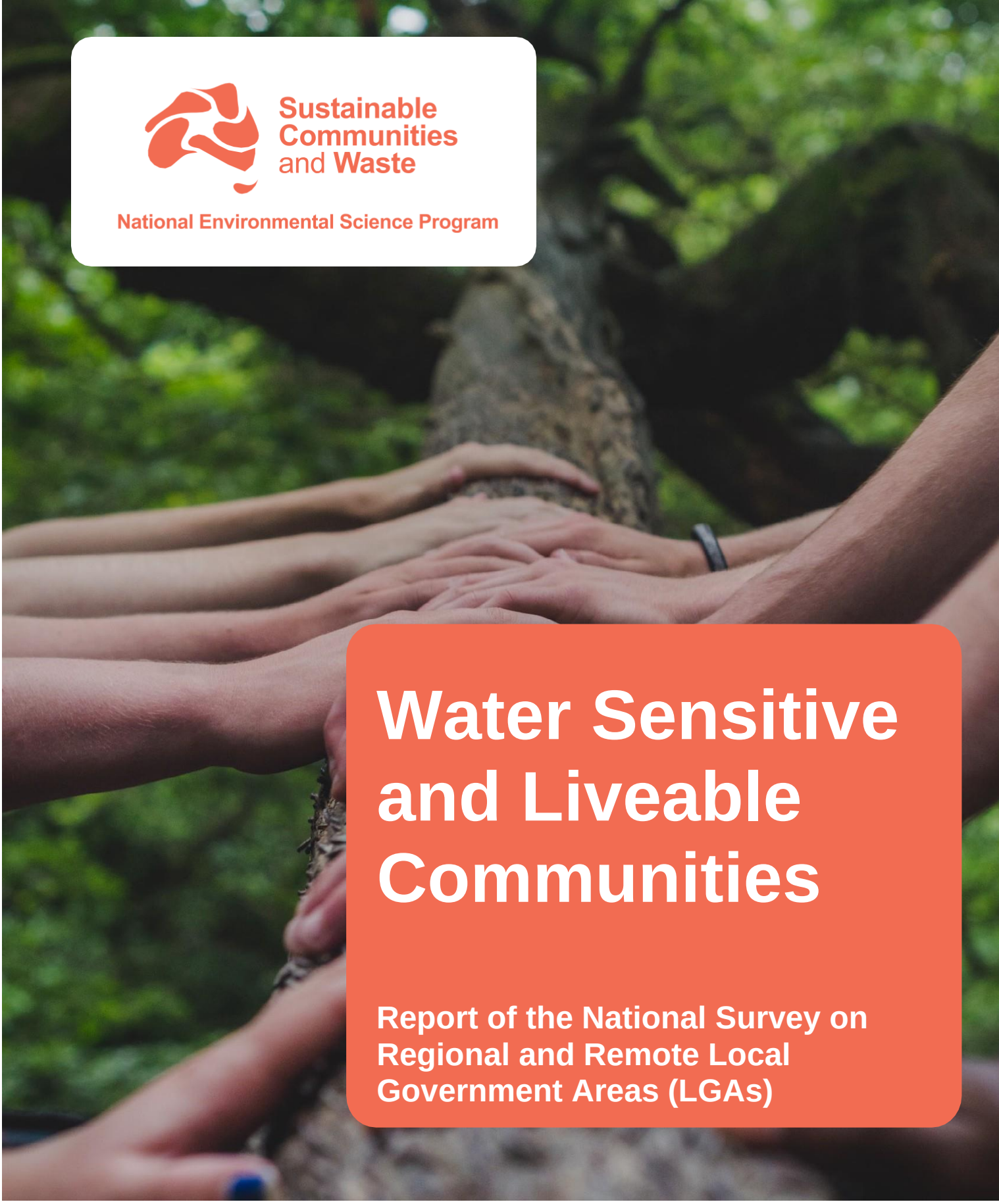

Sustainable Communities and Waste

National Environmental Science Program

Water Sensitive and Liveable Communities

Report of the National Survey on Regional and Remote Local Government Areas (LGAs)

UNSW SYDNEY

CSIRO

MONASH University

Curtin University

UNIVERSITY of TASMANIA

Project IP1.02.02: Water sensitive and liveable communities

Report of the National Survey on Regional and Remote Local Government Areas (LGAs) 2023

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Acknowledgements:
This project is supported with funding from the Australian Government under the National Environmental Science Program.

The project team would like to extend their heartfelt gratitude to all Local Governments participating in this study. Your valuable input and cooperation enabled us to gather meaningful insights and data for the research.

We would also like to express our sincere appreciation to Jeremy Maher from Water Corporation and Md. Ashikuzzaman from Curtin University for their invaluable contributions to this project. Their feedback and support in data analysis were instrumental in enhancing the quality and depth of our research findings.

2023
Funded by the Department of Climate Change, Energy, the Environment and Water (DCCEEW), the research team at Curtin University, Monash University and Commonwealth Scientific and Industrial Research Organisation (CSIRO) jointly conducted this research for the Australian Government. This research is also a part of the Australian Government's National Environmental Science Program (NESP) within the Sustainable Communities and Waste (SCaW) Hub.

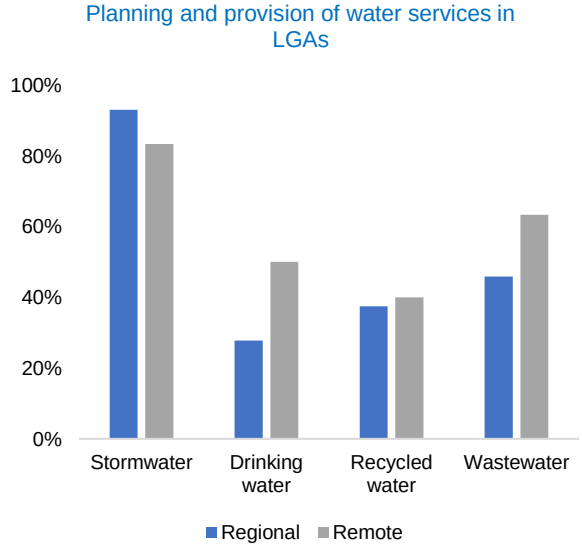
Executive Summary

Background

Amid growing concerns about water scarcity and the increasing frequency of extreme weather events, a significant shift has been reimagining Australian cities and towns as more liveable, resilient, and sustainable. As part of the National Environmental Science Program (NESP) under the Department of Climate Change, Energy, the Environment and Water (DCCEEW), researchers from Monash University, Curtin University, and the Commonwealth Scientific and Industrial Research Organisation (CSIRO) have collaborated on this project to address pressing challenges related to sustainable water management and liveability in regional, rural, and remote areas. This research contributes valuable insights that align with the Australian Government's environmental goals and strategies. The online survey was conducted between May and June 2023 to comprehend the obstacles remote and regional Local Government Areas (LGAs) face in achieving sustainable water management and liveable city outcomes. Additionally, the survey sought to identify crucial research needs that can better support these LGAs, considering their varying circumstances. The target audience comprised 400 LGAs, including 278 regional LGAs and 122 remote LGAs. From this sample, 102 valid responses were received, comprising 72 responses from regional LGAs and 30 from remote LGAs. The study focused on five thematic areas: 1) Roles, responsibilities, and functions of LGAs on urban water management and land use planning; 2) Urban water management situation in LGAs; 3) Urban Heat Management Situation in LGAs; 4) LGA's experience, perspective and familiarity at a local level with current methods, tools and research developed for water sensitive cities and urban heat mitigation and 5) Future priorities for LGAs to achieve more sustainable water management and improved liveability.

