process of envisioning provides an important means by which different stakeholders can come together to imagine what a place could look like and build collective momentum towards its realisation. A vision also serves as a guidepost for preparing more specific development scenarios. Each scenario provides a different possible representation of development outcomes, based on the interplay of a range of factors such as trend projections (e.g. population growth, climate change), performance criteria and policies. These will manifest as differences in the mix and spatial configuration of land uses, open space and street networks, urban densities, built form and landscape typologies depicted in each scenario.

**Why is this important?**

Urban development often proceeds without a clear and shared articulation of desired water outcomes. Creating a collective vision provides a powerful way of inspiring and motivating stakeholders to combine efforts and resources in pursuit of a shared set of place-based outcomes. It also informs subsequent planning activities and provides a means of tracking progress over time.

When it comes to development scenarios, planning processes tend to reinforce siloed and conventional considerations of urban form and water servicing. The often disconnected timing of urban and water planning means that urban layouts that assume standard servicing solutions become 'fixed' before water perspectives are sought, at which point it becomes too late to explore different servicing options. Similarly, traditional water planning practices tend to narrow investigations to a limited set of servicing options, without much consideration for different urban forms. Thinking concurrently about urban form and water systems opens up a greater range of possibilities, in the form of diverse development scenarios that harness water and the built environment to deliver better urban and water outcomes respectively.

Principles and considerations

***A vision should be place-based and aspirational***

A well-articulated vision provides the basis of a planning process and creates a unique place-based identity for building momentum and unifying support. A vision statement should capture the key desired features (look, feel and function) of a place's future state. It should be contextual—responding to local constraints, opportunities and values—and reflect a diverse range of perspectives. The language and imagery should be aspirational and compelling, to mobilise stakeholders into action. Broad-ranging endorsement of the vision gives it legitimacy, which in turn attracts greater investment towards its realisation.

***A vision that evolves over time as stakeholder aspirations become more defined is more likely to generate broad buy-in***

As the collaboration proceeds and different scenarios are interrogated, the vision for a place is likely to evolve into a clearer and more place-based idea. Through an iterative process of comparison and refinement, the vision will crystallise, taking on greater definition and becoming more specific as stakeholder preferences are revealed. Processes should enable a vision to be refined over time, to ensure it represents evolving stakeholder aspirations.

***Development scenarios that consider urban form and water servicing simultaneously are more likely to facilitate better place-based outcomes***

Adding a water sensitive lens to scenario planning exercises enables concurrent thinking about water services and urban form and supports the placement of water at the centre of urban design, to improve development outcomes. This creates opportunities to reimagine the uses and functions of traditional infrastructure and other elements of the urban environment, broadening the range of benefits and

outcomes that can be achieved. As an interdisciplinary and collaborative exercise, practitioners can draw on a diverse range of expertise and tools to explore how urban elements can help deliver water and environmental services (e.g. using rooftops to collect rainwater for non-potable uses and planning deep root zones for shade canopy trees), and how water infrastructure can enhance urban liveability (e.g. harvesting stormwater locally to irrigate parks and enhance habitat).

***Scenarios should clearly communicate different possibilities through a range of visual styles and expressions***

Scenarios are important communication tools. They should not seek to provide 'the answer', but rather demonstrate the range of outcomes that can be achieved. Scenarios should depict different levels of ambition or impact, ranging from 'conventional' outcomes to highly aspirational outcomes inspired by relevant best practice examples. This allows for comparison and refinement over time as the benefits and costs of different scenarios continue to be collaboratively investigated, deliberated and (re)negotiated.

Scenarios are more likely to be effective communication tools if they are:

- developed collaboratively and draw on the input of multiple disciplines to depict the interplay between a range of connected urban elements (such as green infrastructure, waterways, water system services, building typologies, street layouts, tree canopy and open space).
- visually represented through a range of drawing styles and dimensions, to reveal different aspects of the look, feel and function of a place. For example, 2D layout plans clearly depict the location of different land uses, while 3D drawings can help highlight constraints and opportunities for volumetric urban elements (e.g. courtyards or contained plazas), and the relationship between built form and open space. Cross-sections are most useful for evaluating topography and landfall, relative heights and view lines.
- expressed at a range of scales to highlight a place's position within its broader catchment or regional context (e.g. located within a floodplain).

## Case study 4 – Aspirational vision drives collaborative scenario planning in Western Sydney

Sydney Water's first regional servicing master planning process examined regional-scale servicing concepts to support the NSW Government's vision for the Western Parkland City. The process involved stakeholders from federal, state and local agencies. Participants came from a variety of disciplines and backgrounds, including planning, infrastructure, environment, resource and land management, and development.

The process began by exploring the problems and challenges for growth in Western Sydney. Population forecasts suggest a doubling of people by 2056, with a total of 1.5 million people. The limited or non-existent water supply and wastewater infrastructure in the area mean large capital investments are needed to meet increased demand. The region regularly experiences hot and dry conditions (e.g. in 2018, there were 46 days over 35 degrees), which are expected to worsen under climate change. Growth will mostly occur in the catchment of the Hawkesbury–Nepean River, which already has escalating problems with chemical and nutrient runoff, and treated waste from 20 major sewage treatment plants, causing eutrophication and increased algal growth. These problems present opportunities and drivers for innovative water servicing and water sensitive urban development.

The Western Parkland City vision seeks to drive different development outcomes, through its emphasis on connected communities, holistic integration with South Creek and its tributaries, and the provision of cooling and greening through generous open space and increased tree canopy cover. These broad aspirations informed four combined scenarios (referred to as pathways), which were inspired by the city developmental states of the Urban Water Transitions Framework:

- Pathway 1 (the Western Drained City) outlines business as usual, using existing water supply sources, minimal water reuse, discharge of wastewater into waterways, some irrigation demands met by drinking water, stormwater managed by councils.
- Pathway 2 (the Western Water Cycle City) promotes medium density multi-dwellings, which unlock additional open space, and which is irrigated using recycled water as well as centralised storages to retain stormwater in the landscape.
- Pathway 3 (the Western Water Centric City) promotes decentralised servicing from rainwater tanks, and package plants in the short term, enabling out of sequence growth, followed by purified recycled water for drinking featuring more prominently in servicing greenfields.
- Pathway 4 (the Western Water Resilient City) considers purified recycled wastewater and stormwater for drinking via surface water or groundwater augmentation, to increase water security and reduce impact on waterways.

An economic analysis of the four pathways determined the best value pathway for the region. Pathway 2 was chosen as the preferred pathway to realise the Western Parkland City vision because it delivers the greatest economic value at the least cost and is the most readily deliverable in the current regulatory environment. It was found that servicing the Western Parkland City vision provided $10 billion in liveability and amenity benefits, at an incremental cost of $2 billion.

The Western Sydney Regional master planning process highlights the additional value that can be created when water servicing (e.g. water supply, wastewater, stormwater, recycled water and waterways) is considered in conjunction with urban form. This depended on a collaborative process that brought together different stakeholders and experts to collectively investigate alternative development and servicing pathways, in response to a clearly defined vision.

