CRC for
Water Sensitive Cities

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

CRCWSC Integrated Research Project 1: WSC Visions and Transition Strategies

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

Authors
Katie Hammer[1,2], Briony Rogers[1,2], Fiona Chandler[3], Chris Chesterfield[2]

[1]School of Social Sciences, Monash University
[2]CRC for Water Sensitive Cities
[3]Alluvium Consulting

Publisher

Cooperative Research Centre for Water Sensitive Cities
Level 1, 8 Scenic Blvd, Clayton Campus
Monash University
Clayton, VIC 3800

p. +61 3 9902 4985
e. admin@crcwsc.org.au
w. www.watersensitivecities.org.au

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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.

Executive summary

Townsville's relationship with water has been shaped by its unique dry tropical climate and extreme weather patterns and events. The traditional land owners and custodians, the Bindal and Wulgurukaba people, relied on the region's waterways and adapted their way of life to the dramatic seasonal variations. As the area became settled by Europeans and the town began to grow, water supply, sanitation and drainage services were provided through infrastructure solutions to suit the needs of a growing population. More frequent droughts and cyclones as a result of a changing climate, as well as pressures on surrounding marine and other natural environments, have more recently led to an increased focus on climate resilience, urban liveability, and ecosystem health. Water is now seen not just as a resource to support development and urbanisation, but also as delivering broad values firmly embedded in the daily lives of Townsville's people.

A project by the Cooperative Research Centre for Water Sensitive Cities (CRCWSC) brought together 29 leading thinkers across water, planning, environment and development in Townsville in a series of three action research workshops. They 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.

This report presents the project findings in detail. A companion report, "*Vision and Transition Strategy for a Water Sensitive Townsville*", consolidates these findings into an executive summary that is intended for broad circulation.

The vision for Townsville as a future water sensitive city depicts the values and outcomes to be secured over the next 50 years:

Townsville is an attractive, resilient city that manages water to enhance healthy ecosystems, embrace dramatic natural water cycles, drive world-leading innovation, and support citizens who are proud of their dry tropical identity.

1. Townsville celebrates being an attractive, liveable city with integrated and multi-purpose built and natural environments that feature water, bring people together and showcase the city's dry tropical climate.

2. Water is managed holistically to ensure reliability of Townsville's water system and the long-term sustainability of its resources.

3. Townsville's waterways, wetlands, coastline, and surrounding marine and inland environments are healthy, valued, and continuously enhanced.

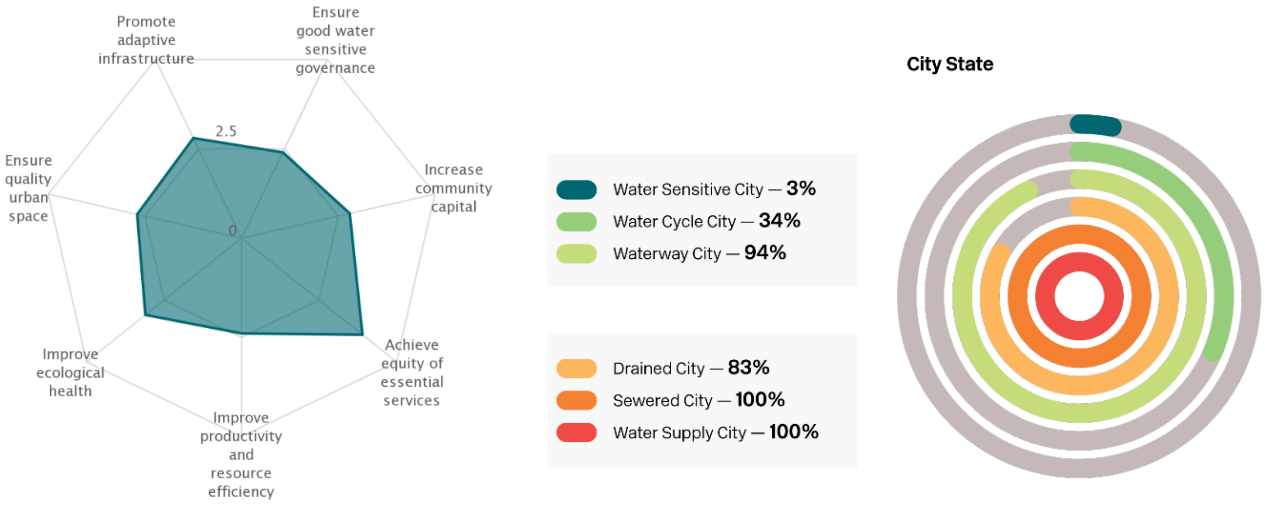
4. Townsville people are proud of their connection to water and are empowered to be active and responsible water stewards.

5. Townsville is an international water innovation hub that showcases water sensitive technology, practices and design for the dry tropics.

6. Inclusive water governance in Townsville enables integration, collaboration, innovation and collective leadership.

7. Indigenous water knowledge, values and ways of thinking are valued in the Townsville community and incorporated into water planning, design and management.

The CRCWSC's Water Sensitive Cities (WSC) Index was used to benchmark Townsville's current water sensitive performance. Townsville scored highest for the goals of *Achieve equity of essential services* (3.9/5) and *Improve ecological health* (3.1/5). Areas for improvement include *Ensure good water sensitive governance* (2.4/5) and *Improve productivity and resource efficiency* (2.4/5). These results are presented in the figures below: (a) against each of the WSC Index goals, and (b) as a percentage attainment of each water sensitive city-state.



Townsville'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 Townsville has made significant advancements towards water sensitive practices, with strong leadership from champions, a growing knowledge base, pilot projects and a range of policy, regulative and practical tools to guide new practices.

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

I. Embed Townsville's water sensitive aspirations in a broad city vision and organisational policies, plans and strategies.

II. Establish platforms that will support and drive integration and collaboration within Council and with external stakeholders.

III. Develop new knowledge on issues and potential solutions for particular aspects of Townsville's water sensitive city vision.

IV. Learn from and scale innovations to provide on-ground demonstrations and practical guidance for water sensitive approaches in the dry tropics context.

Townsville has strong 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 aim to provide orientation and guidance for stakeholders across Townsville in navigating these barriers and advancing its water sensitive city agenda.

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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 to share knowledge and information, develop ideas and establish a collective voice
IRP1	Integrated Research Project 1 Water Sensitive City Visions and Transition Strategies
JCU	James Cook University
Narrative	A well-articulated rationale and/or compelling case for a particular practice or action, including a description of its ecological, economic, and social benefits
Traditional Owners	Traditional custodians of Greater Townsville'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 organised by seven goals: 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, urban 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 design elements integrate nature-based infrastructure into the landscape to provide hydraulic and water treatment function, as well as amenity and urban cooling benefits. 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 climate patterns and community expectations for urban 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 Townsville. This process 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.

Townsville is one of five case studies conducted as part of the *Water Sensitive City Visions and Transition Strategies* project (along with Perth, Sydney, Adelaide and Bendigo). The CRCWSC has also undertaken a similar project for the City of Gold Coast outside the IRP1 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.

The report brings together the results of 23 one-on-one interviews and three workshops with industry, government, non-government stakeholders, as well as analysis by the project team. Some examples of the evidence accumulated in the form of quotes of participants or photographs of workshop outputs have been included throughout the report to support the presentation of findings. Perceptions expressed in the quotes or images should not be interpreted as representative of the views of the whole participant group, organisations represented in the workshop series, or of the authors.

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

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

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

Alongside the production of practical guidance for the Townsville 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 Townsville's transition towards its envisioned water sensitive future.

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1.3 Case methodology

The IRP1 approach is based on ongoing research by the CRCWSC[1] 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 Townsville case stakeholder engagement was conducted over a three-month period between October and December 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 Townsville'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 Townsville's water system and identify evidence important for benchmarking the city's current water sensitive performance and transition progress. Key sources of secondary data included QLD Government and Townsville City Council policy documents relevant to the topic areas of the WSC Index, key QLD Acts and

[1] CRCWSC Integrated Research Project 1: Water sensitive city visions and transition strategies (https://watersensitivecities.org.au/content/project-irp1/)

regulations, department and agency websites, as well as published academic literature relevant to water policy in the Townsville region. Key sources are listed in the References section.

Participant recruitment

Water, planning, development and environment sector representatives drew from water, government and non-government organisations that are relevant to Townsville's governance, culture, economy or environment. Participants were personally invited to ensure a rich mix of organisations, disciplines and perspectives. The participant group included a total of 29 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 Townsville's water, development, planning and environment sectors. Most interviews were conducted individually, though in some cases two individuals were interviewed together. A total of 23 people were interviewed. Interviews examined participants' understanding of Townsville'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.

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 workshop sessions

The sessions were structured and designed to lead participants through an iterative series of discussions to understand the existing system conditions, develop shared aspirations for Townsville's future, identify barriers to change, and understand strategic priorities. Three full-day sessions were held in November and December 2017, with the first two sessions held on consecutive days.

The project team produced an interim report after the first two sessions that synthesised key outputs and incorporated subsequent analysis that drew on the desktop review and participant interviews, in addition to workshop discussions. At the third and final session, 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.

Sessions 1 and 2 – Narrative building, benchmarking and envisioning

Sessions 1 and 2 were held across two days (7-8th November, 2017) at the Reid Park Pit Complex. The first session developed a collective water story for Townsville by looking to the past and exploring how certain events, patterns and trends have shaped how water is managed today. The session then focused on applying the WSC Index tool to benchmark Townsville's current water sensitive performance. Three out of seven WSC Index goals were assessed, which included Ensure quality urban space, Promote adaptive infrastructure, and Ensure good water sensitive governance.

Session 2 continued the benchmarking activity by scoring the remaining four goals, including Improve ecological health, Improve productivity and resource efficiency, Increase community capital, and Achieve equity of essential services. The afternoon focused on beginning to develop a shared 50-year vision for Townsville as a future water

sensitive city. This was done through a creative activity to develop future TIME magazine headlines, and then expanding on the headline themes to develop more detailed outcome statements.

Session 3 – Advancing Townsville's transition

Session 3 was held on Tuesday 5th December at Riverway. The session begun by refining and validating Townsville's historic 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 session then validated and refined the draft water sensitive city vision by adding further detail and tailoring it to the Townsville 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 Townsville and what that means for the role of the participant group. The results of these discussions have contributed to the content of this project report.

2 Townsville'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 in Townsville. 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, governance, environment, community, and personal experiences. This subsection is a synthesis of the activities and discussion of participants, supplemented by further literature review, to present Townsville's historical and contemporary water story.

Townsville is an iconic Australian city situated in the Dry Tropics of North Queensland. It is adjacent to the world heritage listed Great Barrier Reef, which creates opportunities for tourism, science and research. The City has been shaped by its unique dry tropical climate and extreme weather events such as droughts and cyclones. It is blessed with natural assets such as Mount Stuart, the Paluma Range, Castle Hill, Cape Pallarenda, Cleveland Bay, the Strand, Ross River, and the Great Barrier Reef, all of which play a pivotal role in creating Townsville's dry tropical lifestyle that locals and visitors cherish. Water is seen not just as a resource to support development and urbanisation but also as delivering broad values firmly embedded in the daily lives of Townsville's people.

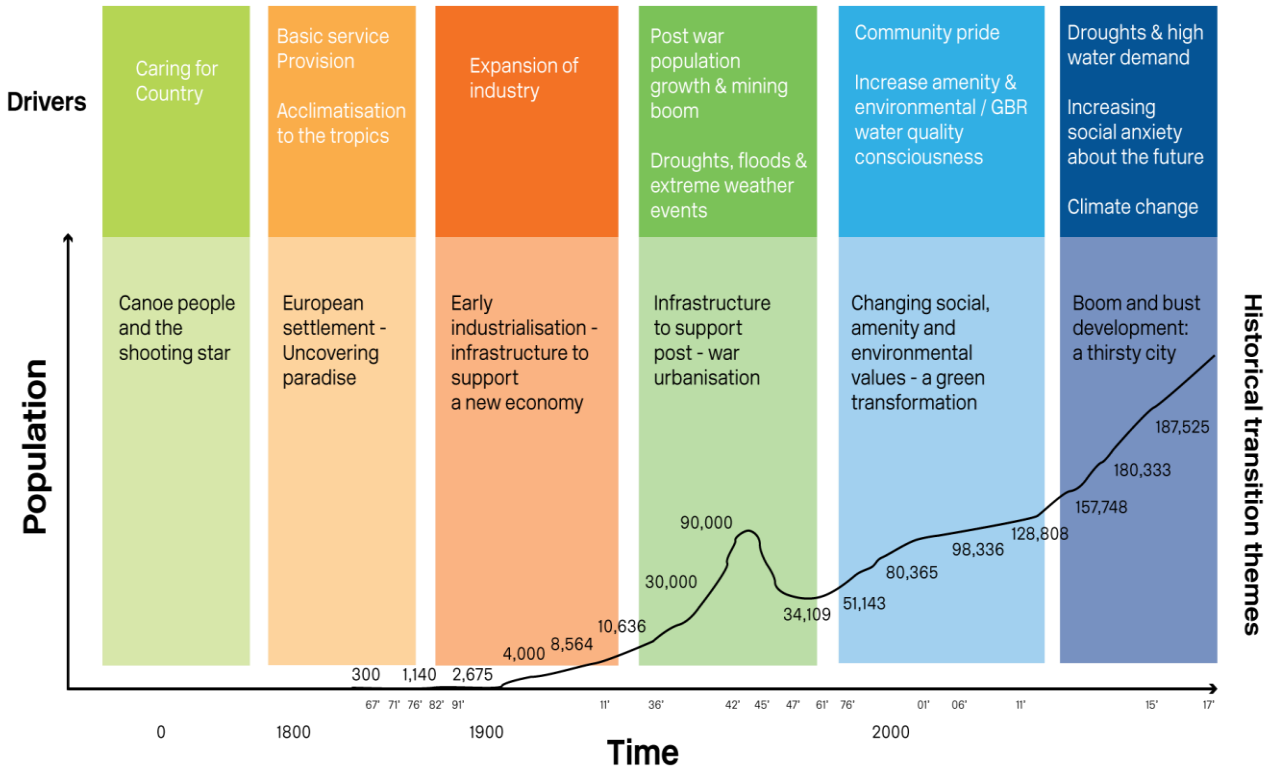


Figure 1: Townsville's water story comprises key themes influenced by unique drivers over time

Pre-1800AD: Caring for our country - *Canoe people and the shooting star*

Traditional Owners and custodians, the Bindal and Wulgurukaba, are recognised as the first people to have inhabited the Townsville region.

An important symbol of the Wulgurukaba (meaning 'canoe people') is the Carpet Snake. The Wulgurukaba creation story tells of the creation snake that comes down from the Herbert River, went out to sea creating the Hinchinbrook Channel and down to Palm and Magnetic Islands. His body broke up leaving parts along the coast. The tail of the snake is at Halifax Bay, his body is at Palm Island, while his head rests at Arcadia, Magnetic Island (Townsville City Council, 2017).

The Bindal people call the country "Thul Garrie Waja". An important symbol for the Bindal people is the shooting star (Townsville City Council, 2017). The approximate area of interest for the Bindal Traditional Owners is north of Townsville from Black River, south to the Haughton River, east to the Barrier Reef (excluding Magnetic Island) and west to the Mingela Range (NQ Dry Tropics, 2017).

The Aboriginal people relied on the region's waterways for survival and adapted their way of life to seasonal variations. The region's creeks, rivers and floodplains were a rich source of food and plants, which were used to make tools and equipment such as fishing nets and canoes. Other raw materials from the waterways were used for making baskets, necklaces, huts and canoes for fishing and transportation. During the dry season, the Aboriginal people lived a relatively settled existence concentrating near lagoons and large water holes and making use of the riverine environment. In the wet season, when neither water nor game was restricted, they were much more geographically dispersed (Townsville City Council, 2014). The Aboriginal people lived their lives completely connected to and reliant on the natural water cycle, allowing them to thrive in the harsh dry tropical conditions. Rowes Bay, Garbutt and the Town Common remain contemporary wetlands for Traditional Owners of the area.

1800s – 1900s: European settlement – *Uncovering paradise*

After Captain James Cook encountered Townsville and Magnetic Island in 1770, Townsville was settled by Europeans in 1864 due to the recognition of Cleveland Bay as an important port facility. Townsville's maritime-based industry continued to grow in the following years, with the discovery of copper, lead, and zinc resources in the early 1900s leading to a rapid expansion of Townsville's pastoral and goldmining industry and the establishment of the Townsville Port (Port of Townsville, 2017).

The first European settlers on Magnetic Island arrived in 1876. Early settlers from the mainland found relief from the heat on Magnetic Island, with Picnic Bay becoming a favoured resort for local holiday-makers. Magnetic Island continues to be considered a suburb of Townsville and is popular with locals and visitors.

The first water conflict between Aboriginal people and European settlers arose over a wetland on the Strand, which ultimately died off due to overuse and pollution by the settlers. The wetland has since been artificially reconstructed, with Melaleucas re-planted around it. The story, called "Hambalena Spirit Rising", is now told in interpretive panels and represents a shift in environmental consciousness and wetland management.

The Townsville Water Authority was established in 1882 to provide reticulated water to Townsville residents. As urban development spread, new water supplies were constructed. In 1885, Willmett's Well (located near today's suburb of Mundingburra) and Hurbert's Well (located near what is now Ross River Road and West Street) were constructed (Townsville City Council, unknown). This supply supported approximately 13,000 residents by the end of the 19th century.

November 26, 1896 saw one of the first documented cyclones, with Tropical Cyclone Sigma striking the town and causing a reported £600,000 damage (Townsville City Council, 2014). Cyclones would continue to shape the lifestyles of local residents throughout Townsville's history.

This period was strongly influenced by the need to establish basic services such as water supply and the Port. It was also a time where the early settlers had to acclimatise to an unfamiliar dry tropical climate that included tropical cyclones.

1900s – 1950: Early industrialisation – ***Infrastructure to support a new economy***

The North Queensland gold rush and the continuing growth of the pastoral and mining industry led to population increases and urbanisation. Resulting water shortages in the early 1900s led to the commencement of the damming of the Ross River. A series of weirs was constructed on the Ross River for water supply, with pumping from Gleeson's Weir commencing in 1923. Aplin's Weir was constructed in 1927 to prevent tidal inundation of the water supply and to enhance groundwater recharge (Townsville City Council, 2017).

By 1936 the population had risen to more than 36,000. Weirs on the Ross River, with some local use of bores, continued to provide the primary water supply, however these supplies were stretched to their limits and the first water restrictions were imposed that same year.

In part to help mitigate unemployment, funding from the Queensland Treasury in 1933 enabled approval by Council of one of the first major investments in sanitation infrastructure with 6600 acres sewered in the main City area at a cost of £13,000 (National Library of Australia, 1939).

