CRC for
Water Sensitive Cities

Benchmarking, Envisioning and Transition Planning for a Water Sensitive Greater Sydney: Final Case Report

CRCWSC Integrated Research Project 1:
WSC Visions and Transition Strategies

Australian Government
Department of Industry, Innovation and Science

Business Cooperative Research Centres Programme

Benchmarking, Envisioning and Transition Planning for a Water Sensitive Greater Sydney: Final Case Report

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Executive summary

This Vision and Transition Strategy defines a vision of a water sensitive future for Greater Sydney, NSW, and outlines the broad steps the city should take to enable a transition towards this future. It is the outcome of a project by the Cooperative Research Centre for Water Sensitive Cities (CRCWSC), which brought together 51 leading thinkers across water, planning, environment and development in Greater Sydney in a series of action research workshops. Participants considered the city's long-term water aspirations, benchmarked today's water sensitive performance and explored strategic priorities for the short- to medium-term that will be important in pursuing their water sensitive city vision.

Sydney's unique water story

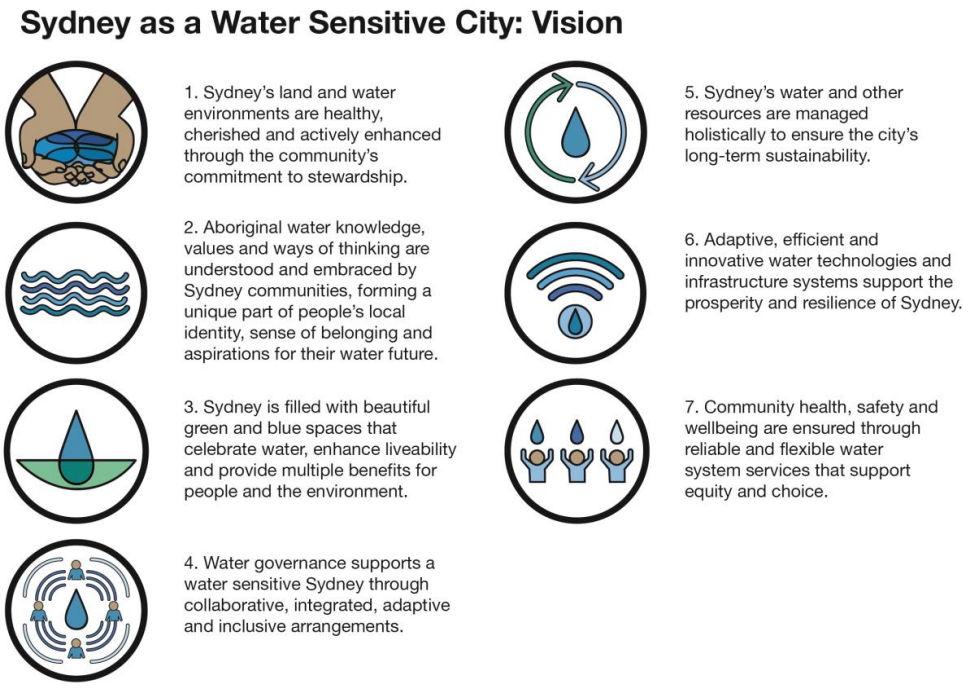
Greater Sydney has a unique, complex relationship with water that has been shaped by its diverse landscape and population. The people and culture of the Eora Nation were sustained by a diverse natural landscape and rich biodiversity spanning across the ocean, beaches, coastal estuaries, and rivers extending to the Blue Mountains. The iconic natural features of the area attracted people from all over the world and gradually the natural landscape was transformed by land clearing for farming and exploitation of the region's rich natural resources.

As the population boomed in the 19th century, public health became the key driver of investment in water supply and sewerage systems. Urban and water planning arrangements emerged in an increasingly complex governance landscape to guide development, environmental protection and flood risk mitigation. Today, Greater Sydney faces a changing climate and rapidly growing population, and is presented with a new challenge of how to manage its water in a way that enhances liveability and ensures Sydney remains a great place to live for future generations.

Vision of a water sensitive Greater Sydney

The 50-year vision for Greater Sydney as a future water sensitive city depicts the values and outcomes to be ensured over the long-term:

Sydney is a beautiful, prosperous and resilient city with thriving communities, healthy ecosystems and cherished urban landscapes supported by active water stewardship.

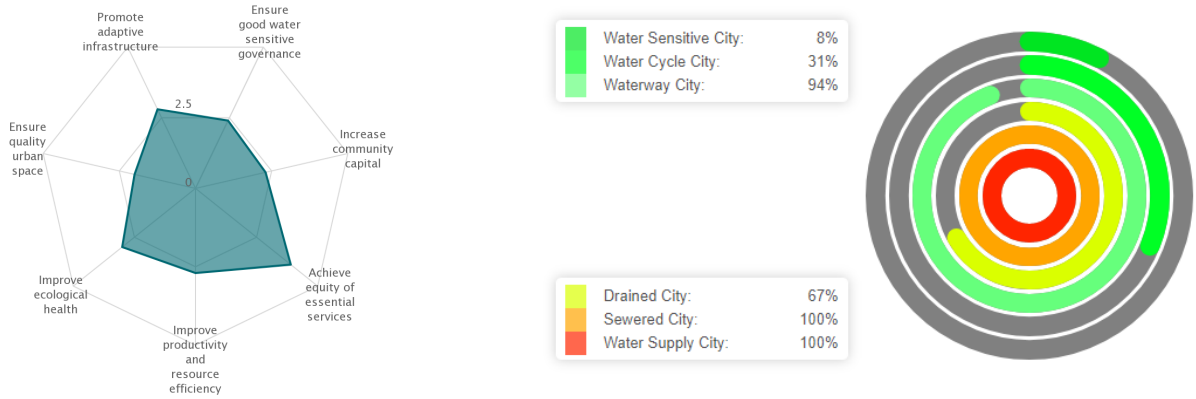


Current water sensitive performance

To understand Greater Sydney's current water sensitive performance, the CRCWSC's Water Sensitive Cities Index (WSC Index) benchmarking tool was used. Sydney's performance in the Index suggests it is strongest in the goal of *achieve equity of essential services* (3.9/5.0) and *improve ecological health* (3.0/5.0). Areas for improvement include *ensure quality urban space* (2.0/5.0) and *increase community capital* (2.3/5.0).

Interpreting these results against the six city-states of the Urban Water Transitions Framework highlights Greater Sydney's high performance in the provision of basic services of water supply and sewerage. Improved flood risk management in some parts of city would help increase the drained city status. Beyond these, Sydney has shown good progress in the waterway and water cycle city states, with room for further innovation to increase these ratings as it becomes more water sensitive.

Given the large geographic areas of Greater Sydney, benchmarking different parts using the WSC Index would give more in-depth insight into priority management actions for improving scores for specific locations.



Transition assessment and strategic recommendations

Greater Sydney's progress towards its vision was analysed using the CRCWSC's Transition Dynamics Framework, which assesses the presence of important enabling factors that would support a city's transition to a new practice. This analysis indicates that Greater Sydney has made significant advancements, with strong leadership from champions around specific issues, demonstration projects of successful water sensitive practice, and a range of policy tools to guide new practices.

To further advance Sydney's water sensitive city transition, particular focus is needed on establishing platforms that will support collaboration across diverse stakeholders to drive new solutions for the broad range of issues associated with water sensitivity. Specific high-level strategies recommended to address priority transition needs in the short- to medium-term include:

I. Create formal and informal networks for driving Sydney's water sensitive city agenda to support a collaborative, flexible and integrated governance approach.

II. Embed Sydney's water sensitive city vision in organisational policies, plans and strategies.

III. Establish a cross-organisational framework that enables and drives an integrated and strategic approach for managing the whole water cycle.

IV. Increase knowledge about the social, technical and design solutions that are not sufficiently developed yet to deliver the full scope of Sydney's water sensitive city vision.

V. Identify and establish pathways for implementing water sensitive solutions through innovation and investment.

Greater Sydney has been building momentum towards achieving its vision of a future water sensitive city. However, strategic attention is needed to overcome the social and institutional barriers that could impede further on-ground progress. The recommendations presented in this *Vision and Transition Strategy for a Water Sensitive Greater Sydney* aim to provide high-level orientation and guidance for stakeholders across the city pursuing a water sensitive city agenda. Implementation planning is now needed to develop tangible actions and specific opportunities that will help to further advance the city's transition progress.

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Glossary

CRCWSC	Cooperative Research Centre for Water Sensitive Cities
Collaboration platform	A forum, network, group, program, project, or other mechanism for connecting a diverse group of stakeholders in order to share knowledge and information, develop ideas and establish a collective voice
IRP1	CRCWSC Integrated Research Project 1 *Water Sensitive City Visions and Transition Strategies*
Narrative	A well-articulated rationale that is tailored to a particular audience and makes a compelling case for a particular practice or action, including a description of its ecological, economic, and social benefits
Traditional Owners	Traditional custodians of Greater Sydney's catchments, together with other Aboriginal people who have made it their home
Transition	A fundamental shift in cultures, structures and practices as society changes from one pattern of socio-technological development to another usually more sustainable pattern
Transition Dynamics Framework	A framework that conceptualises how system-wide changes in practice (e.g. the transition to water sensitive practices) unfold over time, based on the establishment of key enabling factors: individual and organisational champions, platforms for connecting, science and knowledge, projects and applications, and tools and instruments
Urban form	The physical characteristics that make up the built environment, including urban density and size, parcels and buildings, public spaces, ecological assets and key services such as transport and drainage
Urban Water Transitions Framework	A framework that conceptualises different forms of urban water servicing as a city responds to evolving drivers: Water Supply City, Sewered City, Drained City, Waterways City, Water Cycle City, and Water Sensitive City
WSC	Water Sensitive City; a WSC provides water system services in a way that reflects an integrated approach to infrastructure, the built form, the environment, governance and community, in order to deliver outcomes that support the enduring sustainability, liveability, resilience and productivity for a place's community and ecosystems
WSUD	Water Sensitive Urban Design; an approach to the planning, design and maintenance of urban landscapes that will deliver WSCs through protecting and enhancing natural water systems and integrating the management of the total water cycle
WSC Index	A tool to benchmark and diagnose the water sensitive performance of a place (from the municipal to metropolitan scale), based on 34 indicators; good water sensitive governance, community capital, equity of essential services, productivity and resource efficiency, ecosystem health, quality urban space, and adaptive infrastructure.

1. Introduction

1.1. Background

As cities and towns globally are grappling with the challenges of climate change and rapid urbanisation, practitioners, decision-makers and academics are recognising the importance of water in supporting urban liveability, sustainability and resilience for a city's long-term prosperity.

In Australia, the concept of the water sensitive city (WSC) is now widely used to represent an aspirational city-state, where water has a central role in shaping a city. In a water sensitive city, people can enjoy reliable water supplies, effective sanitation, protection from flooding, healthy ecosystems, cool green landscapes, efficient use of resources, and beautiful urban spaces that feature water and bring the community together.

A water sensitive city incorporates many innovative infrastructure, design and governance solutions. For example, water recycling at different scales, through wastewater recovery and stormwater harvesting, provides a diversity of water sources and improves the health of downstream rivers and creeks by reducing pollution and flow impacts. Water sensitive urban designs integrate nature-based infrastructure into the landscape to provide hydraulic and water treatment function, as well as amenity benefits such as an aesthetic environment and mitigation of urban heat island effects. Integrated and collaborative land use and water planning results in catchment-scale approaches to enhancing flood resilience and connecting areas of green and blue to create ecosystem and recreation corridors throughout the city footprint. Citizens are active in caring for water and the environment, and there is cohesion amongst the community as their sense of place and collective identity is nurtured through their connection with water.

Many places are starting to articulate aspirations represented by the water sensitive city concept. However, there is not yet an example of a water sensitive city in the world and becoming one is not easy. It requires a significant departure from the conventional mode of water servicing, which typically manages water as separate streams for water supply, wastewater and stormwater through large-scale, centralised infrastructure. These traditional water systems have given us critical benefits such as clean water, safe sanitation and effective drainage, and this mode of servicing is still an important part of a water sensitive city. However, we now recognise that adaptations are needed to address key social and environmental vulnerabilities such as degraded waterways, uncertain and extreme rainfall patterns and growing community expectations for improved liveability.

Significant changes in policy and practice are required for a city to achieve its water sensitive vision. Transitioning to a water sensitive city therefore requires commitment and alignment amongst many different people and organisations. Developing a shared perspective of water today, a vision for the future and a framework to guide coherent strategic action is critical for establishing the understanding, motivation and capacity amongst stakeholders to drive their water sensitive city transition.

1.2. About this report

The Cooperative Research Centre for Water Sensitive Cities (CRCWSC) was invited to develop a WSC vision and transition strategy for Sydney, encompassing the Greater Sydney region. This forms part of the *Water Sensitive City Visions and Transition Strategies* integrated research project (IRP1), which aims to develop tools and processes for bringing city stakeholders together to create strategic alignment and partnerships for transitioning to their envisioned water sensitive future.

The workshop series engaged industry stakeholders in performance benchmarking and diagnostic assessment, the co-creation of a shared vision of a water sensitive city, and development of a strategic framework for guiding the transition to their envisioned water future.

Greater Sydney is one of five case studies conducted as part of the *Water Sensitive City Visions and Transition Strategies* project (along with Perth, Adelaide, Townsville and Bendigo). The CRCWSC has also undertaken a similar project for Gold Coast outside the IRP1 project structure. As these cases are delivered, findings from across cities will be analysed to develop strategic insights about the agenda of transitioning to a water sensitive Australian cities more broadly.

This report presents the outcomes of the Greater Sydney case study, methodological details and full analyses that underpin the results:

Section 1	Introduction and methodology
Section 2	The historical, contemporary and future water story for Greater Sydney
Section 3	A 50-year vision for Greater Sydney as a water sensitive city
Section 4	Benchmark of Greater Sydney's current water sensitive performance
Section 5	Assessment of Greater Sydney's current enabling conditions for transitioning and strategies for advancing individual vision elements
Section 6	Assessment of Greater Sydney's transition progress to its overall vision and four overarching strategies to make further advancements

The report consolidates results of analysis by the project team and participant discussions, iterated over the course of three workshops and a series of pre-workshop interviews. Workshop images and anonymous participant quotes are included to highlight key activities and perspectives.

A companion report, "Vision and Transition Strategy for a Water Sensitive Greater Sydney", consolidates these outcomes into an executive summary that is intended for broad circulation.

Alongside the production of practical guidance for the Greater Sydney water sector contained in this report and its companion document, the engagement process overall has been valuable for strengthening relationships amongst stakeholders and building momentum and commitment for driving Greater Sydney's transition towards its envisioned water sensitive future.

This document and the actions it describes have no organisational commitment or status in government policy. However, it is intended to be used by many different stakeholders as a sector-wide strategic framework to inform the development of intra- and cross-organisational policies, strategies and programs.

1.3. Case methodology

The IRP1 approach is based on ongoing research by the CRCWSC that aims to develop a suite of methods and tools for providing strategic guidance to cities and towns wanting to accelerate and build momentum for the transition towards their envisioned water sensitive future. It applies an action research methodology where stakeholders contribute to knowledge co-production with the research team through a series of workshops, supported by supplementary engagement and analytical activities.

The Sydney case stakeholder engagement was conducted over a five-month period between June – October 2017, and involved desktop review by the project team, individual interviews with workshop participants, a series of three full-day workshop sessions, and iterative synthesis and analysis across all the above sources of data to produce key elements of Great Sydney's vision and transition strategy. Details of the individual activities are provided below.

The workshop design and data analysis drew on theories and frameworks within transitions scholarship, an emerging body of research focused on understanding and navigating sustainability transitions. Within this field, the CRCWSC has developed two key benchmarking and diagnostic tools that were applied in this project: the Water Sensitive Cities Index and the Transition Dynamics Framework (further detailed in Sections 4 and 5).

Desktop review

The project team reviewed relevant literature to examine key themes and developments that have been significant for Sydney's water system and identify evidence important for benchmarking the city's current water sensitive performance and transition progress. Key sources of secondary data include NSW Government policy documents relevant to the topic areas of the WSC Index, key NSW Acts and regulations, department and agency websites, as well as published academic literature relevant to water policy in the Greater Sydney region. Key sources are listed in the References section.

Participant recruitment

Water, planning, development and environment sector representatives drawn from water, government and non-government organisations that are relevant to Greater Sydney's governance, culture, economy or environment were invited to participate in the process. Participants were personally invited to ensure a rich mix of organisations, disciplines and perspectives. The participant group included a total of 52 participants (see Appendix A for full list), though individuals' attendance varied from workshop to workshop.

Interviews and pre-workshop survey

Pre-workshop interviews were conducted with practitioners across Greater Sydney's water, development, planning and environment sectors. Most interviews were conducted individually, though in some cases two individuals were interviewed together. A total of 38 people were interviewed. Interviews examined participants' understanding of Greater Sydney's water management issues, major challenges and opportunities, and professional and organisational culture, systems and processes. The interview questions were open-ended to allow for in-depth narratives about personal experiences and perceptions. Anonymous interview quotes are used throughout the report to illustrate key points. Perceptions expressed in the quotes should not be interpreted as representative of the views of the whole participant group, or of the authors.

Workshop participants also completed a quantitative baseline survey to complement the data provided in the interviews and to inform a national evaluation of the processes implemented as part of the project.

Participatory workshops

The workshops were structured and designed to lead participants through an iterative series of discussions to understand the existing system conditions, develop shared aspirations for Greater Sydney's future, identify barriers to change, and understand strategic priorities. There were three full-day workshops between July and October 2017.

The project team produced an interim report after each workshop that synthesised key outputs and incorporated subsequent analysis that drew on the desktop review and participant interviews, in addition to workshop discussions. At the subsequent workshop, participants were given the opportunity to refine and validate these outputs. Collectively, these outputs produced a strong narrative, clear strategic direction and a framework to create alignment and drive coherent action amongst stakeholders.

Workshop 1 - Understanding and benchmarking today

The first workshop, held on 31 July 2017, applied the WSC Index to benchmark Greater Sydney's water sensitive performance to diagnose key areas of strength and weakness with respect to the seven goals of good governance, community capital, equity of essential services, productivity and resource efficiency, adaptive infrastructure, ecological health and quality urban space.

The WSC Index application involved a full day workshop in which the 34 indicators across the seven goal areas were scored on a 1-5 rating scale. Scoring was performed by participants individually using an interactive web-based tool, before a consensus score was determined by discussion and negotiation. The results of benchmarking enabled comparisons against modelled representations of the "water sensitive city" or "water cycle city", as well as to other cities that have participated in the WSC Index program.

Workshop 2 - Developing a narrative and future vision

The second workshop was held on 14 August 2017. Participants were asked to consider the past and future drivers, industry trends and significant developments for Greater Sydney. The narrative of Greater Sydney's historical and future developments created a deep appreciation of the contextual drivers and trends that have shaped and will continue to shape Greater Sydney. This led participants to consider why a water sensitive city transition is necessary and what a water sensitive city would need to deliver for Greater Sydney to continue to thrive.

Against this context, participants identified their vision for Greater Sydney in a 50-year timeframe. This comprised a suite of outcome statements that represent distinct but interconnected aspirations. The 50-year time frame was chosen to enable participants to think beyond today's paradigms and constraints, since transformative change can occur over such a period.

Also at this workshop, participants were introduced to principles and frameworks emerging from transitions theory to provide them with a conceptual understanding of how transitions dynamically unfold and the types of strategic actions that have been shown to be valuable in enabling successful system transitions. Participants were also asked to discuss the challenges that could hinder the transition to the envisioned future for each of the seven goals of the WSC Index.

Workshop 3 - Reviewing strategic priorities for achieving the vision

The third workshop, held on 21 September 2017, began by refining and validating Greater Sydney's historical water story synthesised by the project team following the previous sessions, and discussing the different drivers for how water has been managed up until today. The workshop then validated and refined the draft water sensitive city vision by adding further detail and tailoring it to the Sydney context.

The afternoon explored recommended strategies for achieving the vision based on analysis using the Transition Dynamics Framework, a tool used to assess the current enabling environment (further detail can be found in Section 5). The discussions explored how these recommended strategies can be taken forward in Sydney and what that means for the role of the participant group. The results of these discussions have contributed to the content of this report.

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2. Greater Sydney's water story

2.1. Looking back to the past

When preparing for future changes, it is helpful to look to the past and learn from patterns of change and previous responses to trends and events. Engagement with participants focused on building a collective timeline of people's historical knowledge and experiences with water management across Greater Sydney. Participants were asked to populate a timeline ranging from pre-history to the present, identifying key events and changes according to the categories of technical systems, environment, governance, community and personal experiences. Group discussion then unpacked the storyline that emerged, analysing key periods and their drivers and impacts, and how the evolving water systems enabled or were affected by the shifts observed. The following section is a synthesis of the activities and discussion of participants, supplemented by further literature review, to present Greater Sydney's historical and contemporary water story.

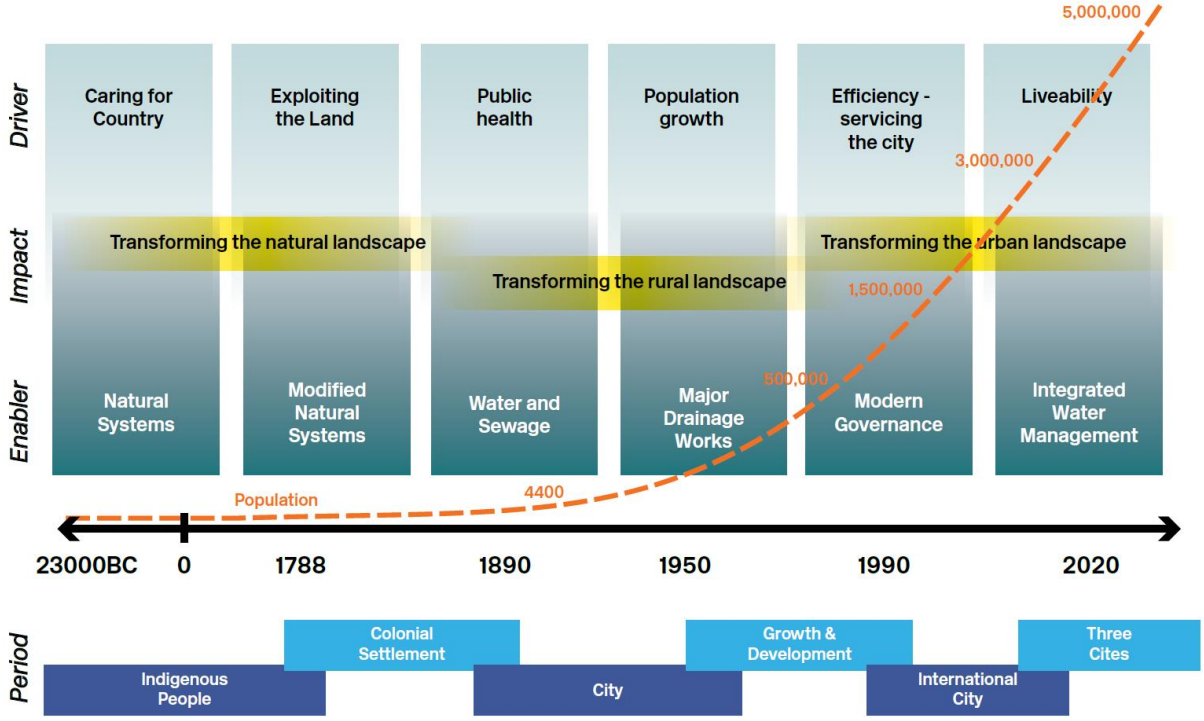


Figure 1: Synthesis of Greater Sydney's water story

Eora Nation, caring for country, natural landscapes

The Sydney region has been the country of the Eora Nation for more than 20,000 years. Prior to European settlement, their people and culture was sustained by a diverse landscape and rich biodiversity that spanned ocean and beaches, extensive coastal estuaries, and rivers extending to the Blue Mountains through plains and forest.

Penal settlement, exploiting the land, transforming natural landscapes

This continuous connection of Indigenous people and country was severely disrupted by the arrival of Governor Phillip and the first convicts transported to the new colony of New South Wales. Water supply played a major role in the struggle for the colony's survival. The convicts and colonists who followed gradually transformed the natural

landscape by clearing the land for farming and exploiting the regions rich natural resources. The harbour and rivers were vital for the colony's survival (Davies and Wright, 2013).

Public health and the first utilities

The population of Sydney boomed in the late 19th century with a rush to exploit the rich natural resources of NSW, whether it was gold or timber or farming. Disease began to take a heavy human toll in the rapidly growing city. Typhoid and cholera were widespread and feared. New understanding of human waste and polluted water as the causes of these diseases led to the creation of the Water Supply and Sewerage Board and the first significant investment in constructing substantial water supply and sewerage systems for the city.

In the first half of the 20th century, the First World War, Great Depression and Second World War held back growth and prosperity and there was little significant investment in infrastructure other than a number of small reservoirs and some employment schemes to rock-lined or concrete drainage channels.