Aerial view of Western Sydney and Nepean River

## Case study 5 – Clearly communicated scenarios lead to a strong community mandate for regenerative practices in the Upper Merri Creek sub-catchment

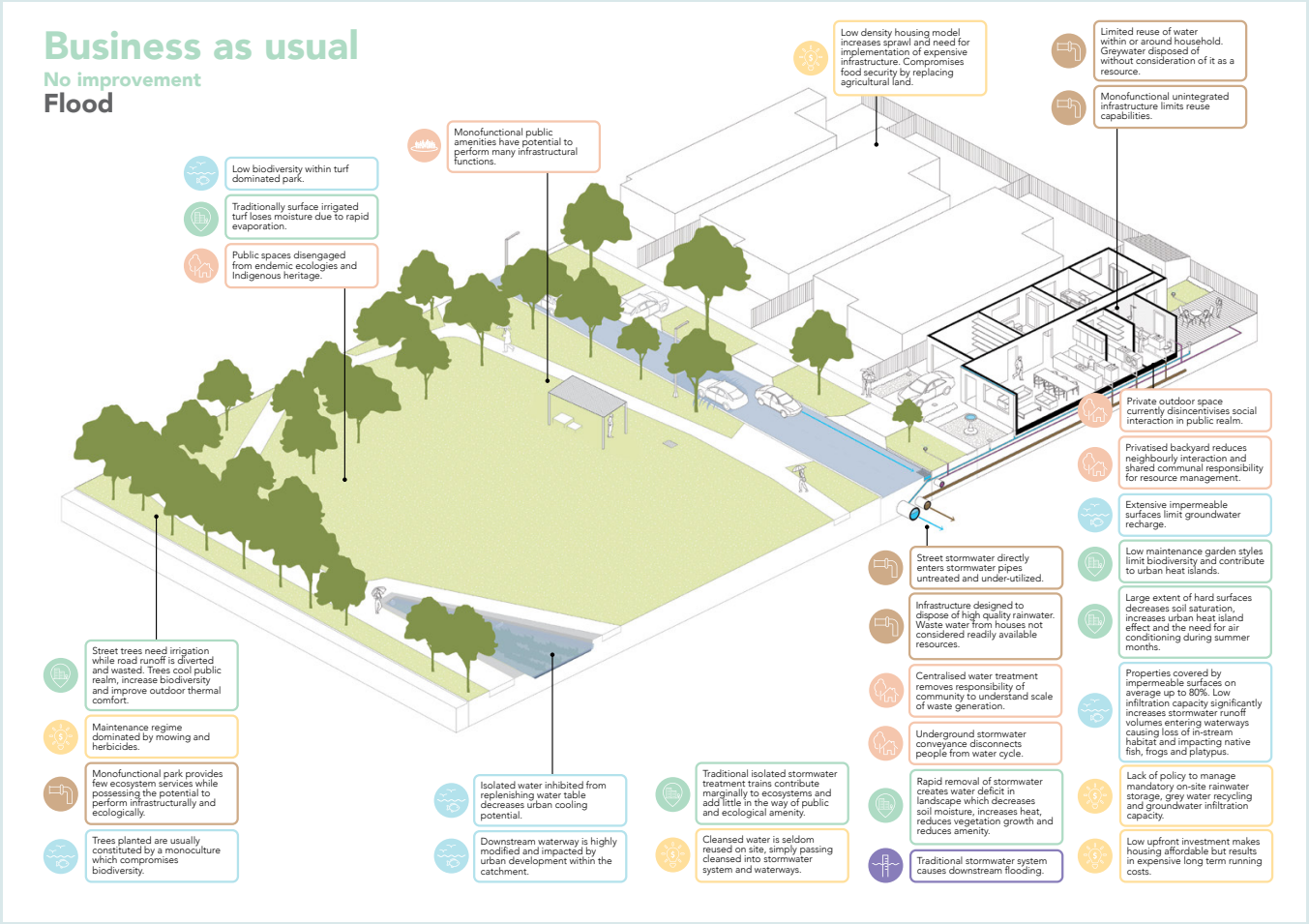
The Upper Merri Creek sub-catchment planning process used scenario thinking to engage with stakeholders and the community (see Case study 1 for more details). Three scenarios were co-developed with partner organisations and tested with stakeholders:

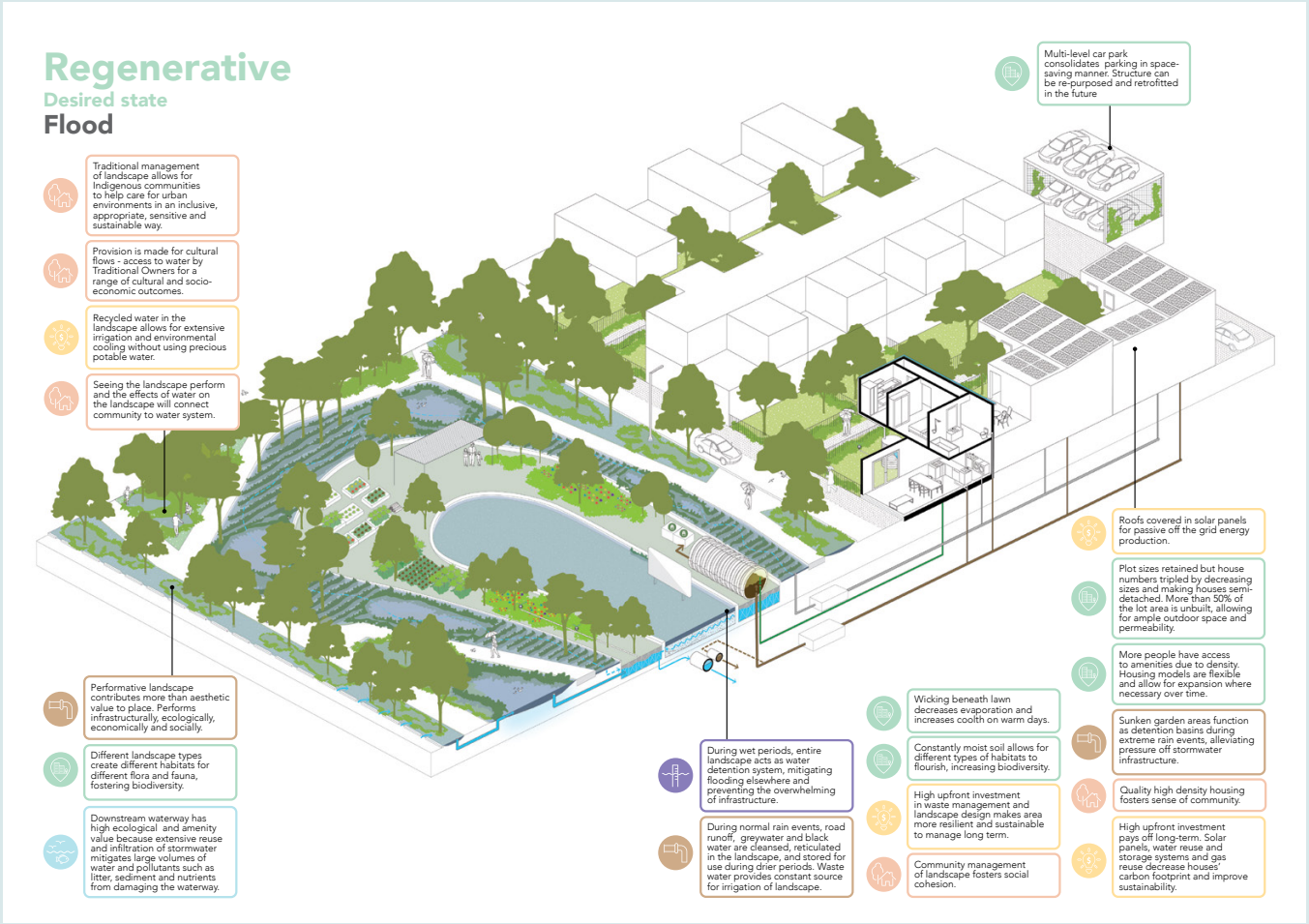
- *Scenario A: Status quo*, which describes the future state of the sub-catchment if development and servicing continues to be provided in the same way it always has been
- *Scenario B: Sustainability*, which describes a sub-catchment that is able to support sustainable communities through the provision of alternative urban forms, different servicing options and fit-for-purpose uses of all available water resources
- *Scenario C: Regenerative*, which describes a sub-catchment that is able to support regenerative communities through the use of innovative approaches to urban form and servicing that are capable of achieving social, cultural, environmental and economic outcomes.