With declaration of war in Australia in 1941, Townsville became one of the largest defence training bases in Australia and its population swelled to more than 100,000 people between 1941 and 1943. This rapid population growth placed even greater pressure on the water supplies, sanitation and waste management services.

This period of history continued to be influenced by the early growth of the new town through the expansion of industry, provision of sanitation services, and the establishment of Townville as a major temporary defence training and supply base during World War II.

1950 – 1990: Post-war growth and development – ***Infrastructure to support post-war urbanisation***

Conflict in Asia in the 1960s saw the permanent establishment of a defence base in Townsville, named Lavarack Barracks in 1966. This defence capability expansion was accompanied by an urban development expansion in the 1970s, required to house the various personnel. Urban development was also triggered by then Prime Minister Gough Whitlam's government who, in the 1970s, pushed for growth in regional centres like Townsville. Another large investment in the region came in 1961 through the establishment of what is now the second oldest university in Queensland – James Cook University (JCU) – which is now internationally recognised for its programs in marine and tropical research (JCU, 2017).

Magnetic Island saw major infrastructure investment in the 1970s, when it became the first Queensland off-shore island to receive water supply from the mainland. An eight kilometre long submarine pipeline was constructed, along with a network of reticulation mains and storage reservoirs to supply water to approximately 600

residences. In May 1970, the Bulletin reported that it was “widely predicted” that completion of the reticulated water scheme would set off a building spree on the island (Fielding, 2016).

State and Federal funding for water infrastructure in Townsville saw the construction of Ross River Dam (completed in 1971), which provides both water supply and flood protection services. The Mount St John Wastewater Treatment Plant, now one of Townsville's largest wastewater treatment plants, started operations in 1972 and has been continually upgraded since then to meet the demands of an ever-increasing population (Townsville City Council, 2017).

The construction of Ross River Dam came just in time, with Tropical Cyclone Althea making landfall near Townsville on Christmas Eve 1971. Despite this cyclone, the wet seasons of the early 1970s were considered ‘normal’, but this quickly flipped in 1974 which saw one of the most intense wet seasons experienced in a long time, although this record would not last for long (Townsville City Council, 2017).

Population growth was a key theme during this post-war period, and with growth came another investment boom in water-related infrastructure and the realisation that this infrastructure needed to be able to respond to substantial fluctuations in climate conditions and extreme weather events. Building resilience to climate variability has remained a focus for the City to this day and beyond.

1990 – 2008: Changing social, amenity and environmental values – *a green transformation*

A forerunner in environmental management, Townsville City Council employed one of the first dedicated environmental officers in Australian local government history in 1988 and, later in 1996, established a full Environmental Planning Unit (Townsville City Council, 2003). The late 1980s and 90s saw an impressive and award-winning effort by the Council on conservation and land management, with the first Environmental Conservation Strategy launched in 1993. Collaboration with the Great Barrier Reef Marine Park Authority (GBRMPA) and the Department of Planning led to further environmentally-focused programs and strategies (Townsville City Council, 2003). Wetlands of Townsville were mapped in the 1990s by JCU scientists (Bruce, 2004), which led to official protection of the mangroves, wetlands and sand dune systems of the South Bank of the Ross River as an Environmental Conservation Park in 2013. An extensive dugong protection area was also established in the eastern end of Cleveland Bay.

Extreme climate events in the following years tested Townsville’s water infrastructure, with the worst flood on record experienced in January 1998. These big rains put drainage and stormwater management on the front agenda for Council. Several long, hot dry seasons in the early 2000s led to drought conditions and high water demand across the city. The dry landscape was unflatteringly dubbed ‘Brownsville’ by many, which generated a strong desire by local residents to prove otherwise.

“Our climate is a major challenge…we face very different conditions than Melbourne or Sydney. We are always going to use more water than them.”

In response to the growing push to be seen as a ‘green’ tropical city, and under the leadership of the then Mayor Tony Mooney, the Greening Townsville and later the Community Greening programs were established as a partnership between Council, community, local schools and businesses. It included substantial investment in irrigation systems, community tree plantings, native plant giveaways and revitalisation of many open spaces and parklands. The Greening Townsville Program, in conjunction with the Strand and foreshore redevelopment, community landcare groups, Creekwatch programs and remediation of Ross River, Louisa Creek and Magnetic Island, helped to transform Townsville into a more modern, liveable city. At the same time, Council commenced ecological catchment and landscape education tours in conjunction with Conservation Volunteers Australia and others, which led to Council achieving Advanced Ecotourism Certification in 2006. These initiatives were heralded

as huge successes, with a legacy of smart, highly instrumented irrigation systems, inviting open spaces that helped drive local tourism and development opportunities, and a proud local community (Townsville City Council, 2003). The initiatives also led Council to establish a Greening and Waterway Team to work on waterway management and landscape ecology.

Council becoming an early adopter of an integrated approach to waterway management, involving engineers, environmental specialists and planners, along with businesses and residents. Associated initiatives include the Clean Seas Program and Urban Stormwater Initiative, coastal zone management rehabilitation projects, a mangrove management strategy, and implementing an erosion control course for professionals.

"One of the biggest barriers in Townsville, this is where they had the reputation of Brownsville, they've used a lot of water to overcome that and now they can't go back."

A national growing environmental consciousness and a regulatory driver to introduce more stringent licencing controls of the city's wastewater treatment plants and request for load-based licensing led to the establishment of the Creek to Coral initiative in 2003 by Townsville and Thuringowa City Councils, in partnership with the then Queensland Environmental Protection Agency (EPA), and with support from GBRMPA. This initiative was the first to bring attention to the relationships between inland waterways and coastal marine environments. The Creek to Coral partnership, although infrastructure based, sought to involve the community in ways such as the Creekwatch program. The partnership was instrumental in the development of Townsville's Black-Ross Water Quality Improvement Plan in 2010 and other community-based wetland and waterway projects.

While water security remained on the agenda during this period, the growing sense of community pride in the City and environmental concern strongly influenced government policy and program investment. These initiatives also led to one of the first integrated sustainability departments in local government around Australia, which grouped water, energy, revegetation and wildlife management under one natural resources management portfolio, Integrated Sustainability Services (ISS).

2008 – 2017: Boom and bust development – *a thirsty city*

A combination of factors resulted in high unemployment in Townsville, including the end of the mining boom, the Storm Financial collapse whose head office was in Townsville, and later the Yabulu Nickle refinery closure. This economic downturn impacted the city's urban development, tourism, and export sectors, and created a level of social anxiety amongst local residents regarding Townsville's economic future. This public anxiety would eventually extend to water security, with concerns about the sufficiency of water infrastructure to support industry (existing and new) along with maintaining local amenity values of waterways.

Meanwhile, through the amalgamation of Townsville City Council, Thuringowa City Council and NQ Water, the integrated sustainability model remained in place, which linked all aspects of active waterway and wetland management with planning. This linkage has since changed to improve the narrative of an evolving water sensitive city and address remaining challenges around water supply and conservation. Community education around water conservation and ecological health also grew with the establishment of the Rowes Bay Sustainability Centre,

implementation of more waterwise gardens and green infrastructure, and the water smart technology trial as part of the IBM Smarter Cities award program in 2011.

Tropical Cyclone Yasi brought an above-average wet season in 2011, and once again created a heightened focus on disaster management, and social and infrastructure resilience. Subsequent failed wet seasons caused dam levels to drop to 15% in November 2017. Pumping from the Burdekin Dam commenced to augment the low water levels, and level three water restrictions were introduced in late 2016. The community's response to the water restrictions has been mixed, with a large majority of citizens reducing daily water use. Others, however, have used it as a platform to question government infrastructure planning decisions and to demand their entitlement to their normal water allocation paid for through rates and taxes. The Water for Townsville Action Group (WFTAG) has become the voice of many disheartened community members, using social media to give residents a platform to share information and 'to pose questions and legitimate infrastructure solutions' (Water for Townsville Action Group, 2017).

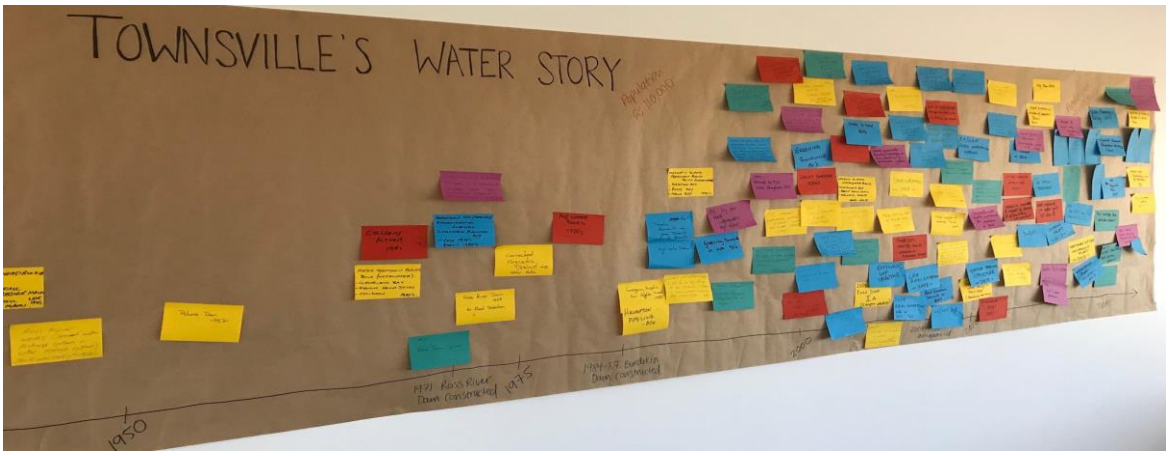
"What does water security actually mean? How does demand management relate to that? The wider community thinks that water security is about providing water to them so they can use as much as they want, whenever they want. If we are actually able to drive demand down, we are actually able to have better water security with what we've already got. It's not a conversation that many people want to hear."

Water security has been a key dimension of Townsville's City Deal, signed in December 2016, which represents a 15 year multi-level government agreement to improve the lives of Townsville residents through investment in jobs, economic growth, infrastructure and a more liveable city. As part of the investment package, $215 million will fund a 36km duplication of the Haughton pipeline as a water security measure. In addition, $10 million will address demand management measures that aim to reduce potable water consumption by residents, industry and local businesses; and implement integrated smart technology solutions favourable to both the water utility and residents.

Recent attention on the condition of the Great Barrier Reef has caused public concern over the health of local waterways. UNESCO's World Heritage Committee agreed to keep the Great Barrier Reef off the 'in danger' list on the provision that State and Federal Governments continue to work closely to invest in and implement the Reef 2050 Long-term Sustainability Plan. This Plan has been supported with State and Federal Government funding to realise significant land management practice change and develop catchment load reduction targets.

More recently, Council has made substantial progress in integrated waterway management around aquatic weeds, and are using an aquatic weed harvester to harvest weeds and treat with microbial formulations to promote soil formation, reduce transportation costs, and to train local Council staff in reducing carbon emissions. This work builds on years of learning how to be more resilient when responding to cyclones and pollution management of wetlands using microbial formulations.

Urban water quality in the Great Barrier Reef region has only recently been seen as an issue of State concern, with the Reef Water Quality Task Force recommending to improve existing minimum regulatory standards and compliance capacity for point source pollution and stormwater, erosion and sediment control in urban and industrial areas. This has been done in consultation with affected industries and gives explicit regard to the costs and benefits of those standards.



2.2 Looking ahead to Townsville's water future

After considering Townsville's water narrative up to the present day, it is then natural to turn to the future. This section explores future trends and drivers that were discussed in the workshops. This section also describes what people love about Townsville and what values they want preserved in the future in the face of these drivers.

Townsville's population of nearly 200,000 is expected to double by 2050, which presents the city with the challenge of maintaining and enhancing its liveability and sustainability in the face of future uncertainties such as climate change and urban growth. Townsville is also striving to establish a strong economy driven by local commercial opportunities, and will need to ensure affordability and equity in service provision are maintained for its communities.

The impacts of climate change will mean less reliable wet seasons and higher temperatures, reducing inflows to dams and increasing evaporation losses. Hotter days will also result in more heat-related illnesses and deaths, and higher energy consumption from air conditioning. Prolonged drought periods will make it more difficult to maintain green parks and gardens. Sea level rise and an increase in extreme weather events (e.g. cyclones) will put coastal and vulnerable areas of Townsville at higher risk of flooding and inundation.

Population growth and urbanisation are also putting pressure on Townsville's existing water systems. More water will be needed to meet growing demand, and consideration will need to be given to how water can be used more efficiently in times of excess. Measures will need to be taken to protect the surrounding environments from increased pollutant loads from a bigger city. Urban planning and design will need to be strategically integrated with water planning as part of an ongoing effort to maintain a green and liveable Townsville.

While these drivers are a challenge for existing water systems services and processes, they also present an opportunity to change the 'business-as-usual' approach. Townsville's City Deal, particularly its investment in additional water infrastructure and demand management initiatives, provides an opportunity to examine water issues holistically and in new, innovative ways, with the confidence that immediate water security concerns are being addressed. Links with universities, particularly JCU, can help to build the capabilities needed for innovation. Moving forward, there is a more positive outlook for Townsville's water sector, with significant water system investments committed and a willingness to collaborate between levels of government, the community and business sectors. Townsville has the potential to become an exporter of knowledge and expertise on water management in the dry tropics and to become the world's first tropical, water sensitive city.

"I think the opportunities in a place like this are significant."

The people of Townsville are proud of their city and its unique dry tropical environment. They appreciate their surrounding natural assets and the associated active, outdoor lifestyle offered; and value the connectedness of their communities and the benefits of a city scale that puts everything they need within a short drive. Business-as-usual water management may not be sufficient to ensure protection of these values, especially in the face of a changing climate and growing population. A more water sensitive approach would help ensure the health and safety of future populations, while also protecting natural systems, contributing to the city's liveability, and ensuring Townsville strengthens as an attractive, international city. The following sections of the report describe what participants consider it means to be a water sensitive Townsville and present recommended strategies for achieving the necessary changes in practice.

3 Townsville's Water Sensitive Vision

Against the backdrop of the future drivers and trends presented in the previous section, participants iteratively developed their vision for Townsville as a water sensitive city over the course of sessions two and three. Initial brainstorming was structured around a visioning activity in which participants prepared headlines for a special future edition TIME magazine. The headlines described Townsville in 2067 as "the world's most water sensitive city". Six vision themes emerged from the headlines and were grouped on the wall: community stewardship, liveability and lifestyle, technology and innovation, water system and water resources, leadership and governance, and natural systems and environment. A seventh vision element around Indigenous culture and values emerged in the third session. Participants elaborated on each theme through group discussions, which were consolidated into narrative text that provides a rich description of the aspired future water sensitive Townsville in 2067.

The 50-year water sensitive vision for Townsville 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.

Townsville is an attractive, resilient city that manages water to enhance healthy ecosystems, embrace dramatic natural water cycles, drive world-leading innovation, and support citizens who are proud of their dry tropical identity.

1. Townsville celebrates being an attractive, liveable city with integrated and multi-purpose built and natural environments that feature water, bring people together and showcase the city's dry tropical climate.

2. Water is managed holistically to ensure reliability of Townsville's water system and the long-term sustainability of its resources.

3. Townsville's waterways, wetlands, coastline, and surrounding marine and inland environments are healthy, valued, and continuously enhanced.

4. Townsville people are proud of their connection to water and are empowered to be active and responsible water stewards.

5. Townsville is an international water innovation hub that showcases water sensitive technology, practices and design for the dry tropics.

6. Inclusive water governance in Townsville enables integration, collaboration, innovation and collective leadership.

7. Indigenous water knowledge, values and ways of thinking are valued in the Townsville community and incorporated into water planning, design and management.

1. **Townsville celebrates being an attractive, liveable city with integrated and multi-purpose built and natural environments that feature water, bring people together and showcase the city's dry tropical climate.**

   Water and the landscape is integrated to our urban form, connecting people to surrounding waterways and natural features such as The Strand, Ross River and Magnetic Island. Urban spaces are designed to provide multiple functions and benefits including harvesting stormwater and connecting communities. Streets, footpaths and cycleways are lined with trees for shaded, cool commuting and create a network of green and blue corridors throughout the city. Gardens and landscapes reflect Townsville's dry tropical environment and incorporate appropriate native and exotic plants. Residents flock to shady and cool open spaces to escape the heat and interact with other community members. Townsville attracts people from around the world for water and environmental-based adventures, including opportunities to experience the Great Barrier Reef World Heritage Area.

Example magazine headlines:

"Townsville tops nation's most liveable city for families"

"Residents vote Townsville as a liveable city"

"Townsville – the lifestyle city"

"Brownsville to Green City – shaded trees over roads improves the psyche of the community" "in the hot dry topics and makes for a liveable city"

2. **Water is managed holistically to ensure reliability of Townsville's water system and the long-term sustainability of its resources.**

   Natural water systems and catchments are monitored and protected for long-term sustainability and resilience. A diversity of water sources are utilised at an optimal portfolio to ensure a sustainable and reliable water supply. Water system options are assessed based on whole-of-life costs and consider social, environmental, economic and technological impacts and benefits. Water infrastructure is adaptive, robust and provides multiple functions. Decentralised infrastructure is utilised along with large-scale centralised systems to enable choice and flexibility in service delivery. All water streams are utilised to fit their intended purpose. Wastewater is collected, managed and discharged to best practice environmental and public health standards. Groundwater is part of a managed system utilised for storage and distribution. Stormwater is harvested, treated and used for multiple purposes. System losses through evaporation and leakage are minimised or captured. Resources such as energy and nutrients are recovered from wastewater and stormwater, and reused where appropriate to minimise impacts on surrounding waterways and the waters of the Great Barrier Reef. A holistic understanding of Townsville's water system is communicated to the community.