Key Findings

1) Roles, responsibilities, and functions of LGAs in urban water management and land use planning

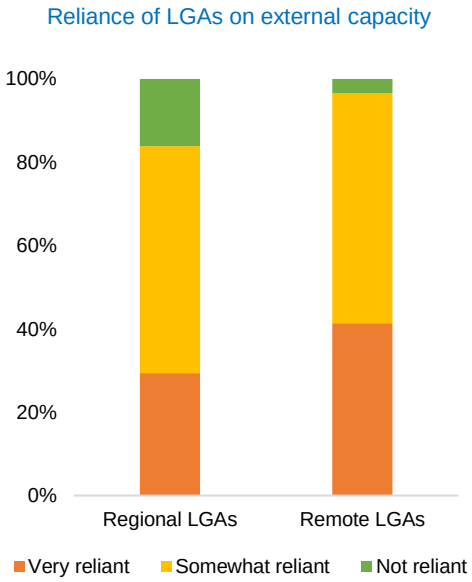


Planning and provision of urban water services

Most LGAs independently handle their stormwater management. However, when it comes to other water management services such as drinking water, recycled water, and wastewater, many regional and remote LGAs rely on external organisations. These services are commonly provided by entities such as the State Government, Water Corporation, Coliban Water, Rio Tinto, and Goulburn Valley Water. Notably, in New South Wales (NSW) and Queensland (QLD), a significant proportion of LGAs (over 80%) independently handle all water-related services, including stormwater management. In contrast, other states lag in managing these services independently, with stormwater management being the exception.

Reliance on external capacity

The aggregated weighted average score indicates that regional and remote LGAs rely to some extent on external resources (to augment internal capacity), such as consultants and advisors, to fulfil their land use and urban water planning responsibilities. However, regional LGAs appear slightly less reliant on external capacity than remote LGAs.

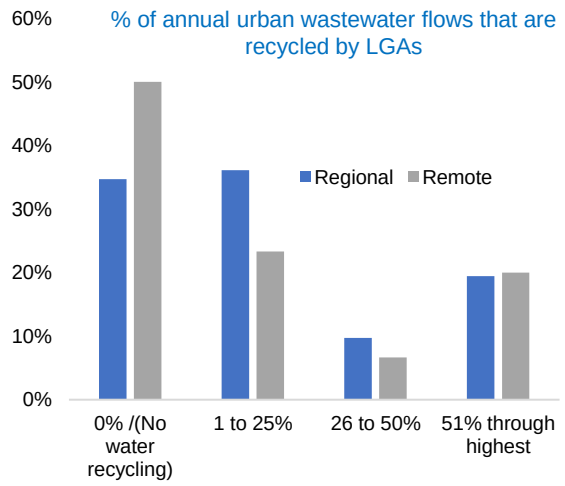


Land use planning and urban water management functions in LGAs

Regarding departmental structure, a notable proportion of regional LGAs (31%) reported a high level of integration between their water management and land use planning functions. Conversely, a similar number of regional LGAs (29%) mentioned a low level of integration between these departments. On the other hand, remote areas often have a single department dealing with water management and land use planning functions.

2) Urban water management situation in LGAs

The analysis shows that over 90% of local government areas can access safe stormwater and wastewater management services. All areas also meet the necessary standards for providing safe drinking water. However, more than 60% of areas lack an integrated water management plan, with noticeable differences in water management aspects. Many areas reported the need for active projects or plans for stormwater harvesting, highlighting the need for more emphasis on sustainable water management practices and promoting water conservation and resilience.



Wastewater recycling

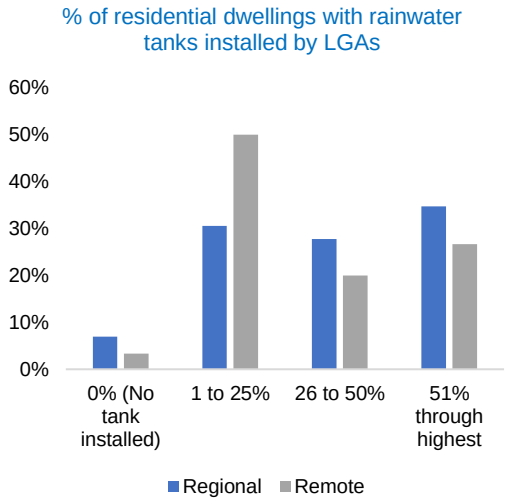
A significant finding is that half of the remote LGAs reported the absence of a wastewater management scheme, resulting in no water recycling practices. Residents typically rely on onsite systems, such as septic tanks or leach drains, for managing wastewater. In regional LGAs, individuals residing in rural areas still depend on septic tanks, while larger towns benefit from a sewerage network. Notably, one council in the regional areas highlighted the existence of an eco-village where residents have independently developed their own wastewater management and water supply system.

Rainwater tank installed in a residential dwelling

Residents in rural and remote areas often rely on rainwater as their primary water source. South Australia has a higher representation of installed rainwater tanks compared to other territories due to the water crisis and drought.

Residential dwellings with tank water for drinking water needs

The analysis shows that tank water is more common in regional towns than remote areas. Remote areas have limited access to tank water, with most relying on untreated rainwater. However, due to aged water infrastructure, regional towns face challenges in maintaining water quality and meeting safety standards.



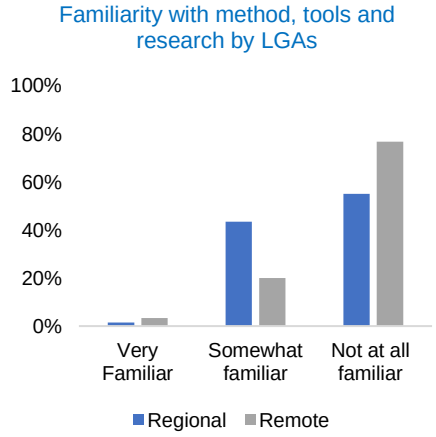
3) Urban heat management situation in LGAs

A notable observation is that participating regional and remote LGAs across Australia must exhibit a significantly advanced position in heat management or urban greening policies. Around 20% of rural LGAs indicated that they had an urban greening policy in place. This suggests a general need for comprehensive policies and initiatives addressing heat management and promoting urban greening across the country's LGAs.