Urban growth and development, major infrastructure, urban planning and governance experimentation

The end of the Second World War brought with it a new energy and nation building vision. A great period of infrastructure investment began with construction of the Warragamba Dam, an engineering triumph and still one of the largest urban water supply reservoirs in the world. The expanding city saw old problems of water pollution and environmental degradation emerge on a massive scale. Huge investment in expanding the sewerage system to service the suburbs was supported by the Federal Government. New legislation and institutions such as the State Pollution Control Commission were established to regulate industry and divert waste from waterways to the sewers.

A number of urban and water planning arrangements emerged in an increasingly complex and shifting governance landscape of somewhat variable effectiveness in guiding urban development, protecting the environment and managing the risks of flooding that were becoming a potential threat to community well-being.

International city, economic reform and the efficiency mindset

Recession, debt from the infrastructure boom and governance complexity and inefficiency drove a wave of reforms in the 1980s and 1990s. Governments and government institutions constantly reformed and restructured with financial efficiency a driving purpose. The Water Board was downsized and was corporatized, splitting into the Sydney Catchment Authority and Sydney Water Corporation in 1998. A major environmental initiative to clean up Sydney's waterways was launched. Sydney Water's 'Clean Waterways' program, designed to reduce sewer spills and improve water quality at ocean outfalls, was followed by the NSW Stormwater Trust, which funded councils to develop and implement stormwater management plans. For a time, Sydney led the nation in these initiatives to protect and improve the health of its waterways. However, momentum ebbed at the end of the century when the water crisis of 1998 spurred a focus on water quality, and the Millennium Drought caused a shift in political priorities.

Third wave of population growth, liveability and the three cities

The 2000 Olympic Games and the new millennium heralded the coming of a third great wave of population growth and urban expansion in Sydney, which is now being experienced. Like the post-war 'boom' period, there are significant threats from this ongoing growth to the environmental health and liveability of Sydney. The economic efficiency mindset characteristic of government in the 1990s is giving way to the emergence of liveability as an important driver of urban policy, institutional settings and investment in infrastructure. The complexity of planning, developing and servicing one of the world's great cities demands new governance thinking and a shift in institutional cultures and behaviours. New technologies and funding arrangements such as public-private partnerships may offer innovative new ways of servicing the city. Centralised command-and-control style management to exercise narrow 'city servicing' institutional functions, has become a somewhat outdated policy setting in an era of unprecedented urban population growth and diversity.

From this need, the Greater Sydney Commission has emerged as a new institutional instrument for collaboration and integration of effort, and with it the idea of the three cities: The Eastern Harbour City, The Central River City and the Western Parkland City.

Sydney has transformed from Country cared for by the clans of the Eora Nation, to a British penal colony struggling for survival in a strange new world, to a bustling and prosperous frontier town, to a modern post-war city, and then to today, widely acknowledged as one of the world's greatest cities, its prosperity and liveability underpinning a third great wave of population growth. Water system services provided by the region's waterways were the reason for the colony's initial establishment; these have also been a critical enabler of Sydney's growth and to a large extent, define its international image today. The scale and complexity of the infrastructure and nature of water system services has been accompanied by a 'modernising' of governance over time. It is critical that water system services and the way they are governed continue to evolve. While housing affordability and transport tend to dominate debates about urban planning, recent shifts have shown a desire to move from a single focus on cost efficiency towards more integrated urban and water planning for the delivery of liveability outcomes. This emerging policy direction may provide opportunities to re-engage with the First Nation peoples and recognise their ongoing connection with the lands and waters of the Greater Sydney region through a stronger voice in determining the future.

The collaborative development of Greater Sydney's water story up to the present day establishes a shared understanding of the trends that have shaped its current context and will influence its future. This provides a foundation for reflecting on the future for water in Greater Sydney, with its ongoing growth and evolution, and the importance of the city's water sensitive transition.

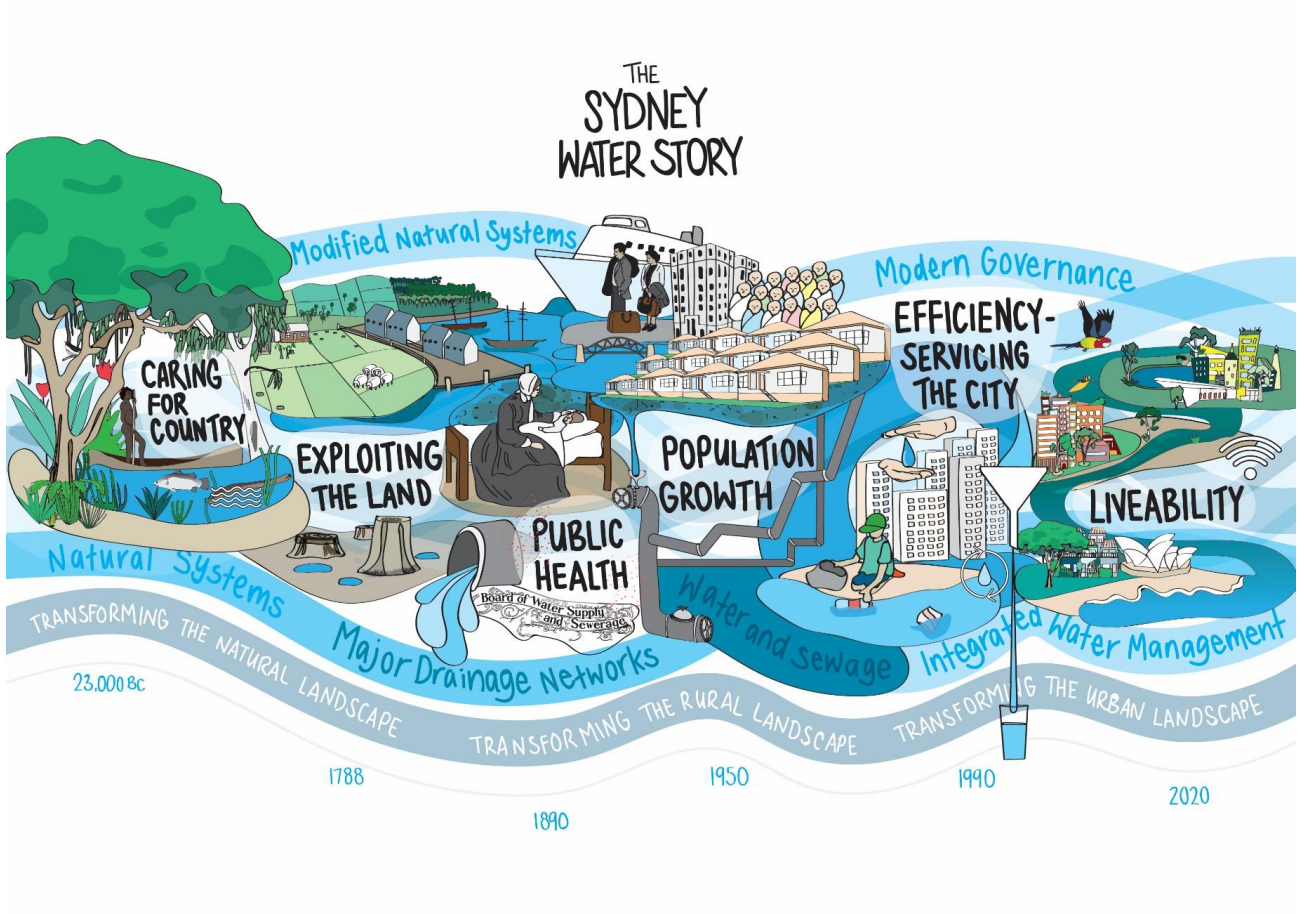


Figure 2: Greater Sydney's water story (Illustration by Lucy Klippan)

2.2. Looking to the future - The rationale for Sydney as a future water sensitive city

Participants were asked about the impacts and consequences of four key drivers (climate change, population growth, urbanisation and globalisation) on water management in Greater Sydney, and what a WSC will need to deliver for Greater Sydney to remain a great place in the future. Eamon Waterford, Committee for Sydney, presented on future living trends for the people of Sydney. Beck Dawson, Resilient Sydney, presented on the resilience of Greater Sydney to future shocks and trends. This section explores the drivers and trends that were discussed in the workshops, as well as what people love about Greater Sydney and what values they want preserved in the future.

Sydney is currently the largest city in one of the most urbanised countries in the world. It is also recognised internationally for its liveability and iconic built and natural features. It is now presented with the challenge of maintaining and enhancing its liveability and sustainability in the face of future trends such as climate change and population growth, while also maintaining affordability and equity for its diverse communities.

The impacts of climate change are already being experienced across Greater Sydney. Urban heat is a major issue for parts of Western Sydney, where temperatures can be significantly greater than those of the eastern suburbs. It is predicted that in the next few years, higher intensity storms and rainfall events will increase the risk of major flooding in the Hawkesbury Nepean floodplain and urban waterways. Intense rainfall will also create more frequent sewer overflows and increase stormwater first flush loads. Longer periods of hot, dry weather will increase bushfire risk in the Blue Mountains and Royal National Parks, which comprise a large portion of the metropolitan water supply catchment. Storm surge will put low lying infrastructure such as pump stations and sewers at risk, as well as the health of coastal wetlands.

"We are planning in an uncertain space; the scale of investment needed and source of funding for roads, water, transport and housing; the aging of assets and upcoming cost of renewal; a lack of understanding of the impacts of development on the rivers. But there are opportunities to overcome these challenges. We need to adopt a combination of approaches; to have smaller, more flexible, adaptable and modular systems and continued research to test ideas and assumptions."

Population growth and urbanisation are also putting pressure on existing water systems, processes and infrastructure. Population growth creates a higher demand on water resources, more pollution in the environment, and increased loads on water infrastructure. Globalisation and the increasing cultural diversity of neighbourhoods raises issues of equitable and affordable access to water services and amenity. The negative impacts of urbanisation are observed in the loss of green space and natural areas, and an increase in impervious surfaces due to extensive development. This is being experienced in both the new developments of Western Sydney and through increasing infill in the eastern parts of the city. This development causes changes in ecosystems and habitats, and in some instances, loss of species. It also exacerbates the urban heat island effect, which further impacts on people's health, wellbeing and behaviours.

While these drivers are a challenge for Greater Sydney's water systems services and processes, they also present a need and an opportunity to change the 'business-as-usual' approach. This may need to go beyond consideration of alternative water sources and innovative ways of re-using water and resources. The diversity of cultural backgrounds, differences in quality of environments and access to opportunity in Greater Sydney suggest that a greater focus on the role of water system services in supporting social equity will be important. This could include creating community connections to water and water-related environments, which in turn creates opportunities for learning and social cohesion.

Extensive greenfield and infill development provides opportunities to trial and implement innovative approaches to water service delivery. New developments will also provide the opportunity to test quality urban space solutions

that mitigate extreme heat and provide multiple benefits. A need for higher density living will reduce private green space, increasing the importance of public open spaces that provide the community with broad benefits, including opportunities to connect with the environment and each other.

"The WSUD concept means different things to different people. There is the assumption that we are doing best practice but this isn't achieving the desired outcomes and cumulative impacts are deteriorating our systems. We need to better understand how current practice is falling short."

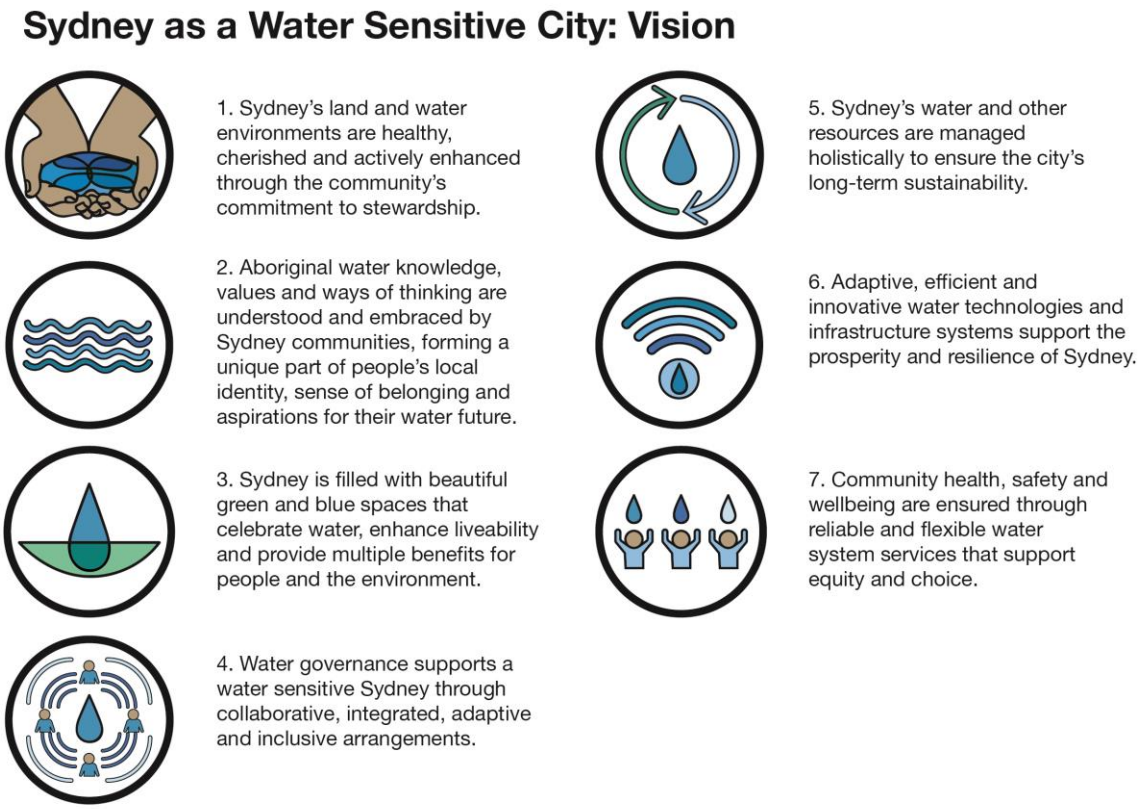
Sydneysiders value the diversity of people, places, and ideas that support their active, engaged, and connected lifestyles. They value the beaches and waterways for recreation activities such as surfing, swimming and sailing. They value the mountains and native bushland for connection to iconic flora and fauna species and Indigenous history. People desire happy, open and connected communities that care for each other. Business-as-usual may not be sufficient to ensure protection of these values, especially as Greater Sydney grows to 8 million or more by 2050. A more water sensitive approach may be needed to ensure the health and safety of future populations, while also protecting natural systems, contributing to the city's liveability, and ensuring Sydney remains an attractive, international city. The following sections of the report outline what it means for Greater Sydney to be water sensitive, and strategies for achieving the necessary practice changes.

3. Greater Sydney's Water Sensitive Vision

Against the backdrop of the future drivers and trends presented in the previous section, participants iteratively developed their vision for Greater Sydney as a water sensitive city over the course of Workshops 2 and 3. Initial brainstorming was structured around a visioning activity in which participants prepared headlines for a special future edition of TIME magazine. The headlines described Sydney in 2067 as "the world's most water sensitive city". Seven vision themes emerged from the headlines and were grouped on the wall: governance, ecological health, knowledge and values, accessing amenity, resources and technology, and innovation and economy. Participants elaborated on each theme through group discussions, which were consolidated into a series of outcomes statements and narrative text that provides a rich description of the aspired future water sensitive Greater Sydney in 2067.

The 50-year water sensitive vision for Greater Sydney aims to orient and align the actions of stakeholders over the long-term. The timeframe enables people to stretch their ambitions beyond today's systems and constraints to reflect on the transformative change that is possible over such a period.

Sydney is a beautiful, prosperous and resilient city with thriving communities, healthy ecosystems and cherished urban landscapes supported by active water stewardship.



1. **Sydney's land and water environments are healthy, cherished and actively enhanced through the community's commitment to stewardship.** People enjoy swimming and fishing in their local waterways. Sydney's water environments, including Sydney Harbour, the Hawkesbury-Nepean, Parramatta and other Rivers, and the city's many bays, beaches, creeks and lagoons are recognised internationally for their health and cultural significance. Water pollution is managed proactively to ensure clean and healthy waterways. Native iconic and threatened species thrive in surrounding bushland and in connected, urban habitats. People understand and value the interconnectedness of waterways, terrestrial environments, groundwater aquifers, and weather patterns. Waterways have legal standing and are afforded human rights, while previously degraded waterways have been reimagined and recreated. Citizens are empowered as custodians of the environment through education and opportunities for action, and advocate for improved environmental health outcomes. Sydney has a low ecological footprint, and water-related programs designed to continuously enhance ecological health are supported by sustainable and effective funding sources.

2. **Aboriginal water knowledge, values and ways of thinking are understood and embraced by Sydney communities, forming a unique part of people's local identity, sense of belonging and aspirations for their water future.** Water is respected, loved and valued as the basis of life and nature by Sydney people. Ancient saltwater and freshwater Aboriginal stories are intrinsic to all Sydneysiders' identity and sense of belonging. These stories, values and knowledge of the water system are widely shared, recognised in education programs and broader community conversations, and drawn on to inform long-term water planning. They contribute to fostering evolving relationships amongst all people and the co-creation of Sydney's water future.

Figure 3: Sydney's WSC Vision - Eastern Harbour City (Illustration by Lucy Klippan)

3. **Sydney is filled with beautiful green and blue places that celebrate water, enhance liveability and provide multiple benefits for people and the environment.** Its urban environments are green, peaceful and of high quality. A diversity of places celebrate water, encourage social cohesion and enhance people's connection to water. People in the east of the city enjoy Sydney's beaches, harbours and coastlines for their amenity, recreation and lifestyle values. People in the west of the city are proud of Sydney's clean rivers and creeks that flow alongside green, multi-functional parklands. Neighbourhoods are walkable with shady, pleasant streets and shared paths. Everyone in Greater Sydney can access areas of recreation and amenity. The built form incorporates living, green vegetation coverage and urban environments function as habitats for local species. Urban heat is mitigated through water sensitive solutions. Water and land use planning are integrated to ensure the delivery of multiple benefits.

4. **Water governance supports a water sensitive Sydney through collaborative, integrated, adaptive and inclusive arrangements.** Water is governed through a catchment approach and includes all elements of the water cycle. Collaboration amongst people and organisations, integration across sectors and disciplines, and supportive organisational cultures deliver broad water sensitive outcomes for Sydney. Decisions are made openly and transparently through the sharing of data, knowledge, stories and insights. Place-based decision-making is underpinned by system thinking and takes into account broad social, environmental and economic outcomes. Roles, responsibilities and accountabilities of people and organisations are clearly articulated and well understood. Traditional Custodians and Aboriginal people are valued as partners in water decision-making and occupy leadership roles in water organisations. Community values are incorporated in decision-making through innovative engagement processes. Citizens participate actively in water governance and are empowered to shape decisions in the water sector.

Figure 4: Sydney's WSC Vision - Central River City (Illustration by Lucy Klippan)

5. **Sydney's water and other resources are managed holistically to ensure the city's long-term sustainability.** Integration and alignment of water, land management, energy, communications, and waste sectors enables the delivery of broad social, environmental and economic outcomes. A holistic approach to water policy and planning takes into account the embodied and consumed energy and other resources that form part of the system. Stormwater and wastewater resources are managed to improve environmental flows and utilised for irrigating green spaces. Nutrients, water, biogas, biosolids and other resources are recovered from wastewater and reused fit-for-purpose. Local food production is supported by the water system to provide benefits for the local community, including jobs and urban greening.

6. **Adaptive, efficient and innovative water technologies and infrastructure systems support the prosperity and resilience of Sydney.** Water is delivered to residents fit-for-purpose at an optimal supply portfolio and through infrastructure at multiple scales. Household-scale technology, such as smart metering and onsite recycling, along with community education programs, influence consumer behaviour and drive a low per capita potable water consumption of less than 50 litres per day. Sophisticated scenario modelling informs the design of infrastructure that is robust and resilient to future uncertainties. People use integrated decision-making frameworks to assess solutions according to optimal scale, cost and energy. Technological innovation is fostered through a culture of learning and experimentation, an enabling regulatory environment and adaptive planning frameworks. Market structures support the range of water system participants needed to deliver broad water sensitive outcomes. Strong relationships between government agencies, public and private organisations and the research sector allow for rapid transfer and adoption of the latest research and knowledge.

7. **Community health, safety and wellbeing are ensured through reliable and flexible water system services that support equity and choice.** Everyone in Sydney has access to safe, reliable and affordable drinking water and sanitation services. Sydney's catchments are protected and water infrastructures are robust to ensure high quality drinking water. Water system services are adaptable to suit multigenerational and multicultural living. People are prepared to cope with natural hazards and extreme events such as bushfires, extreme heat and flooding in locations like the Hawkesbury-Nepean basin. Emergency response systems are in place to ensure effective communication of information and emergency plans. Sydney's pattern of growth accommodates flood risk and is managed with respect to enhancing the city's resilience to climate change impacts, particularly for vulnerable communities. Sydney's areas of water-related amenity are accessible to everyone and its communities thrive amongst the green, cool places that promote physical and mental wellbeing.

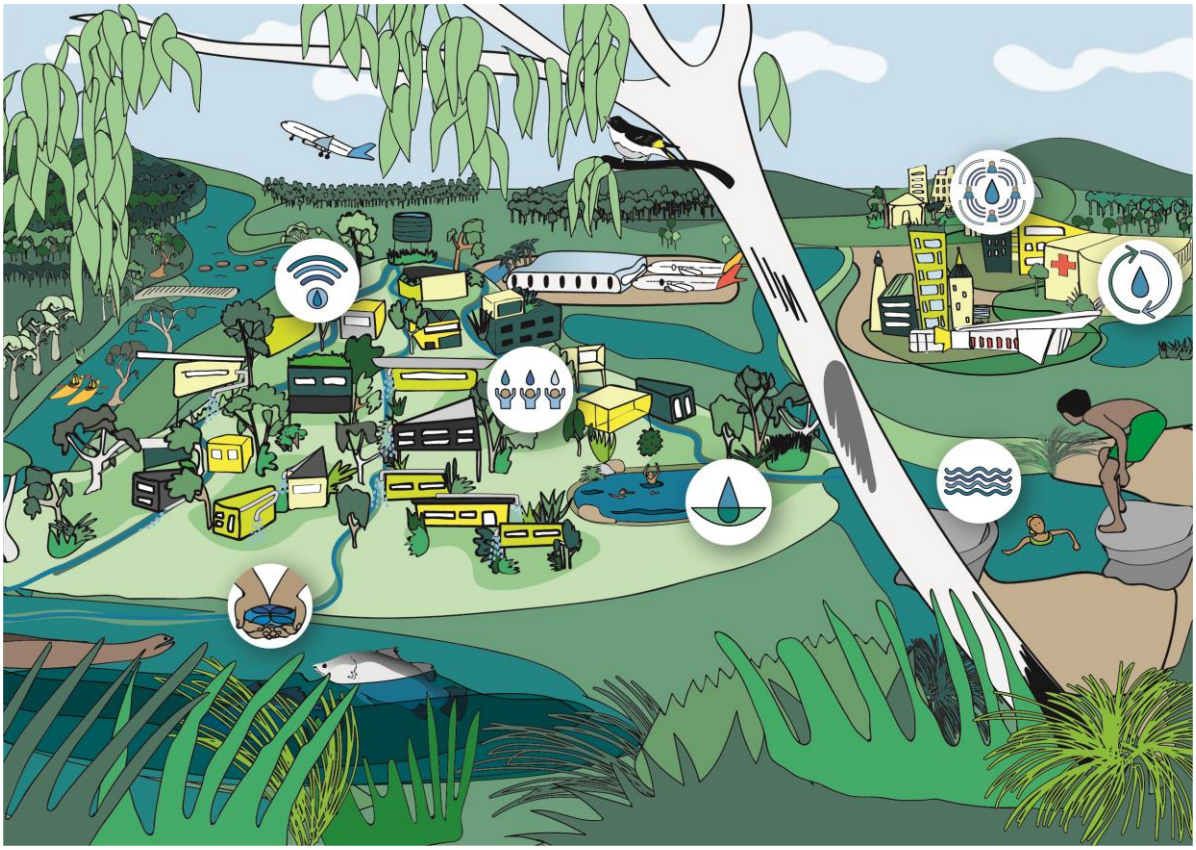


Figure 5: Sydney's WSC Vision - Western Parkland City (Illustration by Lucy Klippan)

4. Benchmarking Greater Sydney's water sensitive performance

Planning actions to reach Greater Sydney's water sensitive city vision requires an understanding of today's water system with respect to the broad future aspirations set out. Participants benchmarked Greater Sydney's current water sensitive performance using the CRCWSC's WSC Index tool, following the process described in Appendix B. The WSC Index framework, key results and analyses are presented here, with further discussion provided in Appendix B. It is recommended that subsequent benchmarking would be undertaken every few years in order to track progress and achievements.

4.1. WSC Index framework

Water servicing within cities has traditionally focused on meeting the basic needs of society through essential service provision. However, there is now a growing emphasis on the importance of water system services in enhancing a city's liveability, sustainability, productivity and resilience. These goals are partly what is meant by the water sensitive approach. Other concepts captured in this approach include integrated management of the whole water cycle, consideration of water systems as an integral part of the urban landscape, and engagement with citizens as active stewards of a city's water resources and environments (Wong & Brown, 2009).

Water sensitive cities strive to enhance biodiversity, encourage connected communities, and foster cultural significance. They also protect the health of waterways, reduce flood risk, and create multi-functional public green spaces. Ultimately, a water sensitive city recognises how water can both meet the basic needs of society and also contribute to the creation of connected, vibrant and liveable communities.