Example magazine headlines:

"Water means life: Townsville a self-sustaining oasis in the dry tropics"

"Townsville first city off the grid"

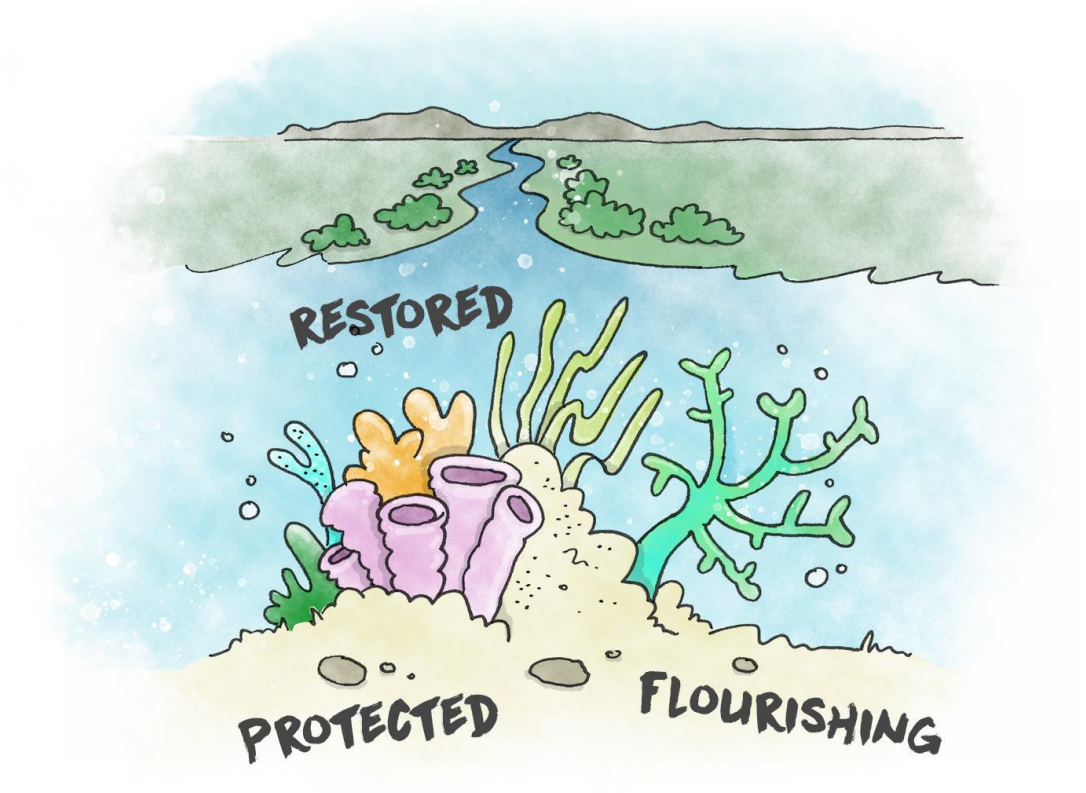
"Townsville exports water to Burdekin region"

"A water source for energy 'sink'"

"The water story recycled"

3. **Townsville's waterways, wetlands, coastline, and surrounding marine and inland environments are healthy, valued and continuously enhanced.**

   Townsville's rivers and creeks, wetlands, coastline, aquifers, forests and reef environments are healthy and continuously enhanced. The Great Barrier Reef is flourishing, protected and enjoyed for recreation, while also providing opportunity for world-leading marine research. The dry tropics region and adjacent Wet Tropics World Heritage Area are valued for their diversity and attract people from around the world for ecotourism. Townsville's waterways have been restored and provide local amenity, connecting people to their surrounding natural ecosystems. Townsville's catchments are healthy, protected and resilient. Magnetic Island is valued by Townsville residents for its reef environment and native flora and fauna.



This theme emerged after the creation of magazine headline statements

4. **Townsville's people are proud of their connection to water and are empowered to be active and responsible water stewards.**

   Townsville's past, present and future water stories help bind the Townsville community and create a sense of belonging. Everyone understands and appreciates the interconnectedness of the entire water cycle and the catchment they live in. People value water deeply, which drives them to use it responsibly and adopt water sensitive behaviours. Water system diversity is valued and embraced through choices and options in lifestyle. Communities participate in water planning and decision-making and are eager to do so. The community accepts and encourages innovation, are active in adopting new practices and technologies and are eager to showcase demonstration projects. People are safe from flooding and are prepared for natural disasters. Knowledge about ecological and cultural values of water and its sustainable management are integrated into schools, universities, industries and work places.

Example magazine headlines:

"Community embraces the Dry Tropics: lowest water consumption in Australia"

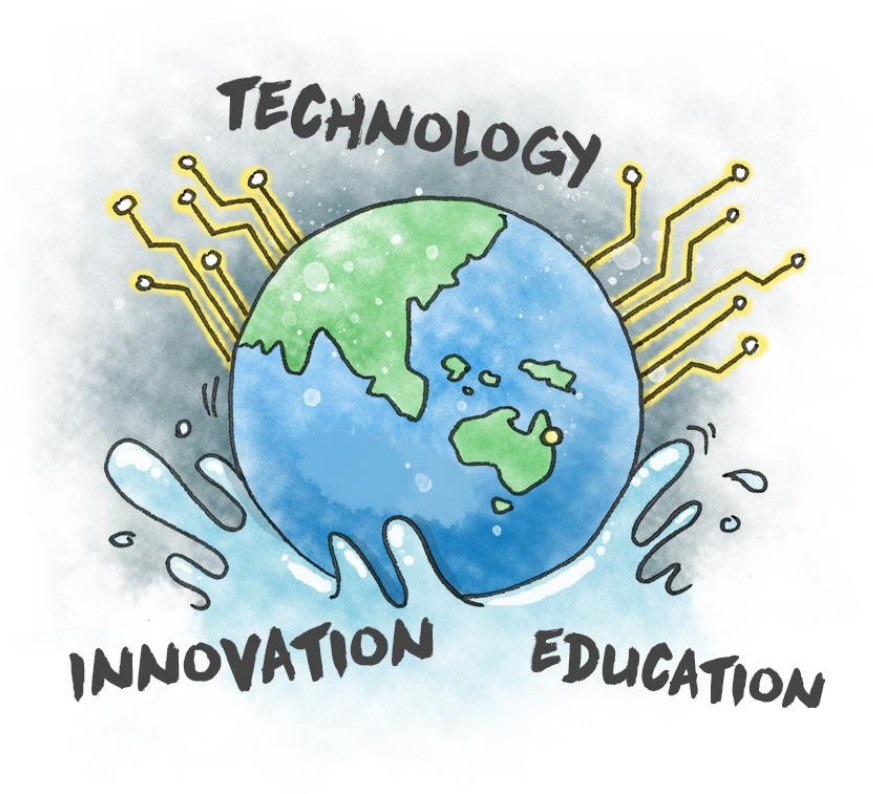
"Seeking behaviour change…follow Townsville's lead"

"Residents stop watering lawns"

"Townsville: resilience achieved through community planning for water sensitivity"

5. **Townsville is an international water innovation hub that showcases water sensitive technology, practices and design for the dry tropics.**

   Townsville is a living laboratory that demonstrates best practice in water cycle management and attracts people from around the world to learn from Townsville's experiences. Research and technology development anticipates, responds and adapts to changing drivers and circumstances. Opportunities from the water industry, such as manufacturing, consulting, and training, are exported internationally to support and drive a strong economy for Townsville. Residents are empowered by technologies at multiple scales and are educated in order to actively participate in water management. Innovation capability is built and maintained through water sensitive city education and training.



Example magazine headlines:

"Townsville – Tech City"

"Stepping outside the box on water…innovation wins"

"Technology and tourism: the oasis of Townsville leads the way"

6. **Inclusive water governance in Townsville enables integration, collaboration, innovation and collective leadership.**

   Townsville's water governance arrangements reflect an integrated approach to water system services, and city planning and design. Collaboration across sectors, disciplines and levels of government is embedded in institutional culture, systems and processes to develop and implement innovative solutions. Townsville's water sensitive city vision is championed and embedded through shared leadership into policy and practice. Water governance structures and processes are flexible and adaptive, which enables collective leadership across departments, organisations and scales. Decision-making reflects long-term water sensitive city goals for Townsville, fostering resilience to extreme events and other crises, and the water sensitive city agenda endures. Leadership is driven by community values and aspirations, and residents and business are empowered to be part of water planning and decision-making. Sharing knowledge and data openly drives transparency and evidence-based decision making.

Example magazine headlines:

"Visionary planning success: how Townsville's economy led the way in the Northern oasis"

"The new capital: How Townsville became the capital of the new state of Northern Australia"

"When Townsville took over Cairns as the darling of the North"

7. **Indigenous water knowledge, values and ways of thinking are valued in the Townsville community and incorporated into water planning, design and management.**

   Aboriginal and Torres Strait Islander knowledge and stories about water are understood and embraced throughout the community. Culturally significant sites (e.g. Enduring Spring in the Town Common) are identified, preserved and enhanced. Townsville's water story captures a holistic, long-term way of understanding the region and resonates with Indigenous ways of thinking. Indigenous communities actively participate in water planning and decision-making, built on the foundation of strong relationships with water professionals.

This theme emerged after the creation of magazine headline statements

4 Benchmarking Townsville's water sensitive performance

Planning actions to reach Townsville's water sensitive city vision requires an understanding of today's water system with respect to the broad future aspirations set out. Participants benchmarked Townsville'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 2). The framework identifies six distinct developmental states that cities may move through on their path toward increased water sensitivity. Figure 3 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.

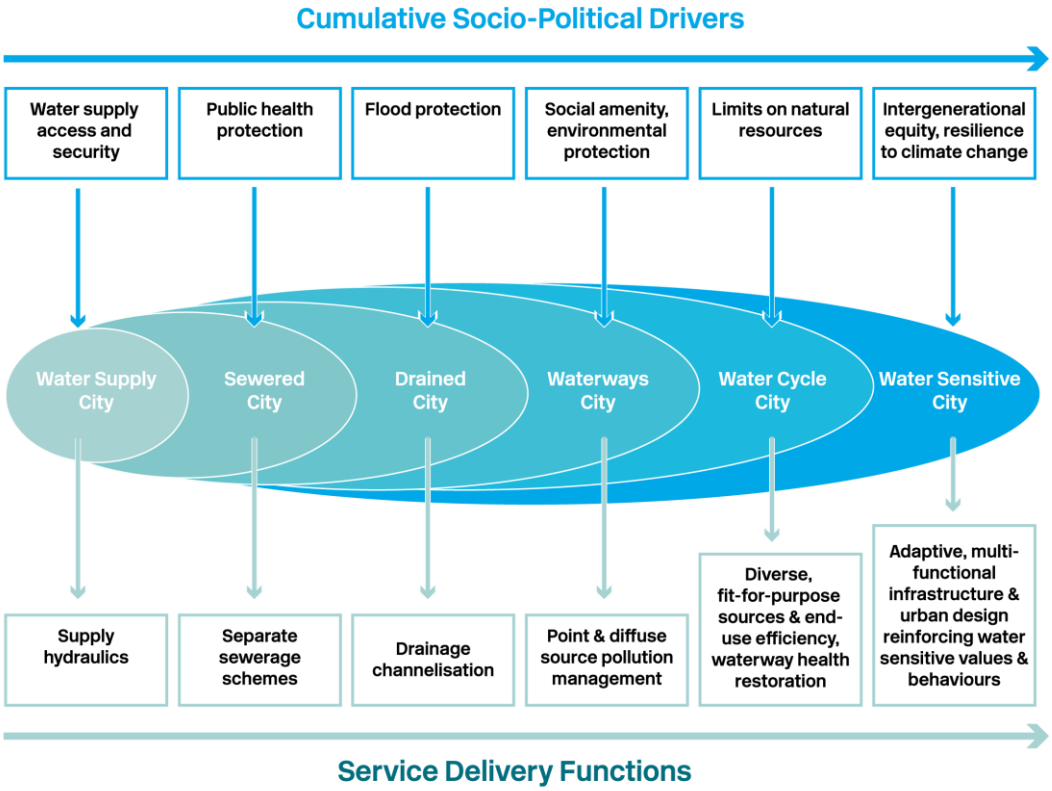


Figure 2: Urban Water Transitions Framework (Brown et al., 2009)

Planning Townsville'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.

Figure 3: Descriptions of each of the city-states in the Urban Water Transitions Framework (Brown et al., 2016)

4.2 WSC Index indicator scores

The WSC Index was applied to Townsville to benchmark current water sensitive performance. Table 1 shows the scores agreed by participants to each of the WSC Index Indicators and scores for the goals. A summary of the justification behind the individual indicator scores for each of the WSC Index goals can be found in Appendix B.

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

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

Figure 4 summarises Townsville's performance against the seven goals of a water sensitive city. The results for Townsville are shown by the shaded teal area. *Achieve equity of essential services* and *Improve ecological health* were the highest average scores, while *Ensure good water sensitive governance*, and *Improve productivity and resource efficiency* achieved lower average scores.

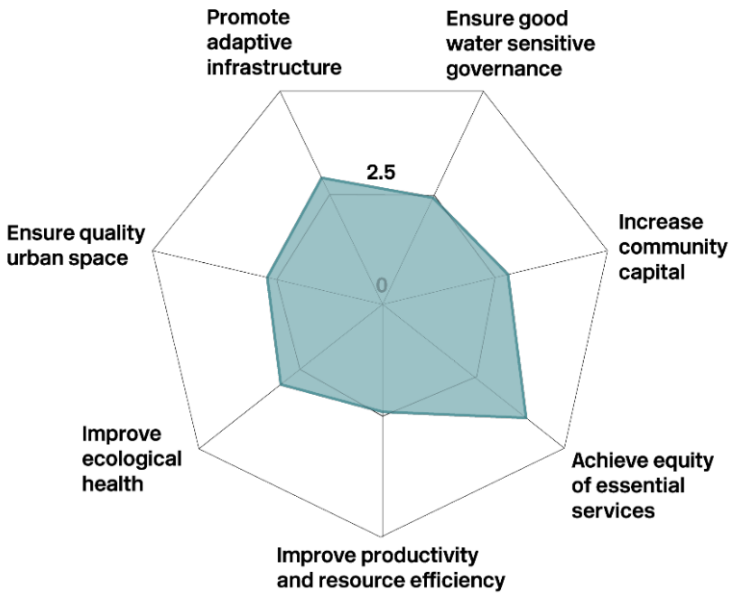


Figure 4: WSC Index goal scores for Townsville (shaded teal area)

4.3 Townsville's benchmarked city-state

Error! Reference source not found.5 summarises the city-state benchmarking results for Townsville. P ercentage attainment for each city-state ranged from 100% as a Water Supply City and Sewered City, through to 3% as a Water Sensitive City. This section summarises the key elements that contribute to the overall percentage attainment of each city-state.

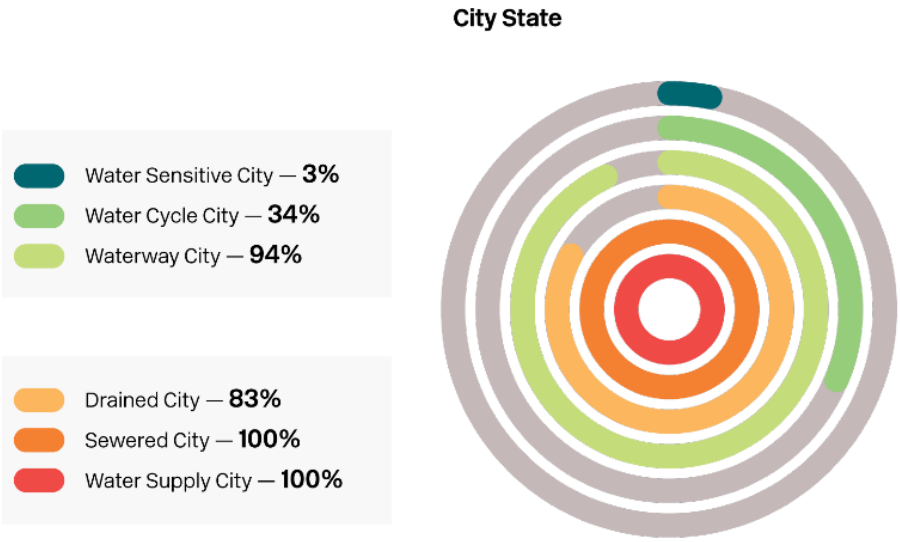


Figure 5: Summary of Townsville's performance against the ideal measures for each city-state

100% Water Supply City and Sewered City

Water supply and sanitation services are managed and provided by Townsville Water and Waste, a division within Townsville City Council. It supplies more than 51,000 megalitres of safe, high-quality potable water to over 83,000 service connections in the Townsville region each year, and collects and treats more than 16,000 megalitres of sewage each year. This reliable service provision means that Townsville has been rated 100% as a Water Supply and Sewered City.

From a water supply perspective, the Ross River Dam and Paluma Dam have historically provided sufficient water for the city; however with several failed wet seasons in a row, the implementation of water restrictions and commencement of pumping from the Burdekin Dam ensures residents continue to have access to potable water. The Water Security Task Force, as part of the City Deals program, has identified short-to-medium term solutions for securing Townsville's water supply and is exploring long-term solutions as well.

Townsville Water and Waste operates six sewage treatment plants and over 180 sewage pump stations. All wastewater is treated to high quality and discharged to the environment, with a small portion of it reused (e.g. for parks and the golf course on Magnetic Island).

83% Drained City

Townsville rated 83% as a Drained City. There is an extensive amount of knowledge and information around flood risk, and flood risk modelling has been conducted across Townsville through the City Wide Flood Constraints Project, which aimed to identify areas likely to be inundated during river and rainfall flood events. While this

information is informing the design of some new developments, there are limited adaptations being considered for existing vulnerable areas. Some low-lying areas are still being inundated by coastal flooding and king tides.

"It is the dry tropics, so we don't have a particularly reliable water supply. It is also very variable. So managing stormwater volumetrically is a challenge"

At the time the workshops were conducted, there had not been a major flood event since 2011. In the context of relatively frequent staff turnover, this means many professionals working at Council have not experienced flooding in Townsville and may lack awareness of the risks. The development of the Townsville Floodplain Management Strategy, however, is a good opportunity going forward to build community resilience to flooding by guiding future infrastructure investment, land use planning, development controls, emergency management and community programs.

94% Waterway City

Townsville rated 94% as a Waterway City, reflecting its significant focus on receiving water quality and protection of surrounding natural assets. Townsville's proximity to the Great Barrier Reef world heritage area and surrounding fringing reef systems has resulted in extensive legislation on surface water quality (including wastewater treatment and discharge quality). The Creek to Coral initiative was established in partnership with Townsville City Council, Thuringowa Council and the then Queensland Environmental Protection Agency, and was supported by the Great Barrier Reef Marine Park Authority. It promotes a 'whole-of-catchment' approach to managing water to help protect the marine environment from impacts of land-based activities. While there is a lot of attention on the health of receiving marine waters, there is limited capacity and capability to implement effective mitigation measures.

Water Sensitive Urban Design and stormwater quality improvement devices are being implemented across Townsville (e.g. basins, wetlands and sediment traps). While these solutions are seen to be effective in improving surface water quality to an extent, there are ongoing issues with irrigation, maintenance and highly concentrated sediment loads from new developments.

"That's been a major challenge – we spend a lot of money on bioretention basins, wetlands and treatment things that are ineffective in Townsville because you need to irrigate them 11 months of the year. You put them in and they pretty much do one treatment a year, because it doesn't rain for most of the year and then they get hit with this influx…and I don't know how much that affects downstream"

The general public feels connected to their surrounding marine and terrestrial environments, which is evident through active lifestyles centred around water activities such as boating, fishing, paddle-boarding, and scuba diving. They value areas such as Magnetic Island, the Strand, and Ross River for connecting them to nature and providing opportunities for recreation and amenity.