Each scenario description detailed the look, feel and function of the sub-catchment. Different features of the sub-catchment—from housing products through to streetscapes and public open space, as well as commercial and industrial development—were described and illustrated with examples. Governance arrangements, service delivery and funding models were also outlined and included in discussions with stakeholders and communities.

The use of visual examples and detailed descriptions provided an effective way of communicating different servicing and design concepts to community members. By clearly and tangibly demonstrating how particular urban elements of relevance to locals (i.e. streets, open spaces and housing) might look like under different scenarios, community members were able to engage with the ideas being communicated. The engagement process highlighted the need to avoid water sector jargon and instead use plain language to explain the significance of key issues, such as increased stormwater flows into waterways following urban development.

This exercise served to build support for challenging conventional approaches to servicing and development. A strong response from the community was that business-as-usual outcomes are no longer acceptable. Instead, regenerative practices that favour natural management approaches and put water at the centre of urban design were preferred. Authorised by this mandate, the Upper Merri Creek sub-catchment planning process has sought to give effect to community aspirations by exploring different approaches to water management and taking a more holistic approach to planning.




Upper Merri Creek scenario illustrations for BAU flood (top) and Regenerative flood (bottom).
Credits: Yarra Valley Water, Realm Studios, e2deisgnlab and CRCWSC

# 4. Analyse development scenarios and servicing options

Alternative scenarios are collectively tested and refined, to identify the ideal scenario for implementation. 'Servicing options' make up one of the building blocks of each scenario, and are a particular focus of this planning activity. In this document, 'servicing options' refer to different configurations of water systems (both natural and constructed). These systems provide a broad range of water dependent services to local communities, such as water supply and sanitation, waterway health, urban cooling, cultural and recreational amenity, and flood protection. The performance, feasibility and costs of these options are iteratively explored and assessed in relation to desired outcomes, to identify a mix of options that optimise community benefits.

**Why is this important?**

The fragmentation of responsibilities for water services and urban amenity typically encourages options to be considered and analysed separately by each organisation, often with very little transparency. These practices tend to result in a selection of options that optimise outcomes for individual organisations or service providers rather than the community.

A collaborative approach to analysing scenarios and options requires assessment criteria and methods to be collectively defined and agreed on upfront. This ensures investigation processes are transparent, rigorous and guided by shared goals. Consequently, generated outputs are more likely to be robust—delivering whole-of-community benefits—and well-supported by stakeholders, which in turn improves the likelihood of implementation.

## Principles and considerations

Before commencing this planning activity, collaborators should discuss and agree on the approach to evaluation they will adopt. Making this decision early on will help ensure subsequent investigations generate the necessary data and information required to undertake the evaluation.

Collaborators should consider these factors:

***Defining measurable performance outcomes***

Scenarios and options should be tested and refined against a collectively defined range of performance criteria. These measures provide a means of distinguishing between different scenarios and options. Selected criteria should cover multiple outcome areas such as water, architectural and urban space quality, and urban heat (Renouf et al., 2020). A mix of qualitative and quantitative measures should be considered.

One key performance outcome is cost effectiveness. The benefits and costs of different scenarios and options should be defined in relation to the full range of social, environmental and economic outcomes they deliver. Such analyses should be expansive, focusing on net community benefits in the longer term, rather than the costs and benefits that may accrue to any single stakeholder. They should also account for later stages in the project lifecycle, such as operation and maintenance. This will provide a stronger basis for preparing a compelling business case.

***Fit-for-purpose methodology and tools***

Analytical methods and tools should be carefully selected to ensure they are best suited to the purpose of the evaluation. Many tools and techniques exist, each with their own strengths and limitations. For example, modelling platforms can facilitate collaboration by organising, integrating and visualising different data sets to clearly and effectively communicate ideas, support exploratory analyses and combined assessments (e.g. scenarios for urban heat, density, greening and water management).

Different approaches may be more appropriate at different stages of planning, depending on the depth of analysis required and the nature of resources available. Rapid but shallow assessments against a broad range of criteria may be suitable during the early stages or when resources are

limited, while tools and techniques capable of generating more comprehensive outputs (and often in relation to a narrower set of parameters) may be more appropriate during later stages of planning when preferences are more clearly established.

***Internal and external decision making***

Planning and delivering an urban development project involve a range of decisions across multiple organisations. Some of these decisions will be taken within the collaborative planning process, while others will be external to it, such as the decisions of approval authorities (e.g. councils, water utilities).

Decision making within the collaboration, such as how the preferred scenario and options will be selected, should be guided by collectively defined rules. Collaborators should develop and implement a clear decision making framework that ensures processes are equitable, transparent, encourage rigorous deliberations and yield outcomes in which stakeholders can be confident.

Regarding external decisions, understanding who makes key decisions and how they go about making these decisions (i.e. what templates or criteria they use) should inform the way performance outcomes are defined and the assessment approaches that are employed.

***Iterative processes of refinement***

Assessment approaches should be iterative, allowing scenarios and options to be refined through multiple rounds of analysis. Once a broad range of options are defined, it may be useful to undertake a preliminary evaluation to quickly explore and rule out different scenarios and options before concentrating on a few scenarios and options for more detailed analysis. Eventually, investigations will identify a preferred development scenario and set of servicing options that optimise performance across all desired outcomes. It may take several attempts, and involve deconstructing, reconstructing or combining scenarios before the final selections are made.

## Case study 6 – Water sensitive scenarios outperform business-as-usual scenarios in Knutsford

Knutsford is an infill precinct in the City of Fremantle (Western Australia). The local development agency wanted to build on the area's history of innovative, award winning medium density designs, and so it partnered with CRCWSC researchers to come up with a site design that provides more infill housing diversity, improves water security through innovative water servicing, and complies with ambitious water and energy targets that demonstrate sustainability.