As cities seek to adopt this approach, they need to understand both its present status with regard to urban water management and define their short and long-term sustainability goals. An analytical tool has been developed specifically for this purpose: The Urban Water Transitions Framework (Brown, Keath & Wong, 2009) (Figure 6). The framework identifies six distinct developmental states that cities may move through on their path toward increased water sensitivity. Figure 7 describes each of the city-states in more detail. This understanding can help urban water strategists define the attributes of more sustainable cities and identify the capacity needs and institutional changes required for more sustainable water management.

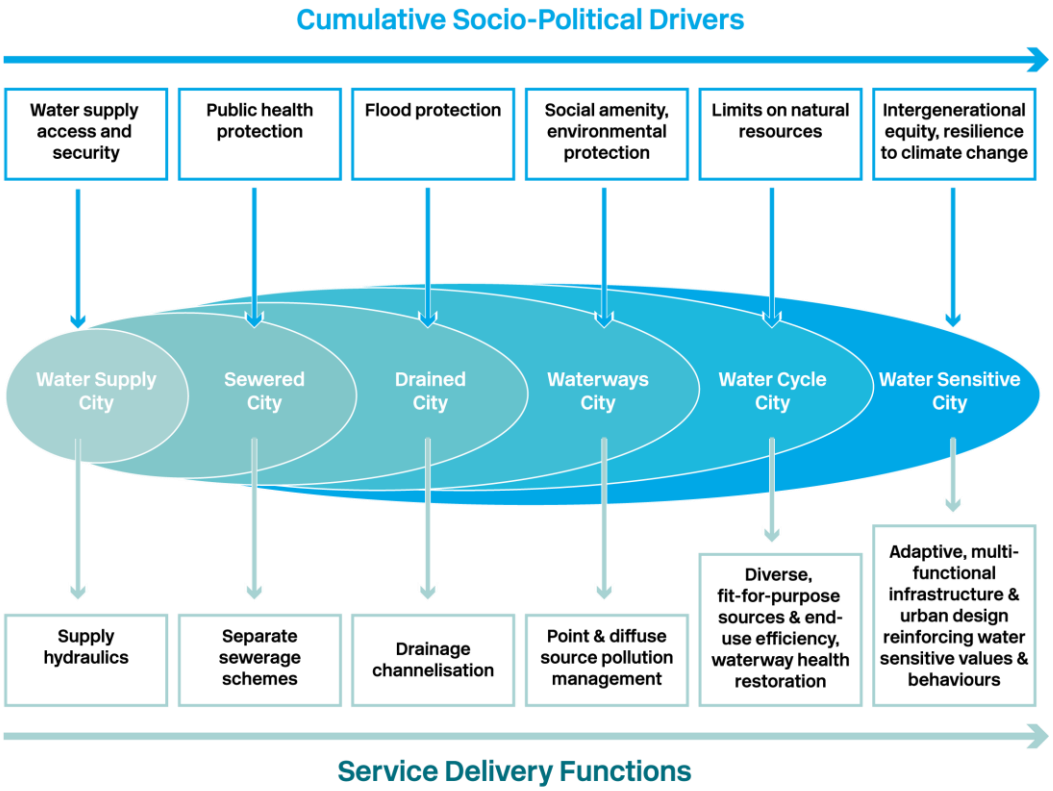


Figure 6: Urban Water Transitions Framework (Brown, Keath & Wong, 2009)

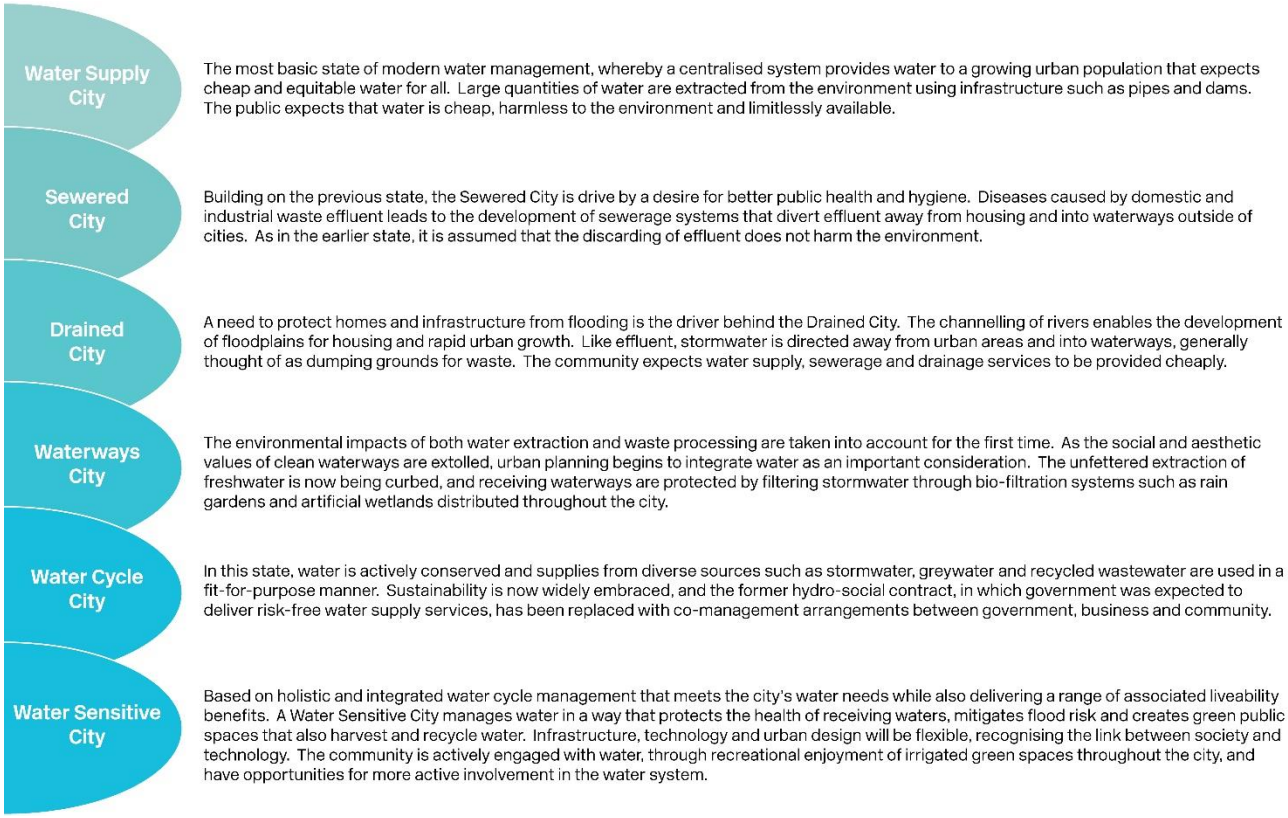


Figure 7: Descriptions of each state in the Urban Water Transitions Framework (Brown et al., 2016)

Planning Greater Sydney's transition to its WSC vision requires a detailed understanding of its current performance in relation to its aspirations. The CRCWSC's WSC Index is a benchmarking tool designed for this purpose. It articulates seven WSC goals, which organise 34 indicators representing the major attributes of a WSC. These indicators are also mapped to the idealised city-states represented in the Urban Water Transitions Framework to provide a benchmarked city-state.

While a city's local WSC vision may not emphasise all indicators of the WSC Index to the same degree, the tool enables diagnosis of key areas of strength and weakness. This insight can then inform the prioritisation of actions and it provides a framework for ongoing monitoring and evaluation of a city's water sensitive performance.

4.2 WSC Index scores

The WSC Index was applied to Greater Sydney to benchmark current water sensitive performance. A challenge encountered in doing so was determining a score that represents all of Sydney when the city is so large and diverse. Participants reflected that there would be value in applying the WSC Index across Sydney at smaller scales, potentially for the 'three cities' identified by the Greater Sydney Commission.

Table 1 below provides the individual indicator scores for each goal. Further detail on the individual indicator scores and justification can be found in Appendix B.

Table 1: WSC Index scores (goals and indicators) for Greater Sydney

WSC Index Goal and Indicators	Score /5	WSC Index Goal and Indicators	Score /5
1. Ensure good water sensitive governance	**2.4**	**4. Improve productivity and resource efficiency**	**2.7**
1.1 Knowledge, skills and organisational capacity	2.0	4.1 Benefits across other sectors because of water-related services	2.5
1.2 Water is key element in city planning and design	2.0	4.2 Low GHG emission in water sector	3.0
1.3 Cross-sector institutional arrangements and processes	2.0	4.3 Low end-user potable water demand	3.5
1.4 Public engagement, participation and transparency	2.5	4.4 Water-related commercial and economic opportunities	2.0
1.5 Leadership, long-term vision and commitment	2.5	4.5 Maximised resource recovery	2.5
1.6 Water resourcing and funding to deliver broad societal value	2.5	**5. Improve ecological health**	**3.0**
1.7 Equitable representation of perspectives	2.5	5.1 Healthy and biodiverse habitat	2.0
2. Increase community capital	**2.3**	5.2 Surface water quality and flows	3.0
2.1 Water literacy	3.0	5.3 Groundwater quality and replenishment	3.0
2.2 Connection with water	3.0	5.4 Protect existing areas of high ecological value	4.0
2.3 Shared ownership, management and responsibility for water assets	2.0	**6. Ensure quality urban space**	**2.0**
2.4 Community preparedness and response to extreme events	2.0	6.1 Activating connected urban green and blue space	2.5
2.5 Indigenous involvement in water planning	1.5	6.2 Urban elements functioning as part of the urban water system	2.0
3. Achieve equity of essential services	**3.9**	6.3 Vegetation coverage	1.5
3.1 Equitable access to safe and secure water supply	5.0	**7. Promote adaptive infrastructure**	**2.8**
3.2 Equitable access to safe and reliable sanitation	4.5	7.1 Diverse fit-for-purpose water supply system	3.0
3.3 Equitable access to flood protection	3.0	7.2 Multi-functional water system infrastructure	2.5
3.4 Equitable and affordable access to amenity values of water-related assets	3.0	7.3 Integration and intelligent control	2.5
		7.4 Robust infrastructure	3.0
		7.5 Infrastructure and ownership at multiple scales	2.5
		7.6 Adequate maintenance	3.0

Figure 8 below summarises Greater Sydney's performance against the seven goals of a water sensitive city. The results for Great Sydney are shown by the shaded teal area. *Achieve equity of essential services* and *Improve ecological health were the highest average scores, while Ensure quality urban space*, and *Increase community capital achieved lower average scores.*

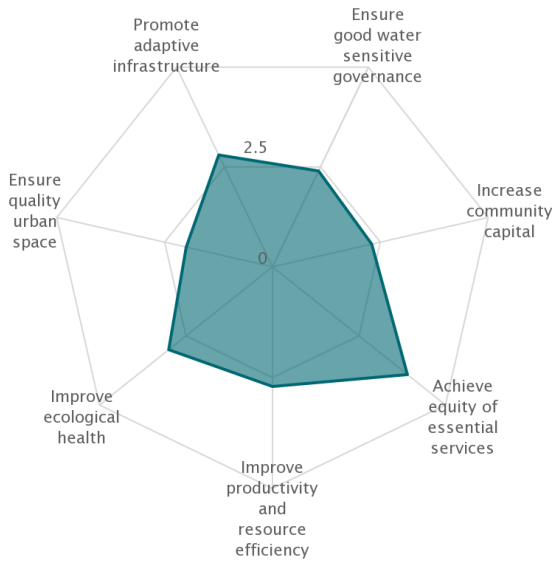


Figure 8: WSC Index goal scores for Greater Sydney (shaded teal area)

4.3 Greater Sydney's benchmarked city-state

Figure 9 summarises the city-state benchmarking results for Greater Sydney. Percentage attainment for each city-state ranged from 100% as a Water Supply City and Sewered City, through to 8% as a Water Sensitive City. This section summarises the key elements that contribute to the overall percentage attainment of each city-state.

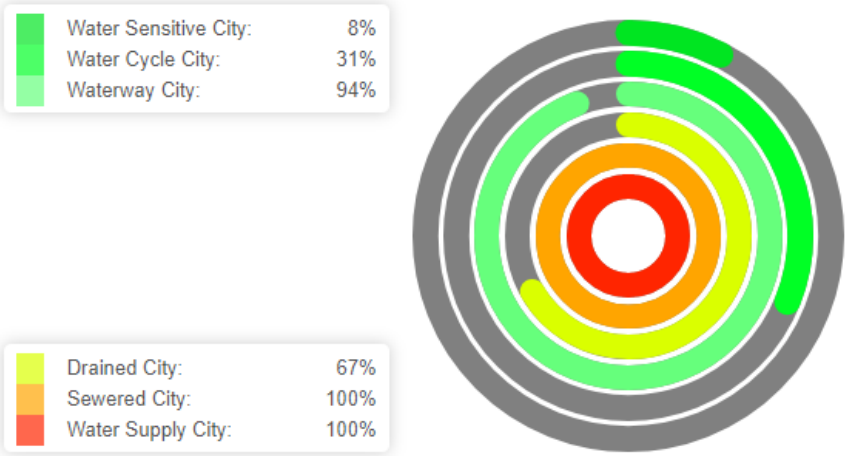


Figure 9: Summary of Sydney's performance against each city state

100% Water Supply City & Sewered City

Greater Sydney is well regarded for water security and has thus rated 100% as a Water Supply City. Sydney sources the majority of its water from its surrounding catchments, with 80% of the supply sourced from the Warragamba Dam. The catchment area covers 16,000 square kilometres and includes several world heritage national parks. There is little concern about water scarcity as the dam levels currently sit at 92%. In the case of extreme low rainfall, the Sydney Desalination Plant can supply water for up to 1.5 million people.

Water supply is managed centrally, provided at an affordable cost to end users and with reliable public health outcomes. Sydney Water reported 100% compliance with the Australian Drinking Water Guidelines (ADWG) health guideline values for 2015-2016 and 99.5% compliance with the ADWG aesthetic guideline values (Sydney Water, 2016).

Similarly, Sydney Water provides wastewater services to 1.8 million properties, ensuring safe and reliable sanitation and 100% attainment of a Sewered City (Sydney Water, 2016). Sydney's sewerage system consists of 24 separate sewer systems that link to 16 wastewater treatment plants that treat wastewater and discharge to the environment.

While the system is reliable, there is concern about overflows. While it is realised that further investments needed to achieve reductions in sewer overflows are significant for an incremental improvement, investment in other water quality improvement initiatives could also increase the city's liveability. In addition, the water and resources currently discharged to the environment through ocean outfalls could be harvested and used in a more strategic way.

67% Drained City

Greater Sydney rated 67% as a Drained City. The region has a high level of drainage services, which are the responsibility of local government and Sydney Water. The system generally operates effectively on a day-to-day basis, however not all residents have equitable access to flood protection. Extensive development in the floodplains of the Hawkesbury, Georges and Cooks Rivers and within local flood flow paths exposes many in these areas to significant flood risk. Many small-scale flash flooding events also occur from everyday rainfall events across Eastern Sydney. These flood events have a significant impact in many places, and communities are not well prepared for flood events.

"Flooding is a hot topic in Sydney – we are needing to increase housing yet we are pushing development into floodplains."

Some data collection and modelling exists to support knowledge of these risks (e.g. City of Sydney flood management plan process) however much of this work is undertaken by councils and is not comprehensive or consistent across the city and practical implementation of adaptation/mitigation strategies is limited by resources, capability and commitment. Flood modelling and risk assessments are often performed for specific local government or sub-catchment areas rather than the full catchment.

Improvements across each of these dimensions would help Sydney achieve 100% Drained City status.

94% Waterway City

Greater Sydney rated 94% as a Waterway City, reflecting diverse water-related environmental assets and recent advancements in policy and regulatory arrangements for their management and protection. While significant investment in the late 1990s and early 2000s led to the creation of the Stormwater Trust, which supported a total water cycle approach to managing stormwater, a loss of funding led to its closure. Community activism and the famous *Turn back the Tide* concert of 1989 led to efforts to clean up Sydney's beaches and the establishment of

the ocean outfalls for wastewater. While coastal beaches and the iconic Sydney Harbour are readily accessible to residents of Eastern Sydney, ensuring access to amenity in Western Sydney remains a challenge.

The general public values waterways for amenity and recreational purposes and desires clean, swimmable water environments. Increased regulation and the decrease in industrial activity in the last 30-40 years has reduced some causes and types of contamination, though there remains a historical legacy of pollution and neglect that has caused significant decline in the health of water environments. While people value water for recreation and amenity, there is little understanding of the entire catchment and the impact of their everyday behaviours.

"The impact of stormwater pollution on water quality and amenity is a big topic. The community wants a healthy environment – they want clean rivers and waterways for swimming, fishing, and visual amenity."

There have been a number of initiatives to improve waterway health such as the 'Clean Waterways' program of the 1990's. Sydney Olympic Park and the adjoining Homebush Bay, were once amongst the most polluted sites in the Sydney Region. Recent environmental remediation works, revegetation, habitat management, removal of industry and banning of chemicals have significantly improved ecological functioning. Catchment groups (such as the Cooks River Alliance, Parramatta River Catchment Group, Georges River Combined Councils Committee and Sydney Coastal Councils Group) are also working collaboratively to improve river and catchment health.

31% Water Cycle City

Greater Sydney has begun to diversify its water supply, reflected by its 31% attainment of the Water Cycle City status. Non-potable water sources include household rainwater tanks, groundwater extraction from private bores in some councils, stormwater harvesting and reuse and wastewater recycling and reuse. Stormwater management remains a challenge in Sydney since responsibility lies with both Sydney Water and local councils, and there is limited state policy or coordinated planning in place. Planning for greenfield developments generally consider stormwater and waterway health separately from water supply and wastewater. The main strategic document for water in Sydney, the Metropolitan Water Plan, is based on a supply-demand balance rather than a water sensitive approach to managing water.

Despite this challenge, some local councils are demonstrating considerable vision and innovation in activities such as stormwater harvesting and sewer mining, but the approach to water sensitive urban design remains ad-hoc across Greater Sydney.

"There is some collaboration, but not enough. There are a few individuals barking but there is no single vision or goal across the water sector."

During the Millennium Drought, uptake of demand management measures was common through the installation of water saving fittings, fixtures and appliances due to successful behaviour change programs. Because of these measures and increased community awareness around water usage, Greater Sydney is seen as a world leader in reducing residential potable water usage. Despite its significant population increase, Sydney is using no more potable water than it did in the 1970s.

Sydney's urban water sector has mostly focused on system augmentation through large scale, centralised infrastructure. It was reported that during this period regulation hampered innovation at the local level (Rijke, Farrelly, Brown & Zevenbergen, 2013). However, in 2006 with the Water Industry Competition Act (WICA), NSW introduced Australia's first third-party licensing system to enable the private sector to enter the urban water industry.

"We need governance arrangements that support innovation…we are not keeping up with innovation. This is critical with population growth."

Sydney's first large residential recycled water scheme was at Rouse Hill. It is Australia's largest dual-pipe residential recycling scheme, supplying up to 2.5GL per day to 32,000 properties in Sydney's north-west suburbs for non-potable use (Sydney Water, 2016). In 2015-16, Sydney Water recycled 36GL in the Greater Sydney region and, including schemes operated by others, there was a total of approximately 270 recycled water schemes in operation with the potential to recycle around 70GL (Watson, Mukheibir & Mitchell, 2017).

8% Water Sensitive City

Greater Sydney rated 8% as a Water Sensitive City, achievement of which is largely attributed to equity of essential services of water supply and sanitation. Both supply and sanitation services are accessible to everyone; they are safe, secure and affordable. Sydney's protection of existing areas of high ecological value also contributes to the 8% Water Sensitive City.

To achieve a Water Sensitive City, Greater Sydney will need to fulfil the multiple objectives of ecosystem protection and restoration, security of supply, flood control, public health, amenity, liveability and economic sustainability, among others. While Greater Sydney has begun to make strides towards a Water Sensitive City, significant efforts are still needed in order to transition current water management practice to water sensitive practice.

5. Advancing Greater Sydney's transition to individual vision outcomes

This section connects Greater Sydney's future water sensitive aspirations with its current performance to examine the transition pathways that will need to be pursued through strategic action. Focus is given to establishing a supportive context for transitioning by analysing the presence or absence of important enabling factors. This leads to recommended strategies for implementation in the short- to medium-term as a basis for developing effective transition actions.

5.1. A brief introduction to transitions theory

Participants explored Greater Sydney's progress in its WSC transition through interviews and workshop activities that examined the barriers to and enablers of change currently experienced. The project team analysed this data to give insight into how advanced Greater Sydney is in its transition towards specific aspects of its envisioned water sensitive future, which is important for understanding what should be given priority focus in the development of strategic actions.

Greater Sydney's transition towards its water sensitive city vision will require significant changes across the structures, cultures and practices of urban and water system planning, design, management, engagement and decision-making. Transitions theory is a body of interdisciplinary research that studies how these changes are driven and enabled over time. CRCWSC research that draws on this work has identified six distinct phases of change during a city's water sensitive transition (Figure 10). As a city moves through each phase sequentially, enabling conditions are established to support its trajectory towards its water sensitive city vision and avoid the risk of change pathways that reflect lock-in, backlash or system failure patterns (Figure 11).

Figure 10: Six phases of change that occur in the transition to a new practice

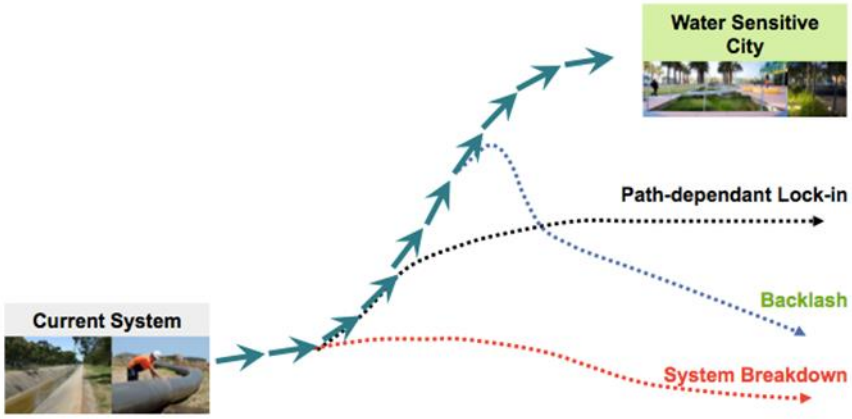


Figure 11: Transition pathways: successful transition, lock-in, backlash and system breakdown

Actions to orient and drive change towards a city's envisioned water sensitive future need to progressively establish these enabling conditions. Actions with the most impact during the early transition phases of Issue Emergence and Issue Definition will be different from those during the later transition phases of Policy and Practice Diffusion and Embedding New Practice. It is critical to identify a city's current phase of change to ensure that actions are prioritised according to the effectiveness they will have in accelerating the water sensitive city transition.

5.2. Assessment of Sydney's enabling conditions for transitioning

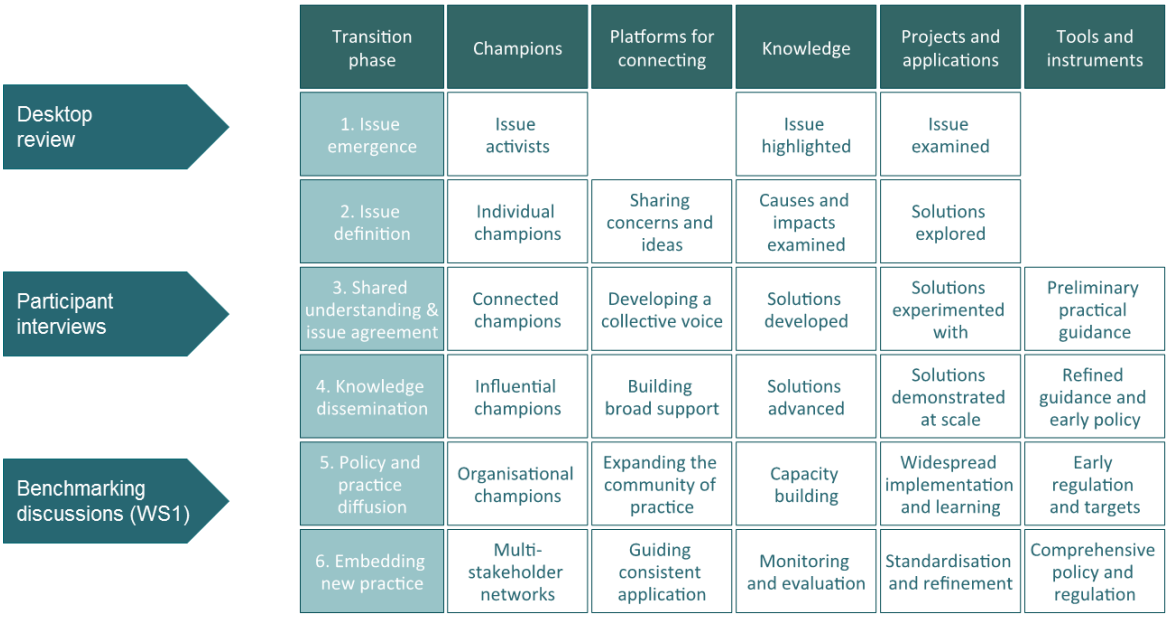
Workshop 2 introduced the concept of water sensitive city transitions, and the advocating and contesting narratives that develop as a transition unfolds over time. The analysis below has been conducted using evidence from Workshop 1 discussions and pre-workshop analysis (including participant interviews and desktop analysis). Workshop 3 then explored the specific strategies for achieving Sydney's vision, and how these strategies could be implemented.