34% Water Cycle City

Townsville rated 34% as a Water Cycle City. It is in the early stages of considering ways to diversify its water supply and pursue a more holistic and integrated approach to water management. The current approach to water supply tends to focus on large-scale infrastructure to secure supply. Non-potable water sources currently being utilised include the use of private bores for groundwater extraction, however these are not integrated into the broader water supply system and there is limited consideration of extraction impacts on the groundwater system. Other household-scale solutions such as rainwater tanks and greywater recycling are perceived to be either inefficient in the dry tropical context or too challenging to navigate regulative barriers.

The majority of Townsville's wastewater is treated to a very high standard and discharged to the environment. This potentially creates a major opportunity for effluent reuse within Townsville, however there are still challenges regarding the cost of reducing salinity and getting water back to markets with suitable use profiles. The two wastewater treatment plants on Magnetic Island treat and reuse all wastewater on native parklands and a golf course. While effluent reuse has historically not been considered, it is now seen to be on the agenda.

"Regarding effluent reuse…cost is without a doubt the number one inhibitor."

At the time of the workshops, Level 3 water restrictions were in place and programs such as the Dry Tropics Water Smart Initiative and Townsville Water Futures aim to reduce water consumption and raise awareness amongst the community in reducing their usage. Despite these initiatives, many residents continue to use large allocations of water for outdoor use. The current pricing structure, based on household allocations, does not act as a disincentive for high consumption, reinforcing a perception amongst the community that they have 'the right' to use all of the allocated water they have paid for. Greater diversity and flexibility in water system service delivery will be needed to obtain Water Cycle City status.

"We have some of the highest [consumption] rates in Australia, and there's a perception that we don't get a lot from it."

3% Water Sensitive City

To achieve a Water Sensitive City, Townsville will need to implement solutions that fulfil the multiple objectives of ecosystem protection and restoration, security of supply, flood risk management, public health, amenity, liveability and economic sustainability, among others. While Townsville has begun to make strides towards a Water Sensitive City, significant efforts will be needed to transition to water sensitive technologies and practices.

5 Advancing Townsville's transition to individual vision outcomes

This section connects Townsville'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 Townsville'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 Townsville 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.

Townsville'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 6). 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 7).

Figure 6: Six phases of change that occur in the transition to a new practice

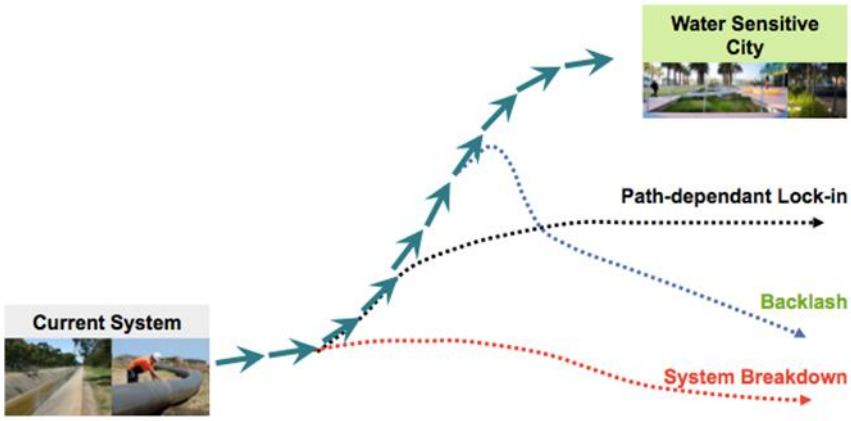


Figure 7: Transition pathways: successful transition, lock-in, backlash, and system breakdown

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 Townsville's enabling conditions for transitioning

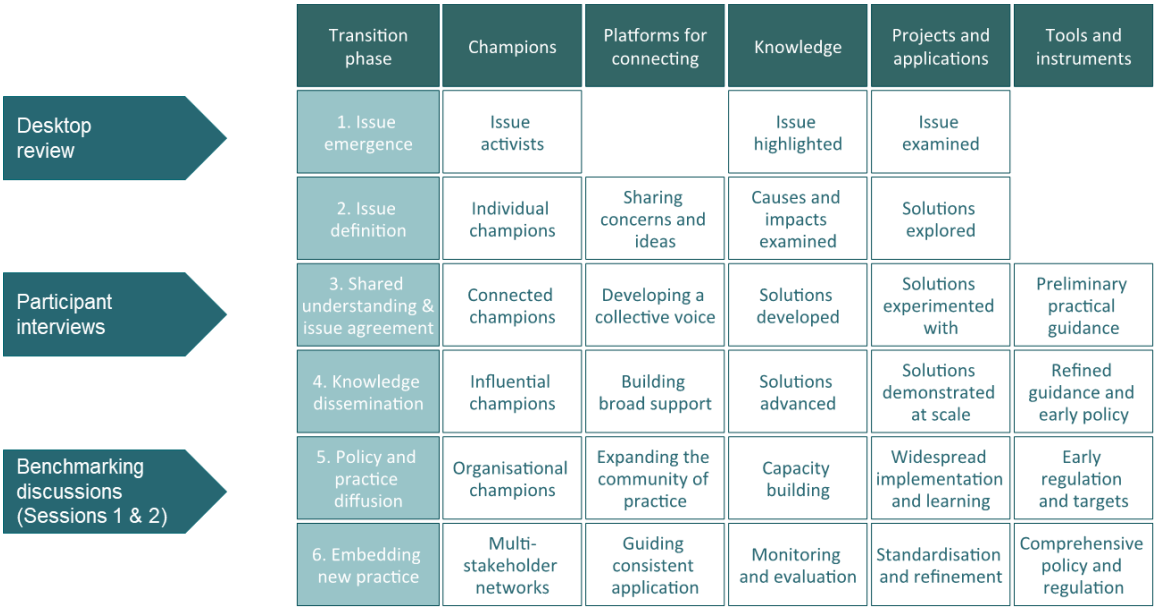
Sessions 1 and 2 introduced the concept of water sensitive city transitions, and the advocating and contesting narratives that develop as a transition unfolds over time. Transition phases for each WSC Index goal were explored in the benchmarking discussions. Session 3 explored specific strategies for advancing Townsville's WSC vision, and how these strategies could be implemented.

The Transition Dynamics Framework (Brown et al. 2016) outlined in Figure 8 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 Townsville'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 8: Transition Dynamics Framework - assessing the enabling conditions potentially present during transition phases

5.3 Townsville's transition progress for each vision outcome

Figure 9 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.

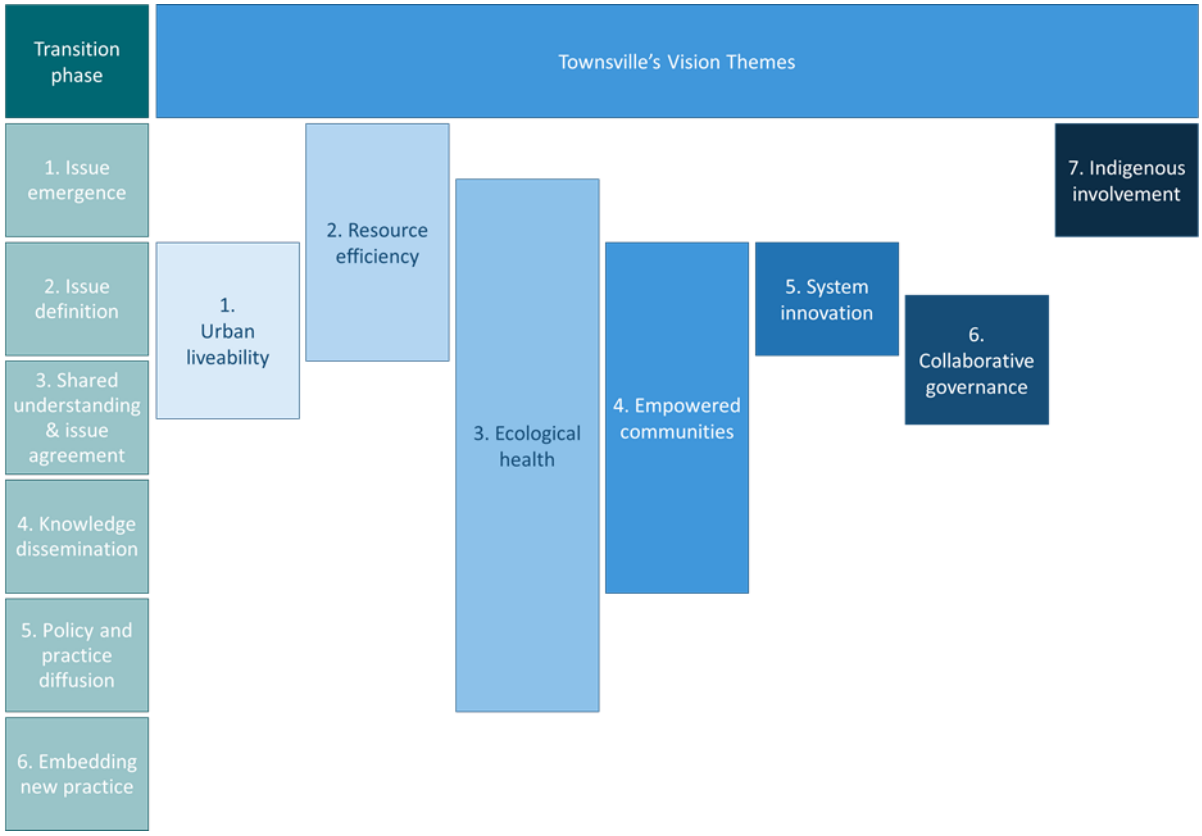


Figure 9. Summary of transition phases for each of the vision outcomes

Vision Outcome 1: Townsville celebrates being an attractive, liveable city with integrated and multi-purpose built and natural environments that feature water, bring people together and celebrate the city's dry tropical climate.

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 tend to facilitate development and set basic requirements for open space: the provision of transport and housing tend to dominate as considerations, while water system services are an important but secondary consideration. Conversely, conventional water system planning and design processes focus on delivering the water system service connections 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 (such as aesthetic, green, cool and healthy urban environments), which rely on synergies between the built form and water system services, are not optimised.

A central aspiration of Townsville's vision of a water sensitive future is quality urban space, including public and private spaces that are blue, green, cool, aesthetic, connected and utilised. 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 Townsville's enabling conditions:

Figure 10: Current transition phases for WSC Index indicators related to vision outcome 1

There are currently individual champions within Townsville City Council and some private developers advocating for integrated water system and urban planning and design. While it is recognised as an issue amongst these individual champions, there are few opportunities beyond individual projects to connect with the diverse mix of people and organisations that would need to be involved in delivering water sensitive planning and design outcomes. **A platform for bringing champions together and communicating the benefits of water sensitive approaches to a broad range of stakeholders** (Strategy 1.1) would help to build a collective voice around the issue.

The need for connected urban green and blue space is more widely acknowledged amongst a broader range of stakeholders, especially for benefits such as recreation and ecosystem health. Both levels of government (local and state) are promoting this issue in plans and future projects.

"I haven't seen any conversations around better urban design, both in terms of new build and also existing build. It's just not part of the conversation at all about water savings and retention."

While there have been some studies to determine effective water sensitive urban design solutions in Townsville, with its dry tropic conditions, solutions have not yet been implemented through trials or demonstrations, which means there is limited evidence of their costs, benefits and risks. As such, health and cooling benefits of solutions such as street trees, for example, have not yet been quantified or incorporated into an economic business case to help communicate the value of these solutions. **The value of quality urban space solutions would be better understood and communicated with further examination and evaluation to inform business case development** (Strategy 1.2). This insight could **inform a compelling narrative that articulates the importance of multi-functional, connected urban green and blue spaces** (Strategy 1.3). Such a narrative would help to build the support needed from a broad range of stakeholders to support solution implementation across both public and private spaces.

There are greater examples of implementing connected urban green and blue space, such as the James Cook University campus corridors, Ross Creek green space and bike paths, and the new stadium development that encourages connectedness and corridors. Implementation of water sensitive urban design is also increasing in some of the new developments around Townsville. These types of examples should be built upon through **more pilot-scale trials and demonstrations of urban form solutions that function as part of water system service delivery, and more significant and large-scale projects featuring connected urban green and blue space** (Strategy 1.4) in order to demonstrate their benefits across both the private and public realm.

While policy exists that aims to integrate water and urban planning and design (e.g. State Planning Policy, Street Tree Policy), the link to implementation and practice on the ground could be strengthened. In particular, the Townsville City Plan articulates the need for better integration and for green and blue corridors. However, guidance for developers on how to implement these solutions effectively and without creating maintenance or environmental issues is limited. Demonstration projects, both new and existing, should **integrate a learning agenda that captures lessons about implementation and evidence of costs and benefits** (Strategy 1.5) to inform the development of solution refinement and practical guidance for solution delivery. In addition, t**he City Plan's implementation could be strengthened with more explicit links to the overarching narrative** of Townsville's broader water sensitive city vision **and the business case for quality urban space solutions underpinned by water sensitive design principles** (Strategy 1.6).

Table 2: Recommended strategies to advance integrated water and urban planning and design

#	Strategies	Outcome
1.1	Establish a platform to connect champions around the need to improve quality urban space and the potential of water sensitive solutions to do so	A broad range of stakeholders understand and communicate the benefits of water sensitive urban design solutions
1.2	Examine and evaluate evidence to quantify value of quality urban space solutions and inform the development of a business case (e.g. microclimate benefits)	The costs, benefits and risks of quality urban space solutions are understood and communicated to a broad range of stakeholders
1.3	Develop and communicate a compelling narrative that articulates the importance of multi-functional, connected urban green and blue spaces across both the public and private realm	Broad support exists from private developers and Council demonstrates leadership in driving the implementation of these solutions
1.4	Implement pilot scale trials and demonstrations for innovative urban design solutions that enable the built environment to function as part of water system service delivery, and significant trials and demonstrations of connected blue and green spaces	Quality urban space solutions are demonstrated to provide evidence of their costs, benefits, and risks, and to learn about the capabilities needed for their effective implementation
1.5	Incorporate a learning agenda into new and existing demonstrations of quality urban space solutions	Solutions are refined and inform the development of practical guidance
1.6	Strengthen the effectiveness of the City Plan by linking it to the overarching narrative and business case for quality urban space solutions supported by water sensitive design principles	Implementation of the City Plan is improved and linked to Townsville's water sensitive city vision

Vision Outcome 2: Water is managed holistically to ensure reliability of Townsville's water system and the long-term sustainability of its resources.

Required changes in practice

Traditional water system services are designed to meet singular objectives (e.g. water supply, sanitation, drainage) that have prioritised cost efficiency over resource efficiency and tend to externalise environmental costs. Services are delivered through traditional systems and methods that tend to isolate and separate these objectives, rather than consider the entire water cycle. Delivery systems offer consumers limited choice or flexibility in infrastructure or pricing options. As cities and towns around the world are growing and diversifying, ensuring equity amongst all residents will likely remain a key concern of water services. Water supply options will need to be optimised in order to provide water for growing cities without depleting natural resources or degrading the environment. Communities are starting to become 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).

In order to improve the sustainability of water systems and long-term reliability of water sources, 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. Options for water service delivery will need to take into account broad social, environmental and economic benefits in order to deliver Townsville's water sensitive city vision.

Assessment of Townsville's enabling conditions

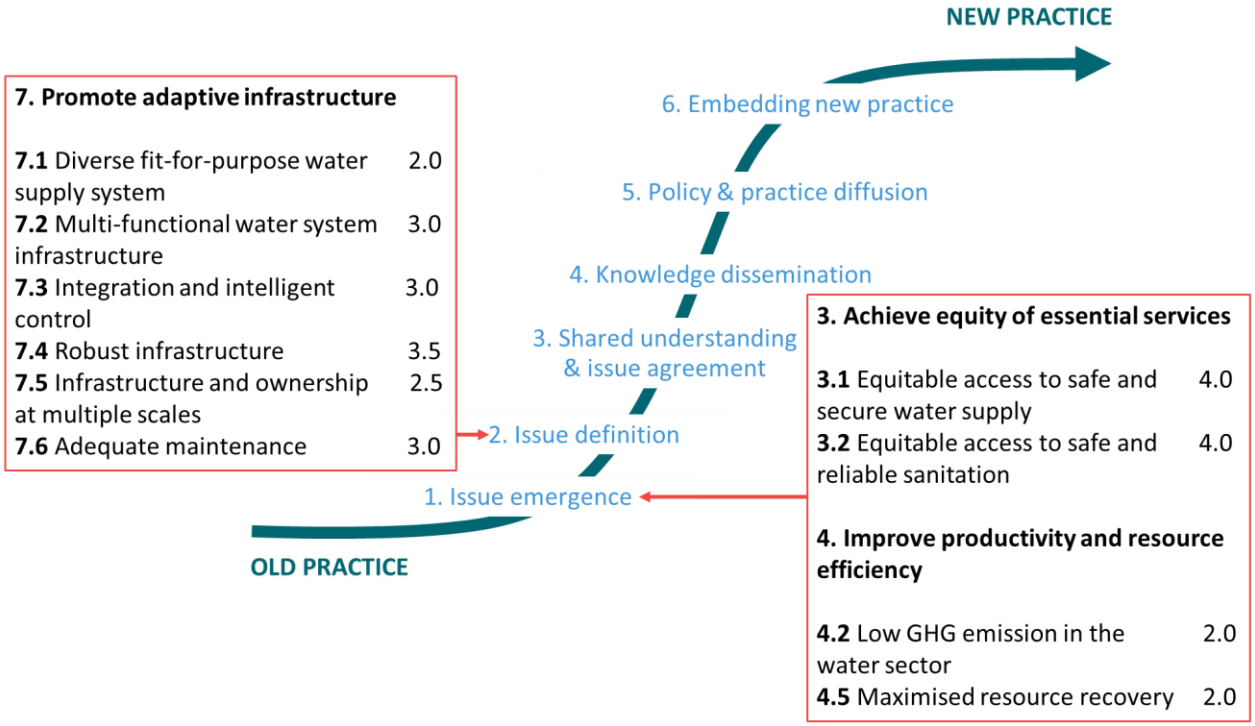


Figure 11: Current transition phases for WSC Index indicators related to vision outcome 2

While Townsville is excelling at providing safe and secure potable water supply and sanitation to its residents, this is being done in the traditional centralised, large-scale way with limited options or flexibility for service delivery. In the recent period of drought, the reliability of the water supply system based on this approach has been challenged, prompting consideration of how resilience can be ensured into the future. The current pricing structure of a set rate for a water allocation (with the option for a user pays model) potentially raises issues of affordability amongst residents. Solutions such as alternate water sources or alternate pricing options are beginning to be considered but with focus on affordability rather than broader community equity, flexibility and choice. In order to raise awareness around these issues and consider whether and how they should be addressed, **evidence about the need for flexibility and choice in delivering water supply and sanitation services will need to be examined and evaluated** (Strategy 2.1).