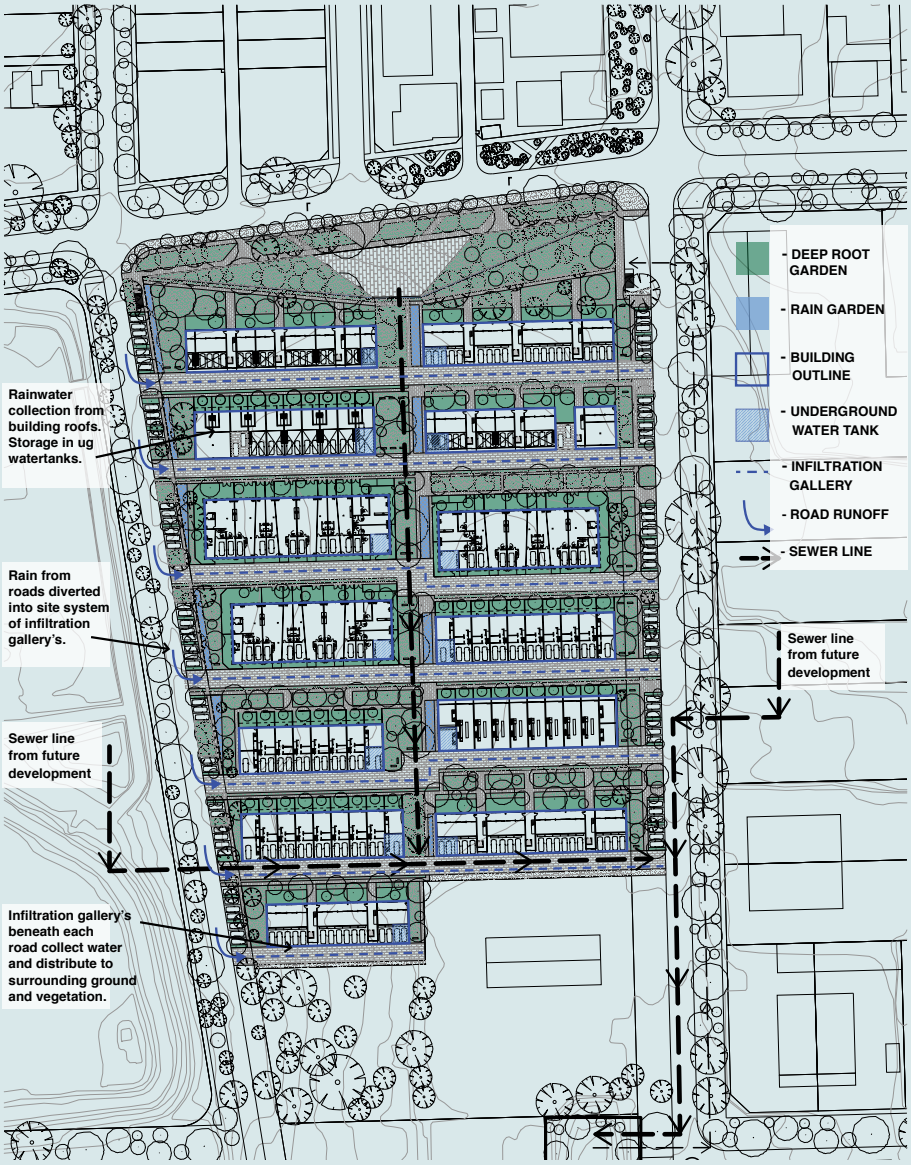
The project first defined existing suburbs subject to infill densification and then compared this with both a business-as-usual higher density future, and water sensitive infill scenarios, as a way of demonstrating the business case for improved water sensitivity in urban development outcomes.

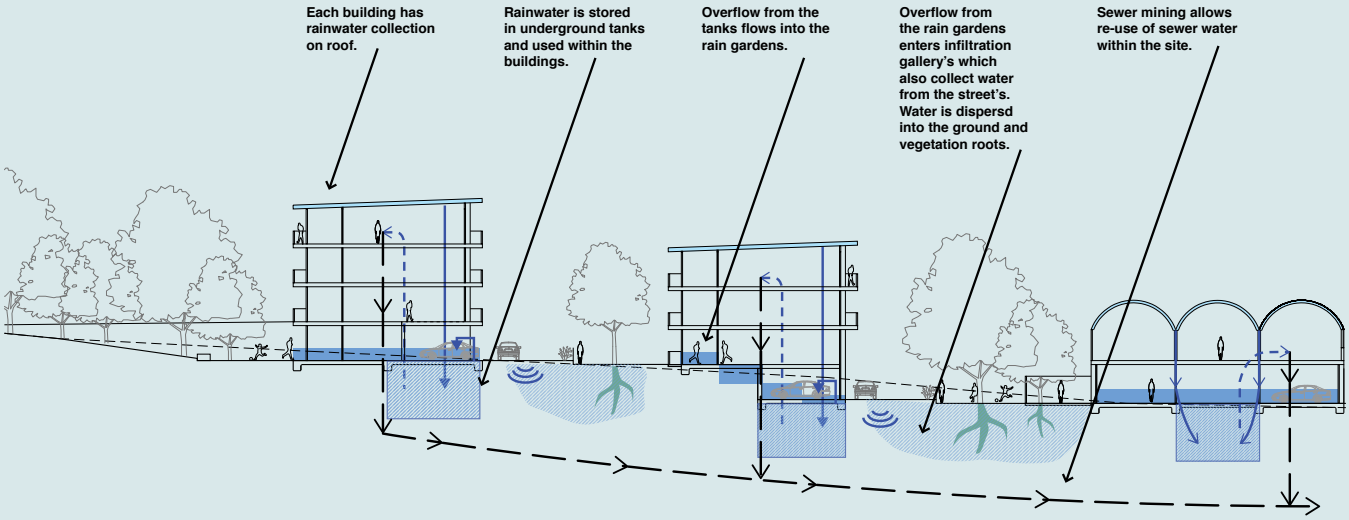
The Knutsford site forms part of a redevelopment precinct made up of low-rise medium density housing, on large ex-industrial allotments. In its existing state, the residential areas surrounding the development site contain a range of lot sizes, with an average dwelling density of 16/ha and 41% imperviousness. A quarter (25%) of rainfall that falls on the area is converted to runoff. Under a business-as-usual future, dwelling density increases to 45/ha, imperviousness increases to 75% and 62% of rainfall is converted to runoff. The water sensitive scenarios explored different combinations of apartments and townhouses, with rainwater tanks and sewer mining. They were able to achieve 81–105 dwellings/ha and a total imperviousness of 49%, which only converts 16% of rainfall to runoff.

The Knutsford project shows considerable water savings are possible through a combination of sewer mining and rainwater harvesting, which together can reduce reliance on imported potable water by 62%. The concept design for rainwater harvesting was large, shared underground tanks beneath apartment buildings and grouped row houses, which provide 10 kL of underground rainwater storage per dwelling for washing clothes and hot water systems. The concept design for sewer mining was a local wastewater treatment and reuse system for outdoor irrigation (public and private spaces) and toilet flushing.