The Transition Dynamics Framework (Brown et al. 2016) outlined in Figure 12 below, is an analytical framework that outlines the enabling conditions needed to progress a transition to a new practice. The framework sets out five broad factors that have been found to enable transitions: **champions, platforms for connecting, knowledge, projects and applications, and practical and administrative tools and instruments.**

The matrix is a diagnostic tool that assesses the presence or absence of enabling factors as an indicator of the current phase of change in relation to its aspired change in practice. It provides a checklist of the factors that should be deliberately and sequentially built up to inform the prioritisation of strategies and actions.

As a city progresses through its transition, it will fulfil the requirements of the enabling factor at each phase, and in its current phase of change the city may meet only some of the conditions, which places it at risk of regression. Progression along each phase may be uneven for the five enabling factors, such that a city may be in Phase 4 for champions and platforms for connecting but only Phase 3 for the other factors.

Analysis of the enabling conditions currently present for each WSC Index goal using the Transition Dynamics Framework revealed which factors need attention in the short to medium term. This analysis has guided the development of the priority objectives and strategies for overcoming the transition barriers and establishing the enabling environment for Greater Sydney's water sensitive city transition.



Transition phase	Champions	Platforms for connecting	Knowledge	Projects and applications	Tools and instruments
1. Issue emergence	Issue activists		Issue highlighted	Issue examined	
2. Issue definition	Individual champions	Sharing concerns and ideas	Causes and impacts examined	Solutions explored	
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
5. Policy and practice diffusion	Organisational champions	Expanding the community of practice	Capacity building	Widespread implementation and learning	Early regulation and targets
6. Embedding new practice	Multi-stakeholder networks	Guiding consistent application	Monitoring and evaluation	Standardisation and refinement	Comprehensive policy and regulation

Figure 12: Transition Dynamics Framework - assessing the enabling conditions potentially present

5.3. Greater Sydney's transition progress for each vision outcome

Figure 13 below summarises the current transition progress for each individual vision outcome. Vision outcomes early in their transition will require different types of strategies to progress further change than those later in their transition. As many of the vision themes have been assessed as being in similar phases, some parallels in the strategic recommendations across themes is to be expected.

The remainder of this section discusses the transition assessment for each outcome theme and the strategies recommended in the short to medium term to enable transition within the theme. These strategies are designed to establish the enabling conditions necessary for driving change.

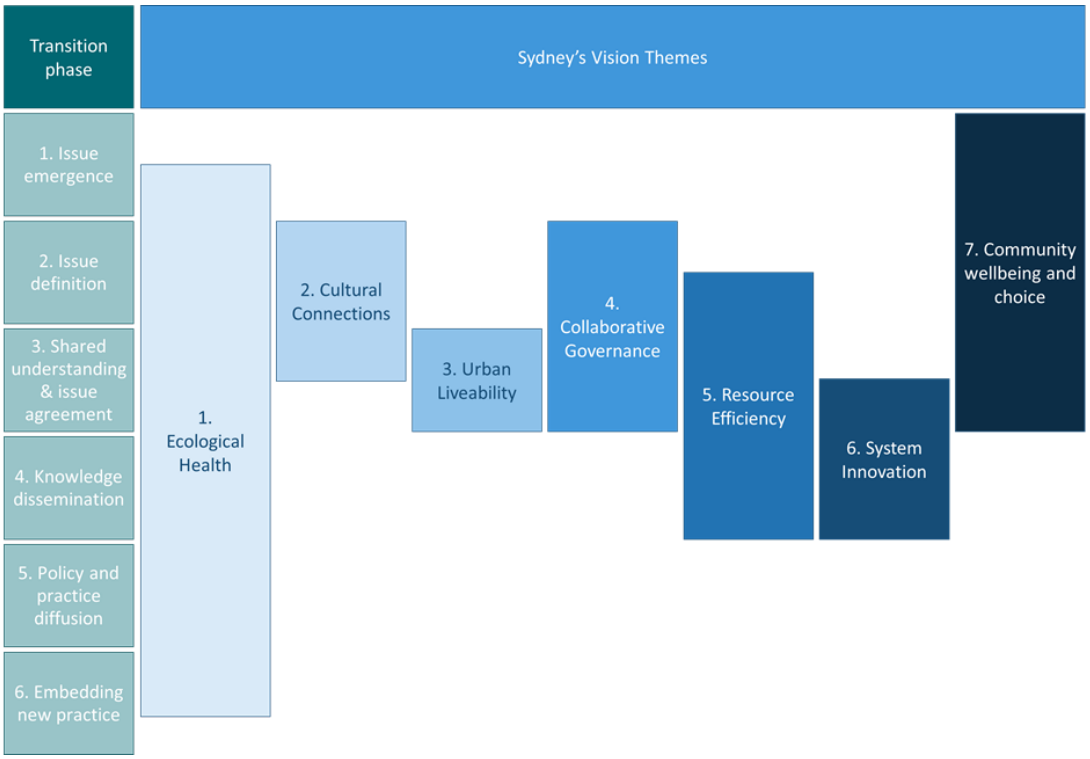


Figure 13: Summary of transition phases for each of the vision outcomes

Vision outcome 1: Sydney's land and water environments are healthy, cherished and actively enhanced through the community's commitment to stewardship

Required changes in practice

Water system services can have both serious negative impacts on ecological health and play a critical role in protecting and enhancing ecosystem health and delivering ecosystem services for people. Historically, ecological health objectives have not been a primary concern of water supply, sewerage and drainage systems. However, in recent decades the removal of pollution from wastewater treatment plant discharges has become standard practice. The treatment of diffuse pollution in surface water and groundwater, and managing the hydraulic impacts of stormwater flows, is more challenging, however, and conventional water system services are not typically designed to address these objectives. For example, traditional drainage systems that aim to convey stormwater efficiently away from developed areas can have significant impacts on the health of the receiving waterways. In many jurisdictions, water resource management does not prioritise environmental flow objectives and natural water environments often become degraded as part of nearby urban development activities.

"The impact of stormwater pollution on water quality and amenity is a big topic. This pollution is the biggest threat to [Sydney's] waterway health"

Improved ecological health therefore requires substantial shifts in water management practice. The characteristics, functions, conditions and values of ecosystems need to be better understood and respected, and

controls are needed to manage the impacts of urbanisation and pollution. Achieving these outcomes will require natural assets and the water management system to be integrated so that management is well planned, holistic and resourced.

The individual and community knowledge of, connection with, and sense of responsibility for water and the environment is likely to significantly influence Greater Sydney's transition towards its water sensitive city vision. Fostering success will require community engagement practices to be meaningful and transparent, focused on empowering people to have the interest, capability and opportunity to be active partners in achieving water sensitive outcomes.

"There has been an uptake in community engagement in last 15 years, involving communities more to plan for and reach solutions"

Assessment of Sydney's enabling conditions

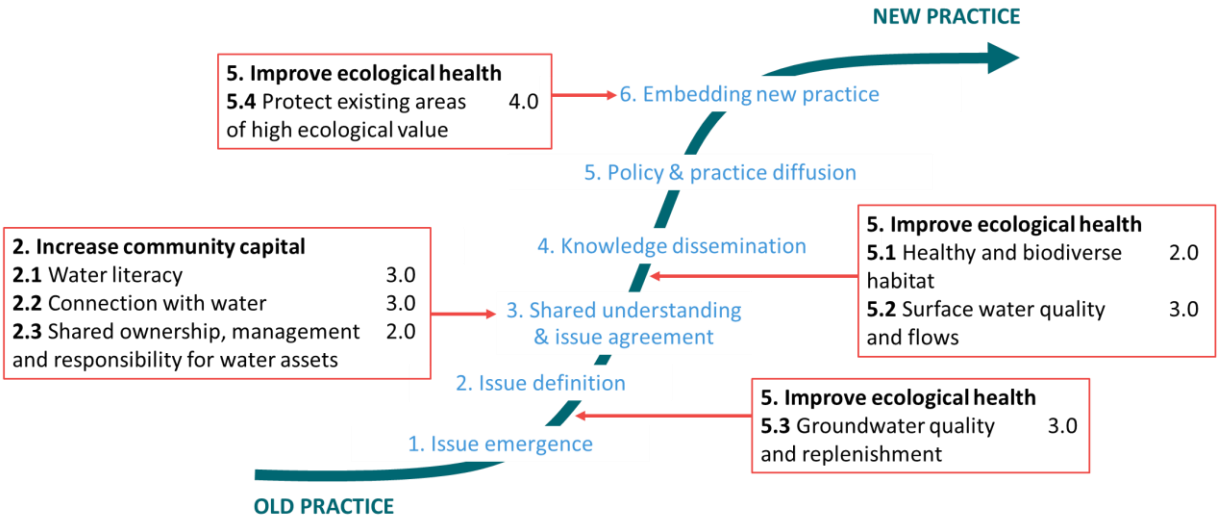


Figure 14: Transition phases for vision outcome 1

Groundwater resources are currently not considered an important resource for Sydney and groundwater-dependent ecosystems are not widespread. Consequently, groundwater systems are not considered to be well understood or their management coordinated. To advance the management of groundwater such that dependent ecosystems are well protected, **new knowledge of Greater Sydney's groundwater system would need to be developed** (Strategy 1.1) through scientific research and monitoring**. Data and information about the groundwater systems would then need to be shared across research groups and agencies through collaboration platforms** in order to further define the issues associated with groundwater management and identify possible solutions (Strategy 1.2).

"Groundwater use is not talked about enough. It is out of sight out of mind. Sydney doesn't have major groundwater. We don't rely on it for water supply so groundwater-dependant ecosystems are not considered much."

Champions in Greater Sydney are advocating for the protection, conservation and enhancement of natural waterways, habitats and ecosystems. Leading champions in this space are river catchment groups (e.g. Parramatta River Catchment Group, Cooks River Alliance, Georges River Combined Councils Committee, and Sydney Coastal Councils Group) that bring together local governments, state agencies and community representatives to improve the health of the river catchments. These networks have successfully implemented a range of projects designed to improve ecological health through managing surface water and ecosystem habitats in innovative ways. There is an opportunity to **learn from existing ecosystem health projects by identifying and consolidating lessons** (Strategy 1.3) and use these insights to inform the development of a practical solutions and implementation guidance, as well as administrative standards and policies.

The initiatives above reflect a range of regionally coordinated activities to manage water quality and environmental health. Splash Network and the CRC NSW Regional Advisory Panel offer an opportunity for organisations to build a collective voice and identify a holistic approach, however these programs are relatively new and are still gaining local influence. There is not yet an influential government agency champion advocating for a state-wide, holistic approach to improved water quality and ecological health. Therefore, it is recommended that whole-of-government support be actively harnessed through **developing and communicating a compelling narrative that articulates the importance of ecosystem health in delivering broad societal benefits** (Strategy 1.4).

While participants perceived that point source pollution has largely been addressed except for a number of wet and dry sewer overflows still occurring each year, the management of diffuse source pollution is still fragmented. Local governments have individual stormwater and water sensitive urban design policies, making it challenging to undertake a coordinated, holistic approach to managing water quality and flows across the city. Progress towards vision outcome 1 would therefore be accelerated with a **coherent and comprehensive healthy waterways and catchment strategy for managing Sydney's natural environmental assets as an integrated and dynamic system (**Strategy 1.5)**.**

"There is currently a larger focus on point source pollution over diffuse, specifically in relation to nutrient reduction"

Greater Sydney is seen to be effectively protecting areas of high ecological value through an extensive national parks and heritage sites system. The Office of Environment and Heritage and National Parks and Wildlife Service are champions in this space and responsible for the protection, conservation and management of native flora and fauna. The Environmental Planning and Assessment Act 1979 protects areas of high ecological value through a strategic planning system. **Monitoring and evaluating the condition of natural assets** (Strategy 1.6) will be important for continuous improvement of existing standards and practices for protecting areas of high ecological value.

The notion of community stewardship is in its early stages of transition in Sydney. While it is recognised in Greater Sydney that community engagement is important for water-related planning and decision-making, and there are some promising examples to learn from, consultation is often the focus of interactions, rather than empowerment that actively engages community members as partners. The river catchment groups are a good example of including community representatives in waterway health management, and citizen science programs such as Streamwatch aim to better engage communities around river health. To advance this aspect of community stewardship, **exploration of the full scope of solutions for engaging and empowering communities in water-related planning and decision-making** (Strategy 1.7) is needed.

No.	Strategy	Outcome
1.1	Develop new knowledge about Greater Sydney's groundwater-dependent ecosystems	Better understanding of the system's functioning, threats and potential values
1.2	Create collaboration platforms for people and agencies to examine groundwater management practices	Better knowledge of solutions for managing and protecting groundwater-dependent ecosystems
1.3	Identify and consolidate lessons from existing ecosystem health improvement projects	A holistic suite of solutions, guidelines, policies and standards
1.4	Develop and communicate a compelling narrative that articulates the importance of ecosystem health in delivering broad societal benefits	The authorising environment supports initiatives that may challenge current practice but are needed to achieve healthy ecosystems and waterways
1.5	Develop and implement a coherent and comprehensive healthy waterways and catchment strategy for managing Sydney's natural assets as an integrated and dynamic system	A mechanism exists for guiding target-setting, governance reforms and implementation planning
1.6	Monitor and evaluate the condition of natural assets and areas of high ecological value	Consistent and effective implementation and continuous improvement of existing standards and practices
1.7	Explore a full suite of solutions for engaging and empowering communities in water-related planning, decision-making, innovation and action	Solutions for engaging the community as stewardship partners, beyond a traditional consultation approach, are identified

Vision outcome 2: Aboriginal water knowledge, values and ways of thinking are understood and embraced by Sydney communities, forming a unique part of people's identity, sense of belonging and aspirations for their water future

Required changes in practice

Sydney's Traditional Land Owners and Aboriginal communities share unique cultural, spiritual and economic values of water that form a critical part of the city's historical, contemporary and future waterscape. Achieving Sydney's water sensitive city vision will require these knowledge and values of water to be understood, respected and recognised in water planning and decision-making, as well as by the broader community.

However, this is challenging to achieve in a context where water system services are typically delivered by corporatised authorities operating commercial business models within policy environments where water is considered a commodity. Water governance systems frequently lack the mechanisms necessary to recognise broader benefits of water system services that are often unpriced or have public good characteristics.

Achieving the vision for integrating Aboriginal water knowledge, values and ways of thinking will require greater inclusion of different perspectives in processes, along with opportunities to share cultural values and connections to ensure a full diversity of values is considered and incorporated in decision-making. Cost-benefit analysis tools and frameworks would need to incorporate these broad values. Beyond formal planning processes, opportunities to communicate diverse values amongst the greater community would encourage harmonious co-existence. Languages and ideas could be embedded in mainstream life through visible representations and symbols. Practices that encourage a deeper cultural and spiritual connection to water and place would enhance wellbeing and influence peoples' behaviours as stewards of the city's water sensitive future.

Assessment of Sydney's enabling conditions

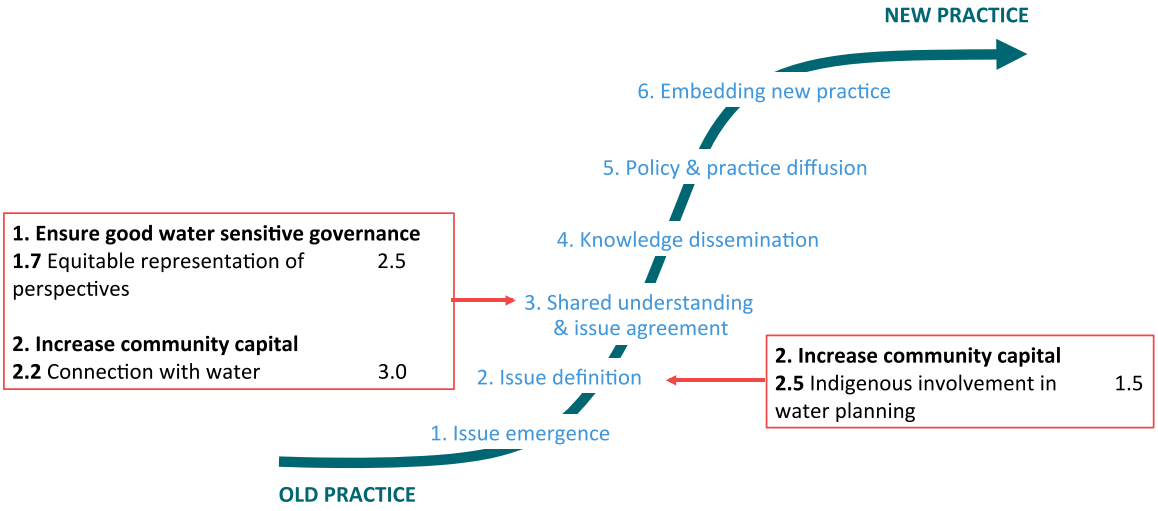


Figure 15: Transition phases for vision outcome 2

People's connection to water in Greater Sydney is currently based mainly around amenity and recreation, with little acknowledgement or support of cultural or spiritual relationships with water. Indigenous stories and values are beginning to be showcased through heritage trails and sites, but they are not obvious in people's day-to-day life. These types of cultural connections to water could enhance Sydneysiders' community connections, local identity and sense of place. Learning between Traditional Owners and other parts of Sydney's diverse communities would also help strengthen connections between people and nature. This would require **new knowledge to understand the barriers and potential solutions for enabling the incorporation of Indigenous knowledge and values into water planning and decision-making** (Strategy 2.1).

"Community and indigenous groups need a seat at the table. They are sometimes represented at project level but not so much in planning"

While there are some opportunities for Aboriginal communities to contribute to water planning and decision-making, this engagement is generally done as traditional consultation. Numerous Reconciliation Action Plans across agencies and organisations exist and they are getting better at genuine engagement. **Platforms to facilitate stronger connections between Traditional Owners and people in the water sector** (Strategy 2.2) would help advance progress towards more proactive and empowering engagement in support of establishing a community-wide understanding and appreciation of diverse historical, cultural and spiritual connections to water.

The need for greater engagement with Traditional Owners in water planning and decision-making is widely recognised and champion networks such as Local Aboriginal Land Councils are beginning to advocate for broad knowledge and values to guide water planning and decision-making. However, structures and processes are not yet set up to enable its effective implementation. Further **advocacy is therefore needed to profile the need for and benefit of meaningful involvement of Traditional Owners in water planning and decision-making, as well as the inclusion of broad cultural and spiritual values** (Strategy 2.3).

No.	Strategy	Outcome
2.1	Develop new knowledge about how to effectively and meaningfully incorporate Indigenous knowledge and values into water planning and decision-making	Solutions exist for effectively and meaningfully incorporating Indigenous knowledge and values into water planning and decision-making
2.2	Advance platforms to facilitate collaboration between Traditional Owners and the water industry	A community-wide understanding and appreciation of diverse historical, cultural and spiritual connections to water
2.3	Advocate for water planning and decision-making to meaningfully involve Traditional Owners and to account for a broad range of cultural, spiritual and other water values	A broad appreciation of the need for, benefits of and opportunities for greater involvement of Traditional Owners in water planning and decision-making

Vision outcome 3: Sydney is filled with beautiful green and blue places that celebrate water, enhance liveability and provide multiple benefits for people and the environment.

Required changes in practice

The conventional approach to city planning and design typically considers water systems and the built form separately. Urban planning and design processes facilitate development and set basic requirements for open space. The provision of transport and housing tend to dominate planning as considerations, while water system services are an important but secondary consideration. Conversely, conventional water system planning and design processes focus on delivering water system services at the lowest cost, and rarely consider the built form as an integral part of service delivery. The consequence of this separation is that liveability outcomes and opportunities for multiple benefits, which rely on synergies between the built form and water system services, are not optimised.

"As we move through time, open space will be a challenge. We will be see greater need to deliver multiple level functions. How we integrate these will be important. Linking the blue and green"

A central aspiration of Greater Sydney's vision of a water sensitive future is quality urban space, including public and private places that are blue, green, cool, aesthetic, utilised, and deliver multiple benefits. Achieving this will require the practices of water system planning and urban planning to be more integrated and collaborative so that standards and service outcomes that link to a broader vision of urban liveability and environmental health can be achieved.

Assessment of Sydney's enabling conditions

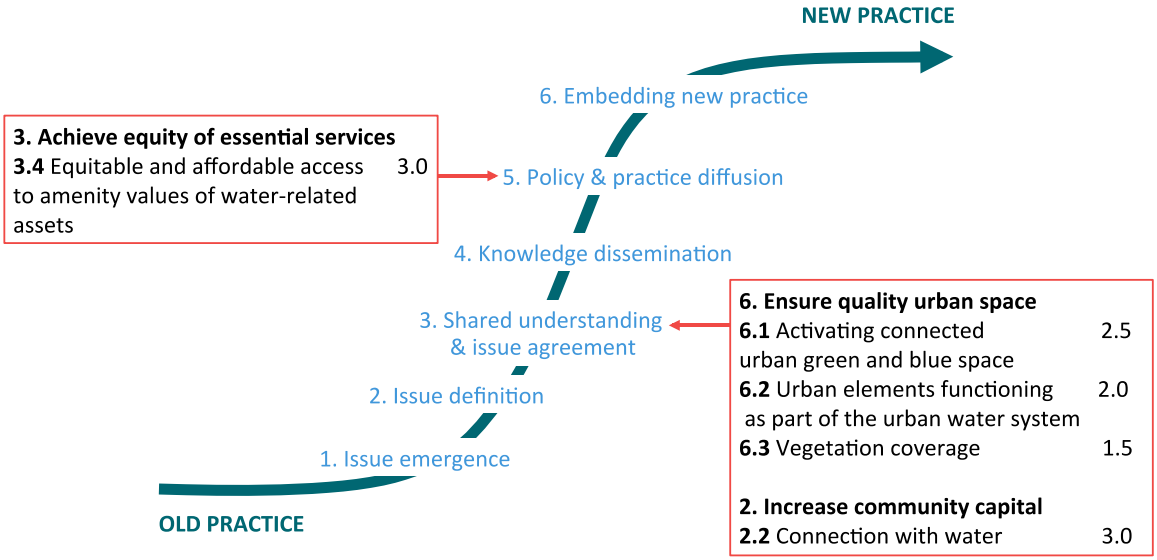


Figure 16: Transition phases for vision outcome 3

Historically, water planning and land use planning have not been well integrated in Greater Sydney. However, the recently established Greater Sydney Commission (GSC) is advocating for improved integration, which is reflected in its *Directions for a Greater Sydney* report and District Plans. Some local governments, developers and consultants are also advocating for a more integrated approach, however this drive is not yet coordinated or widespread. The GSC and other **existing platforms could be advanced to connect champions across water, urban planning, development, transport and environment to develop a unified voice calling for integration across sectors** (Strategy 3.1). Such platforms would encourage collaboration and collective leadership to promote a community of practice focused on creating and connecting areas of water-supported amenity.

"Integration is a really hot topic at the moment…looking beyond the silos."

There have been some innovative projects in Sydney demonstrating a collaborative approach to achieving multiple benefits (e.g. Central Park, Green Square). The Water Smart Cities Program, a collaboration across government agencies, is an opportunity to trial approaches for better integration within two pilot growth areas. These are considered isolated efforts, however, and do not yet reflect a consistent shift in practice across the city. Many efforts to include water sensitive urban design in projects are still rejected due to perceived costs and problems of maintenance. Local governments are often discouraged from adopting innovative water sensitive infrastructure due to perceived risks associated with these projects. These types of projects have led to the development of some practical guidance on how to develop quality urban spaces that are water sensitive, however it is somewhat fragmented. Sydney would therefore benefit from the **consolidation of existing practical guidance to identify gaps that need to be addressed** (Strategy 3.2) to inform comprehensive guidelines in relation to collaboratively developing and implementing solutions for high quality, multi-functional urban spaces. Progress would be further accelerated by **incorporating a learning agenda into new and existing demonstrations of integrated liveability solutions** (Strategy 3.3) to inform the development of the business case and further practical guidance.

The *Metropolitan Water Plan for Greater Sydney* incorporates aspects of liveability and cool, green urban spaces; however the plan is not linked to a legislative framework that would support its translation into practice. The *Greener Places* policy, being produced by the Government Architect NSW, aims to create a more liveable and sustainable urban environment focusing on community connection and recreation. Local councils each have individual stormwater and water sensitive urban design policies, however they vary and are not aligned by state policy and direction. Similarly, many local governments have policies for tree cover but they are not consistent in approach and can be more intent on reducing maintenance costs than creating green spaces with multiple benefits. **Strengthened policy, regulation and targets would therefore enable more widespread and consistent adoption of integrated approaches to the planning and implementation of quality urban space solutions** (Strategy 3.4).