"There's two elephants in the room – one is demand management, and the other one is pricing. They're not being discussed but they're under the surface and real hot potatoes"

Townsville's centralised water supply and sanitation system is robust, maintained, and monitored by Council. Council also operates the largest open space irrigation system in the southern hemisphere, which incorporates a sophisticated level of intelligent control. Amongst this focus on the operation and maintenance of large-scale infrastructure, a few individual champions are advocating for the incorporation of decentralised infrastructure, including green infrastructure, into the system. **A compelling narrative about the need for diverse, adaptive and multi-functional infrastructure that is connected to a broad city vision for Townsville** (Strategy 2.2) would help to build a stronger, more collective voice around the value of decentralised solutions as part of the overall system.

While initiatives such as the Queensland Water Directorate and Water Services Association Australia exist as platforms to bring together stakeholders at the national and state level, their focus is on water supply and sewerage and mainly large-scale infrastructure. As such, they do not yet play a local role in bringing champions together to explore current infrastructure issues and opportunities. They may provide a valuable base from which to **establish a collaboration platform that brings focus to the need for diverse, flexible infrastructure** (Strategy 2.3).

There is limited knowledge about the application of decentralised and green infrastructure solutions that are effective in Townsville's dry tropical environment. For example, local stakeholders have reported ongoing challenges with irrigation and sediment making it difficult for green infrastructure solutions to be incorporated and maintained. **New knowledge about the implementation and maintenance of green infrastructure solutions that are appropriate for the dry tropical context is therefore needed** (Strategy 2.4).

"I don't think, in terms of water treatment, that the (stormwater) systems match our climate. Because they rely on plants to do the treatment, which means you need to irrigate them, which means when you have water restrictions and you turn the irrigation off, they die"

There are currently innovative projects being implemented by Council to monitor and assess the water system leakages through the use of smart metering to enhance system efficiency. From the private sector, Innovation House, a project by Finlay Homes and Stockland, demonstrates household-scale infrastructure and technologies for water efficiency. Wastewater recycling is being implemented on Magnetic Island, largely driven by the need to reduce discharges to the marine environment. These projects, as well as others involving artificial aquifer recharge systems and onsite water recycling systems, are promising early examples of adaptive infrastructure in Townsville. However, they tend to be delivered on an *ad hoc* basis rather than being integrated into a broader holistic urban water strategy for the city and lessons from their implementation are not well captured to create a broader opportunity for change. There is an opportunity to **expand Council's existing water strategy to include a more integrated and holistic approach for pursuing flexible, diverse and intelligent infrastructure at multiple scales** (Strategy 2.5)**. Significant (for example, large-scale and high profile) demonstrations of adaptive infrastructure** (Strategy 2.6) would also help to advance a learning agenda for its implementation, and strengthen awareness of the importance of such approaches to achieving Townsville's broad water sensitive city vision.

Utilising groundwater as a resource and monitoring the health of groundwater systems and impacts of extraction is just emerging as an issue in Townsville. There are a few individuals in Townsville advocating for a more holistic approach to groundwater use, however there is not enough known about the groundwater system to clearly

articulate the issues and opportunities. **Knowledge and data about Townsville's groundwater system will need to be developed and shared** (Strategy 2.7) to **ensure sustainable** groundwater management practices**.**

Greenhouse gas emissions are an important aspect of sustainable resource use, however it does not currently appear to be considered a critical issue in Townsville; *cost* of energy is seen as the main driver of actions to improve energy efficiency. This may be due to Townsville's historic focus on affordability and an absence of local political champions driving a low-emissions agenda. There are some individuals conducting small-scale studies and projects around recovery of resources (e.g. energy, nutrients), however they do not yet form part of a broader agenda and approach. Currently, nutrient capture is mainly due to catchment load targets with respect to the receiving waterways and Great Barrier Reef. In order to profile the need for a focus on energy and nutrients as part of a sustainable resource management approach, **evidence about the need for a holistic approach to nutrient and energy recovery will need to be examined and evaluated** (Strategy 2.8).

Table 3: Recommended strategies to advance holistic resource management

#	Strategies	Outcome
2.1	Examine and evaluate evidence about the need for flexibility and choice in delivering water system services, including infrastructure and pricing options	The costs, benefits and risks (including avoided costs and risks) are understood for service providers and customers in providing flexibility and choice for customers in their water system services
2.2	Develop a narrative for the value of diverse multi-functional infrastructure that is connected to a broad city vision for Townsville and water's role in delivering the vision	The importance of diverse multi-functional infrastructure is communicated to a broad range of stakeholders to begin building a collective voice
2.3	Establish a platform that brings focus to diverse, flexible infrastructure, building on and broadening the scope of existing platforms	A collective voice exists around the need for diverse, flexible and adaptive infrastructure
2.4	Develop new knowledge about design and maintenance of green infrastructure in the dry tropics	Green infrastructure solutions exist that are appropriate for the dry tropics context
2.5	Expand the existing Council water strategy to include an integrated and holistic approach for pursuing flexible, diverse, intelligent infrastructure at multiple scales	An integrated and holistic approach to water management exists beyond traditional centralised water systems
2.6	Implement significant demonstrations of adaptive infrastructure, incorporating a learning agenda and linking to a broader narrative that emphasises the importance of such approaches	An understanding of how these solutions can be delivered, evidence of their costs, benefits and risks, and an understanding of the capabilities needed for their effective implementation
2.7	Develop and share new knowledge about Townsville's groundwater system	To inform the improvement of groundwater management practices so that it can be used as a sustainable resource while protecting local ecosystems
2.8	Examine and evaluate evidence about the need for a holistic approach to nutrient and energy recovery	To understand the costs, benefits, risks and potential of nutrient and energy recovery

Vision Outcome 3: Townsville's waterways, wetlands, coastline, and surrounding marine and inland environments are healthy, valued and continuously enhanced.

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. Traditionally, water supply, sewerage and drainage systems have not considered ecological health objectives to be a primary concern, 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 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.

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 to be integrated into the water management system so their management can be adequately planned and resourced.

Assessment of Townsville's enabling conditions

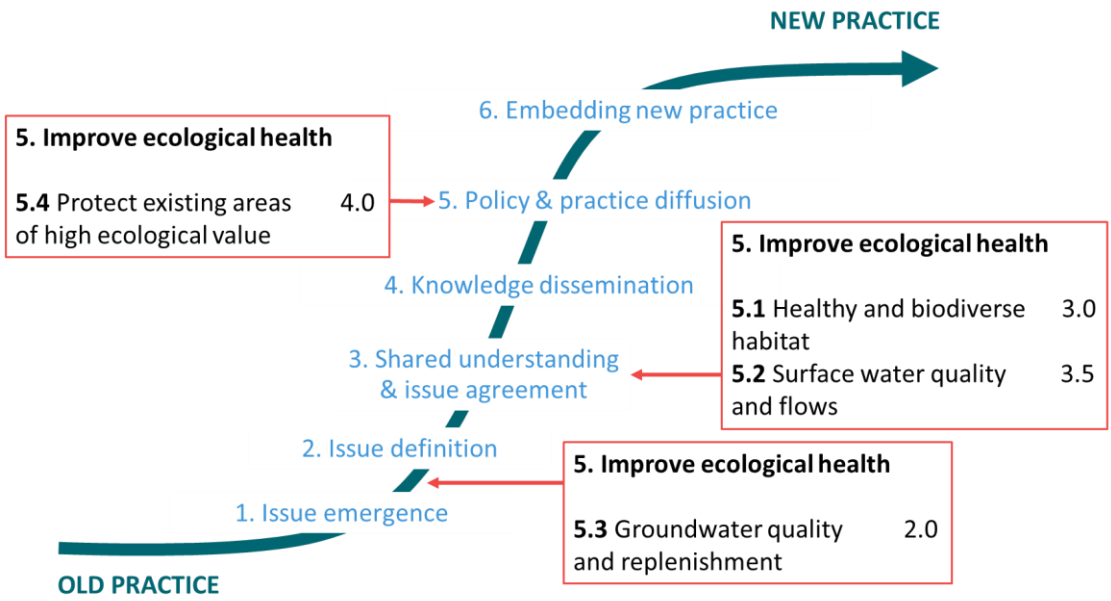


Figure 12: Current transition phases for WSC Index indicators related to vision outcome 3

There is a wide acknowledgement of the need to protect surrounding areas of high ecological value in Townsville. Individual champions in Townsville are advocating for improved surface water quality and habitat health, including some individuals in Council and private developers. Due to Townsville's close proximity to the Great Barrier Reef, the Great Barrier Reef Marine Park Authority plays a significant role in minimising the impact of surface water on the reef ecosystems. The Reef 2050 Water Quality Improvement Plan and introduction of the report card process

provides an effective water quality monitoring framework for the Reef. Platforms such as the Creek to Coral program and Reef Guardian Program are beginning to connect a broad range of stakeholders around this issue. There is extensive regulation for the marine environments, and there are vegetation clearing controls.

However, with the Great Barrier Reef playing such a significant local, national and international role, other aspects of Townsville's natural environment have received less attention. While water quality objectives for Townsville are articulated (in the Black Ross Water Quality Improvement Plan and the Environmental Protection Policy for Water), these values and objectives are not widely socialised and therefore not broadly acknowledged. Achieving this aspect of the vision will require an expanded strategic focus that includes the protection of riparian and waterway corridors. An important foundation for this will be a deeper understanding of the community's appreciation of the broader ecosystems in the region in order to **articulate and communicate local values with respect to local waterways and ecosystems** (Strategy 3.1).

"There is an opportunity to connect to the reef…we don't yet understand the impact of urban runoff, we are just now starting to consider it."

There is substantial knowledge on how to improve and monitor water quality and habitat health, such as sediment traps and constructed wetlands. Projects such as the Louisa Creek retrofit and Ross River mangrove restoration has helped improve waterway health. The Water Environmental Protection Policy outlines environmental values and water quality objectives for the Townsville region. These monitoring frameworks, however, focus mainly on receiving water quality and do not address systemic issues in waterways and riparian zones. They also do not yet take into account the impacts on urban runoff on receiving waterways and the Great Barrier Reef. An important step to bring attention to these dimensions would be to **consolidate existing knowledge and data on the health of waterways and riparian zones, and the impacts of urban runoff** (Strategy 3.2)**.** This would form an important basis for **developing a strategic and catchment-wide approach to managing urban runoff and protecting waterways and riparian zones** (Strategy 3.3), including targets, monitoring frameworks and management actions. The existing Black Ross Water Quality Improvement Plan and Reef 2050 Water Quality Improvement Plan may be valuable to build on in developing this approach.

Table 4: Recommended strategies to advance ecosystem health

#	Strategies	Outcome
3.1	Articulate and communicate local values with respect to Townsville's waterways and ecosystems (in addition to the Reef)	A catchment-wide management approach to waterway management
3.2	Consolidate existing knowledge and data on the health of waterways and riparian zones, and the impacts of urban runoff	A catchment-wide management approach to waterway management
3.3	Develop a strategic and catchment-wide approach to managing urban runoff and protecting waterways and riparian zones, building on the existing Reef 2050 Water Quality Improvement Plan	Targets, monitoring frameworks and a management strategy exist that underpin a whole-of-catchment approach to water quality and ecosystem health

Vision Outcome 4: Townsville's people are proud of their connection to water and are empowered to be active and responsible water stewards.

Required changes in practice

Conventional water servicing 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 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, as water systems evolve into more complex configurations to deal with changing community expectations and the challenges of climate change, population growth and urbanisation, this linear relationship between people and water servicing also needs to evolve into a partnership approach and drive strong social capital in relation to water. For example, the community's expectation for healthy and liveable urban environments will drive standards for water system services and influence the degree of political support for innovative water sensitive initiatives. The integration of water planning and urban planning means the way people modify and manage the built form in both the private and public realm may have an impact on the level of water system services delivered. The incorporation of decentralised technologies such as onsite recycling and stormwater harvesting into water systems will need changes in water markets, with opportunity for private landowners and businesses to become water providers, as well as water users. The community's knowledge of, connection with, and sense of responsibility for water as individuals and as part of the broader community will therefore significantly influence a city'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.

Assessment of Townsville's enabling conditions

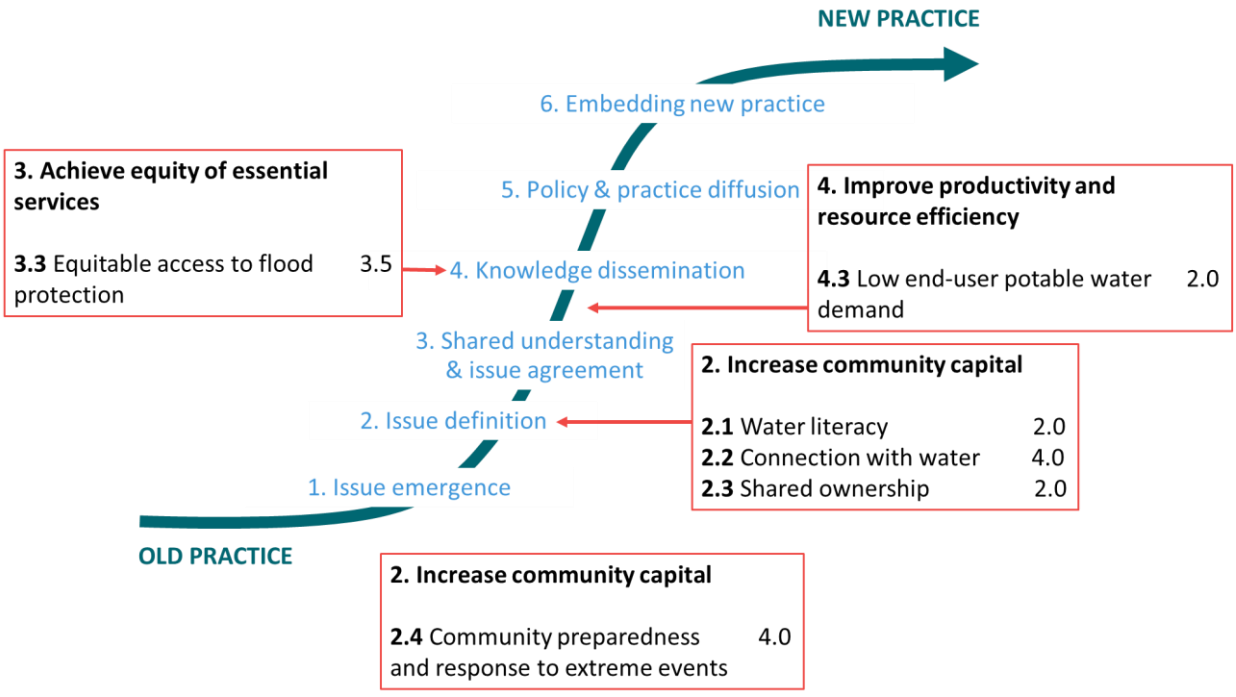


Figure 13: Current transition phases for WSC Index indicators related to vision outcome 4

The Water Security Taskforce has been doing a lot of work during the recent period of drought to consult the community on the issue of water security. There is also an emerging interest within Townsville City Council to engage more effectively with communities on a broader set of water issues. There is currently momentum from senior champions within Council to explore what this would mean and how it can be done. This direction would be supported by an **organisational strategy for community engagement that aims to empower communities as partners in water stewardship** (Strategy 4.1). The water and wastewater strategy currently being developed may provide an opportunity for embedding this approach to community and broader industry engagement within Council strategy.

There are several examples of platforms that aim to engage the community, for example, the Water for Townsville Action Group, the Reef Guardian Program, and Local Management Advisory Committees. While these platforms provide a good basis for community engagement, they tend to focus on a single issue rather than linking to a broad vision for Townsville's water system, and at times they become politicised. Encouraging the community's broad stewardship of water will require engagement solutions that go beyond messaging to manage political risks. This could include such things as co-design opportunities and democratic water planning and leadership. In addition, it will need to be approached collaboratively across organisations with different water management roles and responsibilities so that there is coherence and consistency in the communication approaches and opportunities. This collaboration and innovation would be enabled by **establishing a new platform that explores new approaches and solutions for community engagement** (Strategy 4.2), drawing on the existing platforms noted above.

The implementation of new engagement solutions may raise some challenges, particularly in the context of the current drought and the political attention it has received. For example, there may be tension between Council and some parts of the community around issues of community concern, such as water security. **The potential challenges or barriers associated with innovative engagement solutions would need to be explored and examined** (Strategy 4.3) in order to develop feasible implementation opportunities for empowering the community. The resources and funding provided through the City Deals' Community Water Transition Package may provide an opportunity for pursuing these solutions.

Potable water demand is widely acknowledged as an issue that needs attention across the sector, and champions (particularly in Council and some private developers) are becoming influential, implementing water efficiency projects and demand reduction initiatives across Townsville. Some examples are Council's Dry Tropics Water Smart Initiative and associated community activities, and the North Shore development that incorporates water efficiency technologies and appliances. The Community Water Transition Package as part of the City Deals program will provide a platform for exploring potential solutions. While there is lots of activity to support demand management, a further focus would be to integrate such solutions into a broader approach that also includes alternate non-potable water supply options that can substitute for potable demand. **A long-term water demand strategy that is embedded in a strong narrative for achieving Townsville's water sensitive city vision** (Strategy 4.4) would help drive such an approach.

"The level of service is a key thing that needs to be understood … no one has agreed to how much water is OK"

Flood risk in Townsville is generally well understood, informed by Council's extensive flood risk modelling and identification of high flood-risk areas. Some new developments are incorporating flood mitigation infrastructure in their urban design; however, there has been less focus on existing vulnerable developments. It is therefore recommended that **adaptation solutions for existing areas that are exposed to high flood risk are developed** (Strategy 4.5) to ensure there is equitable access to flood protection as part of Townsville's water sensitive city vision. In addition, knowledge and data from flood modelling are not yet incorporated consistently into planning decisions. Therefore, **policy and regulatory frameworks will need to be improved to ensure land use planning and urban developments consider flood risk mitigation objectives** (Strategy 4.6) that are expressed in Townsville's broader water sensitive city vision. The Local Government Association of Queensland

along with the Queensland Water Directorate may provide platforms for sharing lessons and knowledge from flooding in Southeast Queensland to support some of these initiatives.