The capacity of heat management and urban greening

Many regional and remote Local Government Areas (LGAs) do not prioritize urban heat management and greening schemes due to their focus on industrial infrastructure and reliance on existing bushlands. Some LGAs have informally committed to tree plantation targets, but formal policies are needed. Certain regional LGAs have developed climate change adaptation plans that include heat management and canopy improvement targets, but there is no separate policy specifically aimed at addressing urban heat management.

4) LGA's experience, perspective and familiarity at a local level with current methods, tools and research developed for water sensitive cities and urban heat mitigation



Familiarity with research in water sensitive cities

Over 75% of remote LGAs and 55% of regional LGAs are not familiar with recent Australian Government-funded research on water-sensitive cities and heat mitigation through blue-green infrastructure. Most LGAs, over 95%, lack awareness of knowledge products for urban heat mitigation.

Familiarity with research in urban heat mitigation

Two-thirds of the LGAs surveyed were unfamiliar with Australian Government-funded research on low-carbon living and urban heat mitigation. However, some of the LGAs familiar with the research mentioned a specific tool called the "Guide to Urban Cooling Strategies" and expressed willingness to incorporate it into their town planning strategies.

5) Future priorities for LGAs to achieve more sustainable water management and improved liveability

Top 10 priority issues identified by the LGAs	Future Research Priorities (in order)
• Climate change and extreme weather events • Urban water supply • Irrigation management • Stormwater system • Local knowledge • Water reuse • Integrated planning • Groundwater usage • Upgrade aged infrastructure • Resource constraints	1. New methods and tools relevant to the local context and capacities of regional and remote communities 2. Adaptations of existing CRC WSC and CRC LCL methods and tools for regional and remote area applications 3. An authoritative national platform for hosting nationally endorsed, locally validated methods and tools and for shared learning Other potential research areas Funding arrangements (mainly for remote LGAs); climate resilient planning; water sensitive urban landscape; ensuring water sensitive good governance; sustainable urban water management and innovation and capacity building.

The way forward

The research aimed to explore the factors that hinder sustainable water management and liveability outcomes in regional and remote areas. It highlighted key differences between urban and non-urban local governments, such as their reliance on consultants and unfamiliarity with urban issues like urban heat. The study also emphasised the need for tailored strategies to address the distinctive characteristics of regional and remote areas in achieving sustainable water management and liveability outcomes.

The way forward involves addressing the unique needs of regional and remote LGAs by tailoring research and tools to their specific contexts, especially regarding water-sensitive practices. Integrating the NRM super-clusters and geographical classifications can help match research outputs with practical needs. While urban tools like the CRCWSC Water Indexing Tool may be too resource-intensive, a streamlined version for rural towns could offer valuable insights. Most importantly, acknowledging First Nations' cultural water knowledge is essential for promoting sustainable water management. Collaborative approaches with larger utilities and local governments are recommended to enhance service delivery and liveability outcomes.

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1. Background

The global phenomenon of climate change, accompanied by its extensive and proven impacts, including severe climatic conditions, has necessitated the adoption of integrated planning approaches to safeguard human well-being and environmental sustainability (Giles-Corti et al., 2022). Australia recognised as a prominent hotspot for heatwaves (Adnan et al., 2022; Davis & Hanna, 2020), confronts significant challenges in effectively managing these extreme heat events, which adversely affect areas such as food security, human health and mortality, ecosystems, infrastructure, and social cohesion. Moreover, the availability of water resources is also jeopardised by these extreme weather patterns and the impacts of climate change (Frantzeskaki et al., 2022).

Against the backdrop of water scarcity and the prevalence of extreme weather events, there has been a noteworthy shift in conceptualising Australian cities and towns as more liveable, resilient, and sustainable entities (Shelton et al., 2022). The Australian Government established the Cooperative Research Centre for Water Sensitive Cities (CRCWSC) in 2012 to facilitate this transition process. The primary objective of this initiative is to accelerate and strengthen the continuous endeavours towards establishing sustainable urban environments that prioritise effective water management (T. H. F. Wong et al., 2013). The CRCWSC embarked on a comprehensive programme, collaborating with various partners, including state governments, local governments, water utilities, and other stakeholders. The CRCWSC aimed to conceptualise and promote water-sensitive urban design principles (WSUD) through this collaborative effort. The initiative sought to create holistic and innovative approaches to urban water management, integrating various aspects such as stormwater management, water reuse, and green infrastructure (Iftekhar & Pannell, 2022; Wong et al., 2020). Notable advancements have been made by metropolitan cities throughout Australia regarding sustainable water management, leading to enhanced urban liveability outcomes. However, it is essential to note that certain regions, particularly remote and regional towns, continue to face challenges and need further improvements. The remote and regional Local Government Areas (LGAs) encounter obstacles in implementing sustainable water management practices and achieving liveable city outcomes, primarily due to limited exposure to available tools, resources, and capacities.

Research has indicated that in many remote communities around Australia, the water and wastewater facilities fail to match the standards that urban residents would typically expect (Delany-Crowe et al., 2019). The remote First Nation Communities often have no access to water that is safe to drink and of acceptable quality to use for household activities, leading to adverse health outcomes and reduced liveability. In addition to that, the water governance arrangement in many of these small towns is cumbersome and deficient in terms of accountability (Vanweydeveld, 2020). Across much of the country, the policy and legislation governing the distribution of water to regional and remote communities is less robust and of lesser quality compared to metropolitan areas (Infrastructure Australia, 2019). To narrow the disparity, multiple water reform initiatives are currently underway to ensure the provision of clean drinking water, encompassing efforts to improve water quality and enhance water security (Vanweydeveld, 2020). The Committee on Aboriginal and Torres Strait Islander Water Interests was formed in 2020, to give Aboriginal and Torres Strait Islander Peoples an equal voice in Australia's water planning and management. The committee aims to raise awareness

of and protect their water rights and interests (Australian Government, 2023). It further encourages the federal, state, and tertiary governments to collaborate with First Nation Peoples in the co-design and engagement of water management, ownership, and governance. This collaboration should prioritise the principle of free, prior, and informed consent in relation to Indigenous Cultural and Intellectual Property (ICIP) rights (Australian Government, 2023; Schultz, 2020). This research aims to comprehensively examine the factors that impede regional and remote LGAs from effectively delivering sustainable water management and enhancing urban liveability considering local context and values.

This research initiative was undertaken collaboratively by Curtin University, Monash University, and the Commonwealth Scientific and Industrial Research Organisation (CSIRO), with funding provided by the Department of Climate Change, Energy, the Environment, and Water (DCCEEW). The Australian Government commissioned the project as part of the National Environmental Science Program (NESP) under the Sustainable Communities and Waste (SCaW) Hub. This collective effort aimed to address critical issues related to sustainable water management and liveability outcomes in regional and remote areas, contributing valuable insights to support the Australian Government's environmental goals and strategies.