No.	Strategy	Outcome
3.1	Advance existing platforms to connect champions and develop a unified voice calling for better integration across water, planning, development, environment and transport sectors	A community of water sensitive practice amongst water, planning, development, environment and transport professionals focused on implementing solutions for the creation and connection of high quality urban spaces
3.2	Consolidate existing preliminary practical guidance for quality urban space solutions and identify gaps that need to be addressed	Comprehensive guidelines for creating high quality, multi-functional urban spaces that are linked to local environmental plans and development control plans
3.3	Incorporate a learning agenda into existing and new projects and demonstrations of quality urban space solutions to develop evidence of costs, benefits and risks	Knowledge of the capabilities needed for the effective implementation of multi-functional urban spaces
3.4	Strengthen policy, regulation and targets to improve the implementation of quality urban space solutions	Widespread and consistent adoption of integrated approaches to the planning and implementation of quality urban space solutions

Vision outcome 4: Water governance supports a water sensitive Sydney through collaborative, integrated, adaptive and inclusive arrangements.

Required changes in practice

Governance arrangements to deliver urban water system services have evolved over more than a century to meet the community's needs for safe and reliable potable water supply, sewage treatment and removal, and stormwater drainage. Typical urban water governance structures and processes for conventional water systems include large centralised institutions with responsibilities for planning and delivery of single-objective water system services. This approach clearly defines the role for the community as customers who pay central utilities to provide water system services such as water supply, sanitation and drainage. This relatively simple transaction between single government provider and end-user has been effective for services that are delivered through the single-objective large-scale centralised infrastructure that characterises most Australian water systems to date.

However, in the face of pressures from climate change, population growth and urbanisation, the community's expectations for services delivered by the water system are evolving further, and now reflect a broader agenda for water to support a city's liveability and resilience. This shift is becoming well recognised in jurisdictions around Australia and is beginning to influence policy and institutional reforms. As water systems services evolve, the transactional relationship between people and water servicing is also likely to shift to enable more complex partnerships across organisations, communities and households, and the building of stronger social capital in relation to water. For example, the community's expectation for healthy and liveable urban environments will require a new generation of standards for water system services. The built form of cities will become a more integral part of how water system services are delivered. The incorporation of decentralised technologies into water systems will require changes in water markets, with opportunity for property owners and businesses to become service providers, as well as service users.

"The community are concerned with the cost of service, their ability to use water ways, crowding in their city and greening issues, such as the cooling of heat islands"

Delivering healthy and liveable urban environments that are supported by resilient and sustainable water system services will therefore require governance structures, processes, cultures and capabilities that enable and drive integrated, long-term, cross-sector and inclusive planning and design decisions.

"By including community in decision making you will get something really sensible. Community participation is really important"

Assessment of Sydney's current enabling conditions

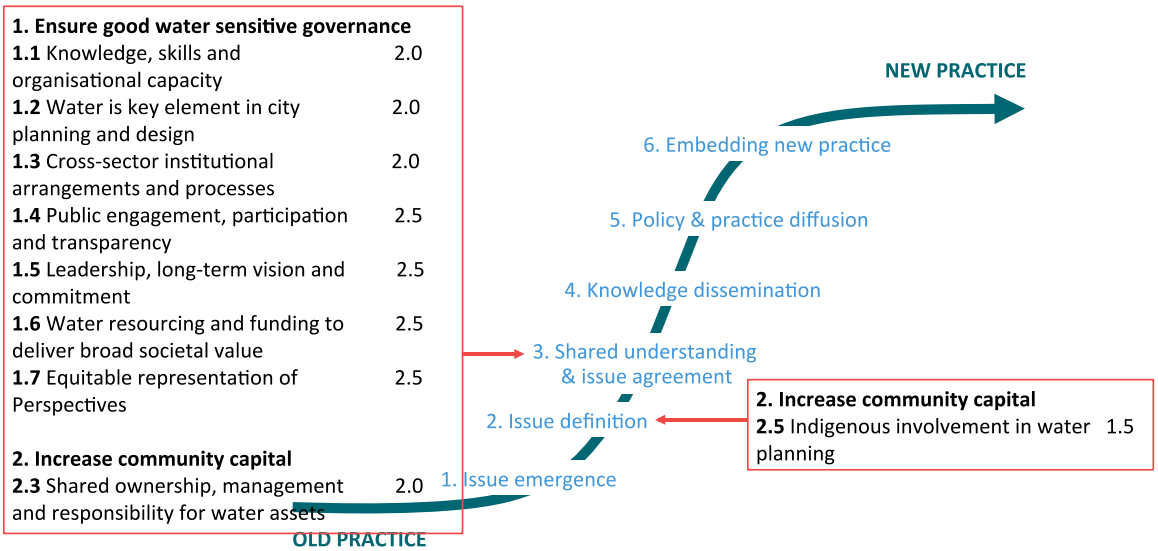


Figure 17: Transition phases for vision outcome 4

There are various small-scale projects demonstrating innovative and collaborative governance arrangements across Greater Sydney. For example, river catchment groups (e.g. Cooks River Alliance, Parramatta River Catchment group, Georges River Combined Councils' Committee, Sydney Coastal Catchments Group) operate on a collaborative model in which local governments, state agencies, and community groups work together to achieve healthy river catchments. Some local governments are trialling innovative governance solutions for local water sensitive urban design projects. For example, the Inner West Council has successfully implemented a Living Laneways Program that encourages shared ownership and maintenance of green infrastructure. The Water Smart Cities program along with a collaboration across government agencies, demonstrates an opportunity to examine institutional barriers for implementing water sensitive solutions in greenfield and renewal growth areas and provide recommendations on how to improve integration. The NSW Regional Organisations of Councils also provide an opportunity for collaboration amongst councils. These diverse initiatives should be **showcased as examples of innovative and collaborative governance solutions that can be learned from** (Strategy 4.1) to develop understanding of their costs, benefits and risks, as well as the capabilities and incentives needed for their implementation.

"The Sydney water sector is open to learning and experimentation, although this is more so on smaller-scale projects led by developers and local government. I have experienced good collaboration between the water organisations that I have worked with."

However, the water governance projects above tend to be ad hoc and not linked to the broader strategic goals for the city. Collaboration is encouraged in the NSW Government's Metropolitan Water Plan; however the Plan does not provide guidance on how to effectively collaborate and is not embedded within a broader legislative framework that would give it strength. It is therefore important to deliberately build whole-of-government support that encourages, enables and drives cross-organisational and cross-sectoral collaboration to deliver water outcomes that will help create a future Sydney the community aspires to. **Developing and communicating a compelling narrative that articulates the necessity of collaborative water governance structures, cultures and processes** (Strategy 4.2) would help with this.

"We are creating suburbs that we won't like in the future. We need to think about the whole system. We need true collaboration between public and private entities to support WSUD outcomes and create spaces that celebrate and support the water cycle to create green areas."

Water sector champions who have been involved in some of the initiatives identified above have been advocating for solutions for innovative and flexible governance arrangements that support collaboration. The voice of these champions would be strengthened through the **establishment of an ongoing network that has focus on collaborative governance** (Strategy 4.3) in order to advocate for a broad governance framework based on a culture of collaboration and shared water sensitive city vision, as well identify opportunities for further demonstration of collaborative governance solutions.

No.	Strategy	Outcome
4.1	Incorporate a learning agenda into new and existing trials of collaborative governance solutions	Lessons are incorporated to improve governance solutions at multiple scales and demonstrate commitment to collaborative governance frameworks
4.2	Develop and communicate a compelling narrative that articulates why collaborative governance structures, cultures and processes are necessary	The authorising environment supports initiatives that may challenge current practice but are needed to effectively empower community and other partners in water planning and decision-making
4.3	Establish a platform to advocate for a collaborative governance framework based on a shared water sensitive city vision and identify opportunities for demonstration of collaborative governance solutions	Regular communication and deep relationships are fostered between stakeholders and a culture of collaboration is embedded amongst a broad network of stakeholders

Vision outcome 5: Sydney's water and other resources are managed holistically to ensure the city's long-term sustainability.

Required changes in practice

Traditional water system services are designed to meet singular objectives (e.g. water supply, sanitation, drainage) that have historically prioritised cost efficiency over resource efficiency and tended to externalise environmental costs. As the impacts of human activity on planetary health reach an unprecedented scale, the community is becoming more aware of the natural limits in the availability of water, energy and nutrients and the need for more sustainable water systems. In the water sector, the potential for water system services to reduce resource consumption, pollution and waste, as well as create new resources through alternative modes of service provision, is being explored and experimented with (for example, through wastewater recycling, nutrient recovery and biogas production).

To increase the sustainability of Greater Sydney as it works towards its water sensitive city vision, water system services could be designed as regenerative or 'net-positive' to take advantage of the synergies and connections between water, energy, food and land resources.

Assessment of Sydney's current enabling conditions

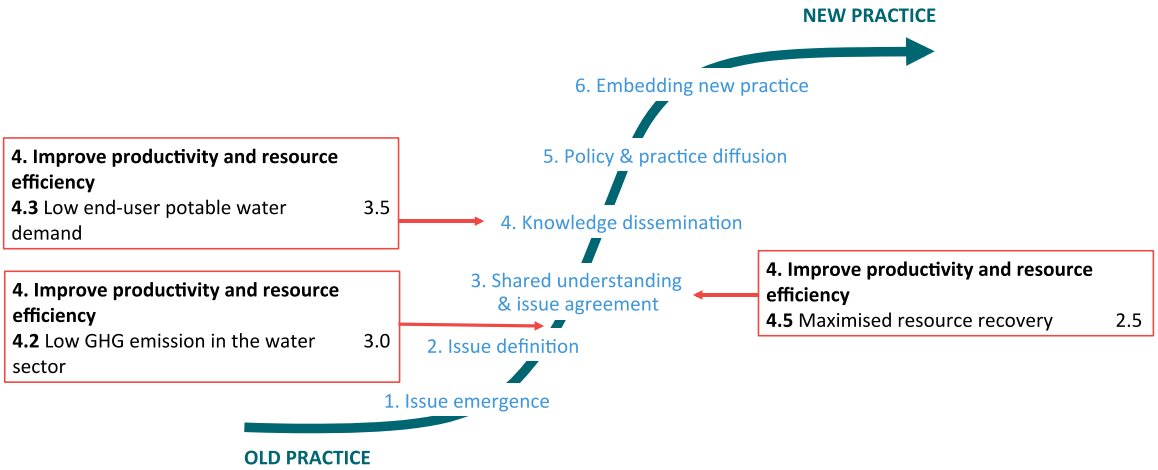


Figure 18: Transition phases for vision outcome 5

Sydney is regarded as leading the nation in low end-user potable water demand, with the combined efforts of Sydney Water and the NSW Government's Water Wise Rules keeping consumption low. The importance of low potable water consumption has been well understood amongst the community since the Millennium Drought. Third pipe systems for recycled water are being rolled out, mainly in new developments, but they can be challenging to implement due to institutional and regulatory barriers. To further improve low end-user potable water demand, **demonstrations and roll-out of supply-side solutions, including recycled wastewater projects in areas beyond new developments** (Strategy 5.1) to include solutions such as stormwater harvesting and wastewater recovery systems at the household and precinct scale.. This will enable lessons to be learned to advance a broad range of solutions, develop robust business cases, and build the capabilities needed for effective implementation.

"Recycled water investment has been slowed for economic reasons. Lifecycle cost is not being considered, we need to be looking to new approaches such as the Picton (wastewater recycling) project. And we need to consider closing-the-loop more seriously. I think this has fallen off the agenda since the desalination plant was implemented as this back-up solution has taken the pressure off water security."

The objective of reducing greenhouse gas emissions is largely driven by international and national agendas, which have not yet been translated to provide significance for the local Sydney water context. National targets exist for greenhouse gas emissions but local drive to meet these targets is limited. Similarly, there is not yet a clear push for solutions that take a holistic approach to resource recovery. Achievement of Sydney's vision would therefore be advanced through the **development of a strategic and holistic business case for effective resource recovery and low greenhouse gas emissions** (Strategy 5.2). This business case would be a valuable tool for champions to use in their advocacy work to build broad appreciation of the opportunities for, and benefits of holistic and sustainable resource management.

Advancing an integrated approach to resource recovery in Sydney would also benefit from a research focus on developing **new knowledge to develop and advance solutions for recovering resources and reducing greenhouse gas emissions** (Strategy 5.3), particularly solutions that go beyond wastewater recycling, such as

nutrient, energy and stormwater recovery. These solutions may be technical or governance in nature, and may exist elsewhere but need contextualisation for Sydney.

Some private sector companies, such as Flow Systems and Veolia, have integrated resource recovery as a core part of their business. While there is ongoing technical innovation in this area, there is a perception that the regulatory and market environments can be barriers to enabling city-wide adoption of these technologies. The Water Industry Competition Act, the first of its kind in Australia, was intended to enable competition but legislation for third party participation in water services is still limited. To ensure the administrative environment for water system services is coherent, consistent, coordinated and comprehensive with regard to sustainable resource use, it is important to **embed Sydney's WSC vision into policy, planning and design standards that enable resource recovery in accordance with the aspired water system outcomes** (Strategy 5.4).

No.	Strategy	Outcome
5.1	Implement demonstrations with an explicit learning agenda about supply-side solutions for low end-user potable water demand, including recycled wastewater projects in areas beyond new developments	A business case for a broad scope of solutions, including supply-side solutions, informed by evidence of costs, benefits, and risks and knowledge of the capabilities needed for their effective implementation
5.2	Develop a strategic business case for solutions that support resource recovery and low greenhouse gas emissions	An understanding of the costs, benefits, risks, and opportunities for a holistic approach to resource recovery and low greenhouse gas emissions in the water sector
5.3	Develop new knowledge of technical and governance solutions for increasing resource recovery and reducing greenhouse gas emissions	A broad scope of solutions to be trialled and demonstrated for efficient resource recovery
5.4	Embed Sydney's WSC vision into policy, planning and design standards that enable resource recovery in accordance with the vision	An administrative environment that is coherent, consistent, coordinated and comprehensive for enabling and driving planning and design decisions that achieve water sensitive outcomes

Vision outcome 6: Adaptive, efficient and innovative water technologies and infrastructure systems support the prosperity and resilience of Sydney.

Required changes in practice

The conventional mode of providing water system services typically delivers large-scale centralised infrastructures designed to meet singular objectives (e.g. water supply, sanitation, drainage) under a set of relatively narrow assumptions about parameters such as future rainfall, population and urbanisation patterns. The services provided by conventional water systems can therefore be vulnerable if conditions vary beyond the system's design capacity (e.g. in extreme drought or flood events). The installation and maintenance of these separate infrastructure systems can also require significant investment, which may be difficult to sustain in the face of ageing infrastructure and new infrastructure needs.

In addition to these vulnerabilities, a focus on cost and risk minimisation and maximising efficiency within a narrow objective set can also limit the contribution of the water sector to a city's broader prosperity. For example, the opportunity for water system services to deliver economic benefits in sectors beyond water (such as health, recreation and tourism) are largely incidental to traditional approaches to water system services that doesn't consider their potential multi-functionality. Commercial opportunities could also result from the direct supply of regenerated resources, improved environmental health and business activity attracted to Sydney as a leading international city in water system innovations.

"We need to adopt a combination of approaches; to have smaller, more flexible, adaptable and modular systems and continued research to test ideas and assumptions"

Achieving the vision for water innovation supporting the resilience and prosperity of Greater Sydney will require a gradual transition to a more adaptive water servicing approach, involving greater integration of multi-functional systems across scales and possibly supplying more diverse fit-for-purpose water resources. This goal may require greater ability for individuals and businesses to provide infrastructure and services at property and precinct scales, which can be integrated with centralised systems through flexible regulation and intelligent control. The planning, design, management and maintenance practices to deliver such an approach will need to be highly collaborative, with systems and process in place to enable the sharing of risks, costs, benefits, data and lessons between infrastructure providers and operators, including individual properties owners.

Assessment of Sydney's current enabling conditions

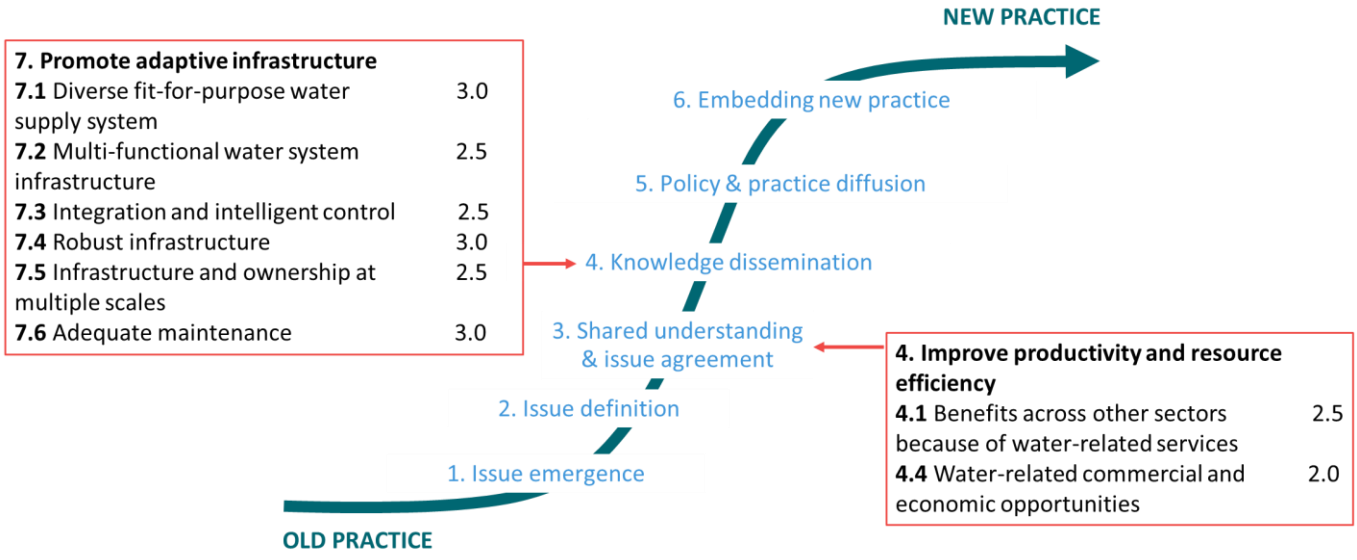


Figure 19: Transition phases for vision outcome 6

Currently in Greater Sydney, there is a range of organisations championing innovative infrastructure solutions. Sydney Water has diverse water supply options including recycled water and stormwater, which incorporate intelligent control and redundancies. Private utilities and consultants, such as Veolia and Flow Systems, as well as some local governments and developers, have implemented innovative local solutions that incorporate recycled water schemes and multi-functional infrastructure. Projects include Sydney Park, Green Square and

Central Park, which demonstrate decentralised, multi-functional and adaptive infrastructure. While these local pilots and demonstrations have been valuable to showcase potential solutions, it has been challenging to integrate the solutions with the existing centralised infrastructure and governance systems to enhance the overall system flexibility and adaptability. Further investment in significant **demonstrations of multi-functional, multi-scale and fit-for-purpose infrastructure solutions** (Strategy 6.1) will therefore be important for understanding the opportunities for implementation of adaptive infrastructure at multiple scales, as well as advancing solutions and learning about the capabilities needed for their effective implementation, as well as the broad multi-sectoral benefits they provide.

Mainstream integration of multi-functional, multi-scale adaptive infrastructure solutions into the whole water system will ultimately require the commitment of government and key agencies such as Sydney Water and local councils. Securing their leadership and support will require the **development and communication of a compelling narrative that articulates the importance of adaptive infrastructure** (Strategy 6.2) in delivering Sydney's future WSC vision of resilience and prosperity**.** This narrative would be strengthened and supported by a **strategic business case for adaptive, multi-functional solutions that deliver broad cross-sectoral and commercial benefits** (Strategy 6.3) to drive investment in innovative water technologies and infrastructures. Finally, **embedding Sydney's vision for adaptive, multi-functional infrastructure into organisational policies, strategies and plans** (Strategy 6.4) will create a coherent, consistent and coordinated administrative environment for promoting adaptive infrastructure approaches for the whole water cycle across organisations.

"Innovation is being discussed. Things are starting to change. Institutions are coming out of their shells but they still often meet resistance at approvals level."

On a more specific note, there are still challenges with ownership and maintenance of stormwater infrastructure. There are concerns that green infrastructure and WSUD solutions often fail to operate as designed due to poor construction or maintenance. This could be attributed to lack of investment in learning and building the capacity of industry. **Incorporating a learning agenda into projects that have demonstrated successful operation and maintenance of stormwater infrastructure** (Strategy 6.5) will be important for informing the development of capacity-building packages and guidelines.

"The WSUD concept means different things to different people. There is the assumption that we are doing best practice but this isn't achieving the desired outcomes and cumulative impacts are deteriorating our systems. We need to better understand how current practice is falling short."

No.	Strategy	Outcome
6.1	Implement significant demonstrations of multi-functional, multi-scale and fit-for-purpose infrastructure solutions	An understanding of the opportunities for implementation of solutions at multiple scales, advancement of adaptive infrastructure solutions, and knowledge of the capabilities needed for their effective implementation and the broad benefits they provide
6.2	Develop and communicate a compelling narrative that articulates the importance of adaptive infrastructure in delivering Sydney's future WSC vision	Broad leadership and government support are secured for undertaking an adaptive infrastructure approach
6.3	Develop a strategic business case for adaptive, multi-functional solutions that deliver broad cross-sectoral and commercial benefits	Investment in innovative water technologies and infrastructures
6.4	Embed Sydney's vision for adaptive infrastructure into organisational policies, strategies and plans	An administrative environment that is coherent, consistent, coordinated and comprehensive for enabling and driving adaptive infrastructure approaches for the whole water cycle
6.5	Incorporate a learning agenda into existing projects that demonstrate successful operation and maintenance of stormwater infrastructure (including green infrastructure)	Capacity building packages and refined guidelines for operation and maintenance of stormwater infrastructure (including green infrastructure)

Vision outcome 7: Community health, safety and wellbeing are ensured through reliable and flexible water system services that support equity and choice.

Required changes in practice

Conventional water systems are explicitly designed and managed to ensure equity in the level of service of water supply, sanitation and drainage provided to customers. Most Australian cities achieve this equity, although some have a backlog in connecting properties to the sewerage system. It is also difficult to ensure equitable and affordable levels of flood protection for all properties, given their different degrees of exposure to flood risk - a challenge likely to be exacerbated as climate change impacts make cities more vulnerable to flooding during heavy rainfall and storm surge events.

Maintaining levels of these different water system services that are acceptable to the community at an affordable price through conventional approaches can be challenging for cities under the pressures of growth, urbanisation and climate change. A different way of achieving equity and affordability in the provision of water system services could be based on principles of diversity, flexibility and choice. Implementing this approach for Greater Sydney will require a gradual transition to a system that involves greater integration of water systems across scales and greater customer choice of services and service levels.

Assessment of Sydney's current enabling conditions

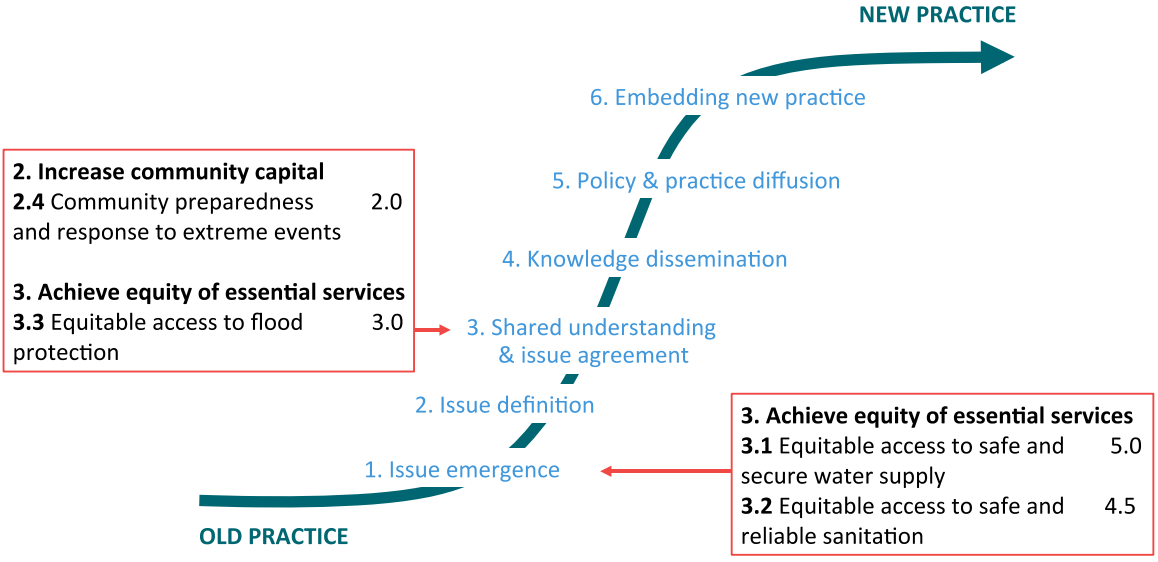


Figure 20: Transition phases for vision outcome 7

Ensuring Sydneysiders' water-related health, safety and wellbeing over the long-term will require an integrated understanding of system resilience, including focus on agency planning, preparation and responses to drought, flood and heatwave through infrastructural and governance solutions, as well as the broader community's resilience to such extreme events.