Table 5: Recommended strategies to advance community engagement and stewardship

#	Strategies	Outcome
4.1	Develop a clear organisational strategy for approaching community engagement with the aim of empowering communities to be active water stewards	Support and direction for approaching community engagement in a new way exists within Council
4.2	Establish a platform to explore community engagement solutions beyond risk minimisation, drawing on strengths from non-Council organisations	People collaborate and share knowledge to develop innovative community engagement solutions
4.3	Explore and examine barriers to effective community engagement and how these barriers can be overcome through new engagement solutions	Knowledge from outside organisations helps to develop innovative community engagement solutions for Townsville
4.4	Develop and commit to a long-term potable water demand strategy that addresses both demand and supply solutions, informed by lessons from existing projects and embedded in a strong water sensitive city narrative	Organisational commitment and direction exists for a holistic approach to driving low end-user potable water demand
4.5	Develop adaptation solutions for existing areas of high flood risk	All parts of Townsville benefit from flood risk mitigation measures
4.6	Improve policy and regulatory frameworks to ensure land use planning and urban development considers flood risk mitigation objectives	Knowledge around flood risk is translated into practice and adaptation solutions are implemented for supporting Townsville's water sensitive city vision

Vision Outcome 5: Townsville is an international water innovation hub that showcases water sensitive technology, practice and design for the dry tropics.

Required changes in practice

Traditional approaches to water management focus on the single purpose of delivering safe, reliable, and sustainable services to customers. The opportunity for economic benefits in sectors beyond water (such as health, recreation, and tourism) is largely missed through this traditional approach. The potential for business and commercial opportunities from water innovation is also not typically taken advantage of.

Achieving Townsville's water sensitive city vision will therefore require innovation in the types of technologies that are incorporated into the system, the way in which the city is designed, and the planning, management and engagement practices that are adopted by government, the water industry, businesses and the community. Innovation will need to be fostered in organisational culture and systems and processes developed to support the translation of innovation into economic and business opportunities nationally and internationally.

Assessment of Townsville's enabling conditions

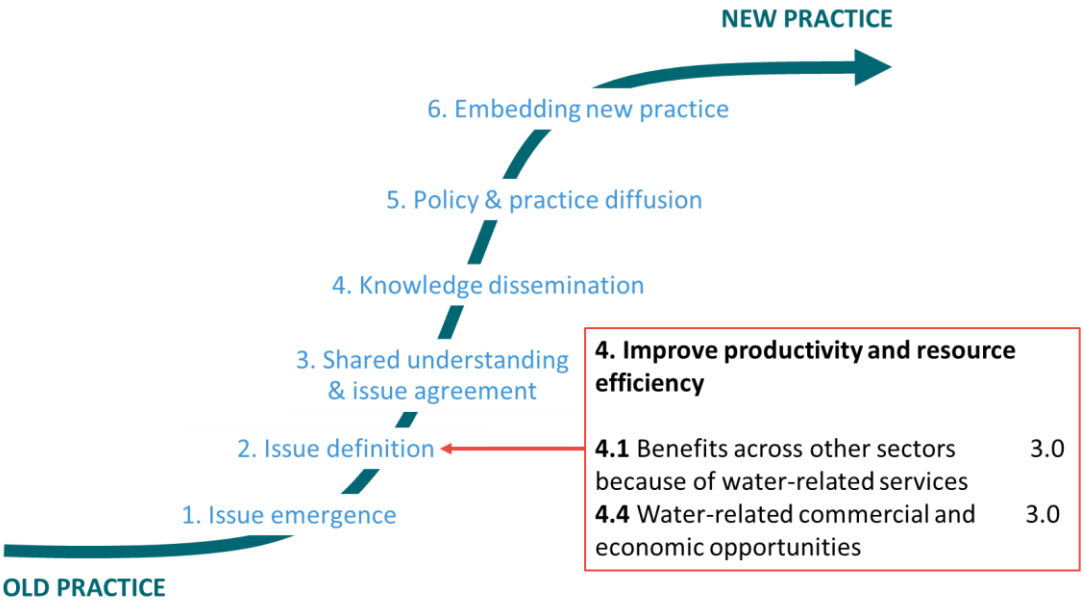


Figure 14: Current transition phase for WSC Index indicators related to vision outcome 5

There has been water-related innovation in Townsville, led by Council in partnership with James Cook University, particularly in relation to resource recovery (e.g. a bio-solid reuse program for agriculture, investigations into using algae for bio-recovery). These initiatives have typically been driven by internal champions and focus on implementing small-scale studies and pilot projects. The lessons from these projects provide an important evidence base from which to **inform and update the business case for innovative solutions as part of a water sensitive city approach** (Strategy 5.1). However, they are yet to lead to ongoing commitment or funding to scale their application. Support for novel water sensitive solutions is therefore needed to **enable and encourage uptake of water innovations through organisational culture, systems and processes** (Strategy 5.2).

"Council really wants innovation and is trying to link in more with JCU. Smart meters for example have hit road blocks…so that's where we've got the intent, it's just trying to get the action at the moment."

The broader cross-sectoral and commercial benefits that water services can provide are starting to receive recognition, but this agenda is not currently actively pursued. For example, the open space irrigation system operated by Council may have commercial and economic opportunities that have not been fully explored. Council are beginning to consider some broader benefits of water sensitive approaches (such as human health benefits of urban cooling and greening) but they have not been defined or quantified in the local Townsville context. **Examining the costs and benefits of solutions that create broad cross-sectoral and commercial benefits** (Strategy 5.3) in collaboration with broader industry is necessary to set strategic goals and investment priorities.

Table 6: Recommended strategies to advance water sensitive technology and innovation

#	Strategies	Outcome
5.1	Learn from existing resource recovery projects to develop a business case for innovative water sensitive solutions	A business case for resource recovery that is integrated into Townsville's broader water sensitive city vision
5.2	Enable and encourage innovation uptake through organisational culture, systems and processes	Innovative ideas are mainstreamed beyond the pilot project phase
5.3	Examine the costs and benefits of solutions that create broad cross-sectoral and commercial benefits	The potential is understood for implementing water management solutions that provide broad, cross-sectoral and commercial benefits

Vision Outcome 6: Inclusive water governance enables integration, collaboration, innovation and collective leadership.

Required changes in practice

Governance arrangements to deliver urban water system services have been evolving over more than a century in response to the community's need for safe, affordable and reliable potable water supply, sanitation, and stormwater drainage. Typical urban water governance structures and processes for conventional water systems in Australia include large centralised institutions responsible for service delivery, usually with separate agencies responsible for policy, planning, and regulation to various degrees. The recent trend in Australia has been to merge smaller authorities into larger corporatised entities with a strong commercial focus. Water supply and sewerage services are commonly provided by the same authority, drainage services are commonly provided by local government while waterways are managed by state government or catchment management authorities.

Governance has largely been based on the idea of separating commercial and public good activities and improving the efficiencies of service delivery by commercialisation and decision-making by skills based boards of directors.

The community's expectations for outcomes 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 water policy in jurisdictions around Australia.

The embedded water governance arrangements may need to evolve to deliver outcomes that meet these changing expectations. Delivering healthy and liveable urban environments that are supported by resilient and sustainable water system services will require governance structures, processes and capacities that enable and drive integrated, long-term, cross-sector and inclusive planning and design decisions.

Assessment of Townsville's enabling conditions:

Figure 15: Current transition phase for WSC Index indicators related to vision outcome 6

The need for better collaboration and integration across sectors, disciplines, and levels of government is widely acknowledged across Townsville. However, this approach is challenging to put into practice. People are accustomed to working in traditional departmental and disciplinary silos and may find it difficult to adopt new practices without clear strategic direction. **A broad city vision for Townsville that articulates the role of water in delivering shared future aspirations** (Strategy 6.1) would create a basis for organising new ways of engaging with each other and working together at the individual and organisational level. Existing policies and plans (e.g. the State Planning Policy and Townsville City Plan), are promising in their articulation of the need for integration between levels of government, but do not yet explicitly acknowledge the role of water in achieving desired outcomes for the city and they do not link to projects and initiatives on the ground. **Embedding**

Townsville's city and water vision in organisational policies and plans (Strategy 6.2) would therefore provide a framework for implementation and organisational alignment.

"It's around the way that societies have evolved to manage water, where they look at the silos of potable water or wastewater or stormwater or groundwater…and they tend to look at it as silos…but that doesn't think about water holistically and doesn't take into account the opportunities looking across all streams of water, so that's our biggest challenge I think."

There are good examples of platforms that enable collaboration on specific issues. The Reef Urban Stormwater Quality Working Group aims to identify opportunities for people and organisations to work together on areas of mutual benefit with respect to the Great Barrier Reef and local water quality improvement. The Queensland Water Directorate provides an opportunity for sharing knowledge and ideas across the state, mainly around water supply and sewerage. Drawing on these issue-focused initiatives, it would be helpful to **establish a platform that aims to support a broad range of water sensitive city objectives that can explore the issue of collaborative governance** (Strategy 6.3). Such a platform would need to involve stakeholders both internal and external to Council, and should explore a range of governance issues, including the role of state government in influencing regional investments and frameworks.

Several projects and initiatives in Townsville demonstrate collaborative governance solutions for particular issues or opportunities. The North Shore development provides a good example of water and land-use planning working together to achieve broader environmental and social outcomes. The Water Security Task Force, as part of the City Deals Program, involved people coming together to consider water security options. These examples show the potential for collaborative approaches but they have not been set up to pursue broader water sensitive city principles. **New solutions for collaborative and integrated governance arrangements for delivering Townsville's full water sensitive city vision therefore need to be explored and piloted** (Strategy 6.4). These new solutions can build on existing examples of collaboration and integration in order to demonstrate the benefits of such an approach to water governance.

Table 7: Recommended strategies to advance collaborative and inclusive governance

#	Strategies	Outcome
6.1	Develop a broad city vision for Townsville that articulates the role of water in delivering future aspirations	A basis for working together is established in order to achieve shared future aspirations
6.2	Embed Townsville's water sensitive vision in organisational policies and plans	A framework exists to support organisational alignment and widespread implementation of solutions
6.3	Establish an ongoing platform to explore the issue of collaborative governance for achieving water sensitive outcomes	The sharing of ideas and solutions is promoted to encourage collaboration across sectors, disciplines and levels of government
6.4	Explore and pilot solutions for collaborative and integrated governance approaches that will deliver the broad city vision, beyond issue-specific solutions	A suite of governance solutions exists aimed at achieving broad water sensitive city outcomes and evidence of their costs, benefits, and risks

Vision Outcome 7: Indigenous water knowledge, values and ways of thinking are valued in the Townsville community and incorporated into water planning and design.

Required changes in practice

Townsville's Traditional Owners share unique cultural, spiritual and economic values of water that form a critical part of the city's historic, contemporary and future waterscape. Understanding, respecting and recognising these knowledge and values of water in water planning and decision-making, as well as by the broader community, will be an important pathway for Townsville to achieve its water sensitive city vision.

However, this can be 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 way 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. Evaluation tools and decision making 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 Townsville's enabling conditions

Figure 16: Current transition phase for WSC Index indicators related to vision outcome 7

The need for greater and more meaningful engagement with Indigenous communities in water planning and decision-making is just emerging as an issue in Townsville. Examples where Indigenous communities have been engaged include the Great Barrier Reef Marine Park Authority's Indigenous Advisory Board, and numerous development projects across Townsville that consulted with Indigenous people throughout the development process. Advancing this aspect of Townsville's water sensitive vision will require more attention to be given to the issue and opportunity. Existing knowledge and initiatives can be built upon to **profile the value of Indigenous knowledge and values in achieving Townsville's water sensitive vision and the importance of greater and more meaningful Indigenous involvement in water planning** (Strategy 7.1). The recent creation of two positions in Council dedicated to Indigenous affairs, along with the development of Council's Reconciliation Action Plan, provide an opportunity to advance this issue going forward.

"I'm not aware of it happening [Indigenous involvement]. I'm not aware of any conversation about that…there's not a great community acceptance. It's changed a lot with migration. There's still an institutional hesitancy."

Table 8: Recommended strategies to advance greater Indigenous involvement

#	Strategies	Outcome
7.1	Profile the benefits of Indigenous knowledge and values in achieving Townsville's water sensitive vision and the importance of greater and more meaningful Indigenous involvement in water planning.	The need for better and more meaningful engagement with Indigenous communities is broadly acknowledged

6 Advancing Townsville's overall water sensitive city transition

This section examines Townsville'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 Session 3, where participants explored different ideas for taking these strategies forward in Townsville. These ideas for implementation can be found in Appendix 3.

6.1 Analysis of Townsville'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 Townsville'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 14 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 Townsville'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 Townsville.

Table 9: Assessment of Townsville's overall 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

This overall assessment in Table 9 for Townsville suggests that while there are some significant advancements in the champions, knowledge, projects, and tools that support change in practice, there are few platforms for connecting stakeholders around the broad range of issues associated with water sensitive cities. Townsville City Council is seen as a major champion in advancing certain water sensitive projects, however, this is mainly with respect to individual champions in departments rather than Council as a whole driving a WSC agenda. Individual champions external to Council are also driving specific aspects of Townsville's WSC vision, however they are finding it difficult to implement solutions due to the lack of a broader enabling environment for innovative solutions.

There are many collaboration platforms across Townsville, for example, the Water Security Taskforce, Water for Townsville Action Group, Creek to Coral Partnership, and the Reef Guardian Program. While these are generally issue-specific and narrow in scope, they could provide important opportunities to create leverage for establishing an overarching platform to drive action towards Townsville's WSC vision as a whole.

Small-scale projects and trials of new technologies are happening across Townsville, including smart metering trials driven by JCU and WSUD projects in new developments (including stormwater capture and household-scale water efficiency technologies). However, it has been challenging to mainstream these innovations and there has generally not been an explicit learning agenda associated with their implementation. Significant demonstrations, such as the new stadium development, generally rely on funding injections from State or Federal Government.

Organisational policies and plans across Townsville are beginning to incorporate WSC principles, however they are not yet unified by a common water vision. The City Plan, for example, articulates liveability through connected green and blue spaces across Townsville, however it does not link to practice and thus provides limited implementation guidance. Extensive targets and regulation exist for water quality due to the proximity of the Great Barrier Reef, but these are not yet linked with the City's water sensitive aspirations.

Based on this analysis, the following four overarching strategies are recommended to advance Townsville's water sensitive transition:

I. Embed Townsville's water sensitive aspirations in a broad city vision and organisational policies, plans and strategies

II. Establish platforms that will support and drive integration and collaboration within Council and with external stakeholders

III. Develop new knowledge on issues and potential solutions for particular aspects of Townsville's water sensitive city vision

IV. Learn from and scale innovations to provide on-ground demonstrations and practical guidance for water sensitive approaches in the dry tropics context

I. Embed Townsville's water sensitive aspirations in a broad city vision and organisational policies, plans and strategies

It is critical to link the narrative of the benefits of the envisioned water sensitive city with the aspirations for Townsville more broadly, including the city's future prosperity, the health and wellbeing of its people, and the preservation and enhancement of its natural environments. Townsville appears to be in the early stages of shaping such a broader city vision, so there is potential for the ideas, values and priorities expressed in this water sensitive vision to have direct influence. Clear articulation of the importance of a water sensitive approach to achieving Townsville's broad city vision will be essential to harness the support of leadership and the general community.

The WSC vision for Townsville needs to become embedded within the policies, plans and strategies of Townsville City Council and other stakeholder organisations. This will enable and encourage an integrated and holistic approach to water management that works towards the shared future water vision for Townsville, and will provide a framework for supporting intra- and inter-organisational alignment and the implementation of solutions.

II. Establish platforms that will support and drive integration and collaboration within Council and with external stakeholders

Townsville's professional workforce at all levels of seniority appears to be fairly transient, with only a handful of project participants having been in the city for more than ten years. As such, while its scale is significantly smaller than major metropolitan cities, the professional networks and relationships (both formal and informal) that must underpin the collective pursuit of Townsville's water sensitive vision need focus. In addition, it would be valuable to review Townsville's organisational structures and processes to consider how they could more explicitly function as platforms that create greater opportunities for integration and collaboration.

Establishing a platform that supports and drives collaboration will provide an opportunity for people to share knowledge, ideas and lessons across disciplines, departments, organisations and sectors. This will be critical for examining issues in more detail and from different perspectives, for informing the development of innovative solutions, and for identifying opportunities to implement solutions that will advance Townsville's water sensitive vision on the ground.

Platforms can take a variety of forms and should be developed according to the specific need and focus. These could include a Water Sensitive Transition Network that meets regularly to progress the vision and transition agenda, a community of water sensitive practice that hosts events, digital platforms for information sharing, specific projects or initiatives that require collaboration, embedded organisational structures that facilitate integration. There are a number of existing collaboration platforms in Townsville, such as the Creek to Coral Partnership, the Water Security Task Force, and the Reef Guardian Program, that, while they have a pre-existing issue focus, may be valuable to draw upon in establishing platform(s) to advance the city's water sensitive vision more broadly.

III. Develop new knowledge on issues and potential solutions for particular aspects of Townsville's water sensitive city vision

Knowledge will underpin many elements of a successful transition to a more water sensitive Townsville. In some cases, new knowledge is needed to better define issues and to establish the need for an action or response. Where the need is unfamiliar or novel, new knowledge may be needed to understand the various responses or solutions available and the associated costs and benefits. Developing and implementing solutions can be very

challenging and carry significant risks. Pilots and demonstrations of solutions can help to show the benefits and also build capability in the delivery of solutions. This can include knowledge on how to manage risks, whether they be technical, financial or reputational. Ultimately, the collective knowledge of solutions will need to be harnessed to support decision-making and guide implementation.

Townsville has a characteristic attitude of self-reliance and 'getting it done'. This is reflected in both the sporting team success and professional culture of the City. This attitude has helped drive significant investment in knowledge and trialling solutions, but translation of new approaches into the mainstream has often been limited. This may reflect a situation where individual champions may be working in isolation, or the transient professional population of Townsville that sees knowledge lost as champions move on. It may also reflect the weakness of collaboration and knowledge-sharing platforms, or poor alignment of strategic priorities across people and sectors. More systematic investment in solution development, aligned with strategic priorities and knowledge sharing platforms that span sectors, disciplines, stakeholders and levels of government will be important to advancing the vision for a more water sensitive Townsville.

IV. Learn from and scale innovations to provide on-ground demonstrations and practical guidance for water sensitive approaches in the dry tropics context

Becoming a water sensitive city will require a range of innovative solutions across social, technical and design domains to be developed and mainstreamed. There has been a range of innovative water solutions trialled in Townsville, such as water efficiency appliances, smart metering, and nutrient and algae recovery. However, to date, there has been limited progression of these innovations beyond the trial stage, and lessons from their experimentation have not yet been incorporated into practical guidance on how they might be improved and eventually implemented.