The research project involved conducting organisational surveys with regional and remote LGAs across Australia. These surveys were carried out during the period from May to June 2023. The primary objective of the surveys was to gain a comprehensive understanding of the challenges remote and regional LGAs face in achieving sustainable water management and enhancing liveable city outcomes. Furthermore, the study aimed to identify critical research needs that could effectively support these LGAs in overcoming their specific challenges and promoting more sustainable and liveable communities in their respective regions. The research project focused on several critical aspects of LGAs in regional and remote areas. These aspects included:

- Functions of LGAs: The study sought to understand the roles and responsibilities of LGAs in regional and remote settings, particularly in urban water and heat management. This involved examining how LGAs manage various water services, such as drinking water supply, wastewater management, stormwater drainage, and urban heat mitigation.

- Current Status of urban water and heat management: The research aimed to assess the current state of urban water management and heat mitigation in regional and remote LGAs. This included evaluating the existing infrastructure, planning instruments, and overall capacity of the LGAs to manage water resources and address urban heat challenges effectively.

- LGA's familiarity with available tools and methods: The study explored the level of familiarity that LGAs in regional and remote areas had with various tools and methods related to water and heat management. This included investigating their awareness and usage of research outputs and practical tools provided by organisations like the CRCWSC.

- Future priorities for improved sustainability and liveability: The research project aimed to identify the priority areas that regional and remote LGAs considered crucial for achieving more sustainable water management and improved liveability outcomes. This involved understanding the challenges and needs of these LGAs and their vision for future development and resilience in the face of climate change and other environmental factors.

By addressing these aspects, the research project aimed to provide valuable insights into the unique challenges faced by regional and remote LGAs and help develop appropriate strategies and policies to support their transition towards more water-sensitive and liveable communities outside major cities in Australia.

2. Water Sensitive and Liveable Communities

A water sensitive city is characterised by its transformation into a reliable, liveable, productive, and sustainable urban environment. Achieving this transition necessitates significant changes in water system planning, policies, structures, culture, and practices (Hammer et al., 2020). In this regard, T. Wong et al. (2013) identified three pillars that define water sensitive cities:

- A potential water supply catchment with diverse fit-for-purpose water sources for various uses.
- Functional ecosystem services that offer versatile social, economic, and ecological benefits.
- Knowledgeable and aware water sensitive communities actively involved in decision-making and exhibiting positive behaviour towards conserving water usage.

The Urban Water Transition Framework developed by Brown et al. (2009) outlines six individual development states that every city undergoes while transitioning towards becoming water sensitive. These stages include the "water-supply city," "sewered city," "drained city," "waterways city," and the "water-cycle city," ultimately culminating in the "water-sensitive city" (Figure 1). However, this transition is more complex and linear, as each city has distinct hydrology, climate, topography, urban infrastructure, and socio-cultural perspectives. Thus, successful water sensitive transitions require tailored and context-specific developments, considering local cultures, traditions, and socio-political structures. It necessitates collective and collaborative efforts involving various stakeholders from government, industry, and the community (Hammer et al., 2020; van der Meulen et al., 2023).

Figure 1: Thematic presentation of water sensitive cities vision
(Brown et al., 2009; Wong et al., 2020)

In Australia, local governments hold a significant role as planning authorities and managers of roads, lands, and public spaces in water resource management and land use planning. Enabling these local governments and authorities is crucial to accelerate the transition towards improved water management and green cities (Catchlove, 2020). The CRCWSC has undertaken extensive research initiatives and developed a comprehensive framework to expedite this transition process. It proposes fostering a collective and collaborative shared vision among diverse stakeholders for an aspired water-sensitive future. Although cities and towns across Australia face unique challenges, targets, and priorities, the CRC framework articulates these contextual differences under broader themes for a collective vision of future Australian water sensitive cities (Hammer et al., 2020; WSTN, 2019). These themes include governance (supporting policy, standards, regulations, and legislation changes); urban metabolism (measuring urban water trajectories and resource recovery options for more efficient water use); urban liveability (integrating urban planning and water sensitive outcomes, such as urban heat management, green infrastructure, and climate change mitigation); environment (enhancing urban waterways and natural ecosystems); circular economy (wastewater recovery and recycling at different stages); essential services (ensuring easy, safe, and effective operation and maintenance of water-sensitive assets); and community engagement (fostering a collaborative working environment involving community members and reflective water-sensitive planning that considers local contexts).

The CRCWSC has developed several tools to assess the transition of cities towards water sensitivity and measure their overall water-sensitive performance. Considering various water servicing variables, these tools offer valuable insights into sustainable urban water management. Some of the notable tools include:

a) Water Sensitive Cities Index Tool: This benchmarking tool allows cities to evaluate their water sensitivity levels against a range of societal, biophysical, and ecological indicators related to seven water sensitive index goals. These goals encompass resource efficiency, water governance, equity, community capital, quality urban space, ecological health, and adaptive infrastructure (Rogers et al., 2020). The tool utilises a certified assessment methodology based on 34 indicators, enabling city authorities to identify their strengths, weaknesses, and areas of improvement to achieve water-sensitive targets.

b) Water Sensitive Cities Scenario Tool: This online computer modelling tool leverages Geographic Information System (GIS) data to generate various water sensitive development options. This powerful tool produces real-time scenarios with different water-sensitive development options by utilising baseline geospatial data, such as land cover, meteorological data, building footprints, or any customised data the operator provides (Chandrasena & Zhu, 2021). It assists cities in making informed decisions by analysing the comparative effectiveness of various water sensitive features.

c) Water Sensitive Cities Benefit-Cost Analysis Tool (INFFEWS): The INFFEWS tool assesses the cost and potential benefits of projects to determine their feasibility for implementation (Pannell, 2020). It employs a comprehensive process that logically integrates various monetary and non-monetary data to evaluate the benefits of water investments made by cities. Considering that blue-green infrastructure development projects often involve multiple stakeholders at the local government level, this tool is

specifically designed to assess the distribution of costs and benefits shared among all stakeholders involved.

By employing these sophisticated tools, cities can make more informed decisions, optimise water sensitive planning, and enhance their overall water management performance, contributing to more sustainable and resilient urban environments. In addition to the tools related to water sensitivity, there are also tools available in the context of low-carbon living and urban heat mitigation that can aid local governments in making well-informed decisions at the local level. For instance, the Microclimate and Urban Heat Island Mitigation Decision-Support Tool utilises Geographic Information System and Building Information Modelling data to measure urban heat island impacts at both building and precinct levels. Similarly, the Urban Heat Island Mitigation Index supports local governments by offering a wide range of urban heat island mitigation options, including considerations of outdoor thermal comfort, health risks, energy, and water demand (Ding et al., 2019). The Guide to Urban Cooling Strategies also offers valuable guidelines for professionals and regulatory bodies, including local governments, to optimise development projects with urban heat mitigation initiatives in mind. This tool provides practical guidance regarding processes and products (Osmond & Sharifi, 2017).