The water sensitive scenarios also demonstrated considerable improvements in the access to and quality of outdoor communal space, tree canopy cover, recreational and broader amenity values. An additional public open space was added to the northern boundary of the site, increasing space for vegetation, tree canopy and recreation. The scenarios also included a central north–south path that connected all apartments along a series of pocket parks, and internal laneways that run east–west. Further, the north-facing frontages of each block contained a garden setback with space for canopy trees, providing shade to the buildings and to the ground level shared landscape.

As well as increasing the amount of vegetation, the water sensitive scenarios also demonstrably increased vegetation health and resilience. Irrigation demand in these scenarios would be adequately met year-round by recycled water from the sewer mining treatment plant. The availability of this water means a densely planted landscape can be sustained, including areas of turf and leafy understory plantings beneath the canopy trees to create a sense of lushness and summer reprieve at the ground plane. This was particularly significant for this ex-industrial site because the underlying contaminated groundwater could not be used for outdoor irrigation. All of these performance outcomes are quantifiable and can be used to produce a compelling business case for water sensitive development typologies and servicing options.




Site plan of water sensitive scenario, including landscape and water services (top image) and site section for the maximised water sensitive scenario, including landscape services in detail (bottom image). Credits: Monash Urban Laboratory with The University of Western Australia

## Case study 7 – Infill design choices shown to strongly affect water performance in Salisbury

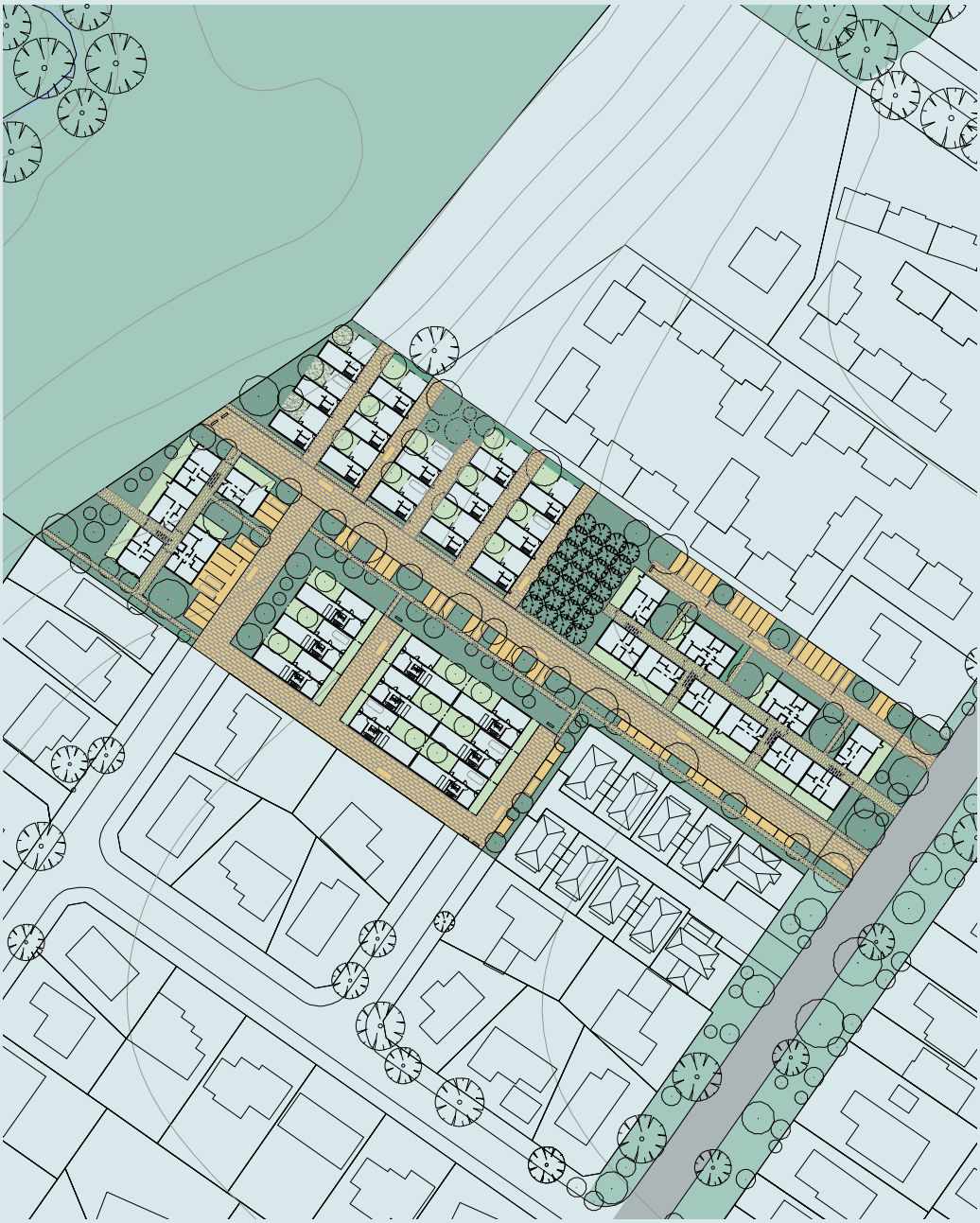
Salisbury is a northern suburb in Adelaide, South Australia, which is renowned for leading water sensitive practices because of its extensive use of stormwater to substitute potable demands. Over the past 20 years, Salisbury Water, a separate business unit within the City of Salisbury, has supplied urban stormwater, harvested and treated in wetlands, or groundwater, via managed aquifer recharge, for various non-potable uses such as public open space irrigation, industry and more recently, toilet flushing and gardens.