In addition, there is good awareness of innovative solutions that have been implemented outside Townsville, but many have yet been locally tried or demonstrated to explicitly consider the city's dry tropical context. These local applications will be important for developing and testing solutions that suit Townsville's specific conditions, demonstrate their benefits, costs and risks in the local context, and to foster the practical knowledge and experience of practitioners in Townsville.

6.3 Towards strategy implementation

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

For Townsville 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 this document to provide a resource for Townsville 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 Townsville through the provision of tools, strategic advice, facilitation of further processes, and sharing of lessons from other places.

7 Conclusion

Townsville's dramatic natural climate cycles and regional context have historically created a challenging environment for meeting the community's evolving water needs. As the climate continues to change and social values shift, there is an opportunity to take proactive steps to preserve and enhance Townsville's liveability, productivity, resilience and sustainability.

This report marks the culmination of a process that brought together strategic thinkers from across Townsville'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 Townsville 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 Townsville'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:

- Townsville's historic, contemporary and future water story
- A benchmark of Townsville'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 Townsville, the most significant improvement is needed for the goals of Improve ecological health, Increase community capital, and ensure good water sensitive governance.
- A 50-year vision for Townsville as a water sensitive city, describing Townsville as attractive, resilient city that manages water to enhance healthy ecosystems, embrace dramatic natural water cycles, drive world-leading innovation, and support citizens who are proud of their dry tropical identity.
- An assessment of Townsville'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 Townsville's water sensitive city transition

These outputs form a transition strategy as a framework for prioritising and designing action across the range of people and organisations that will need to work collaboratively to facilitate Townsville's water sensitive city transition.

The insights from this research show that Townsville has a strong foundation to build on as it pursues its envisioned water future. The city's appetite for innovation and experience in trialling new water solutions, the dedication of individual champions at various levels of seniority and across organisations, and the existing collaborative platforms that can be drawn upon reflect an enabling environment that will help local stakeholders advance their water sensitive city vision.

In addition, Townsville City Council's scale of operation from catchment to coast, along with its functions and responsibilities across water supply, catchment management, sewerage, stormwater and floodplain management, waterways, open space and environment; provide a promising base for enabling the integration and collaboration needed to deliver water sensitive outcomes.

Participants in this project agreed on shared aspirations for Townsville, with the vision themes of urban liveability, ecosystem health, sustainable resource use, and engaged and educated communities receiving unanimous support. Throughout the group discussions, it became apparent that 'liveability' needed to be defined for the local

dry tropical context, as creating green, lush spaces is more challenging for Townsville compared to many other Australian cities. These conversations highlighted the pride felt by Townsville residents for their unique context and its dramatic climate cycles, and the importance of embracing these elements in defining their future aspirations.

Among Townsville's water sensitive champions, there is an encouraging awareness of the direction in which water planning and management practices needs to shift. While traditional silos are still present within Council and externally, the importance of breaking down these silos is increasingly realised. It is now critical for Townsville to broaden and strengthen its network of champions in order to engage all of the disciplines, organisations and stakeholders necessary for delivering integrated and collaborative solutions. To this end, there are many existing opportunities in Townsville that can be leveraged to create a platform for broadening people's perspectives and the scope of water sensitive solutions that need to be pursued.

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

Perhaps most importantly, the benefits of a water sensitive city need to be understood and appreciated throughout Townsville's broad community and stakeholder network. This understanding requires a compelling narrative of the value of Townsville's water sensitive future to be developed in order to give stakeholders, decision-makers and the community focus and clarity around their priorities and aspirations for the city.

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

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Appendix A: List of Workshop Participants

Workshop Facilitators			
Briony	Rogers	CRC for Water Sensitive Cities	Project Leader
Chris	Chesterfield	CRC for Water Sensitive Cities	Director Stakeholder Engagement
Fiona	Chandler	Alluvium	Regional Manager Townsville
Katie	Hammer	CRC for Water Sensitive Cities	Project Manager
Richard	McManus	Alluvium	Regional Manager Sydney
Workshop Participants*			
Adrian	Gabrielli	A. Gabrielli Constructions	Managing Director
Anna	Whelan	Townsville City Council	Process Engineer - Wastewater
Andrew	Astorquia	Stockland	Development Manager
Andrew	Hannay	Townsville City Council	Coordinator Environmental Management & NRM
Brian	Walters	Townsville City Council	Senior Irrigation Designer
Catherine	Hobbs	DILGP	Principal Planning Officer
Chris	Cocklin	James Cook University	Senior Deputy Vice-Chancellor
Chris	Manning	Townsville City Council	Coordinator Coasts and Catchments
Chris	Tanner	CRC for Water Sensitive Cities	QLD Regional Manager
Darron	Irwin	Townsville City Council	A/Coordinator Infrastructure Planning
Dave	Cameron	Qld Water Directorate	Chief Executive Officer
Grant	McOmish	Ingenta	Managing Director
Greg	Bruce	Townsville City Council	Principal Sustainability, Future Cities
Inga	Davis	Townsville City Council	Economic Activation – City Deals
James	Ruprai	Townsville City Council	General Manager of Planning
Janice	Moody	GHD	Senior Water and Wastewater Engineer
John	Irving	DILGP	Principal Planner, Regional and Spatial Planning
Kelvin	Olzard	HydroGeology	Principal Hydrogeologist
Mac	Haque	Townsville City Council	Planning Officer (Land Use)
Marco	Bonotto	Economic Development Queensland	Principal Engineer – Technical Services
Melinda	Louden	Port of Townsville Ltd.	Manager Environment and Planning
Paul	Johnston	Townsville City Council	Team Manager Planning
Roxana	Caha	Port of Townsville Ltd.	Environmental Advisor
Sarah	Strutt	Great Barrier Reef Marine Park Authority	Project Manager, Reef Guardians
Scott	Hawkins	Townsville City Council	Public Open Space Planner
Scott	Moorhead	Townsville City Council	General Manager Water and Waste
Sen	Vigneswaran	Townsville City Council	Asset Engineer
Simon	Walker	Lendlease	Development Manager
Wal	Smith	Place Design Group	Director
Interviewees (did not attend workshops)			
Darren	Finlay	Finlay Homes	Owner
Graeme	Kenna	DILGP	Manager (Planning)
Rob	Saunders	GHD	North Qld Market Leader, Water

*Some participants may not have attended all three sessions

Appendix B: WSC Index Scoring Process and Justification of Results

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

Process for scoring indicators

The benchmarking workshop was the first of Townsville's sessions. 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,) before reaching consensus on a given rating and level of confidence.

WSC Indicator scores and justifications

Goal 1: Water Sensitive Governance (Overall score: 2.4/5)

Indictor 1.1 Knowledge, skills and organisational capacity (Score: 2.5/5)

There is a clear recognition that maintaining individual and organisational capacity in regional areas is a challenge and requires constant and continuous investment.

Engineering has been a dominant discipline in the development and implementation of various water-related initiatives but it is also recognised that there are champions in other areas that work well across disciplines. Council acknowledges that they are committed to and very good at commissioning studies across a range of issues in an effort to access the latest technical information. These studies are considered to contain valuable information, however on reflection could be better consolidated and integrated, as well as being used better to influence long term investment and decision-making.

There are some good examples of networks that have been developed to share local and regional knowledge, experiences, and lessons. Many of these are underpinned with strong science principles such as those that council has established with James Cook University, and the Reef Urban Stormwater Management Improvement Group (RUSMIG) which allows officers from across local Councils in north and central Queensland to facilitate improved stormwater planning and management. The Queensland Water Directorate has also played an instrumental role in providing platforms such as the Regional Alliance Programs for council water retailers to similarly share lessons and knowledge.

Indicator 1.2 Water is key element in city planning and design (Score: 2.5/5)

While the Townsville City Plan comprises various policy statements and outcomes that suggest the importance of water in the planning and design of the City, some participants feel there is a disconnect between planning for urban growth and infrastructure provision. For example, some perceived that water is commonly seen as an afterthought, with early integration not recognised as being important. This is especially the case with some major urban redevelopment projects.

Within Council, the co-location of planning engineers with other planning functions is a positive start to enhancing integrated outcomes, however, as with many other local government areas, many approval processes and pathways that relate to water are fragmented across multiple levels of government.

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

There is general agreement that there are many opportunities to improve institutional arrangements, both within Council and externally with other government agencies. Workshop participants identified a number of opportunities within Council to improve communication and the coordination of management activities, such as the management of the Ross River. Coordination and management of issues involving external organisations can also be improved, such as environmental licencing and approvals for wastewater treatment plants, which are complex and involve multiple layers of government. Other missed opportunities were also referred to by participants, in which enhanced communication and collaboration could have resulted in multiple benefits and cost efficiencies being realised.

Recently the signing of Townsville's City Deal between the three levels of government demonstrates relationships are improving. There are other examples where arrangements and processes are improving, especially with Department of Environment and Heritage Protection in the management of the Great Barrier Reef region, however they are generally viewed as being ad hoc and reliant on individual personalities.

Indicator 1.4 Public engagement, participation and transparency (Score: 2/5)

There is evidence to suggest that historically, community engagement around Townsville's strategic water issues has been approached with a view to risk minimisation, which has left limited opportunity for communities to participate meaningfully in water planning and decision-making processes.

Participants suggested that the Water for Townsville Action Group has emerged to fill this gap, resulting in a space for its 14,000 community members to voice their views. This high level of participation could also be seen as demonstration that there is strong interest amongst the community in being more closely engaged. However, improvement for this indicator would require engagement to expand beyond single issues to also focus on strategic, long-term water issues and opportunities.

Townsville does have some community engagement programs such as Reef Check and Creek Watch, which could provide a foundation to build on in considering new ways to engage with the community about the broad water system.

Indicator 1.5 Leadership, long-term vision and commitment (Score: 3/5)

Townsville has recognised leaders and champions on environmental topics, the Great Barrier Reef and specific parts of the water cycle. Strong leadership for integrated water management is still needed, although there is a general willingness to establish a long term vision for integrated water management across the region. However, implementation of associated initiatives is proving to be more challenging, particularly as single issue priorities such as water security tend to dominate.

Again, Townsville's City Deal and more locally the Water Security Taskforce may provide a catalyst to develop a coordinated long-term vision and commitment to addressing the long-term water needs of the city, including beyond water supply.

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

Expenditure of public funds and grants are commonly subject to rigorous analysis with the majority of capital asset programs at local, state and federal levels requiring multi-criteria analysis processes. State funding

processes for water system business cases point to some of the multiple benefits that are expected to be delivered. However, they are not yet comprehensive in scope, despite some consideration of broader outcomes such as jobs creation.

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

Townsville City Council is seen to be relatively well linked to the local community and has strong gender diversity in senior positions. The Mayor and CEO are seen to be significant drivers for increasing representation of different perspectives and needs, however this is not widely demonstrated across Council. Low socio-economic groups, Indigenous communities, industry groups and the business sector are considered to be relatively well represented and influencers of decisions at the local and regional level, although not necessarily influencing water-related decisions.

Goal 2: Increase community capital (Score: 2.8/5)

Indicator 2.1 Water literacy (Score: 2/5)

Townsville has a long and successful history of working with schools and younger generations to build awareness of environmental issues in relation to the Great Barrier Reef, for example through the Reef Guardian Schools program and Reef HQ, and also with regards to water conservation through initiatives such as the Rowes Bay Sustainability Centre. This supports recent CRCWSC studies that show Townsville residents have relatively high water literacy compared to the Queensland average around stormwater pollution and some water use issues.

However, for other community sectors across the city and other water issues there are concerns that they are not as well informed and consequently have lower literacy levels, specifically in relation to:

- options and choices available to households to better manage their own water usage (e.g. water billing options and the Water Watchers Plan)
- roles and responsibilities for local and regional water management
- costs associated with the provision of water and sanitation services and expenditure of rates
- sources and impacts of different pollutants on local waterways and inshore areas versus outer areas of the Great Barrier Reef.

Indicator 2.2 Connection with water (Score: 4/5)

The physical location of Townsville and its proximity to the Strand, Great Barrier Reef, northern beaches, Paluma Range and the Ross River ensures there is a strong community connection to local environmental and water assets. The proliferation of backyard pools and boats, and high participation in water-based sports and recreational activities are all obvious signs of a lifestyle based on the community's affinity for water. Water features are also commonly the flavour of real estate advertising and tourism commercials.

While many Townsville residents live within close proximity to water, there are also many, especially in the lower socio-economic areas to the west of the city that do not have easy access to these natural features, waterways or open spaces.

Recent drought conditions and the introduction of Level 3 water restrictions have resulted in a strong awareness of and connection to a lack of water, and the growing importance of water in supporting Townsville's amenity values as the community's desire to have a green, tropical environment is reinforced.

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

With the exception of backyard bores, local water management issues are commonly seen as Council's problem by local citizens. The introduction of water restrictions has helped to increase local ownership and self-monitor water use.

In the absence of a strategic long-term water plan, some participants perceive that Council's responses to water issues (such as the low dam levels at the time of writing) have historically been reactive and ad hoc. On the other hand, there was wide consultation in the development of Townsville's City Plan to work towards innovative frameworks for development. The City Deal has also helped to demonstrate a new willingness for the all levels of government to work together to develop long-term solutions with shared funding contributions.

However there are still many perceived risks and issues to resolve with regards to the role of decentralised systems and alternative water resources, which has limited their implementation and resulted in a continuation of traditional approaches that have minimal role for shared ownership, management and responsibility amongst the community.

Indicator 2.4 Community preparedness and response to extreme events (Score: 4/5)

Townsville is recognised nationally as a leader in community preparedness and disaster management, especially in relation to cyclones. The Disaster Management Centre and events such as 'Cyclone Sunday' help ensure the local community and businesses are prepared and aware of the potential for extreme events, and that all emergency services and essential service providers are coordinated and have strong relationships to deal with local disasters. This is strengthened by Townsville's large presence of the Australian Defence Force.

Council has invested heavily in the development of flood maps, understanding the impact of climate changes on coastal management, and development of local disaster management plans, all of which provide important information to help the community become prepared for flood events.

The last cyclone to physically impact Townsville was Tropical Cyclone Yasi in 2011, so many newer residents and Council staff may be unfamiliar with the risks and required response. The close proximity of Tropical Cyclone Debbie in 2016 was a timely reminder that community and government preparedness is a constant and on-going priority.

Extreme UV events also present long-term risks to residents with high skin cancer rates, and reiterates the importance of shade and public awareness campaigns.

Indicator 2.5 Indigenous involvement in water planning (Score: 2/5)

Participants recognised that there are many opportunities to improve Indigenous people's involvement in water planning and to build on the example set by the GBRMPA and NQ Dry Tropics and their Indigenous Advisory Groups. Opportunities include the development and implementation of Council's Reconciliation Plan and Cultural Heritage Agreements. The establishment of two new staff positions at Council to focus on local Aboriginal and Torres Strait Islander initiatives demonstrates an increasing commitment and willingness to engage on indigenous values.

At the site and project scale there are some good attempts to engage with Indigenous communities and integrate traditional knowledge, such as with the Jezzine Barracks redevelopment and Riverway.

State and local regulation requires consultation with appropriate Traditional Owners. However, this is recognised as only setting a minimum standard and the policy guidance could be stronger.

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

Indicator 3.1 Equitable and affordable access to safe and secure water supply (Score: 4/5)

Townsville provides very high quality water supply services with the exception of some isolated water quality issues associated with aging infrastructure at Paluma, and potentially during natural disasters.

The perceived high Council property rates and relatively large population considered potentially socio-economically disadvantaged gives rise to some potential concerns in terms of affordability. There are opportunities to enhance the policy associated with the provision of concessions and financial support for these groups.

Indicator 3.2 Equitable and affordable access to safe and reliable sanitation (Score: 4/5)

As with most water and wastewater service providers in Queensland, there are strict regulations in place around wastewater treatment and discharge. There are some isolated examples of operating issues associated with aging infrastructure, such as sewer overflows, blockages and pressure main breaks. Some populations in rural-residential areas are on septic systems, which may not be consistently well-maintained.

Townsville's location within the Great Barrier Reef region results in higher costs to meet increasingly strict licence and nutrient load reduction targets. It is also recognised as an increasingly complex regulatory environment. This presents similar concerns regarding affordability for the socio-economically disadvantaged as for water supply services.

Indicator 3.3: Equitable access to flood protection (Score: 3.5/5)

Townsville provides relatively good flood protection for local communities and business, with robust mapping information and disaster management planning. Floods associated with a big wet season and Tropical Cyclone Yasi in 2011 resulted in issues with sewer overflows and impacts on local waterways. Change and improvement to flood risk management often results from large events (e.g. cyclones, floods) which haven't happened for a while.

Many low-lying areas across Townsville can be inundated by king tides. Some of these areas are older suburbs, which may be difficult and costly to retrofit and have therefore had limited consideration of adaptation options. While the risks of climate change and flooding are well understood, there are opportunities to improve policy guidance around integrated flood management, climate adaptation and land planning.

Indicator 3.4 Equitable and affordable access to amenity values of water-related assets (Score: 4/5)

Natural assets such as the Strand and Cleveland Bay, Cape Pallarenda, Town Common, Castle Hill, Ross River, Mount Stuart, and Paluma all provide immense amenity value to Townsville, with a large number of free, easily accessible parks and open space areas available for use.

Some western suburbs have less opportunities than coastal communities and those suburbs that adjoin the Ross River, however many new developments such as North Shore and Elliot Springs have integrated stormwater management infrastructure with public open space resulting in the creation of multi-purpose areas with high amenity value.

Goal 4: Improve productivity and resource efficiency (Score 2.4/5)

Indicator 4.1 Benefits across other sectors because of water-related services (Score: 3/5)

While there has been some recognition of benefits across other sectors because of water services (e.g. urban cooling), there has been limited quantification of these benefits. The role of street trees in reducing the urban heat island effect is reflected in policy but only recognised by a few individuals within Council. While there are examples across the city where vegetation and irrigation enhance urban cooling, there are still projects and developments (e.g. parking lots) with no recognition of these benefits.

Indicator 4.2 Low greenhouse gas emissions in the water sector (Score: 2/5)

Lowering greenhouse gas emissions in the water sector is currently not a driver in Townsville – reduction of energy consumption is instead driven by cost. While data on energy consumption is available, it is not reported against greenhouse gas emission targets since there is no associated policy goal. Solar energy is not being used in the water and waste sector, although it is currently being considered for the new Haughton pipeline duplication. The Port of Townsville articulates a sustainability policy goal, and is implementing small-scale solar projects and hybrid vehicles. While Townsville has signed up to a Solar City policy, it has not yet been translated to the water sector.