3. Survey Design and Research Methodology

LGAs' participation in the survey involved submitting a coordinated response to the online questionnaire on behalf of their respective organisations, addressing various aspects related to water sensitive and liveable communities.

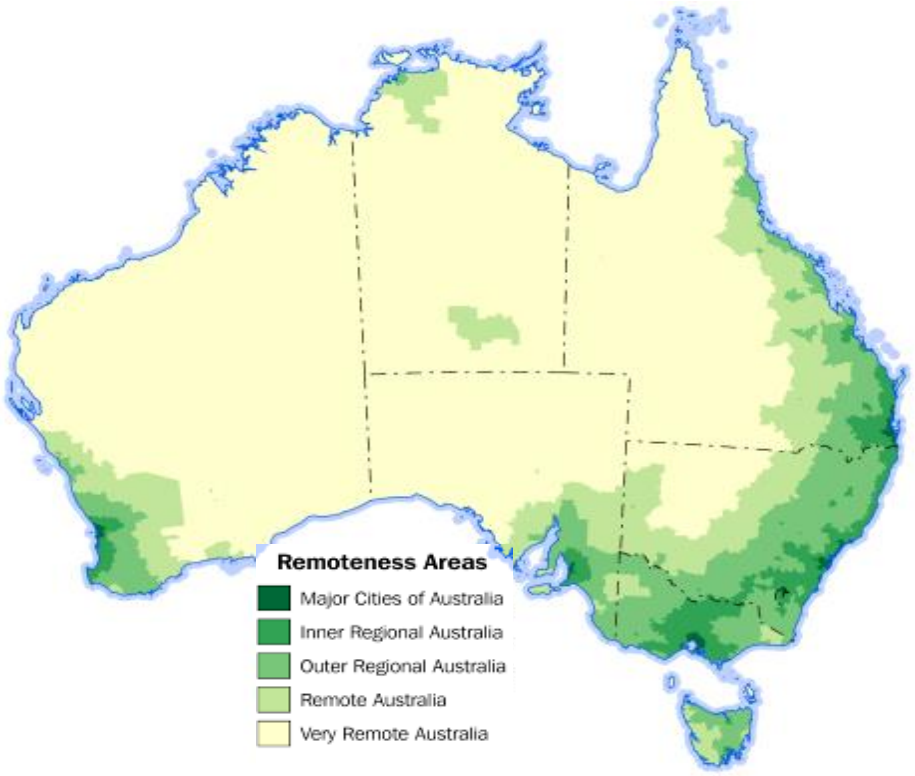


Figure 2: Remoteness structure of Australian Local Government areas
[Source: Australian Statistical Geography Standard (ASGS) Volume 5 – Remoteness Structure]

This response provided insights into their experiences, challenges, current situation, and future potential regarding water sensitive practices. According to the Australian Statistical Geography Standard (ASGS) Edition 3, there are 566 LGAs across Australia, encompassing 19 particular purposes, both incorporated and unincorporated, and outside the Australian code. Additionally, the ASGS Remoteness Structure further classifies these LGAs into five categories based on relative geographic remoteness: major cities, inner regional, outer regional, remote and very remote areas (Figure 2).

A targeted approach was adopted for this survey, focusing on regional and remote areas. Out of the total 566 LGAs, the study aimed to include 400 LGAs in its sample. This sample consisted of 278 regional LGAs and 122 remote LGAs. The selection of regional and remote LGAs allowed for a more specific and relevant exploration of water sensitive and liveable communities in areas with distinct geographic and socio-economic characteristics.

An online questionnaire was developed on the Qualtrics platform hosted by Curtin University. The survey instrument adopted a blended approach to address multiple research themes, utilising diverse response formats to collect extensive data. Prior to conducting the study involving human subjects, an ethics application was submitted to the Ethics Review Committee at Curtin University. The study received approval from the Human Research Ethics Committee (HREC) under the designated approval number HRE 2023-0108. This rigorous ethical review process ensured that the research adhered to ethical standards and upheld the rights and welfare of the participating LGAs throughout the entire study duration.

The survey involved a self-administered questionnaire, in which LGAs responded to a set of questions categorised under the following themes:

a) Roles, responsibilities, and functions of participating LGAs in urban water management and land use planning.
b) Urban water management situation, including challenges and prospects in LGAs.
c) Urban heat management situation in LGAs.
d) LGA's experience, perspective, and familiarity at a local level with current methods, tools and research developed for water sensitive cities and urban heat mitigation.
e) Future priorities for LGAs to achieve more sustainable water management and improved liveability.

The questionnaire aimed to obtain comprehensive information regarding the organisational structure of LGAs and their responsibilities in delivering water management and land use planning services. Subsequently, the LGAs were required to respond to inquiries about ample drinking water and stormwater management perspectives. This section specifically focused on the current situation and identified significant challenges the LGAs face in addressing urban water management issues.

In the third section of the questionnaire, the LGAs were requested to furnish details about their plans and activities to address challenges related to urban heat mitigation. Additionally, community-level information was incorporated to assess how individuals protect themselves during hot summers. Numerous research initiatives funded by the Australian Government were undertaken to develop tools and methodologies for water-sensitive urban design, urban

heat management, and low-carbon living. Section four of the questionnaire primarily aimed to gauge the level of knowledge and adoption of these available tools at the local level.

Finally, the LGAs were invited to provide research topics they considered vital for effectively supporting transitions towards more sustainable water management and improved liveability for regional and remote urban settlements. This valuable input would help identify key areas requiring further investigation and guide future research endeavours to address the specific needs and challenges these LGAs face in their pursuit of water sensitive and liveable communities.

3.1 Survey implementation and follow-up

The online survey was conducted between May and June 2023. The Curtin Qualtrics platform provided a convenient and efficient method for administering the survey to the targeted participants, comprising 400 regional and remote LGAs. Each LGA received the survey link along with comprehensive project summary information. The invitation email explicitly outlined the survey participation process, ensuring clarity and ease of understanding.

The research team proactively communicated with the LGAs over the phone to further support and encourage participation. This personal approach aimed to motivate and assist LGAs in completing the survey. In cases where LGAs encountered challenges filling out the online questionnaire, they were offered the option to respond to the survey over the phone. A dedicated research assistant was assigned to facilitate phone communication during the survey, ensuring smooth and effective interactions.

By employing this comprehensive approach, the research team maximised survey participation and obtained valuable insights from the targeted regional and remote LGAs. The combination of online and phone-based survey administration allowed for flexibility and convenience, enabling LGAs to provide their input in a manner that suited their preferences and circumstances.

3.2 Data analysis and reporting

The research team utilised various statistical tools to analyse the data and draw meaningful insights, including SPSS and Excel. Descriptive analysis techniques such as frequency count, percentage, and contingency tables were employed to represent survey data for both regional and remote LGAs.

For specific analyses related to the Likert scale and weighted average score index, the team calculated measures to gauge LGAs' positions in urban water and heat management. These analytical approaches provided comparative and relative information about the perceptions and priorities of the participating LGAs.