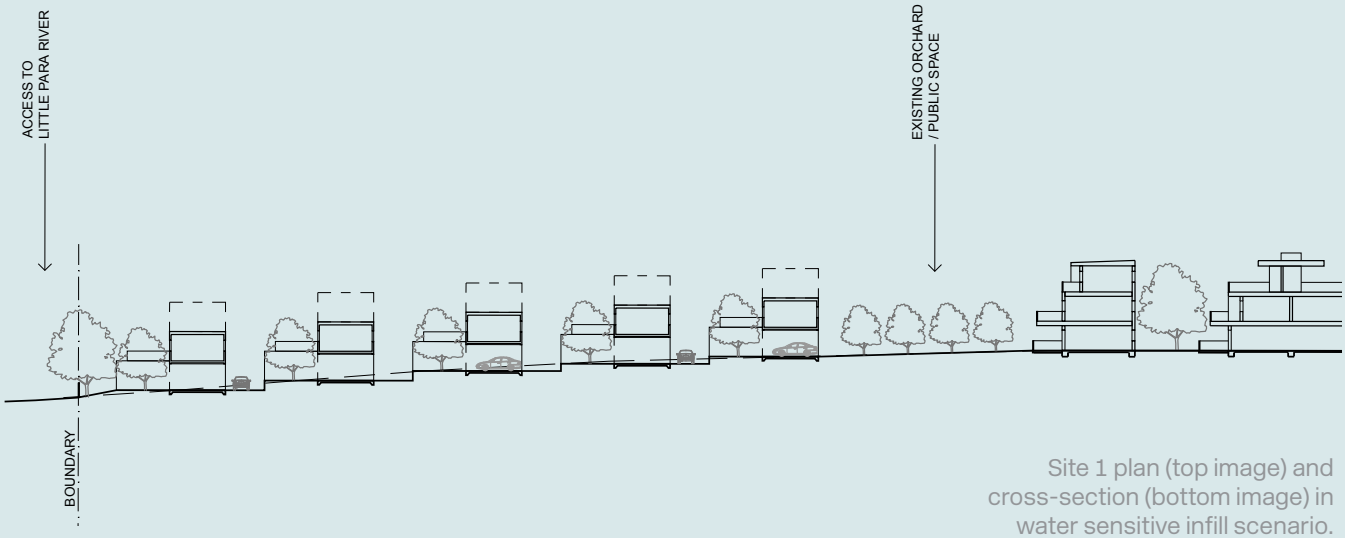
The CRCWSC collaborated with the City of Salisbury, which is a major enabler of residential subdivisions in their local government area, to explore different potential infill development opportunities for a 130 ha precinct on the eastern perimeter of the Salisbury City Centre. Participants were led through a clear assessment process for defining and evaluating alternative development scenarios. Multiple scenarios were developed at a range of scales, including a rigorous design of site plans for individual properties that were later aggregated to explore impacts at the precinct scale.

Existing and pre-urbanisation scenarios formed the baseline against which three alternative urban renewal futures were compared: business-as-usual (without planning intervention), water sensitive conservative, and water sensitive maximised. Scenarios were assessed in terms of urban water flows, urban heat, and architectural and urban space quality. Results were also compared with context-specific targets where available.

Overall, the case study demonstrated that choices of infill development design can significantly change the water performance of a development. Alternative site planning and building typologies that integrate water sensitive principles can considerably influence stormwater runoff, infiltration, evapotranspiration, and urban heat, and thereby improve liveability, resilience and water security. Both water sensitive scenarios outperformed existing and infill business-as-usual scenarios in all evaluated areas. In providing alternatives to business-as-usual, and quantifying all water inputs and outputs from a site, this work provides a foundation for a more quantified business case for water sensitive interventions.

3D view of Site 1 in water sensitive infill scenario.
Credits: Monash Urban Laboratory with
The University of Western Australia






Site 1 plan (top image) and cross-section (bottom image) in water sensitive infill scenario.
Credits: Monash Urban Laboratory with The University of Western Australia

# 5. Facilitate implementation

Implementation is concerned with embedding the preferred development scenario and servicing options within policies and plans, funding and financing, and service delivery arrangements. Because urban development may proceed over decades, it is important to ensure planning instruments and governance arrangements are able to facilitate the delivery of water sensitive outcomes over these timeframes.

## Why is this important?

Existing planning instruments (e.g. policies and development standards) and governance arrangements (e.g. organisational roles, approval processes) are likely to reinforce conventional approaches to servicing and development. This makes it difficult to pursue water sensitive forms of urban development (e.g. serviced by integrated and multi-functional infrastructure), which generally raise more complex implementation risks and challenges.

Practitioners need to think about pathways to proactively address these implementation risks and challenges. This should occur early on, when the vision and aspirations are being set, and consider how planning instruments are defined and enforced, and how costs and responsibilities are shared.

### Principles and considerations

Analysing the planning landscape for implementation risks and opportunities (see 'Investigate the development context') is an important input for this activity. This will help determine where to focus efforts and what type of interventions are required to ensure desired water sensitive outcomes are delivered.

***Planning instruments that are clear, comprehensive and consistent are more likely to facilitate desired outcomes***

Many implementation pathways are likely to involve the formal creation or modification of planning instruments. These may involve planning scheme amendments or new referral documents such as engineering standards, structure plans or sub-catchment plans.

In any of these cases, key things to consider are the *type* and *quality* of instruments. Different instruments affect an outcome in different ways (e.g. through economic, regulatory or informational means), so choosing the right type of instrument is key. The quality of instruments relates to how *clearly* they communicate directions so that they are interpreted by others as intended, how *comprehensively* they address the issues of concern, and how *consistently* they relate to other instruments with minimal redundancies and contradictions.

***Implementation arrangements need to be collectively defined and agreed to in advance***

Well-designed planning instruments are not enough on their own to facilitate water sensitive outcomes. Practitioners also need to consider how different stakeholders work together to implement decisions. Explicit attention needs to be given to ongoing implementation arrangements.

Given the breadth of stakeholders involved in the construction, operation and maintenance of various assets and services—which are often different from those involved in earlier planning and strategy development—it is important that some form of collaboration continues once planning is complete and the project shifts its focus to delivery. All collaborators must clearly understand the implications of committing to the preferred development scenario and servicing options in terms of costs, benefits, risks and responsibilities. They should also agree on how decisions will be made and how conflicts will be resolved during implementation.

***Advocate early for enabling planning conditions***

The stage of development and related decision making processes will have a bearing on the implementation pathways available. Ideally, scenarios and options are fully investigated before implementation pathways need to be determined.

However, sometimes the analysis of alternative development scenarios and servicing options may lag key urban planning milestones with the risk of emerging options being locked out by the adoption of narrow or prescriptive planning instruments. Where this risk arises, it may be possible to advocate for planning conditions that are enabling (or at least neutral) of the water sensitive servicing options or solutions being considered. These 'placeholders' can be converted to more specific instruments at later stages in the development process when there is more certainty.

***Monitoring is necessary to address implementation issues as they arise***

Progress needs to be monitored for any emerging issues. It is almost inevitable that some aspects of the preferred scenario will encounter problems with implementation. Collaborators must be agile in responding to such issues as they arise and work together to decide on strategic responses, to avoid abandoning desired outcomes in favour of more conventional approaches.

***Policy and planning reforms may be required to facilitate desired outcomes***

In some cases, available implementation pathways will be insufficient to achieve desired outcomes. Where planning instruments are absent or constraining, a separate program of intervention focused on planning or governance reform might need to be considered. This may seek to trigger a new planning activity to fill a gap in policy (such as corridor planning) or significantly change existing policies, regulations and standards. These activities are likely to require significant time, effort and resources, and involve extensive and strategic engagement with relevant authorities.

## Case study 8 – Collaboration secures implementation pathways for water sensitive outcomes in Fishermans Bend

Fishermans Bend is Australia's largest urban renewal (brownfield) area, situated on the southern edge of Melbourne's central business district. It is expected to house 80,000 residents and 80,000 workers. The site is subject to a number of environmental constraints including high levels of ground contamination, tidal and storm surge issues and projected sea level rise. The scale and profile of the renewal area presents a unique opportunity to showcase a range of water sensitive infrastructure and design solutions.

Prior to the rezoning of Fishermans Bends in 2012, water utilities had begun to explore integrated water servicing approaches in collaboration with local councils. Initially, collaborative arrangements were relatively informal, but the need to engage at a higher level with decision makers and provide greater transparency led to the formal creation of the Fishermans Bend Taskforce in 2016 by the State Government.