Indicator 4.3 Low end-use potable water demand (Score 2/5)

Townsville has one of the highest per capita water consumption rates in Australia, reaching 400-500 L/person/day. While this is partially explained by the dry tropical climatic conditions, participants considered there is significant room for reduced consumption without compromising on city greening outcomes. At the time of writing, Townsville was on Level 3 water restrictions, which brought this figure down to around 300 L/person/day. Of this amount, about 70% of water is used for outdoor purposes (e.g. watering lawns and gardens).

There has been a wide acknowledgement from Council that it is necessary to reduce community water demand through behaviour change and water efficiency technologies. To this end, projects such as community education campaigns and sprinkler exchange days are being run by Council.

Indicator 4.4 Water-related economic and commercial opportunities (3/5)

There is significant opportunity within Townsville's water sector for private economic and commercial benefits, however these are largely not yet taken advantage of. For example, there is potential to sell intellectual property about Townsville's irrigation system, which is the largest in the Southern Hemisphere and utilising intelligent controls; however, this is not currently being pursued.

Indicator 4.5 Maximised resource recovery (Score 2/5)

Wastewater recycling is being fully utilised on Magnetic Island, where its two wastewater treatment plants use reverse osmosis to treat water and reuse it on native parklands and the golf course. Due to issues with salinity of recycled water and highly sodic soils, wastewater recycling is only just starting to be considered in other places for industrial use.

There have been many smaller pilots of recovery of resources such as nutrients, biosolids and biogas, however, they have not been incorporated into any larger scale implementation. For example, studies have been done by James Cook University and industry to look at biorecovery with algae, and using recovered biosolids for agriculture.

Goal 5: Improve ecological health (Score 3.1/5)

Indicator 5.1 Healthy and biodiverse habitat (Score 3/5)

There are several examples of healthy, functioning ecosystems in Townsville, including Louisa Creek and its fish biodiversity, Ross River and the open space along it, and the city's restored mangrove systems. However there are also several systemic issues, such as weeds in the Ross River, filling in of mangrove systems, and a recent fish kill event in the Ross River.

While these ecosystems are present, they require significant effort to be restored and maintained as well-functioning ecosystems.

Indicator 5.2 Surface water quality and flows (Score 3.5/5)

There is currently substantial work being done to improve the water quality of Townsville's waterways, which includes cleaning up weeds and capturing sediment and nutrients. While there are measures put in place in new developments to capture highly-concentrated sediment, there are challenges with ensuring builders are compliant in adhering to these measures.

Strict policy and regulation exists (e.g. Reef 2050) for discharge water quality due to the Great Barrier Reef world heritage area.

Indicator 5.3 Groundwater quality and replenishment (Score 2/5)

While Townsville sits on an extensive groundwater aquifer system, there is little understanding of how the aquifers are connected, or of their potential to be integrated into the water supply system. There is a high use of private groundwater bores amongst residents to access what they perceive as an 'unlimited' water source. There are few management systems in place to support these valued ecosystems, and groundwater depletion is happening at a high rate as people are unaware of their consumption's impact on the aquifer systems. There is a need for monitoring and data to examine this impact.

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

There are many areas in Townsville protected by regulation, especially around the marine environment and Great Barrier Reef. While vegetation clearing controls exist in urban areas, they are often not adequate.

Goal 6: Ensure quality urban space (Score 2.7/5)

Indicator 6.1 Activating connected pleasant urban green and blue space (Score 3.5/5)

Townsville is regarded to have a fairly high proportion of connected blue and green spaces, including the Strand, Ross Creek, Ross River, Castle Hill, and numerous parks throughout the city. While the more iconic areas are maintained and utilised by residents, some of the parks are not well distributed, underdeveloped and not well utilised. Many areas are not within a ten minute walk, but that was not regarded as important due to the heat in Townsville and its entrenched culture of driving.

There has been some mapping of open space done to identify green corridors, bike paths and vegetation coverage along Ross River and Ross Creek.

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

Urban forms that function as part of the water system is an emerging concept in Townsville, with not much known about what approaches are effective in the dry tropics. Some solutions (e.g. rain gardens, green walls) that function elsewhere are difficult to implement in Townsville's climate. While this approach is starting to be considered, it is not yet fully acknowledged within urban planning and design.

Indicator 6.3 Vegetation coverage (Score 2.5/5)

Vegetation coverage is fairly inconsistent across Townsville, with the older mature suburbs having quite good vegetation coverage but newer suburbs having limited trees. Streetscapes vary from good tree canopy to little or no tree canopy with only small to medium trees. The 202020 Vision, developed by a collaboration of industry, NGO, government, academia and individual partners, includes an analysis of Townsville's vegetation cover. While there is substantial data in this plan, interpretation of the data was poor, resulting in little action to improve local vegetation coverage.

There is a widespread perception that large trees create a high risk for property/infrastructure damage during cyclones. The notion that fewer trees is better because there will be less to clean up after the next cyclone is reflected by the fact that there was no re-planting process after the last cyclone.

Townsville's City Plan does not include tree planting or shade cover in car parks, which makes implementing shade trees difficult in the city.

Goal 7: Promote adaptive infrastructure (Score 2.8/5)

Indicator 7.1 Diverse fit-for-purpose water supply system (Score 2/5)

Townsville's water supply is mainly reliant on surface water from the Ross River Dam. There are a number of smaller dams in surrounding areas, and residents use private groundwater bores for household use. Alternatives (e.g. desalination, effluent reuse) are being considered but are not yet at the implementation stage. There is a high potential to use recycled wastewater as a major supply since it is already being treated to a high standard for discharge to the waters surrounding the Great Barrier Reef. Removing salinity in treated wastewater, a costly process, is the main challenge.

Indicator 7.2 Multi-functional water system infrastructure (Score 3/5)

Most of Townsville's rivers and drains incorporate surrounding open space and paths for walking, running and biking. Several dams have surrounding mountain biking trails, but access to the water is highly restricted. Some new developments that are implementing water sensitive urban (e.g. wetlands and detention systems) are including community access and promoting use of open space for community gardens.

Indicator 7.3 Integration and intelligent control (Score 3/5)

Townsville's irrigation system includes the largest irrigation control network in the Southern Hemisphere and demonstrates a great example of intelligent control. There are other smaller projects happening, such as a smart metering trial to determine system losses due to leakage and early installations of bore monitoring equipment. While smart meters are beginning to be implemented to gather data, this information is not yet being incorporated into the design of infrastructure control systems.

Indicator 7.4 Robust infrastructures (Score 3.5/5)

Townsville's centralised water supply and sanitation systems incorporate significant redundancies, and high risk assets are monitored and checked regularly. While the infrastructure system is seen to be resilient over the long-term, there is a risk of failure and service interruption due to short-term shocks such as cyclones. There are some back-up storage tanks (e.g. on Castle Hill) but these would be insufficient in the case of major system failure.

The leakage loss in the system is currently very high, but plans are in place to identify and fix this.

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

Many Townsville residents use private backyard bores for household water consumption, however some bores are running dry which is becoming a major issue. Other examples of household-scale infrastructure such as rainwater tanks and greywater recycling systems are not highly implemented. Rainwater tanks are perceived by many to be inefficient in the dry tropical context and therefore not worth the cost. Household greywater reuse is strictly regulated because of high clay content in soils, so people tend to consider it too difficult to implement.

Onsite water treatment and decentralised infrastructure is not encouraged on Magnetic Island due to its proximity to the fringing coral reefs and degree of failure of systems. In the case of Magnetic Island, Council encourages a centralised infrastructure approach.

Indicator 7.6 Adequate maintenance (Score 3/5)

Maintenance of large-scale infrastructure (mechanical and electrical) happens on a regular basis, although not as proactively for smaller-scale assets such as pipes. There are guidelines and policies for how often to perform infrastructure maintenance and what information to report.

Maintenance of green infrastructure (specifically how to irrigate) is not fully understood and is not being done well. The more iconic areas (e.g. the Strand) are well maintained but other less iconic parks are not. It is also considered expensive to maintain water sensitive urban design features due to the large amounts of sediment running off from new developments.

Appendix C: Ideas for Implementation

The ideas presented in this section were explored in Session 3 discussions, in the context of the recommended priority strategies. They should be used to inform the development of actions, and do not represent any organisational commitment. The ideas have been rearranged to fit under the four overarching strategies presented in Section 6.

I. Embed Townsville's water sensitive aspirations in a broad city vision and organisational policies, plans and strategies

- Align WSC vision with the current Townsville 2020 vision
- Articulate a long-term city vision for Townsville
- Lobby for WSC aspirations in city planning
- Build on water demand management plan 2016
- Map strategies from WSC transition strategy into Townsville 2020 vision
- Showcase demonstration projects in a way people will understand (e.g. signage)
- Utilise community grants (i.e. put WSC criteria into grant guidelines)
- Raise awareness of the CRCWSC transition strategy process (e.g. communicate in universities, media)
- Research and Development tax breaks and incentives
- Focus urban design on flood risk mitigation for the waterfront
- Revise City Plan to incorporate best-catchment solutions with respect to water supply
- Review policies to identify gaps, barriers, or contradictions with respect to the WSC Townsville process
- Identify priority policies/documents to influence (e.g. City Plan, Vision 2020)
- Identify relevant policies and regulation at the state and Commonwealth level

II. Establish platforms that will support and drive integration and collaboration within Council and with external stakeholders

- Identify existing platforms that would be valuable connect (e.g. Water for Townsville Action Group, Sustainable House, Townsville Enterprise, Reef Guardians, Creek to Coral, City Sustainable Hub)
- Create a separate WSC group to be involved in and bridge the issue-specific ones
- Create a WSC network within Council
- Identify key champions to be involved (Council, developers, community, industry, state and Commonwealth government)
- Build on existing recycling strategy and business case
- Use opportunities for alternate options (state funding for pipeline)
- Construct a broader narrative about the role of recycling and resource recovery in achieving Townsville's long-term vision (i.e. connect outcomes that the community desires with the solutions such as recycling and resource recovery)
- Use existing projects and demonstrations to articulate the benefits and importance of connected blue/green spaces
- Harness community champions to communicate (e.g. creek watch groups)
- Develop visualisations using local videos
- Engage with JCU and Central Queensland University
- Utilise social media to communicate messages

III. Develop new knowledge on issues and potential solutions for particular aspects of Townsville's water sensitive city vision

- Invest in catchments as an alternative to expensive sewerage treatment plant upgrades
- Healthy catchments and waterways partnership
- Environmental Protection Policy process includes understanding community values for waterways
- Case studies inform development of new solutions

IV. Learn from and scale innovations to provide on-ground demonstrations and practical guidance for water sensitive approaches in the dry tropics context

- Include a learning agenda in all demonstration projects
- Street tree bioretention trial
- Use demonstrations projects to inform guidelines and WSC toolkit
- Implement medium density, smaller footprint and larger green space approaches
- "Learn-scapes" with tours and training
- Incorporate monitoring to gather data on effective solutions to counter anecdotes about failures and to inform standards and guidelines
- Build monitoring into capital costs
- Acknowledge failures, learn and adapt practice
- Collaborate with JCU and Central Queensland University

Appendix D: Transition Dynamics Framework Matrices and Evidence

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	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

Champions *Key networks of individuals* People want to work together and acknowledge the need for better collaboration, but it is still challenging. People on ground aren't used to working together. Reef guardian program is a good example. Council focusing internally now.	**Platforms for connecting** *(Semi) Formalised organisations, structures, & processes for coordination and alignment* CRC IRP1 process (establish a longer term network) Qldwater directorate Reef stormwater group (champions from outside Townsville), only focused on stormwater, has potential to grow	**Knowledge** *Research, science & contextualised knowledge* Knowledge on how to collaborate is generally issue-based, no framework that is strategic direction based Potential to learn from other contexts	**Projects and applications** *Experiments, demonstrations, & focus projects* Starting to integrate land use planning at project level Report card process (single issue focused) Water Security Task Force – talking about solutions options but focused on water supply	**Tools and instruments** *Legislative, policy, regulative, & practice tools* Report cards Planning controls are there but little implementation Restructuring of Townsville City Council could create rapid movement City Plan – says great things, little link to implementation

2. Increase community capital (Indicators 2.1 Water literacy, 2.2 Connection with water, 2.3 Shared ownership)

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

Increase community capital (Indicator 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 *Key networks of individuals* Townsville City Council – senior level agreement that community empowerment is a priority Great Barrier Reef Marine Park Authority Indigenous advisory board	**Platforms for connecting** *(Semi) Formalised organisations, structures, & processes for coordination and alignment* Reef Guardian program Water for Townsville Action Group Schools Local management advisory committees	**Knowledge** *Research, science & contextualised knowledge* Citizen science for report cards and water quality monitoring	**Projects and applications** *Experiments, demonstrations, & focus projects* Community Transition Package ($10M) Smart metering of households – opportunity going forward Community engagement on new water/wastewater strategy North Shore – indigenous communities consulted, still being done at consultation level	**Tools and instruments** *Legislative, policy, regulative, & practice tools* Community Transition Package ($10M targeted funding) Community engagement strategy being updated in Council Cultural Heritage Act Various Reconciliation Action Plans Two indigenous advisory positions to be filled in Council

3. Equity of essential services (Indicators 3.1 Equitable access to water supply, 3.2 Equitable access to sanitation)

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

Indicator 3.3 Equitable and affordable 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	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

Champions *Key networks of individuals* Champions exist around the issue of affordability Council has done flood modelling	**Platforms for connecting** *(Semi) Formalised organisations, structures, & processes for coordination and alignment* Community Transition Package Qldwater directorate – lessons from SEQ on flooding	**Knowledge** *Research, science & contextualised knowledge* Exists nationally (through WSAA) but not shared locally or contextualised A lot of flood modelling has been done, know where flood risk is. Knowledge not informing planning decisions in a comprehensive way Some new developments doing good things with urban design, however a lot of vulnerable areas in existing developments – not much done in adaptation Lack of institutional knowledge around flooding due to high turnover – many people haven't been through major flood event	**Projects and applications** *Experiments, demonstrations, & focus projects* Groundwater and greywater solutions exist Alternate pricing options? Some new developments	**Tools and instruments** *Legislative, policy, regulative, & practice tools* Knowledge around flooding not integrated into planning decisions

4. Productivity and resource efficiency (Indicators 4.1 Benefits across other sectors because of water-related services, 4.4 Water-related economic and commercial 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

Indicator 4.2 Low GHG emissions 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

Indicator 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	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

Indicator 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

Champions *Key networks of individuals* Industry (golf courses, industrial) wanting to use recycled water GHG emissions not a driver in Townsville – cost is the driver Low potable water demand – champions in Council, some private developers and landscapers Resource recovery – JCU, Council	**Platforms for connecting** *(Semi) Formalised organisations, structures, & processes for coordination and alignment* Potential for JCU or Central Queensland University to be platforms to build relationships with research Qldwater Directorate Low potable water demand – Community Transition Package $10M	**Knowledge** *Research, science & contextualised knowledge* Benefits (heat) are identified and in policy but little recognition because difficult to quantify	**Projects and applications** *Experiments, demonstrations, & focus projects* Business opportunities in irrigation Artificial aquifers Pockets of things happening, not being communicated or part of a broader agenda/approach Townsville City Council Dry Tropics water smart initiative (sprinkler exchange days) Innovation House JCU nutrient investigations for algae and biorecovery	**Tools and instruments** *Legislative, policy, regulative, & practice tools* Policy around street trees New WSUD guidelines Community Transition Package ($10M)

5. Improve ecological health (Indicators 5.1 Healthy and biodiverse habitats, 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

Indicator 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

Indicator 5.4 Protecting 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	**Platforms for connecting**	**Knowledge**	**Projects and applications**	**Tools and instruments**
Key networks of individuals Great Barrier Reef Marine Park Authority Future Cities Office Need more developers/builders on board	*(Semi) Formalised organisations, structures, & processes for coordination and alignment* Creek to Coral Program Conservation volunteers Reef Guardian Program	*Research, science & contextualised knowledge* There is knowledge around how to improve water quality (sediment traps, wetlands, etc.) Still major issues with sediment concentration from developing areas Many people unaware of groundwater depletion and its impact on ecosystems Need data/monitoring of groundwater bores (no funding). Aboriginal knowledge needs to be incorporated/communicated A lot of protection of marine systems and the Great Barrier Reef, not enough focus on riparian and waterway corridors	*Experiments, demonstrations, & focus projects* Louisa Creek retrofit Ross River mangroves Castle Hill Town Common Cleveland Bay and fringing reef	*Legislative, policy, regulative, & practice tools* Reef 2050 City Plan Local Water Quality Improvement Plans Report Cards Lacking guidance on WSUD, catchment-wide targets, relationship between inshore reefs and water ways protection Lots of regulation around marine areas Vegetation clearing controls

6. Ensure quality urban space (Indicator 6.1 Activating connected pleasant urban green and blue space)

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

Indicators 6.2 Urban elements functioning as part of the urban water system, 6.3 Vegetation coverage

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* JCU – creating green corridors Some developers Some individual champions in Council	**Platforms for connecting** *(Semi) Formalised organisations, structures, & processes for coordination and alignment* Professional associations, engage with others outside Townsville	**Knowledge** *Research, science & contextualised knowledge* A lot of studies in Townsville Knowledge exists, a lot needs to be tailored to Townsville context	**Projects and applications** *Experiments, demonstrations, & focus projects* Stadium development to encourage corridors Some new developments Innovation House	**Tools and instruments** *Legislative, policy, regulative, & practice tools* City Plan – incorporates green/blue corridors, not being implemented well Little/no guidance exists for developing green/blue corridors 202020 Vision State Planning Policy Greening Townsville Minimal practical guidance

7. Promote adaptive infrastructure (Indicators 7.1 Diverse fit-for-purpose water supply system, 7.5 Infrastructure ownership at multiple scales)

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

Indicators 7.4 Robust infrastructure, 7.6 Adequate maintenance

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

Indicators 7.3 Integration and intelligent control, 7.2 Multi-functional infrastructure

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* For traditional large-scale infrastructure, only individual champions for green and decentralised infrastructure Council – smart city	**Platforms for connecting** *(Semi) Formalised organisations, structures, & processes for coordination and alignment* Qldwater Directorate – water supply and sewerage	**Knowledge** *Research, science & contextualised knowledge* Little knowledge on maintaining green infrastructure, especially in dry tropics Maintenance for high-risk assets is well understood – only fix when broken	**Projects and applications** *Experiments, demonstrations, & focus projects* A lot of pilot projects, but no learning agenda, reliance on funding injections and ad-hoc projects rather than broader opportunity for change Pilots not getting mainstreamed	**Tools and instruments** *Legislative, policy, regulative, & practice tools* Operation and maintenance guidance for traditional infrastructure, none for decentralised/green infrastructure

Cooperative Research Centre for Water Sensitive Cities


Level 1, 8 Scenic Boulevard
Monash University
Clayton VIC 3800


info@crcwsc.org.au


www.watersensitivecities.org.au