Additionally, qualitative analysis was necessary to interpret and understand the statements provided by some LGAs when describing their existing challenges and future priorities. The research team coded and grouped this qualitative information under specified themes, allowing for a comprehensive presentation of the context.

GIS maps were developed to enhance the visualisation and spatial representation of the findings. These maps provided a visual depiction of the survey data, enabling a better understanding of the geographical distribution and patterns of water sensitive and liveable practices among the regional and remote LGAs.

4. Survey Findings

4.1 Locational profile

Among the 400 regional and remote LGAs, 102 LGAs participated in the online survey. The distribution of responses indicated that 71% of the participating LGAs were from regional areas, while the remaining 29% represented remote LGAs (Figure 3). In terms of state-wise responses, the highest number of responses were received from Western Australia (WA), followed by Queensland (QLD), Victoria (VIC), New South Wales (NSW), and South Australia (SA). Tasmania (TAS) and the Northern Territory (NT) received the lowest number of responses (Figure 4).

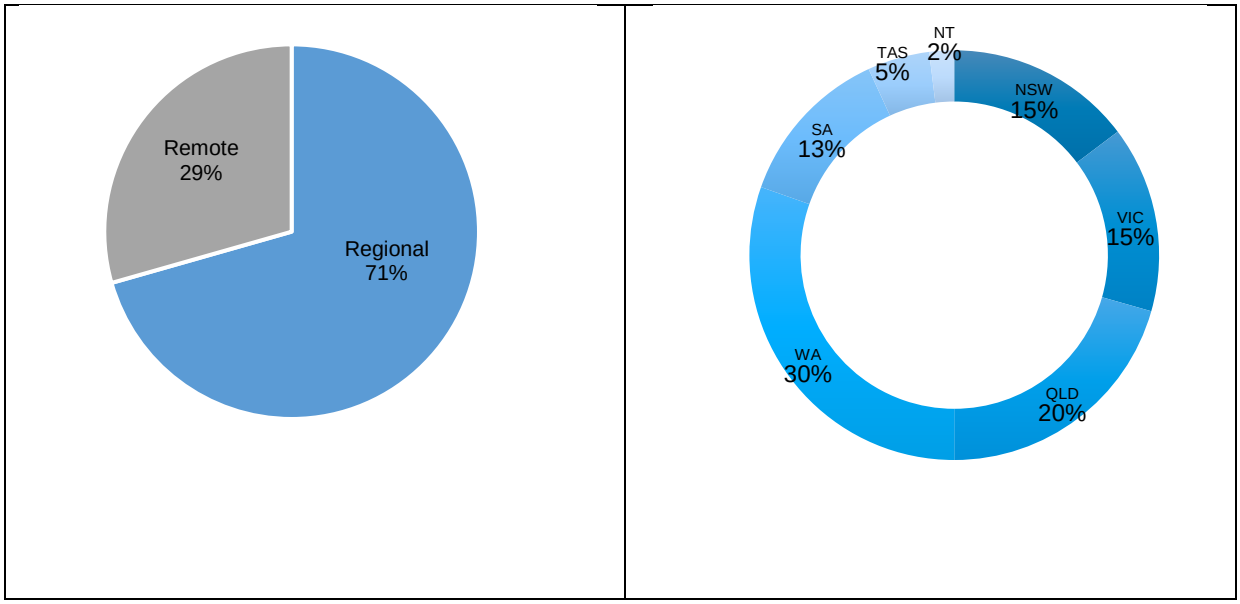


Figure 3: Locational distribution of survey response (Remoteness and State wise)

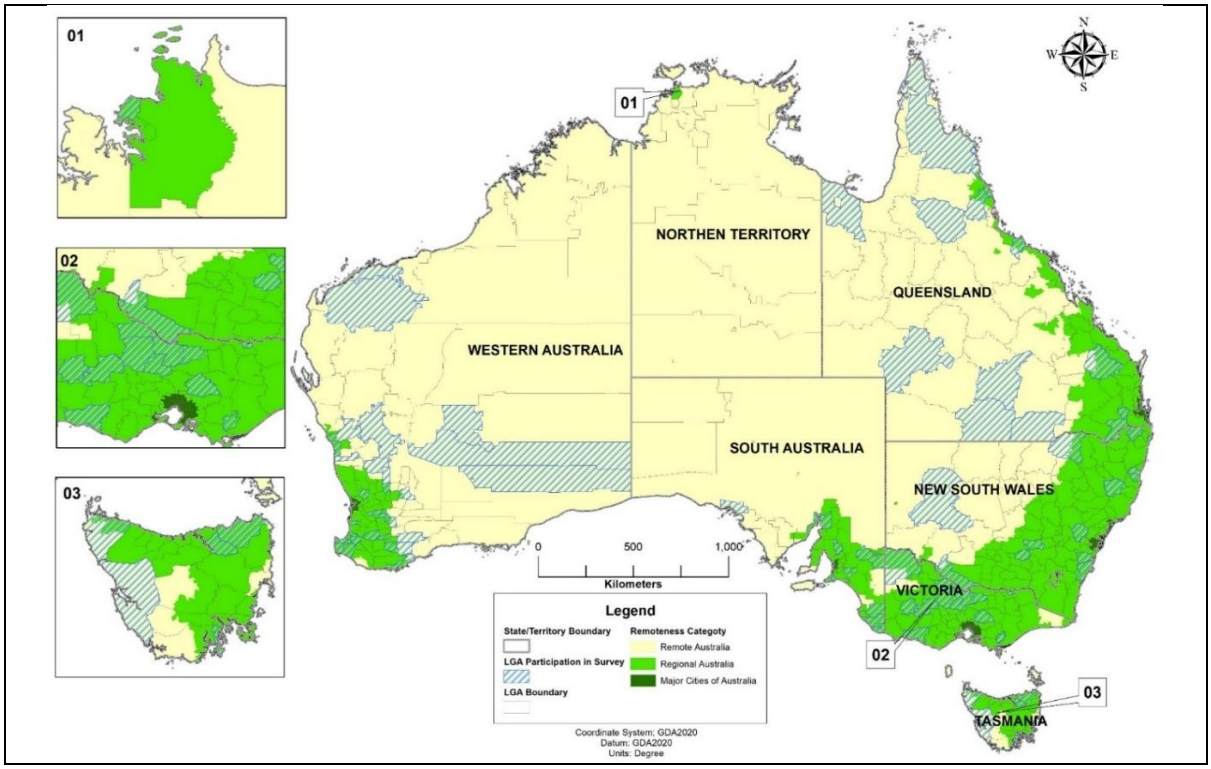


Figure 4: Geographical distribution of participating LGAs in the national survey.

4.2 An overview of current urban water management status

The overall urban water management status of the studied regional and remote LGAs was assessed, considering various factors, such as the availability of planning instruments, capacity, and infrastructure. Six key factors were considered and utilised to calculate an overall score that reflects their current status, as outlined in Table 1. These factors were carefully chosen to capture the essential components influencing urban water management in these regions.