The Taskforce was set up with many seconded members from both councils, state government and South East Water, and has been subject to multiple levels of governance, with a Ministerial Advisory Committee that included community representatives, a Fishermans Bend Development Board comprising highly respected independent individuals, and a Mayors' Forum. A specific working group, the Drainage Working Group, was set up within the Taskforce in 2018 to focus on water servicing options.

With the support of the CRCWSC and consultants, the working group developed a number of water sensitive strategies that informed the infrastructure strategy, precinct planning and water-related developer contributions for Fishermans Bend. These strategies include dual pipe recycled water for most non-potable demands, hybrid drainage infrastructure (through a combination of linear green swales, parks and existing underground drains), and urban ecological design (through green corridors, public open space and building design) to naturalise and cool Fishermans Bend.

Over time, these water sensitive strategies were embedded in various planning instruments. The 2013 Draft Vision and Design Guidelines for Fishermans Bend put in place interim requirements for rainwater tanks, dual water pipes and water sensitive urban design measures for drainage management. These applied until the release of the Fishermans Bend Framework, which was finalised in 2018. In addition to these requirements, the Framework made provision for a local water recycling plant. By embedding the water recycling plant in the Framework, it secured commitment to the solution but allowed detailed design to be deferred until later stages of development, after further investigations and consultation have been completed. The Framework has since been included as a reference document within the Melbourne and Port Phillip Planning Schemes. This means that all development will be assessed against the principles and servicing outcomes that are outlined within them.

Amendments to the Melbourne and Port Phillip Planning Schemes also introduced a suite of permanent planning controls for Fishermans Bend, including new local policies, schedules and various overlays. In combination, these planning controls will require: (a) all buildings to connect to dual pipe recycled water and have rainwater tanks, and (b) all streets to be green and incorporate water sensitive flood reduction measures.

At the time of writing, detailed precinct plans and an Infrastructure Contributions Plan were under development. These plans are expected to build on the strategic directions included within the Fishermans Bend Framework. Finalising the Infrastructure Contributions Plan, which is particularly challenging in redevelopment contexts, will help ensure sufficient revenue can be collected to fund servicing requirements.

Overall, the case study highlights the importance of:

- starting planning early with all relevant parties, to stay ahead of and effectively guide development
- embedding water sensitive aspirations as mandatory requirements (as opposed to discretionary) within relevant planning instruments, to better ensure desired outcomes are delivered.


Public space in Fishermans Bend Urban Renewal Area.
Source: The State of Victoria Department of Environment, Land, Water and Planning 2018, Fishermans Bend Framework, Figure 15

# More information and resources

The CRCWSC has developed a range of resources and tools that can support practitioners apply the framework described in this document. A brief description of key resources and tools, including open access links are provided in this section, organised by planning activity.

**1. Establish a fit-for-purpose collaboration**

For guidance on how to design cross-sectoral collaborations to deliver water sensitive solutions, see:

Malekpour, S., Tawfik, S. and Chesterfield, C. (2020). *Designing cross-sectoral collaborations for integrated urban and water planning*. Melbourne, Australia: Cooperative Research Centre for Water Sensitive Cities.

**2. Investigate the development context**

The Water Sensitive Cities Index (WSC Index) tool is designed to benchmark a city or town's current performance against seven goals and 34 corresponding indicators of a water sensitive city. Benchmarking using the WSC Index can provide a useful way of holistically investigating context.

See also: Rogers, B.C., Dunn, G., Hammer, K., Novalia, W., de Haan, F.J., Brown, L., Brown, R.R., Lloyd, S., Urich, C., Wong, T.H.F. and Chesterfield, C. (2020). Water Sensitive Cities Index: A diagnostic tool to assess water sensitivity and guide management actions. *Water Research*, 186, p.116411.

For guidance on the critical aspects of planning and governance that should be diagnosed as part of this planning activity, see:

Tawfik, S. and Chesterfield, C. (2020). *Facilitating water sensitive urban development through planning integration: A discussion paper*. Melbourne, Australia: Cooperative Research Centre for Water Sensitive Cities.

For guidance on how to engage with communities to understand their values in relation to local water sensitive city transitions, see:

Rogers, B.C., Gunn, A., Church, E., Lindsay, J., Hammer, K., Dean, A. and Fielding, K. (2020). *Principles for engaging communities in water sensitive city transitions*. Melbourne, Australia: Cooperative Research Centre for Water Sensitive Cities.

**3. Create a place-based vision and alternative development scenarios**

The *Infill typologies catalogue* provides a range of water sensitive housing typologies, at densities and configurations relevant to Australian cities, and applicable to contemporary infill development scenarios. See:

London, G., Bertram, N., Sainsbury, O. and Todorovic, T. (2020). *Infill typologies catalogue*. Melbourne, Victoria: Cooperative Research Centre for Water Sensitive Cities.

The six developmental states articulated in the Urban Water Transitions Framework can be used to guide the formulation of development scenarios.

The Scenario Tool can be used to rapidly visualise and compare development scenarios.

**4. Analyse development scenarios and servicing options**

The Investment Framework for Economics of Water-Sensitive Cities (INFFEWS) describes a set of economic evaluation tools and resources that include a:

1. Benefit Cost Analysis Tool which can be used to support balanced and systematic decisions and inform business cases. The tool can be used to assess community-wide and organisation specific costs and benefits.

2. Value Tool which is a database of monetised values for non-market benefits relevant to public and private sector water sensitive investments.

The Scenario Tool can be used to rapidly visualise and compare development scenarios for urban heat, density, greening and water management—all-in-one platform.

The *Infill Performance Evaluation Framework* can help assess and compare the water sensitive performance of different infill designs, see:

Renouf M.A., Kenway S.J., Bertram N., London G., Todorovic T., Sainsbury O., Nice K., Moravej M. and Sochacka B. (2020). *Water Sensitive Outcomes for Infill Development: Infill Performance Evaluation Framework*. Melbourne, Australia: Cooperative Research Centre for Water Sensitive Cities.

The Site-scale Urban Water Mass Balance Assessment (SUWMBA) Tool can be used to understand and manage water sensitive performance by quantifying the water flows associated with an urban area.

For an easy assessment of different water-sensitive housing and open space options and configurations, see:

London, G., Bertram, N., Sainsbury, O. and Todorovic, T. (2020). *Infill typologies catalogue*. Melbourne, Victoria: Cooperative Research Centre for Water Sensitive Cities.

**5. Facilitate implementation**

For guidance on (a) the design of planning instruments and (b) coordinating the implementation of planning instruments to advance water sensitive outcomes, see:

Tawfik, S. and Chesterfield, C. (2020). *Facilitating water sensitive urban development through planning integration: A discussion paper*. Melbourne, Australia: Cooperative Research Centre for Water Sensitive Cities.