Agencies' capacity to respond to drought and heatwave are enhanced by measures described in previous sections relating to adaptive, multi-functional and integrated infrastructure systems, accessing a diversity of water resources and creating more blue and green urban environments. This section therefore specifically focuses on flood risk. There has been some flood modelling by councils of Greater Sydney however this is mostly small-scale and has not yet informed the development of a holistic flood risk management strategy. As a consequence, flood risk management initiatives tend to be local in scale and ad-hoc across councils. This is reflected in the fact that development is still occurring in high flood-risk areas, with residents not fully understanding the risk. There is currently no overarching floodplain manager to take responsibility for flood risk and coordinating messages to community. Emergency plans prepared by councils range in effectiveness and their dissemination to the community.

In response to this fragmentation, water sector champions are beginning to advocate the need for flood risk in Sydney to be addressed more systemically, however there are not yet structures or processes in place to enable this. The issue has been given recent attention by the establishment of Resilient Sydney, which is examining the city's resilience to diverse shocks and stresses. Champions would gain influence with decision-makers through **advancing platforms that facilitate a stronger collective voice advocating for more consistent flood risk management practice across Sydney's catchments** (Strategy 7.1). In addition, flood modelling at a regional scale and consideration of lessons from the catchment approach taken for the Hawkesbury-Nepean would be a valuable basis for **developing and implementing of a coherent and comprehensive strategy for managing flood risk** (Strategy 7.2) to guide a systemic and consistent application of solutions across Greater Sydney.

Recent work by Resilient Sydney determined the community generally has low resilience and do not feel prepared for extreme events after testing different emergency scenarios with community members, and there is currently no overarching body for coordinated messaging around preparedness for extreme events. Focus on community resilience is relatively recent, so **new knowledge about solutions for increasing water-related community resilience as part of an overall approach to enhancing integrated system resilience** (Strategy 7.3) is needed.

Supporting equity and customer choice through the provision of flexible and reliable water system services, as articulated in this vision theme, may be important aspects for Sydney to meet its communities' needs under pressure of future challenges of growth, urbanisation and climate change. This represents a fairly significant departure from the one-size-fits-all approach of conventional water servicing so it is important to understand the costs, benefits and risks (including avoided costs and risks) of this alternative approach for service providers and customers. Agencies should therefore **examine and evaluate evidence about the need for flexibility and choice in delivering water supply and sanitation services** (Strategy 7.4).

No.	Strategy	Outcome
7.1	Advance platforms to facilitate a stronger collective voice advocating for a water sensitive approach to flood risk management, building on work by Resilient Sydney and modelling at a regional scale, building on the Hawkesbury-Nepean catchment experience	A collective voice around a water sensitive approach to flood risk management and solutions for water-related community resilience
7.2	Develop and implement a coherent and comprehensive strategy for managing Greater Sydney's flood risk	A systemic and consistent application of flood risk management solutions across the city
7.3	Develop new knowledge about solutions for increasing community resilience as part of an overall approach to enhancing integrated system resilience, building on work by Resilient Sydney	A suite of community resilience solutions for enhancing integrated system resilience
7.4	Examine and evaluate evidence about the need for flexibility and choice in delivering water supply and sanitation services	An understanding of the costs, benefits and risks (including avoided costs and risks) for service providers and customers in providing flexibility and choice for customers in their water supply, drainage and sanitation services

6. Advancing Sydney's overall water sensitive city transition

This section examines Greater Sydney's transition to its overall water sensitive vision (in contrast to the previous section, which focused on individual component vision outcomes) and recommends overarching priority strategies for the short- to medium-term. These were discussed in Workshop 3, where participants explored different ideas for taking these strategies forward in Sydney. These ideas for implementation can be found in Appendix D.

6.1. Analysis of Greater Sydney's current transition progress to the overall vision

The strategies and actions presented in the previous section represent the full suite of strategies recommended to progress Greater Sydney's WSC transition across all elements of the vision. From these, there emerges a suite of high-level or macro issues that require attention in the short-term. Table 2 uses the CRCWSC's Transition Dynamics Framework to assess the presence or absence of enabling factors as an indicator of the current phase of change in relation to Sydney's overall transition to a water sensitive city. Using it as a checklist of the factors that should be deliberately and sequentially built up helps to identify these overarching strategic needs for Sydney.

Table 2: Overall assessment of Sydney's transition progress

Transition phase	Champions	Platforms for connecting	Knowledge	Projects and applications	Tools and instruments
1. Issue Emergence	Issue activists	N/A	Issue highlighted	Issue examined	N/A
2. Issue Definition	Individual champions	Sharing concerns and ideas	Causes and impacts examined	Solutions explored	N/A
3. Shared Understanding & Issue Agreement	Connected champions	Developing a collective voice	Solutions developed	Solutions experimented with	Preliminary practical guidance
4. Knowledge Dissemination	Aligned and influential champions	Building broad support	Solutions advanced	Significant solution demonstrations	Refined guidance and early policy
5. Policy & Practice Diffusion	Government agency champions	Expanding the community of practice	Capacity building	Widespread implementation and learning	Early regulation and targets
6. Embedding New Practice	Multi-stakeholder networks	Guiding consistent application	Monitoring and evaluation	Standardisation and refinement	Comprehensive policy and regulation

Notes: Green boxes indicate the enabling factor is fully present and regression into the previous phase is unlikely. Yellow boxes indicate some presence, however they are vulnerable to regressing to the previous phase. Red boxes indicate a complete absence of the enabling factor, and that progression is unlikely. Grey boxes are not yet ready for consideration.

6.2. Priority strategies to achieve the overall vision

The overall transition progress assessment for Greater Sydney suggests that significant advancements have been made towards its water sensitive vision. However, it is at risk of stagnation if critical enabling conditions are not established to shore up Phase 2 (issue definition) and Phase 3 (shared understanding and issue agreement), and start pushing into Phase 5 (policy and practice diffusion).

Individual champions across Greater Sydney advocate for elements of the water sensitive city agenda. However, it is challenging for them to become connected and aligned without a common vision or sense of shared strategic purpose, particularly given the number and diversity of actors and institutions involved in Sydney's water, planning, environment and development sectors. There are a number of water sensitive city champions with significant influence across these sectors and key organisations are driving individual aspects of Sydney's water sensitive vision. However, there are not yet key organisations driving collective action towards the vision as a whole.

Similarly, a number of collaboration platforms support existing initiatives (e.g. river catchment groups, individual projects) or drive particular issues. However, these platforms are yet to develop a collective voice on Sydney's holistic water sensitive city vision and have not yet focused on building broad support for the transition agenda.

Innovative solutions have been developed and demonstrated at significant scales that reflect aspects of Sydney's water sensitive city vision, such as low potable water demand, wastewater recycling, and multi-functional urban design (e.g. Central Park, Green Square). There are also smaller scale WSUD solutions being trialled across Sydney and projects for improving waterway health, most of which are being driven or led by local government (see, e.g. Tawfik, 2016). Widespread roll out and scaling of these innovations, however, has not yet been achieved and they are not linked with a comprehensive strategy that provides coherence with a common vision and a learning agenda. There are also many elements of the Sydney vision that still need significant solution exploration, experimentation and demonstration.

Policies such as the *Metropolitan Water Plan* and *Directions for a Greater Sydney* have begun to articulate broad liveability and sustainability outcomes that are consistent with Sydney's water sensitive vision. Practical guidance for implementing these outcomes is somewhat limited, however, and will need to be developed to drive the achievement of these aspirations.

Based on this assessment, five overarching strategies are recommended for advancing Greater Sydney's transition (with further elaboration below):

I.	Create formal and informal networks for driving Sydney's water sensitive city agenda to support a collaborative, flexible and integrated governance approach.
II.	Embed Sydney's water sensitive city vision in organisational policies, plans and strategies
III.	Establish a cross-organisational framework that enables and drives an integrated and strategic approach for managing the whole water cycle
IV.	Increase knowledge about the social, technical and design solutions that are not yet sufficiently developed to deliver the full scope of Sydney's water sensitive city vision
V.	Identify and establish pathways for implementing water sensitive solutions through innovation and investment

I. Create formal and informal networks for driving Sydney's water sensitive city agenda to support a collaborative, flexible and integrated governance approach

Sydney's most significant challenge in transitioning to a water sensitive city is arguably the complexity of actors, structures and processes involved in the governance of water. This complexity has grown with time, as service expectations for water supply, sanitation, drainage and waterway health have evolved and responsibility for policy, planning, service delivery and regulation have become institutionally separated. With the number of actors and institutions and the size of the city, it has been difficult to implement a total water cycle approach to water management when organisations are generally only responsible for certain parts.

To progress Sydney's transition to a water sensitive city, water governance will need to become more integrated and adaptive so that it can account for the entire water cycle. While large-scale institutional reform may ultimately be needed to streamline Sydney's institutional arrangements, this may be unrealistic in the short-term and would need comprehensive consideration as to the form and appropriateness of reform solutions.

However, greater integration and collaboration can still be achieved through collaborative networks that are committed to a shared agenda for driving water sensitive outcomes. Both formal and informal networks are needed so that stakeholders have the freedom to explore issues and opportunities that may sit outside current policy and programs, while maintaining the support and endorsement of the authorising environment.

Collaboration platforms already exist across Greater Sydney but tend to be focused on specific issues and provide limited opportunity for exploration of the broad range of outcomes associated with a water sensitive city. An informal water sensitive cities network that is comprised of local champions and influential organisational representatives could help drive action on the ground and advocate to decision-makers for reforms and investments that will enable practice change. This could be complemented by formalised partnerships between key agencies to drive strategic programs and initiatives.

II. Embed Sydney's water sensitive city vision in organisational policies, plans and strategies

Driving collective action towards Sydney's water sensitive city vision will involve individual organisations committing to action and investment that progressively achieves the aspired outcomes. It is therefore critical to embed the vision in formal policies, plans and strategies to provide a framework for supporting intra- and inter-organisational alignment and the implementation of solutions. Formalising support for the water sensitive city agenda in Sydney will also create a supportive policy environment, which can lead to investment in water sensitive solutions more broadly.

Securing the commitment to and endorsement of Greater Sydney's water sensitive city vision amongst organisational leaders and decision-makers will be critical for embedding the vision in formal structures. Articulating a compelling narrative that links the benefits of the envisioned water sensitive city to organisational priorities and a broader city vision will help to harness the support of leadership and the general community.

III. Establish a cross-organisational framework that enables and drives an integrated and strategic approach for managing the whole water cycle

Sydney's water sensitive city vision will be achieved through the design and implementation of urban spaces and infrastructure systems that are multi-functional, providing a range of benefits that deliver Sydney's ecological, liveability and resource efficiency aspirations. This will require an understanding of the synergies between natural and engineered water systems, taking advantage of the opportunities across all streams of water (e.g. supplied

water, wastewater, stormwater) and working within the interfaces between the water system, the built form and natural landscapes.

In order to achieve this, Greater Sydney will need to adopt an integrated and strategic approach to managing the whole water cycle and its surrounding landscapes that is more consistent and efficient. This type of approach would help mitigate the existing flash flooding issues across the city, as well as inform the development of more water sensitive solutions to managing and re-using wastewater. Establishing such an approach across organisations and sectors is challenging, particularly in the context of the scale of Sydney and the complexity of its institutional arrangements.

A framework is therefore needed to provide clarity and direction for organisations to understand how their individual responsibilities, investments and activities can contribute to the collective achievement of Sydney's water sensitive city vision. Such a framework could include holistic policy, a cross-agency implementation strategy, standards and targets, and collaborative governance mechanisms. It would need to be coherent and comprehensive, articulating and aligning objectives across organisations, clarifying roles and responsibilities, and enabling the identification and pursuit of opportunities that prioritise integrated water sensitive outcomes that offer social, economic and environmental benefits across the city.

IV. Increase knowledge about the social, technical and design solutions that are not yet sufficiently developed to deliver the full scope of Sydney's water sensitive city vision

Innovation will be at the heart of a successful transition to a more water sensitive Greater Sydney. This requires a strong foundation of knowledge generation and application, as novel solutions are explored, tested, refined and eventually mainstreamed. These solutions may be technical in nature (e.g. new green technologies), they may be design-focused (e.g. new built form templates), or they may be social (e.g. new engagement processes).

The type of knowledge required changes over the course of a transition. Early on, new knowledge is needed to better define issues and to establish the need for an action or response. Where the need is unfamiliar, knowledge on the various responses or solutions available and their associated costs and benefits may be required. Developing and implementing novel solutions can be challenging and carry significant risks. In these cases, pilot-scale testing and demonstrations of solutions can help to prove the concept, highlight benefits, and build capability in the delivery of solutions. This can include insight into how risks can be managed, whether they be technical, financial or reputational. Ultimately, comprehensive knowledge of solutions will need to be developed and harnessed to support decision-making and guide implementation.

Sydney has made significant strides towards a water sensitive city, however there are aspects that require new knowledge in order to inform the development and implementation of solutions that address the full scope of its water sensitive city vision. While Sydney's water sector has been able to effectively service its residents with safe and reliable water and sanitation services, the need for flexibility and choice in water service delivery has not yet been explored. The importance of incorporating Aboriginal knowledge and values into water planning and decision-making has only just recently been recognised. More work is needed to determine how to effectively engage and empower people to drive water stewardship practices. Community resilience is an issue currently being explored by Resilient Sydney; solutions for increasing resilience needs further investigation, especially in relation to flooding. The functioning of Greater Sydney's entire water cycle needs further study, with a particular focus on the importance of groundwater and groundwater-dependent ecosystems and their role in total water cycle management.

A deliberate and strategic approach to addressing these knowledge gaps would help Sydney accelerate progress towards its broad water sensitive city vision.

V. Identify and establish pathways for implementing water sensitive solutions through innovation and investment

Becoming a water sensitive city will require a range of innovative solutions across social, technical and design domains to be developed and mainstreamed. There are many examples of innovation in water sensitive technology and design across Greater Sydney. It has been difficult, however, to enable widespread uptake of these innovations. Participants have reflected on a range of perceived institutional barriers, such as complex organisational and legislative arrangements, a multitude of stakeholders with diverse interests, and regulatory limitations associated with water pricing. Some have commented that these barriers present difficulties for allowing competition in the water sector.

While regulatory reform is one solution that has received recent attention, it can take a long time to implement. In the short term, stakeholders can identify alternative pathways for driving innovation and investment that navigate these barriers. Such pathways could include developing business cases for specific opportunities, setting targets, establishing strategic funding programs, investing in capacity building, and supporting innovation through learning and evaluation.

6.3. Towards implementation

The vision developed as part of this project is ambitious and long term. Transitioning a city such as Greater Sydney towards such an aspired water sensitive future involves multiple institutions and individuals acting with common purpose.

For Sydney stakeholders to progress implementation of the strategies identified in this section, further work that goes beyond the scope of this current CRCWSC project will be required. Specific considerations may include:

1. Development of a long list of possible actions to drive the implementation of enabling strategies
2. Prioritisation of outcomes to address in the short- to medium-term, potentially drawing on the WSC Index results to inform reflection on priorities
3. Prioritisation of actions based on factors such target outcome, feasibility, benefit, and potential leverage of current or upcoming projects, initiatives or available resources
4. Action planning for prioritised actions to form the basis of an implementation plan with targets, timeframes, budgets, roles and responsibilities
5. Business case development to progress particular actions or initiatives
6. Structure and process to maintain collective momentum across stakeholders committed to implementing the strategy
7. Strategic communications and influential approaches to secure organisational support and endorsement for implementing the strategy
8. Framework for ongoing monitoring and evaluation of action implementation and transition progress

Ultimately, it is intended for document to provide a resource for Sydney stakeholders to continue collaborating through these next strategy implementation stages.

The CRCWSC has been working with other cities to support their implementation planning and can offer guidance to Sydney through the provision of tools, strategic advice, facilitation of further processes, and sharing of lessons from other places.

7. Conclusion

Throughout history, Greater Sydney's water system has faced the challenge of needing to protect and enhance community and environmental health and wellbeing in the face of a rapidly increasing population and changing climate. Complex governance arrangements have thus emerged to ensure Greater Sydney's liveability, productivity, resilience and sustainability – the outcomes of a water sensitive approach to water system planning, design and management.

This report marks the culmination of a process that brought together strategic thinkers from across Sydney's water, planning, development and environment sectors to explore these issues and opportunities. Workshop discussions and associated analysis aimed to understand the city's unique water story, envision a future water sensitive Greater Sydney and identify the transition pathways that will need to be pursued to achieve their vision.

Using tools and methods of the CRCWSC, the project generated insights into Sydney's transition progress to date, and the shifts in policy direction, organisational frameworks and on-ground practice that will be required. Specific outputs are varied and include:

- Great Sydney's historical, contemporary and future water story
- A benchmark of Sydney's current water sensitive performance using the WSC Index, highlighting the goals that need focus to achieve the Waterway and Water Cycle City benchmarks. For Sydney, the most significant improvement is needed for the goals of Ensure quality urban space and Increase community capital.
- A 50 year vision for Greater Sydney as a water sensitive city, describing Sydney as a beautiful, prosperous city whose relationship with water supports thriving communities and ecosystems, custodianship of resources, and adaptive and resilient urban landscapes.
- An assessment of Sydney's current enabling conditions for the transition towards its vision, using the Transition Dynamics Framework to indicate the presence of enabling conditions and the current transition phase for each vision outcome.
- Short to medium term strategies for accelerating Greater Sydney's water sensitive city transition.

These outputs provide a framework for strategic action across the many stakeholder organisations that will need to work in a collaborative and coherent manner to facilitate Sydney's transition to a more water sensitive city.

The insights from this research show that Sydney has a strong foundation to build on as it pursues its envisioned water future. The city's appetite for innovation and trialling water sensitive solutions, the dedication of individual champions to ensuring broad city outcomes, and the existing platforms for collaboration together provide a strong base to support local stakeholders in advancing their water sensitive city vision.

While Sydney's size can be a challenge in achieving integrated approaches to water management, it also provides a wealth of information, trials and experiments, and water sensitive solutions that can be drawn on and harnessed to realise the vision. Existing collaboration platforms can be expanded or new platforms could be created to foster a strategic approach to implementing and learning from a broad range of water sensitive solutions across the city.

Participants in this project agreed on shared aspirations for Greater Sydney, with vision themes of healthy environments, urban liveability, sustainable resource use, innovative infrastructure, citizen wellbeing, integrated governance, community stewardship and Aboriginal engagement receiving unanimous support. Throughout the

workshop discussions, participants observed that liveability would be defined differently across different parts of Sydney, which needed to be reflected in the vision. The Greater Sydney Commission's concept of the "Three Cities" and associated district plans provide a sound framework for ensuring liveability across Sydney's diverse areas.

Champions across Greater Sydney are generally aware of the direction water management practice needs to shift, however silos within and among organisations still exist which may present challenges for collaboration towards a common vision. Due to the large number of organisations and actors in this space, it is important there is a clear, collective voice that drives an agenda for coherent water sensitive city action. To this end, there are several existing opportunities in Sydney that can be leveraged to create a platform for unifying the range of voices and supporting a coordinated and integrated approach to water management.

Another critical focus area for advancing Sydney's transition includes meaningfully engaging with the community, and especially Aboriginal communities, in order to understand their water values and how these values can be incorporated into water planning and decision-making. Platforms for engaging with communities exist in some parts of Sydney and provide a strong foundation to build upon, however they will need to be expanded in scope to include the full suite of Sydney's water sensitive city aspirations. More meaningful engagement approaches that go beyond standard consultation processes will empower residents to make informed contributions. Engagement with Aboriginal communities will also need to be improved in order to better understand indigenous water knowledge and values, and ways to incorporate this knowledge into water planning and decision-making.

The project participants demonstrated openness, motivation and commitment for undertaking collective action to achieve their shared water sensitive vision. Building on this momentum and broadening industry and public support will put Greater Sydney in a strong position to accelerate its ongoing transition to achieve its water sensitive city vision.

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Appendix A. Participants

Workshop Facilitators		
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Katie	Hammer	CRC for Water Sensitive Cities
Emma	Church	CRC for Water Sensitive Cities
Jamie	Ewert	CRC for Water Sensitive Cities
Jo	Lindsay	CRC for Water Sensitive Cities
Workshop Attendees		
Ruby	Arden	Northern Beaches Council
Judy	Birrell	Department of Planning and Environment
Phill	Birtles	Sydney Water
Jean	Brennan	Inner West Council
Sue	Burton	Cooks River Alliance
Andrew	Carr	Lend Lease Living Utilities
Sarah	Clift	Parramatta River Catchment Group
Lisa	Currie	City of Sydney
Kurt	Dahl	Permeate Partners
Beck	Dawson	Resilient Sydney
Simon	Fane	University of Technology Sydney
Peter	Freewater	Greater Sydney Local Land Services
Kristen	Gabriel	Resilient Sydney
Chris	Gantt	Celestino Pty Limited
Robbie	Goedecke	Australian Water Association
Kristy	Good	Splash/Blacktown Council
Paul	Hackney	City of Parramatta
Mike	Healy	GHD
Paul	Higham	Sydney Water
Kaia	Hodge	Sydney Water
Giselle	Howard	NSW Environment Protection Authority
Hala	Hubraq	Infrastructure NSW
Stuart	Khan	University of New South Wales
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Adam	Lovell	Water Services Association of Australia
Tim	MacDonald	Office of Environment and Heritage
Adrian	Mcgregor	McGregor Coxall
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Paul	Plowman	Sydney Water
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Emma	Pryor	Sydney Water
Daria	Rech	Penrith City Council
Lydia	Robertson	Infrastructure Partnerships Australia
Karen	Shaw	Veolia
Rod	Simpson	Greater Sydney Commission
Alex	Sommer	Urban Growth NSW
Jamin	Tappouras	Urban Development Institute Australia NSW
Nerida	Taylor	Blacktown City Council
Scott	Taylor	Lend Lease Living Utilities
Katrina	Wall	Department of Health
Eamon	Waterford	Committee for Sydney
Rachel	Watson	University of Technology Sydney
Paul	Wearne	NSW Environmental Protection Authority
Tony	Wong	CRC for Water Sensitive Cities
Kim	Woodbury	City of Sydney

Appendix B. WSC Index Result Details

This Appendix supplements the details provided in Section 4 of the main report.

Process for scoring indicators

A full day workshop was held at Customs House, 31 Alfred Street on 31 July 2017. Participants represented a range of stakeholders from across Greater Sydney's water, planning, development and environment sectors. A three-step method for scoring each indicator was used:

1. Live polling to gauge individual participants' perspectives on the score for the indicator in question,
2. Interactive discussion to uncover evidence and justification to inform the indicator's score, and
3. Reach consensus amongst the participants on the score to be assigned.

The live polling used a bespoke web-based tool that participants accessed through their mobile devices to score 1-5. The collective results were then showed in real-time. These results were discussed, with evidence identified (e.g. policy documents, organisational materials, expert views, etc.) before reaching consensus on a given rating and level of confidence.

WSC Indicator scores and justifications

Goal 1: Water Sensitive Governance (Score 2.4/5)

Indicator 1.1: Knowledge, skills and organisational capacity (Score: 2/5)

There is strong technical capacity across individuals and organisations in Greater Sydney. There are opportunities for capacity building through the Australian Water Association.

Knowledge and capacity is lacking across more social aspects such as how to effectively collaborate and how to engage better with communities, moving beyond consultation. There is a need to better understand human behaviour and how to effectively communicate and engage with communities.

Indicator 1.2: Water is a key element of city planning and design (Score: 2/5)

There are numerous examples of policy supporting sustainable water management and WSUD. However, there are concerns over the degree of planning coordination between organisations in addition to the degree of applied integration.

In terms of coordination, there is a view that there is enthusiasm for IWM, but a lack of coordination means that there is a struggle to progress adoption of WSUD and other practices consistent with IWM planning. There is no single leader to define IWM planning and coordinate other stakeholders. Responsibility for managing stormwater lies with local councils and thus is ad-hoc and varied across Greater Sydney. There is also no state planning policy around stormwater.

Sustainability outcomes and targets are reflected in some planning policies, but are typically related to specific singular objectives rather than broader water sensitive city outcomes. The role of water in achieving these outcomes is not yet fully embedded in urban planning.

Indicator 1.3: Cross-sector institutional arrangements and processes (Score: 2/5)

Across Greater Sydney, there is general acknowledgement that greater collaboration is needed to achieve the broad outcomes associated with a water sensitive city. Currently land-use and water planning are done in silos and objectives are single-disciplinary. Practice reflects consultation rather than collaboration, which misses the opportunity to plan for cross-sectoral benefits. Workshop participants reflected on the difficulties in achieving collaboration due to traditional approaches engrained in institutions and the sheer number of players adding to the complexity.

There are several notable examples of collaboration at the local level in the Greater Sydney Region, which include the catchment groups such as the Cooks River Alliance and Parramatta River Catchment Group, among others. These groups work with other councils, government agencies and communities to achieve sustainable urban water management in the river catchment areas.

Indicator 1.4 Public engagement, participation and transparency (Score: 2.5/5)

Engagement with the public is still generally focused on a consultation approach rather than genuine engagement. Some policies such as the Metropolitan Water Plan had engagement processes, however these processes are still in the early phases of development. Some local governments (e.g. Blue Mountains) have established community engagement forums.