Table 1: Methods applied to calculate aggregated urban water management score.

	Factor	Presence	Absence
F1	Have an integrated Urban Water Management plan	1	0
F2	Have an active collaborative network of institutions	1	0
F3	Have access to a safe and secure drinking water service designed and operated to the relevant standard	1	0
F4	Have access to a safe and secure wastewater management service designed and operated to the relevant standard	1	0
F5	Have formal stormwater drainage designed and operated to the relevant standard	1	0
F6	Have any stormwater harvesting projects planned for and currently operating	1	0

Each factor was scored on a scale of 0 to 1, with a higher score indicating a more robust presence or implementation of the respective element[1]. An aggregate score was calculated by summing up the scores of these six key factors (Equation 1), providing a quantitative representation of the urban water management status among the regional and remote LGAs. This approach allowed for a comprehensive and standardised assessment, enabling comparisons and insights into the water management performance of the studied LGAs.

$$LGA\ Score = \frac{\sum(F_1 + F_2 + \ldots\ldots\ldots + F_6)}{N} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where, F = Individual Factor value; N= Total number of factors

The calculated scores were utilised to categorise LGAs into five groups, with lower scores indicating poor water management and higher scores representing a more favourable management status. The analysis revealed that approximately half of the regional LGAs received a medium score falling within the range of 0.41 to 0.60, which was marginally higher than the scores observed in remote areas, as depicted in Figure 5. Moreover, it was noted that nearly 18% of the regional LGAs achieved almost the maximum score possible, signifying their successful fulfilment of all the factors enumerated in Table 1. This observation highlights strong water management practices in these particular LGAs.

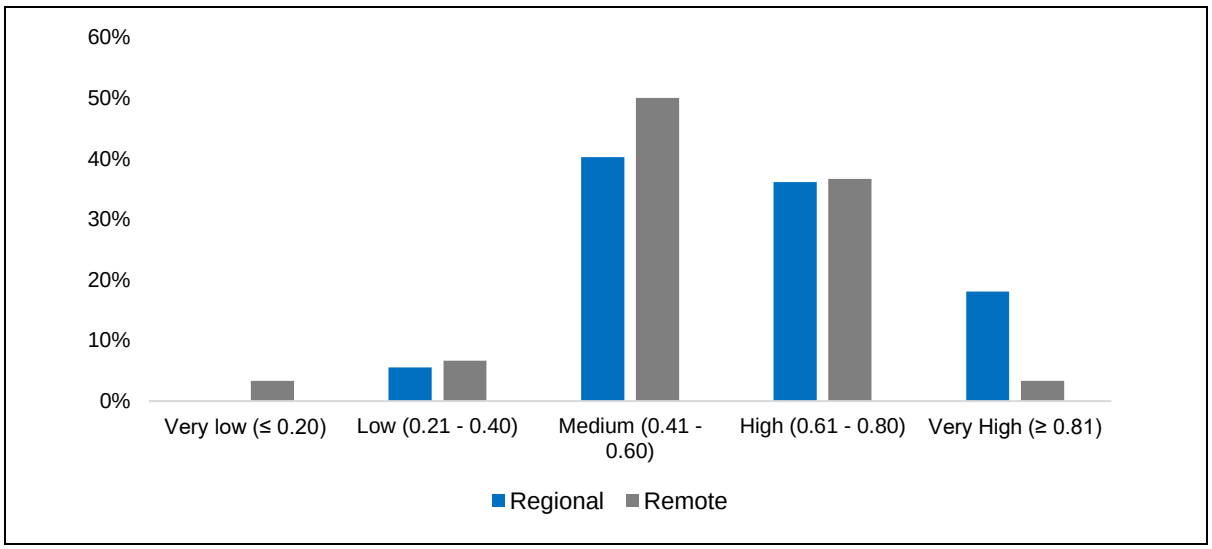


Figure 5: Water management score in regional and remote LGAs

The spatial distribution of urban water management scores further reveals a higher concentration of higher scores among studied LGAs in Victoria and South Australia (Figure 6).

[1] The overall performance of the LGAs against each factor can be found in Appendix 1.