For guidance on some of the changes needed to ensure the authorising environment for water infrastructure investments better enables the delivery of water sensitive urban design projects at scale, see:

Fogarty, J and van Bueren, M. (2020). *A review of existing funding models, economic regulatory frameworks, policies and mechanisms*. Melbourne, Australia: Cooperative Research Centre for Water Sensitive Cities.

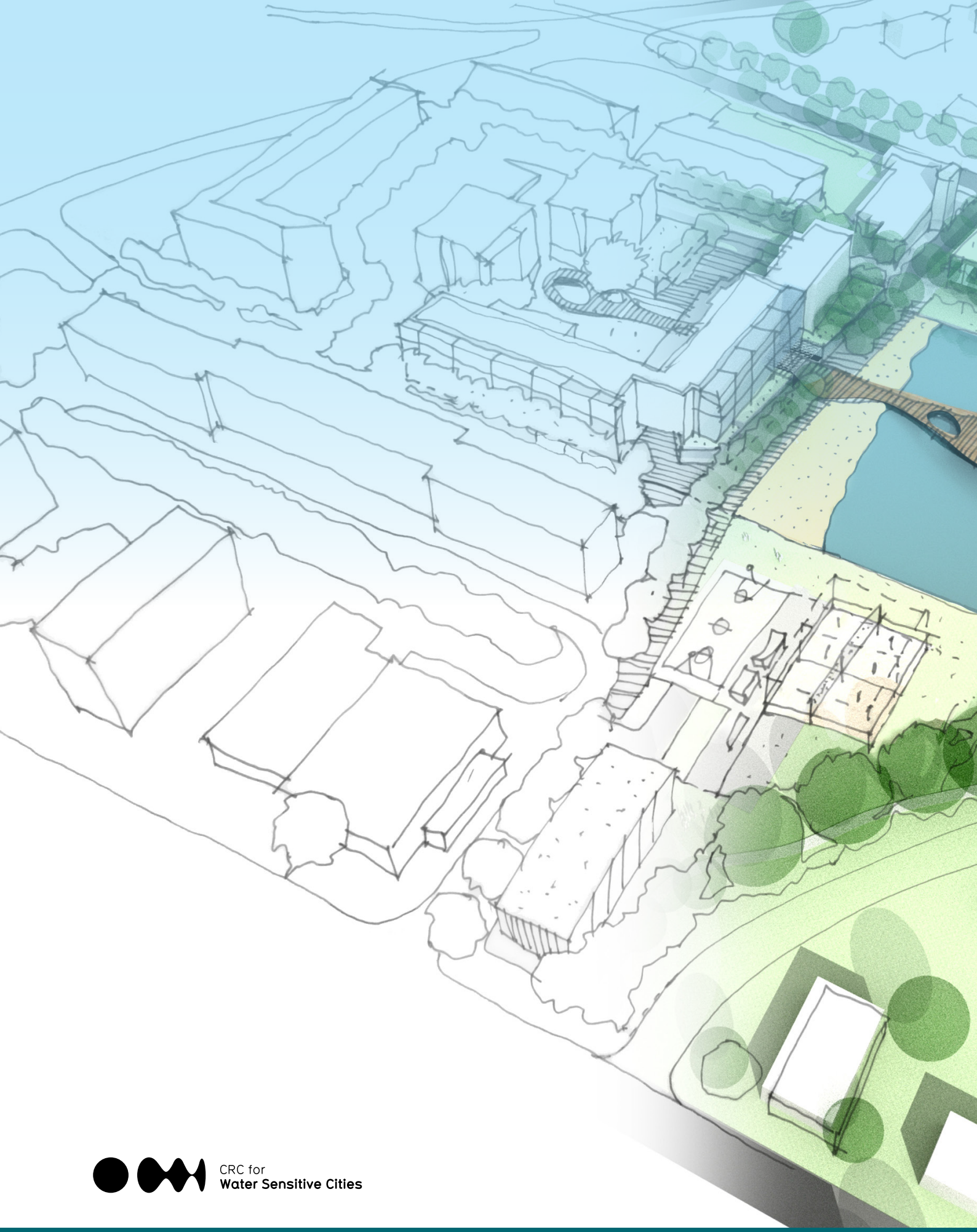
For guidance on how to influence opinion formation and policy making to facilitate progress towards water sensitive cities, see:

Laing, M. & Walter, J. (2018). *Policy influence: tactics and strategies for researchers*. Melbourne, Australia: Cooperative Research Centre for Water Sensitive Cities.

# Glossary

| Term | Definition |
|---|---|
| **integrated urban and water planning**[1] | Integrated urban and water planning describes a means for achieving water aspirations through the urban development process. This enabling context is created through the conscious and systematic integration of water planning with urban planning. |
| **planning instruments**[1] | 'Instruments' are tools of governance that aim to achieve public policy objectives through coercive, economic and/or normative means. Planning instruments, as used in this document, describes a subset of instruments used to influence urban development and water servicing. |
| **urban development** | Urban development typically falls within one of the following categories:<br>a. greenfield development on previously agricultural land or regrowth bushland with no or limited existing infrastructure, which creates more flexibility in the design of the urban form<br>b. brownfield development on previously industrial land, meaning that there is some existing infrastructure (e.g. roads and pipes) that may require augmentation to make development viable, but significant scope still exists to shape urban form<br>c. infill development where existing residential/commercial buildings are gradually knocked down and replaced or embellished over time, allowing for incremental change to the urban form. |
| **urban planning**[1] | Urban planning is concerned with shaping cities, towns and regions by managing development, infrastructure and services to deliver liveability, productivity and sustainability benefits for the whole community. It is both a forward-looking activity, in allocating land for future uses, and a decision making process, in controlling the pace and type of development. |
| **water planning**[1] | Water planning refers to the planning and management of urban water systems (i.e. water supply, wastewater and stormwater, waterways and floodplains) to enable the sustainable growth of cities, towns and regions. This broad understanding of water planning moves beyond traditional conceptions—focused on the safe and reliable delivery of segregated water supply, sewerage and drainage services—to emphasise a total water cycle planning and management approach that supports the delivery of a broader range of urban liveability, productivity, resilience and sustainability benefits. |
| **water sensitive city** | A water sensitive city provides water system services in a way that reflects an integrated approach to infrastructure, the built form, the environment, governance and community, to deliver outcomes that support the enduring sustainability, liveability, resilience and productivity for a place's community and ecosystems. |
| **water sensitive urban development**[1] | Water sensitive urban development refers to urban expansion (through greenfield development) and intensification (through infill redevelopment) that incorporates sustainability and liveability principles, with a particular focus on water as a key enabler. Successful implementation requires adoption of a holistic view of the urban water cycle and services, and consideration of environmental impacts on the larger ecosystem and catchment. Water sensitive urban developments are a critical building block for water sensitive cities; that is, cities that support sustainable, resilient, liveable and productive communities. |

[1] See Tawfik, S. and Chesterfield, C. (2020). *Facilitating water sensitive urban development through planning integration: A discussion paper*. Melbourne, Australia: Cooperative Research Centre for Water Sensitive Cities.



CRC for
Water Sensitive Cities


**Cooperative Research Centre for Water Sensitive Cities**

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

info@crcwsc.org.au

www.watersensitivecities.org.au