Engaging with communities around water has been challenging given it has not been a priority since the end of the drought. Further work is needed to develop key messages for community, potentially around the concept of liveability.

Indicator 1.5 Leadership, long-term vision and commitment (Score: 2.5/5)

Greater Sydney currently does not have a vision for integrated water management which makes it challenging to implement IWM solutions. There are many individual leaders and champions within organisations, however there is not one organisation championing IWM. There are also some local governments demonstrating strong leadership space, however they have limited impact on the broader city context.

Indicator 1.6 Water resourcing and funding to deliver broad societal value (Score: 2.5/5)

There is limited evidence to draw on in order to quantify broad societal benefits of WSUD. Without this evidence, it is difficult to communicate the benefits of a water sensitive approach. Current funding systems do not support WSUD which tends to rely on external grants.

Indicator 1.7 Equitable representation of perspectives (Score: 2.5/5)

There are several community activist groups (e.g. fishermen) who are quite vocal but do not have a seat at the table. Aboriginal communities also do not have a strong voice in water planning and decision-making. Technical roles are generally male dominated, however senior level roles are quite gender and ethnically diverse.

Goal 2: Increase community capital (Score: 2.3/5)

Indicator 2.1 Water literacy (Score: 3.0/5)

The community has a good understanding of their catchment and where their water comes from. The CRCWSC National Survey of Australian Water Literacy showed that 41% of Sydney residents know their catchment boundaries. The community understands the need to conserve water due to the water conservation campaigns.

Some elements of the water cycle are in school curricula, however often they contain only part of the entire water cycle.

The community is less informed on stormwater and the linkages between different elements of the water cycle.

Indicator 2.2 Connection with water (Score: 3/5)

The community feels a strong connection to Sydney's natural water assets such as the harbour, beaches and coastline. They value the lifestyle of these water assets such as sailing, surfing, fishing, and going to the beach. People in Western parts of Sydney are also fairly connected to the rivers and waterways and care about river health. The community also understands the need to conserve water, as demonstrated by the world-leading low potable water demand.

While residents are generally well connected to the amenity and supply aspects of water, they generally have a lower understanding of their impact on water quality.

Indicator 2.3 Shared ownership, management and responsibility of water assets (Score: 2/5)

Infrastructure exists at multiple scales (e.g. rainwater tanks, small-scale stormwater treatment systems) however there are issues around maintenance of these assets. Inheritance of small-scale infrastructure to residents has provided an ongoing legacy and councils are therefore there is little support for this approach.

The Cooks River community is very active in maintaining infrastructure especially along the riverbank. It is important to clarify the role of community in delivering water services in the future.

There has been a recent uptake amongst Sydney residents of household water sensitive urban design elements such as rainwater tanks. Between 2007 – 2013, the number of households with a rainwater tank installed almost doubled (Australian Bureau of Statistics, 2013). While there is a general desire for outcomes such as conserving water, lower water bills, and reduced stormwater runoff, there is a lack of knowledge around the maintenance requirements which results in many rainwater tank systems not operating effectively.

Workshop participants felt there needs to be greater coordination to drive local water management solutions, as they are currently ad-hoc and responsibilities are ambiguous. The legacy of small-scale infrastructure being handed over to residents creates maintenance challenges which causes concerns within local governments around shared ownership.

Indicator 2.4 Community preparedness and response to extreme events (Score: 2/5)

The community generally does not feel prepared for extreme events and are unclear on what to do in the case of an emergency. Local councils are responsible for emergency plans, however there is little coordination with the NSW State Emergency Service to communicate these plans. Messaging to the community is inconsistent and not frequent enough, resulting in a poorly informed community. The infrequency of extreme events (such as major floods and bushfires) in the Greater Sydney region has led to a fairly complacent general population.

In an experiment done by Resilient Sydney, a heat wave scenario was simulated to test community preparedness to such a scenario. Most people were under-prepared and did not know what to do in that situation (Resilient Sydney, 2016).

Indicator 2.5 Indigenous involvement in water planning (Score 1.5/5)

Several strategies and programs exist across Greater Sydney that recognise Indigenous relationships to water. In 2015-16, Sydney Water introduced Heritage compliance indicators to identify risks to both Aboriginal and built heritage from maintenance, operational and construction activities. It involves consultation with Aboriginal people to conserve Aboriginal cultural heritage in landscapes wherever possible.

The Greater Sydney Commission and the Department of Aboriginal Affairs will establish an ongoing engagement forum with Greater Sydney's Aboriginal community to better inform planning. Representatives from Local Aboriginal Land Councils, Aboriginal youth and students, and Aboriginal service providers will be involved in this forum.

The NSW Government has developed water sharing plans as a natural resource management policy framework to outline the rules for sharing water resources between consumptive users and the environment (DPI Water, n.d.). The plans protect native title rights, and recognise the significance of land and water for Aboriginal people.

While several policies are in place to encourage Indigenous involvement in water planning across Greater Sydney, it is generally done on a project basis and only links to certain elements of project planning and design.

Goal 3: Achieve equity of essential services (Score 3.9/5)

Indicator 3.1 Equitable access to safe and secure potable water supply (Score 5.0/5)

Sydney Water is effectively supplying water to all of Greater Sydney's residents. More attention will be needed to provide Sydney's homeless community with water services, which City of Sydney is currently focusing on.

Indicator 3.2 Equitable access to safe and reliable sanitation (Score 4.5/5)

Generally Greater Sydney provides safe and reliable sanitation services to its residents, however there are occasional stormwater overflows. The current system also discharges sewage in deep ocean outfalls which contributes to a lower score.

Indicator 3.3 Equitable access to flood protection (Score: 3/5)

As stated in Section 2.3, the primary indicator that needs to be addressed to achieve a Drained City is equitable access to flood protection. The extensive development in the floodplains of the Hawkesbury, Georges and Cooks Rivers is putting an increased number of people at high risk, especially in the event of a catastrophic flood. Flood risk is not effectively communicated between local councils, developers and residents. Small-scale flooding events are also a hazard to residents, with no city-wide strategy for mitigating these events. Greater flood modelling will need to be undertaken along with communication and dissemination of that knowledge.

Indicator 3.4 Equitable and affordable access to amenity values of water-related assets (Score: 3/5)

Greater Sydney has some of the world's most beautiful waterways, beaches and coastlines. However access to the coastlines and beaches in the Eastern suburbs of Sydney is limited due to private ownership of land. People living in the Western suburbs have even greater difficulty accessing these areas of amenity. Focus is now on providing areas in Western Sydney with parklands and healthy rivers to also be able to access areas of amenity, as seen in the Greater Sydney Commission's three cities concept.

Goal 4: Improve productivity and resource efficiency (Score 2.7/5)

Indicator 4.1 Benefits across other sectors because of water-related services (Score: 2.5/5)

There are quite a number of examples where water services create additional benefits, however the challenge is quantifying these benefits and incorporating them in business cases. It is often also difficult to benchmark and measure these benefits. This creates a challenge in being able to articulate them even though they are obvious and intuitive.

Urban cooling and greening is being looked at by the City of Sydney, however it is difficult to quantify these benefits and therefore difficult to create targets to drive investment.

Indicator 4.2 Low GHG emission in water sector (Score: 3/5)

The Sydney Water annual report states that the water sector emits 144 net tonnes of CO2 equivalents per 1,000 connected properties.

Indicator 4.3 Low end-user potable water demand (3.5/5)

Sydney is a world-leader in water usage, with water use remaining the same in the past eight years despite the population increase. The Sydney Water annual report states a usage of 293 litres per person per day.

Indicator 4.4 Water-related economic and commercial opportunities (Score: 2/5)

In 2006, New South Wales introduced Australia's first third-party licensing system to enable the private sector to enter the urban water industry, the Water Industry Competition Act (WICA). After a recent review of water pricing in the sector, it appears that the price competitiveness of alternative water services is a barrier to innovation when comparing potential investment in new sources of supply with incumbents.

Since the end of the Millenium Drought, there has been little innovation in water recycling technology. A decline in sales of water technology has also been observed in recent years. There is now an increasing demand for technologies for renewable energy and biogas, which water utilities are now turning their attention to.

Indicator 4.5: Maximised resource recovery (Score: 2.5/5)

There are currently some projects around recovery of nutrients from sludge/biosolids, however only to a limited extent. There is little being done in biogas. There is the will and desire to do more in this space and there are many opportunities to do so.

Goal 5: Improve ecological health (Score: 3/5)

Indicator 5.1 Healthy and biodiverse habitats (Score: 2/5)

Much of Sydney's original native vegetation and bushland has been cleared for urban development. Less than 10% of woodlands across the Cumberland Plain remains, and occurs mostly as small patches (Department of Environment Water Heritage and the Arts, 2010). While there are some pockets of terrestrial biodiversity, connectivity needs to improve between these areas in order to improve overall habitat health and biodiversity. While some new developments aim to achieve greater connectivity, there is still room for improvement.

Overall, in broad-scale assessments of the region's habitat condition, catchments were assessed as having 'Poor' physical form and 'Very poor' fish condition. Riparian vegetation was not assessed for the Hawkesbury-Nepean

catchment, but assessed as ‘Poor’ for Sydney Coast-Georges catchment (NSW Environment Protection Authority, 2012).

There are also legacy issues such as pollution that significantly affect the health of waterways and the harbour. While the eastern harbour is very biodiverse due to its interactions with the ocean, moving upstream shows a rapid decline in habitat health and biodiversity. Vegetation communities for Cooks River and tributaries were rated as having poor to very poor (‘D+’ to ‘F-‘) condition. The condition of freshwater macroinvertebrate communities was reported to be healthier, with several streams reported to be in good condition, but others ranging from fair to poor condition for macroinvertebrates (Cooks River Alliance, 2016).

While a historical legacy of pollution has negatively impacted aquatic biodiversity, the general public values waterways for amenity and recreational purposes and desire clean, swimmable water environments. There have been several projects working to improve habitat health such as Sydney Olympic Park and the adjoining Homebush Bay, which were once one of the most polluted sites in the Sydney Region. Recent environment remediation works, revegetation and habitat management have significantly improved ecological functioning. The catchment groups (such as the Cooks River Alliance and Parramatta River Catchment Group) are also working collaboratively to improve river and catchment health.

Indicator 5.2 Surface water quality and flows (Score: 3/5)

Point-source pollution has been addressed across Greater Sydney, and attention is now turning to stormwater and urban runoff. Some councils are addressing stormwater and incorporating water sensitive urban design solutions, however this is generally done on an ad-hoc basis. While there has been a recent increase in investment in stormwater management, the solutions have had limited impact to date and waterway health is still poor.

It is also challenging to deal with flow impacts from stormwater runoff, and solutions are being explored to address this issue.

Indicator 5.3 Groundwater quality and replenishment (Score: 3/5)

Groundwater is not seen as an important resource for Greater Sydney, and thus not much is known about the groundwater system. Some councils utilise groundwater bores (e.g. Northern Beaches Council) and are faced with challenges of saltwater intrusion and overextraction due to a lack of information around monitoring.

Indicator 5.4 Protecting existing areas of high ecological value (Score: 4/5)

There are many national parks surrounding Greater Sydney (e.g. Blue Mountains National Park, Royal National Park) that are well protected with strict regulations around land clearing etc. Historic and heritage sites are also well protected throughout Sydney. Aboriginal heritage trails exist with signage and artwork to tell the local indigenous stories.

Goal 6: Ensure quality urban space (Score: 2/5)

Indicator 6.1 Activating connected pleasant urban green and blue space (Score: 2.5/5)

Greater Sydney consists of beautiful coastlines, waterways and parks which attract people from all over the world. However, these areas are not easily accessed and are generally not well connected. Eastern parts of the city have well-connected green spaces however western areas do not have this same access. Currently in Western Sydney, some people do not have parklands available within a 10 minute walk, and are therefore less likely to use these areas especially in the hot summer months.

While some walking and bike paths exist, along with some blue/green corridors, the sprawling nature of Greater Sydney makes it difficult to achieve connectivity. It would therefore be beneficial to assess the different areas of Greater Sydney separately for this indicator to achieve a more accurate score.

Indicator 6.2: Urban elements functioning as part of the urban water system (Score: 2/5)

The implementation of water sensitive urban design (WSUD) to reduce stormwater impacts and enhance urban greening and cooling is generally driven by innovative local councils and therefore implemented in an ad-hoc way. There is a lack of leadership at the state level to drive a unified approach to water sensitive urban design. There are effective projects and demonstrations across Greater Sydney of how urban elements can function as part of the urban water system, but fundamental practice has not yet shifted. The City of Sydney, for example, is a leader in this space and has implemented a green roofs and walls policy and has constructed a total of 154 raingardens throughout the city.

Greater Sydney's existing infrastructure and urban form was constructed prior to the realisation of their ability to function as part of the urban water system, which creates a physical and economic challenge in retrofitting to achieve water sensitive outcomes. In greenfield developments of Western Sydney, water is generally not considered in planning these developments. Impervious surfaces such as roads and sidewalks are being constructed with no consideration of the stormwater impacts. The role of water and the urban form in mitigating heat impacts is not yet engrained in the planning and design of these new developments. While public open space and green space are a requirement for developers, responsibility for maintenance is passed on to land owners and council which generally results in poor outcomes.

Indicator 6.3: Vegetation coverage (Score: 1.5/5)

The people of Greater Sydney cherish the surrounding national parks for green, natural environments. Conversely, the urban area of Greater Sydney contains around 10% vegetation coverage, with the majority of public open space covered in grass and offering little shade or cooling benefits. There is significant variation between local government areas.

The City of Sydney has developed the Greening Sydney Plan, which aims to increase average total canopy cover by 50% by 2050 (from 15.5% to 23%) and 75% by 2050 (to 27%). The Government Architect's Office has developed the "Greener Places" policy which promotes green infrastructure across the city and in priority locations. The 202020 Vision "Where are all the trees?" also advocates for a greener Sydney.

Goal 7: Promote Adaptive Infrastructure (Score: 2.8/5)

Indicator 7.1 Diverse fit-for-purpose water supply system (Score: 3/5)

Greater Sydney has a diverse water supply system, with 29 individual water recycling schemes across the city, along with desalination. Stormwater collection and recycling is also beginning to happen across the city. However a single, centralised system is cheapest and easiest when the city is not in drought, and there is a tendency to rely on this system. While the infrastructure systems are out there, there is no future planning on ensuring a diverse water supply portfolio for the future. Groundwater is also not considered as a water source, and not much is known about its potential.

The water pricing in Sydney currently does not encourage localised solutions and diversifying water supply for resilience. The private sector is wanting to do more in this space, however are meeting barriers to implementation of solutions.

Indicator 7.2 Multi-functional water system infrastructure (Score: 2.5/5)

There are projects (E.g. Sydney Park in City of Sydney) where water infrastructure is used to improve amenity and biodiversity. There is potential for larger-scale assets to provide multiple benefits as well, however this is difficult to coordinate access while protecting the assets. For example, it is debated whether open reservoirs are beneficial since sometimes closed reservoirs enhance biodiversity in the area.

Concrete channels still exist across Greater Sydney which are often fenced, and could be used for other purposes. There is a legacy issue of highly engineered infrastructure, however there is also a lot of opportunity in areas of new development.

Indicator 7.3 Integration and intelligent control (Score: 2.5/5)

Greater Sydney's water supply system can be very flexible and contains redundancies. Controls are in place for the desalination plant to respond to triggers in the environment. There are also examples of intelligent control for water supply at a smaller scale.

Intelligent control is more limited for the wastewater system, and non-existent for stormwater.

Indicator 7.4 Robust infrastructures (Score: 3/5)

Water supply infrastructure is very robust with many redundancies incorporated in the system. Wastewater infrastructure is also high but there are instances of sewerage overflows. From an engineering perspective, the wastewater systems perform as they are designed, however overflows are not ecologically or socially acceptable.

There needs to be a greater focus on robustness of stormwater infrastructure. Generally, stormwater infrastructure is ad-hoc and not well managed or maintained. There is no agency responsible for water quality, which makes this a challenge. The standards and regulation around stormwater are nowhere as near as robust as water supply and sanitation. Current monitoring of water quality impacts should help inform future directions for stormwater infrastructure and management.

Indicator 7.5 Infrastructure and ownership at multiple scales (Score: 2.5/5)

There is a degree of encouragement for decentralised infrastructure and there are projects (e.g. Green Square, Central Park) that are incorporating solutions at multiple scales. A number of policy and regulatory barriers are present that has made implementation of decentralised solutions more challenging. There are a large number of players in Sydney, especially in the private sector, that are pushing for uptake of more decentralised solutions.

Indicator 7.6 Adequate maintenance (Score: 3/5)

Large-scale and high risk water infrastructure for water supply and wastewater are well maintained. There is less known about how to effectively maintain stormwater infrastructure, which is an ongoing challenge in Sydney. Green infrastructure especially is not fully understood and therefore not adequately maintained. Stormwater guidelines exist however they need to be updated with current information.

Water Sensitive Outcomes

The WSC Index has the ability to filter results based on water sensitive city outcomes. This method of analysis is still in development and a more detailed assessment of Outcomes that compares different city states will be forthcoming.

Water sensitive city outcomes assess the performance of the urban water system against the delivery of resilience, liveability, sustainability and productivity.

- **Resilience** in this context is defined as the capacity to maintain water system services under acute or chronic disturbances, through adaptation or recovery.
- **Sustainability** is the capacity of water system services to deliver benefits for current and future generations.
- **Liveability** is the capacity of the water system to deliver a high quality of life for communities (such as thermal comfort, aesthetics, amenity, connection to place, etc.).
- **Productivity** is the capacity of the water system services to generate economic value.

The ratings from each indicator can contribute to one or more of these outcomes. For example, improving the rating for the indicator 'diversify self-sufficient fit-for-purpose water supply' related to provision of alternative water supplies would improve both resilience and sustainability outcomes.

The results shown in Figure 21 indicate how Greater Sydney scores against the expected Outcomes for the Water Cycle City.

Figure 21: Greater Sydney WSC Index indicator scores represented by the WSC Outcomes of Resilience, Liveability

Appendix C. Transition Dynamics Framework analysis

The Transition Dynamics Framework (TDF) is a tool developed by the CRCWSC to diagnose the current presence of enabling conditions in a system as it shifts from an old practice to a new, water sensitive practice.

Brown et al. (2016) provides details on the conceptual basis of the tool. In short, as a city moves through the phases of a transition, enabling conditions are established to support its trajectory towards its water sensitive city vision and avoid the risk of change pathways that reflect lock-in, backlash or system failure patterns. Actions to orient and drive change towards a city's envisioned water sensitive future need to progressively establish these enabling conditions. Actions with the most impact during the early transition phases will be different from those during the later transition phases. It is therefore critical to identify a city's current phase of change to ensure that actions are prioritised according to the effectiveness they will have in accelerating the water sensitive city transition.

The TDF was applied for Greater Sydney to each WSC Index goal to analyse what enabling conditions are currently fully present, present to some degree, and absent. The results are represented by a simple colour code:

Colour code		Indicators are fully present; regression unlikely
		Some presence of indicators; vulnerable to regression
		Absence of indicators; progression unlikely
		Not yet a consideration as preceding conditions not fulfilled

The TDF results provide insight into the enabling conditions that should be established as a priority. This leads to the formulation of priority objectives that should be pursued through enabling actions to efficiently advance further progress.

This section presents Greater Sydney's TDF results for each WSC Index goal, with a brief list of key evidence supporting the colour code. Where a specific indicator was considered at a significantly different transition phase, an indicator-specific TDF matrix was developed. The evidence that supports the colour coding of the matrix is more fully described in the respective in Section 5. This evidence is organised by the vision outcome rather than WSC Index goal, whereby the goals and in some cases individual indicators were allocated to the vision theme they best represent.

1. Ensure good water sensitive governance (all indicators)

Transition phase	Champions	Platforms for connecting	Knowledge	Projects and applications	Tools and instruments
1. Issue Emergence	Issue activists	N/A	Issue highlighted	Issue examined	N/A
2. Issue Definition	Individual champions	Sharing concerns and ideas	Causes and impacts examined	Solutions explored	N/A
3. Shared Understanding & Issue Agreement	Connected champions	Developing a collective voice	Solutions developed	Solutions experimented with	Preliminary practical guidance
4. Knowledge Dissemination	Aligned and influential champions	Building broad support	Solutions advanced	Solutions demonstrated at scale	Refined guidance and early policy
5. Policy & Practice Diffusion	Government agency champions	Expanding the community of practice	Capacity building	Widespread implementation and learning	Early regulation and targets
6. Embedding New Practice	Multi-stakeholder networks	Guiding consistent application	Monitoring and evaluation	Standardisation and refinement	Comprehensive policy and regulation

Champions	**Bridges**	**Knowledge**	**Projects**	**Tools**
Key networks of individuals Greater Sydney Commission River catchment groups Regional organisations of councils (ROCs) Co-governance work with Marrickville (Inner West) council CRC work Some local governments	*(Semi) Formalised organisations, structures, & processes for coordination and alignment* Splash/CRC Regional Advisory Panel River catchment groups and ROCs Water Smart Cities Program People (LGAs) want to collaborate, no platform	*Research, science & contextualised knowledge* No state water vision – Metropolitan Water Plan has poor implementation CRC governance research No integration of water in planning. Some acknowledgement that integration is needed. 25 councils each responsible for stormwater “old model is broken, difficult to change institutions…legacy government issue”	*Experiments, demonstrations, & focus projects* Wilford lane living lane project – living lane program in Marrickville council public engagement and maintenance Lots of water sensitive projects falling through because of handing over responsibility for construction and maintenance Some citizen science projects, need more (Stream watch) Stormwater NSW – capacity building workshops within councils	*Legislative, policy, regulative, & practice tools* Metropolitan water plan – no legislation for implementation No coherent plan for ownership/management No state planning policy on urban water/WSUD Water Smart cities program (anticipated IWC strategy for greenfield and infill growth area, recommendations for reform to better align land use and water planning, recommendations to address barriers to cost, recommendations to apply state-wide)

2. Increase community capital

2.1 Water literacy, 2.2 Connection with water, 2.3 Shared ownership, management and responsibility for water assets

Transition phase	Champions	Platforms for connecting	Knowledge	Projects and applications	Tools and instruments
1. Issue Emergence	Issue activists	N/A	Issue highlighted	Issue examined	N/A
2. Issue Definition	Individual champions	Sharing concerns and ideas	Causes and impacts examined	Solutions explored	N/A
3. Shared Understanding & Issue Agreement	Connected champions	Developing a collective voice	Solutions developed	Solutions experimented with	Preliminary practical guidance
4. Knowledge Dissemination	Aligned and influential champions	Building broad support	Solutions advanced	Solutions demonstrated at scale	Refined guidance and early policy
5. Policy & Practice Diffusion	Government agency champions	Expanding the community of practice	Capacity building	Widespread implementation and learning	Early regulation and targets
6. Embedding New Practice	Multi-stakeholder networks	Guiding consistent application	Monitoring and evaluation	Standardisation and refinement	Comprehensive policy and regulation

2.4 Community preparedness and response to extreme events

Transition phase	Champions	Platforms for connecting	Knowledge	Projects and applications	Tools and instruments
1. Issue Emergence	Issue activists	N/A	Issue highlighted	Issue examined	N/A
2. Issue Definition	Individual champions	Sharing concerns and ideas	Causes and impacts examined	Solutions explored	N/A
3. Shared Understanding & Issue Agreement	Connected champions	Developing a collective voice	Solutions developed	Solutions experimented with	Preliminary practical guidance
4. Knowledge Dissemination	Aligned and influential champions	Building broad support	Solutions advanced	Solutions demonstrated at scale	Refined guidance and early policy
5. Policy & Practice Diffusion	Government agency champions	Expanding the community of practice	Capacity building	Widespread implementation and learning	Early regulation and targets
6. Embedding New Practice	Multi-stakeholder networks	Guiding consistent application	Monitoring and evaluation	Standardisation and refinement	Comprehensive policy and regulation

2.5 Indigenous involvement in water planning

Transition phase	Champions	Platforms for connecting	Knowledge	Projects and applications	Tools and instruments
1. Issue Emergence	Issue activists	N/A	Issue highlighted	Issue examined	N/A
2. Issue Definition	Individual champions	Sharing concerns and ideas	Causes and impacts examined	Solutions explored	N/A
3. Shared Understanding & Issue Agreement	Connected champions	Developing a collective voice	Solutions developed	Solutions experimented with	Preliminary practical guidance
4. Knowledge Dissemination	Aligned and influential champions	Building broad support	Solutions advanced	Solutions demonstrated at scale	Refined guidance and early policy
5. Policy & Practice Diffusion	Government agency champions	Expanding the community of practice	Capacity building	Widespread implementation and learning	Early regulation and targets
6. Embedding New Practice	Multi-stakeholder networks	Guiding consistent application	Monitoring and evaluation	Standardisation and refinement	Comprehensive policy and regulation

Champions	**Bridges**	**Knowledge**	**Projects**	**Tools**
Key networks of individuals River catchment groups (Our living river) Some local governments (Blacktown) Local Aboriginal Land Councils Greater Sydney Commission Resilient Sydney	*(Semi) Formalised organisations, structures, & processes for coordination and alignment* Local Aboriginal Land Councils Splash, CRC Water smart cities program – pilot development areas River catchment groups Resilient Sydney	*Research, science & contextualised knowledge* Resilient Sydney project to determine community preparedness Flood risk areas are known, not communicated, still being developed Greater Sydney Commission's 'three cities' have water boundaries Some areas don't have flood modelling – done by councils	*Experiments, demonstrations, & focus projects* Marrickville living lanes program – public engagement and maintenance Some citizen science projects (Stream watch, Australia Museum) need more Sydney water campaigns 'keep wipes out of pipes' and address cultural and language diversity Metropolitan Water Plan 'futures forum' community engagement workshops Sydney Water community reference groups for wastewater treatment plants	*Legislative, policy, regulative, & practice tools* Catchment action plans (NRM priorities, Local land services) Sydney Water heritage compliance indicators – consultation with Aboriginal people Water sharing plans Our Living River (Parramatta) Water Smart Cities Program (Metropolitan Water Plan, willingness to pay for liveability) Hawkesbury-Nepean flood risk strategy "Our water our country" Aboriginal Water Initiative (DPI) and Aboriginal Water Trust – both programs don't exist anymore

3. Achieve equity of essential services

3.1 Equitable access to safe and secure water supply, 3.2 Equitable access to safe and secure water supply

Transition phase	Champions	Platforms for connecting	Knowledge	Projects and applications	Tools and instruments
1. Issue Emergence	Issue activists	N/A	Issue highlighted	Issue examined	N/A
2. Issue Definition	Individual champions	Sharing concerns and ideas	Causes and impacts examined	Solutions explored	N/A
3. Shared Understanding & Issue Agreement	Connected champions	Developing a collective voice	Solutions developed	Solutions experimented with	Preliminary practical guidance
4. Knowledge Dissemination	Aligned and influential champions	Building broad support	Solutions advanced	Solutions demonstrated at scale	Refined guidance and early policy
5. Policy & Practice Diffusion	Government agency champions	Expanding the community of practice	Capacity building	Widespread implementation and learning	Early regulation and targets
6. Embedding New Practice	Multi-stakeholder networks	Guiding consistent application	Monitoring and evaluation	Standardisation and refinement	Comprehensive policy and regulation

3.3 Equitable access to flood protection

Transition phase	Champions	Platforms for connecting	Knowledge	Projects and applications	Tools and instruments
1. Issue Emergence	Issue activists	N/A	Issue highlighted	Issue examined	N/A
2. Issue Definition	Individual champions	Sharing concerns and ideas	Causes and impacts examined	Solutions explored	N/A
3. Shared Understanding & Issue Agreement	Connected champions	Developing a collective voice	Solutions developed	Solutions experimented with	Preliminary practical guidance
4. Knowledge Dissemination	Aligned and influential champions	Building broad support	Solutions advanced	Solutions demonstrated at scale	Refined guidance and early policy
5. Policy & Practice Diffusion	Government agency champions	Expanding the community of practice	Capacity building	Widespread implementation and learning	Early regulation and targets
6. Embedding New Practice	Multi-stakeholder networks	Guiding consistent application	Monitoring and evaluation	Standardisation and refinement	Comprehensive policy and regulation

3.4 Equitable and affordable access to amenity values of water-related assets

Transition phase	Champions	Platforms for connecting	Knowledge	Projects and applications	Tools and instruments
1. Issue Emergence	Issue activists	N/A	Issue highlighted	Issue examined	N/A
2. Issue Definition	Individual champions	Sharing concerns and ideas	Causes and impacts examined	Solutions explored	N/A
3. Shared Understanding & Issue Agreement	Connected champions	Developing a collective voice	Solutions developed	Solutions experimented with	Preliminary practical guidance
4. Knowledge Dissemination	Aligned and influential champions	Building broad support	Solutions advanced	Solutions demonstrated at scale	Refined guidance and early policy
5. Policy & Practice Diffusion	Government agency champions	Expanding the community of practice	Capacity building	Widespread implementation and learning	Early regulation and targets
6. Embedding New Practice	Multi-stakeholder networks	Guiding consistent application	Monitoring and evaluation	Standardisation and refinement	Comprehensive policy and regulation

Champions	**Bridges**	**Knowledge**	**Projects**	**Tools**
Key networks of individuals Flooding – Infrastructure NSW Some local governments Amenity – Greater Sydney Commission, Local Land Services, Sydney Water "Everyone in NSW cares about floods but no one wants to take responsibility" No floodplain manager Flood risk – Resilient Sydney	*(Semi) Formalised organisations, structures, & processes for coordination and alignment* Splash 202020 Vision Flooding – Resilient Sydney	*Research, science & contextualised knowledge* Sanitation – ocean outfalls, still sewage overflows Flood modelling done by local councils, not holistic or up to date. Evacuation plans may not be sufficient Catchment scale flood analysis for Hawkesbury only Flood management in Eastern Sydney done on site-to-site basis Less access to amenity in West – this is known, not many people willing to invest in it Still developing in high-risk floodplains	*Experiments, demonstrations, & focus projects* Water Smart Cities Program Green Square stormwater drain Green infrastructure providing amenity – done council by council	*Legislative, policy, regulative, & practice tools* Hawkesbury-Nepean Flood Risk Management Strategy – not focused on small scale urban flooding LGA flood risk strategies, responsible for communicating to community Amenity – Metropolitan Water Plan, Greater Sydney Commission district plans

4. Improve productivity and resource efficiency

4.5 Maximised resource recovery

Transition phase	Champions	Platforms for connecting	Knowledge	Projects and applications	Tools and instruments
1. Issue Emergence	Issue activists	N/A	Issue highlighted	Issue examined	N/A
2. Issue Definition	Individual champions	Sharing concerns and ideas	Causes and impacts examined	Solutions explored	N/A
3. Shared Understanding & Issue Agreement	Connected champions	Developing a collective voice	Solutions developed	Solutions experimented with	Preliminary practical guidance
4. Knowledge Dissemination	Aligned and influential champions	Building broad support	Solutions advanced	Solutions demonstrated at scale	Refined guidance and early policy
5. Policy & Practice Diffusion	Government agency champions	Expanding the community of practice	Capacity building	Widespread implementation and learning	Early regulation and targets
6. Embedding New Practice	Multi-stakeholder networks	Guiding consistent application	Monitoring and evaluation	Standardisation and refinement	Comprehensive policy and regulation

4.1 Benefits across other sectors because of water-related services, 4.4 Water-related commercial and economic opportunities

Transition phase	Champions	Platforms for connecting	Knowledge	Projects and applications	Tools and instruments
1. Issue Emergence	Issue activists	N/A	Issue highlighted	Issue examined	N/A
2. Issue Definition	Individual champions	Sharing concerns and ideas	Causes and impacts examined	Solutions explored	N/A
3. Shared Understanding & Issue Agreement	Connected champions	Developing a collective voice	Solutions developed	Solutions experimented with	Preliminary practical guidance
4. Knowledge Dissemination	Aligned and influential champions	Building broad support	Solutions advanced	Solutions demonstrated at scale	Refined guidance and early policy
5. Policy & Practice Diffusion	Government agency champions	Expanding the community of practice	Capacity building	Widespread implementation and learning	Early regulation and targets
6. Embedding New Practice	Multi-stakeholder networks	Guiding consistent application	Monitoring and evaluation	Standardisation and refinement	Comprehensive policy and regulation

4.3 Low end-user potable water demand

Transition phase	Champions	Platforms for connecting	Knowledge	Projects and applications	Tools and instruments
1. Issue Emergence	Issue activists	N/A	Issue highlighted	Issue examined	N/A
2. Issue Definition	Individual champions	Sharing concerns and ideas	Causes and impacts examined	Solutions explored	N/A
3. Shared Understanding & Issue Agreement	Connected champions	Developing a collective voice	Solutions developed	Solutions experimented with	Preliminary practical guidance
4. Knowledge Dissemination	Aligned and influential champions	Building broad support	Solutions advanced (bc of recycled water schemes etc)	Solutions demonstrated at scale	Refined guidance and early policy
5. Policy & Practice Diffusion	Government agency champions	Expanding the community of practice	Capacity building	Widespread implementation and learning	Early regulation and targets
6. Embedding New Practice	Multi-stakeholder networks	Guiding consistent application	Monitoring and evaluation	Standardisation and refinement	Comprehensive policy and regulation

4.2 Low GHG emission in the water sector

Transition phase	Champions	Platforms for connecting	Knowledge	Projects and applications	Tools and instruments
1. Issue Emergence	Issue activists	N/A	Issue highlighted	Issue examined	N/A
2. Issue Definition	Individual champions	Sharing concerns and ideas	Causes and impacts examined	Solutions explored	N/A
3. Shared Understanding & Issue Agreement	Connected champions	Developing a collective voice	Solutions developed	Solutions experimented with	Preliminary practical guidance
4. Knowledge Dissemination	Aligned and influential champions	Building broad support	Solutions advanced	Solutions demonstrated at scale	Refined guidance and early policy
5. Policy & Practice Diffusion	Government agency champions	Expanding the community of practice	Capacity building	Widespread implementation and learning	Early regulation and targets
6. Embedding New Practice	Multi-stakeholder networks	Guiding consistent application	Monitoring and evaluation	Standardisation and refinement	Comprehensive policy and regulation

Champions	**Bridges**	**Knowledge**	**Projects**	**Tools**
Key networks of individuals Private utilities – recycled water and resources, benefits across other sectors Potable water demand and GHG emissions – Sydney Water Some local governments (City of Sydney)	*(Semi) Formalised organisations, structures, & processes for coordination and alignment* Nothing bringing together Sydney Water and private sector Water Industry Competition Act - lots of legislation, does not enable to work well CRC	*Research, science & contextualised knowledge* Science is there for separate resources, need to look at integrating Innovation in recycled water, not much in recent five years. Now a bit of spark around biogas and renewable energy/nutrients, driving innovation Big regulatory/market barrier for solutions to be advanced and adopted	*Experiments, demonstrations, & focus projects* Central Park, Green Square Small scale projects with private utilities, but have a small consumer base	*Legislative, policy, regulative, & practice tools* Water Industry Competition Act – legislation does not enable it to work well Some preliminary guidelines, refined guidelines, beginning to see in policy (GHG targets) Permanent water restrictions (Water Wise Rules) since 2009

5. Improve ecological health

5.1 Healthy and biodiverse habitat, 5.2 Surface water quality and flows

Transition phase	Champions	Platforms for connecting	Knowledge	Projects and applications	Tools and instruments
1. Issue Emergence	Issue activists	N/A	Issue highlighted	Issue examined	N/A
2. Issue Definition	Individual champions	Sharing concerns and ideas	Causes and impacts examined	Solutions explored	N/A
3. Shared Understanding & Issue Agreement	Connected champions	Developing a collective voice	Solutions developed	Solutions experimented with	Preliminary practical guidance
4. Knowledge Dissemination	Aligned and influential champions	Building broad support	Solutions advanced	Solutions demonstrated at scale	Refined guidance and early policy
5. Policy & Practice Diffusion	Government agency champions	Expanding the community of practice	Capacity building	Widespread implementation and learning	Early regulation and targets
6. Embedding New Practice	Multi-stakeholder networks	Guiding consistent application	Monitoring and evaluation	Standardisation and refinement	Comprehensive policy and regulation

5.3 Groundwater quality and replenishment

Transition phase	Champions	Platforms for connecting	Knowledge	Projects and applications	Tools and instruments
1. Issue Emergence	Issue activists	N/A	Issue highlighted	Issue examined	N/A
2. Issue Definition	Individual champions	Sharing concerns and ideas	Causes and impacts examined	Solutions explored	N/A
3. Shared Understanding & Issue Agreement	Connected champions	Developing a collective voice	Solutions developed	Solutions experimented with	Preliminary practical guidance
4. Knowledge Dissemination	Aligned and influential champions	Building broad support	Solutions advanced	Solutions demonstrated at scale	Refined guidance and early policy
5. Policy & Practice Diffusion	Government agency champions	Expanding the community of practice	Capacity building	Widespread implementation and learning	Early regulation and targets
6. Embedding New Practice	Multi-stakeholder networks	Guiding consistent application	Monitoring and evaluation	Standardisation and refinement	Comprehensive policy and regulation

5.4 Protect existing areas of high ecological value

Transition phase	Champions	Platforms for connecting	Knowledge	Projects and applications	Tools and instruments
1. Issue Emergence	Issue activists	N/A	Issue highlighted	Issue examined	N/A
2. Issue Definition	Individual champions	Sharing concerns and ideas	Causes and impacts examined	Solutions explored	N/A
3. Shared Understanding & Issue Agreement	Connected champions	Developing a collective voice	Solutions developed	Solutions experimented with	Preliminary practical guidance
4. Knowledge Dissemination	Aligned and influential champions	Building broad support	Solutions advanced	Solutions demonstrated at scale	Refined guidance and early policy
5. Policy & Practice Diffusion	Government agency champions	Expanding the community of practice	Capacity building	Widespread implementation and learning	Early regulation and targets
6. Embedding New Practice	Multi-stakeholder networks	Guiding consistent application	Monitoring and evaluation	Standardisation and refinement	Comprehensive policy and regulation

Champions *Key networks of individuals* Splash River catchment groups – Cooks River Alliance, Parramatta River Catchment Group, Georges River, Sydney Coastal catchment group Some local governments Local Land Services OEH , GSC, TEC Community advocacy groups - Cleanup campaigns, plastic in waterways, bass fishermen Politicians and ministers missing	**Bridges** *(Semi) Formalised organisations, structures, & processes for coordination and alignment* River catchment groups CRC Regional Advisory Panel Community groups Local Land Services – Botany Bay, Sydney Harbour, River health Splash	**Knowledge** *Research, science & contextualised knowledge* Water quality testing, polluted rivers, declining biodiversity studies – on the issue Addressed point source, now looking at diffuse pollution Groundwater – no knowledge on system, impacts, or management. Only in some councils.	**Projects** *Experiments, demonstrations, & focus projects* River catchment health groups – individual projects for improving catchment health Living Waterways Framework – Splash	**Tools** *Legislative, policy, regulative, & practice tools* Sydney Harbour Catchment WQIP Living Waterways Framework – preliminary guideline LGA individual stormwater, WSUD policies Developers have targets but no guidance – water quality

6. Ensure quality urban space (All indicators)

Transition phase	Champions	Platforms for connecting	Knowledge	Projects and applications	Tools and instruments
1. Issue Emergence	Issue activists	N/A	Issue highlighted	Issue examined	N/A
2. Issue Definition	Individual champions	Sharing concerns and ideas	Causes and impacts examined	Solutions explored	N/A
3. Shared Understanding & Issue Agreement	Connected champions	Developing a collective voice	Solutions developed	Solutions experimented with	Preliminary practical guidance
4. Knowledge Dissemination	Aligned and influential champions	Building broad support	Solutions advanced	Solutions demonstrated at scale	Refined guidance and early policy
5. Policy & Practice Diffusion	Government agency champions	Expanding the community of practice	Capacity building	Widespread implementation and learning	Early regulation and targets
6. Embedding New Practice	Multi-stakeholder networks	Guiding consistent application	Monitoring and evaluation	Standardisation and refinement	Comprehensive policy and regulation

Champions	**Bridges**	**Knowledge**	**Projects**	**Tools**
Key networks of individuals Greater Sydney Commission – district plans bring together water and land use planning Vision 202020 and horticulture industry – key funder for tree canopy Some LGAs, developers and consultants – ad-hoc. LGAs responsible for stormwater. Individual champions exist, not connected, no alignment. GSC opportunity to be that vehicle.	*(Semi) Formalised organisations, structures, & processes for coordination and alignment* Splash WSUD in Sydney AILA and Stormwater NSW speak to issue Sydney catchment authority – no organisation to lead, fell down Developers starting to collaborate to address maintenance Collaboration happening at small project/precinct scale GSC opportunity WSC Forum (informal) Water smart cities program Vision 202020	*Research, science & contextualised knowledge* No shared definition of WSC concept, best practice falling short of achieving outcomes. Need to better understand how to deliver quality urban space solutions for their context Some councils very advanced, not much sharing of knowledge to other councils Some developers are implementing WSUD, but falls through in handover, knowledge is lost in transition. Not much knowledge in how to facilitate that transition – lack of evidence for business case for councils WSUD will get dropped because costs too much – need business case Lack of knowledge in engineers, shrinking number of experts Lack of knowledge – rapid urban growth, affordable, often seen as not essential still Urban heat – mapping done by councils, water management not linked clearly. Western Sydney, no consideration how streets contribute to stormwater	*Experiments, demonstrations, & focus projects* Some trials and demos but fundamental practice has not shifted Central Park and Green Square– urban renewal – source, treatment, reuse Barangaroo – water positive Canada Bay public open space potable water, had to close, studies not done Inner West Council rain garden project The ponds at Blacktown No learning/evaluation of projects to get evidence for business cases. Lost because of handover	*Legislative, policy, regulative, & practice tools* Policy 45% reduction in TN – no guidance for developers on how to achieve this Tree selection policy – difficult to navigate, cost of street trees high, no capacity to plant/maintain them LGA tree policies, WSUD policies, ad-hoc Metropolitan Water Plan – liveability – no link to legislative framework, therefore no link to practice No state stormwater policy – disconnect between state and local government Water Smart Cities Program

7. Adaptive infrastructure (All indicators)

Transition phase	Champions	Platforms for connecting	Knowledge	Projects and applications	Tools and instruments
1. Issue Emergence	Issue activists	N/A	Issue highlighted	Issue examined	N/A
2. Issue Definition	Individual champions	Sharing concerns and ideas	Causes and impacts examined	Solutions explored	N/A
3. Shared Understanding & Issue Agreement	Connected champions	Developing a collective voice	Solutions developed	Solutions experimented with	Preliminary practical guidance
4. Knowledge Dissemination	Aligned and influential champions	Building broad support	Solutions advanced	Solutions demonstrated at scale	Refined guidance and early policy
5. Policy & Practice Diffusion	Government agency champions	Expanding the community of practice	Capacity building	Widespread implementation and learning	Early regulation and targets
6. Embedding New Practice	Multi-stakeholder networks	Guiding consistent application	Monitoring and evaluation	Standardisation and refinement	Comprehensive policy and regulation

Champions *Key networks of individuals*	**Bridges** *(Semi) Formalised organisations, structures, & processes for coordination and alignment*	**Knowledge** *Research, science & contextualised knowledge*	**Projects** *Experiments, demonstrations, & focus projects*	**Tools** *Legislative, policy, regulative, & practice tools*
Private sector – Flow systems, Veolia Sydney Water Some LGAs – City of Sydney – no access to large infrastructure Not a huge appetite for diverse sources “There are good organisations, but equally as many people saying no (single-function infrastructure)” Green building council – greenstar ratings (onsite treatment)	Specific projects, place-based thinking and planning	Need more knowledge on fit-for-purpose and future planning Water portfolio has options ready – mainly stormwater and recycled water. Could utilise groundwater more Need to focus on robustness of stormwater infrastructure (nowhere near water supply and sanitation) There is knowledge of maintenance of stormwater solutions, a lot of people still doing it incorrectly. Green infrastructure not well understood by everyone Increased development makes a case for recycled water People need to recognise the value of and potential for recycled water (still costs too much, too difficult to implement)	Have individual recycling schemes, alternative and decentralised solutions – cheaper to supply water through centralised Sydney Park – reclaimed wetlands, stormwater harvesting, biofiltration, improved amenity and diversity Green square and Central Park – decentralised solutions A lot of assets already there, difficult to manage, difficult to incorporate decentralised into Sydney water assets Issue with legacy infrastructure Intelligent controls for desalination based on environmental triggers. Intelligent control for drinking water, some for wastewater, none for stormwater Stormwater infrastructure can be poorly built/maintained leading to poor outcomes (capacity of contractors) Recycled water pipe in George Street lightrail	Some master plans still saying separate single-function assets Cannot get decentralised solutions into planning, not integrated in water planning for the city. Projects still owned/operated by centralised authorities Decentralised solutions reflected in Metropolitan Water Plan No market levers Stormwater guidelines, need to be updated, no mechanism to update Landcom WSUD guidelines Water quality objectives and river flow objectives

Appendix D: Ideas for implementation

This section presents a range of local opportunities for implementing the recommended strategies in Sydney. The list of ideas was generated in workshop discussions and is not intended to be comprehensive; rather it should be seen as a starting point when considering specific actions to undertake.

Vision theme 1

- Create a vision and plan for total catchment management to align all stakeholders including state agencies and local government
- Foster a consistent approach to catchment and water quality management
- Support knowledge sharing
- Identify and reward proactive councils
- Identify biodiversity gaps outside growth centres
- Support bush regeneration and landscaping with native seed stock
- Conduct mapping study to locate and characterise groundwater (sand aquifers) and connections to ground water dependant ecosystems (wetlands and rivers)
- Connect groundwater champions from DPI Water, Water NSW, EPA and Indigenous water
- Develop knowledge of fish nursery and passage
- Raise awareness of alignment between urban liveability and ecosystem services
- Create a natural capital use protocol for aligned reporting

Vision theme 2

- Early involvement and targeted consultation of Traditional Owners throughout planning process
- Incorporate Aboriginal stories and lessons of connection between people and place in planning
- Establish and celebrate places of meaning and cultural significance in Greater Sydney
- Embed formal conversation (e.g. Reconciliation plans) within place planning (e.g. catchment)

Vision theme 3

- Identify champions from the Department of Planning
- Work with Department of Planning to raise awareness and support for WSUD and liveability outcomes
- Support early engagement and collaboration between developers, stakeholders and councils to co-plan and design significant developments
- Use health data and modelling to develop a compelling health focused business case for WSUD
- Access health budget to develop, promote and maintain open space
- Increase transparency of decision making process for significant development approvals
- Set urban space, green space and temperature reduction targets for new developments

Vision theme 4

- Support champions within each organisation to promote sector wide collaboration
- Conduct a holistic governance review; identify lessons for improving transparency and clarity of waterway governance
- Develop a shared vision between different agencies and levels of government
- Integrate water and land planning processes
- Investigate a whole of government management plan with embedded legislation
- Leverage the influence of the GSC to support and promote a collaborative governance mechanism
- Engage with and influence developers in urban growth to support WSUD
- Consider Marine Estate Management Authority (MEMA) and the Coastal Management Planning Act (2016) as a model of collaborative governance

Vision theme 5

- Strengthen connection between water planning and urban development planning
- Improve regional and large scale IWM planning
- Ensure integrated water cycle management is embedded in urban planning
- Advocate for public transparency of the Treasury's position on IPART
- Support research, experimentation and innovation to reduce market uncertainty and risk aversion
- Strengthen local planning tools to influence developers to implement WSUD (efficiency and recycling)
- Advocate for pricing and regulatory reforms to enable cost effective water recycling
- Compose holistic business case that links with megatrends of energy, densification, climate change and water planning
- Reorient planning focus towards long term strategies (rather than political cycles)
- Update demand efficiency approach to include;
    - Smart metering BASIX plus trials reintegrating waste
    - Higher BASIX scores
    - NABERS rating tool
    - Mandate water ratings /consumption disclosure

Vision theme 6

- Build a business case to halt and reverse resource losses (nutrients, water, energy). Develop models for forecasting impacts of projected population, density and climate variability trends and a business-as-usual approach.
- Promote the adoption of smart technology that empowers community and supports efficient use of resources
- Support technological innovation (e.g. through technology demonstration sites) to leverage operational improvements and delay asset renewal
- Support more efficient and adaptive regulation to encourage innovation e.g. stormwater operating systems informed by weather forecasting
- Enhance decision making and reduce risk aversion within councils and utilities through the use of smart digital platforms
- Use financial incentives to support uptake of recycled water treatment technology by utilities and developers
- Investigate solutions to achieve appropriate maintenance resourcing
    - Investment (Private finance)
    - Public private partnerships
    - Revised funding model – for more innovation
    - Strong developer/utility relationships
    - Look to infrastructure and transport i.e. highways and bicycles – energy assets
- Support collaboration between private sector, governments and universities to increase efficiency and innovation

Vision theme 7

- Common assumptions or standard scenario modelling (for acceptances)
- Work collaboratively with health agencies to focus attention on prevention through liveability
- Quantify looming public health issues, the health benefits of social infrastructure and the health benefits of green infrastructure to build a persuasive narrative
- Consider complementary strategies for collaboration between water sector and others including public health and state emergency response

    - Maximise the use of floodplain land for passive uses including overlays of parkland, sporting fields, cycle paths
    - Give full consideration to the gap between 1:100 and PMF cost to deliver more options to people in flood (e.g. evacuation access)
    - Raise awareness of the impacts of climate change (Longer, hotter, drier summers) and wildfire risk especially for new residential areas and residents
- Advocate for policy amendments to mandate climate change resilience assessments for Development applications
- Investigate an innovative funding models for community cooling' assets, consider 'safety nets' for those that can't afford
- Early engagement in planning process to support for community buy-in and support real consultation at every stage so everyone has ownership/stewardship
- Water information and knowledge to be shared in public places e.g. Increase language/interpretation signage/activities
- Reinvigorate conversations for an informed awareness strategy e.g. include futures thinking community education and formal education - What was, what is, what could be?
- Investigate mart tech apps, old and new knowledge
- Make funding streams from stormwater charges publically transparent and seek community input on funding allocation e.g. catchments/rivers

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