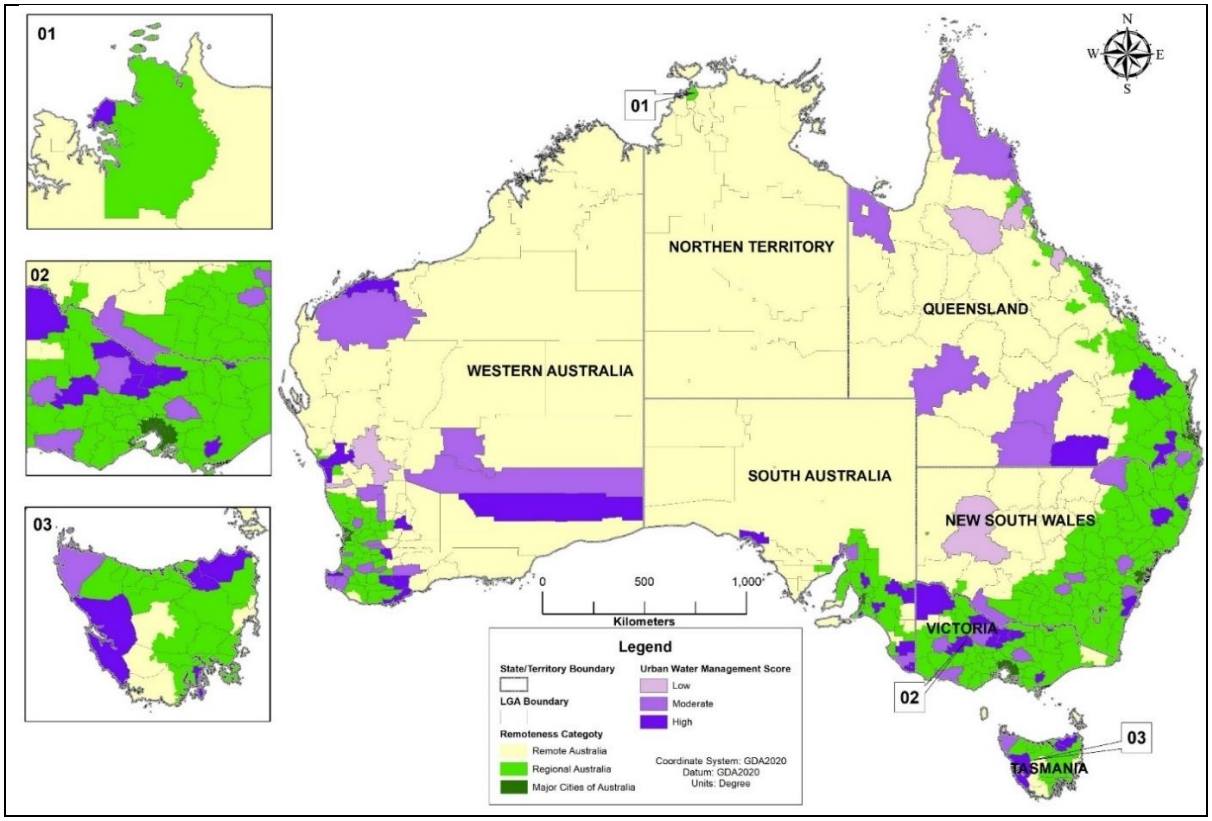


Figure 6: Spatial distribution of LGAs with water management score

4.3 Roles, responsibilities, and functions of LGAs in urban water management and land use planning

From the survey, it is clear that LGAs understand the necessity of an integrated water management plan. The majority of them already have one, and a significant portion are in the process of developing their strategy. Some LGAs also replied that they have allocated a budget and working with the state government to create an integrated plan. It has also been observed that some LGAs have separate programmes for different water services, such as recycled wastewater management plans, water management for agricultural land or drinking water supply system etc. However, they still feel that to have one integrated plan combining all the water components. In addition, collaborative networks between organisations with shared responsibilities seem less in some cases. Unfortunately, several LGAs mentioned coordination and information sharing between the organisations that urged reinvigorating. The governance arrangements and institutional processes employed by the LGAs in managing their water services and urban development decision-making play a crucial role in achieving comprehensive water sensitive and liveable outcomes. These arrangements encompass a mix of formal and informal structures and systems that shape how LGAs approach water management and urban development.

The research findings indicate that, except for stormwater management, many LGAs often rely on external capacity to provide various other water services for their residents. This highlights the importance of considering the roles played by all relevant actors in discussions about water sensitive governance planning and their effective incorporation into the decision-making processes. To successfully achieve water sensitive and liveable outcomes, LGAs must engage in thoughtful governance practices involving a wide range of stakeholders. This includes the LGAs and external entities, such as water authorities, environmental agencies, community organisations, and private sector stakeholders. Emphasising inclusive and collaborative decision-making processes can facilitate the integration of diverse perspectives, expertise, and resources.

Considering these findings, water sensitive governance planning should prioritise establishing partnerships and meaningful engagement with various stakeholders. By incorporating a comprehensive array of perspectives and expertise, LGAs can effectively address the multifaceted challenges of urban water management and urban development. Such an approach is essential to creating sustainable, water sensitive, and liveable urban environments that align with their communities' diverse needs and aspirations.

4.3.1 Planning and provision of urban water services

Most LGAs independently handle their stormwater management (Figure 7). However, when it comes to other water management services such as drinking water, recycled water, and wastewater, many regional and remote LGAs rely on external organisations. These services are commonly provided by entities such as the State Government, Water Corporation, Coliban Water, Rio Tinto, and Goulburn Valley Water. Notably, in New South Wales (NSW) and Queensland (QLD), a significant proportion of LGAs (over 80%) independently handle all water-related services, including stormwater management. In contrast, other states lag in managing these services independently, with stormwater management being the exception.

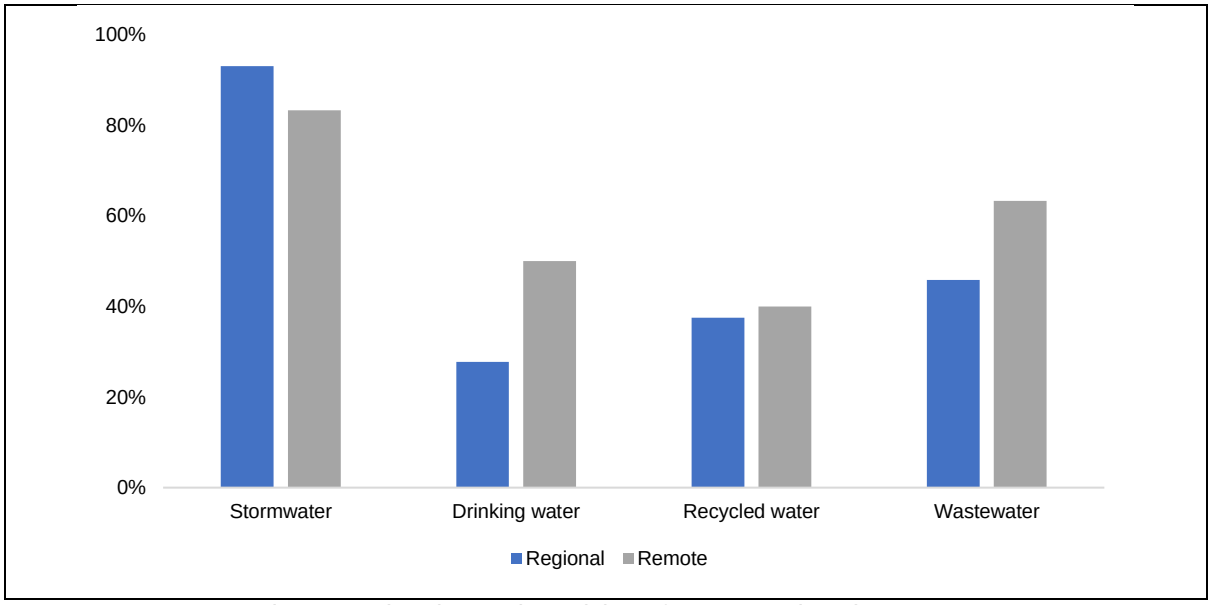


Figure 7: Planning and provision of water services in LGAs.

4.3.2 Reliance on external capacity

LGAs often rely on external resources, such as consultants and advisors, to augment their internal capacity in fulfilling their land use and urban water planning responsibilities. The degree of dependency on external resources was measured using a 3-point scale. LGAs that operate independently and handle all functions through their internal capacity were assigned the highest value of 3, signifying self-reliant entities. On the other hand, LGAs heavily dependent on external resources received the lowest value of 1, representing an increased reliance on external support.

To calculate the weight of these values, Equation 2 was applied. This approach allowed for quantifying the extent to which LGAs depend on external assistance, offering valuable insights into the level of self-sufficiency in land use and urban water planning functions.

$$Weighted\ Reliance\ Index\ (WRI) = \frac{\sum(n_1 f_1 + n_2 f_2 + \ldots\ldots\ldots + n_n f_n)}{N} \ldots\ldots (2)$$

Where, n = rank order; ƒ = frequency and N = total number of responses

Table 2: Weighted Reliance Index to measure reliance on external capacity.

Level of reliance/ rank order (n_n)	*Response (f)*		*Weighted Value (n x f)*	
	Regional LGAs	*Remote LGAs*	*Regional LGAs*	*Remote LGAs*
Very reliant (1)	20	12	20	12
Somewhat reliant (2)	37	16	74	32
Not reliant (3)	11	1	33	3
Total Response (N)	68	29	127	47
Weighted Index (WI)			**1.87**	**1.62**

The weighted average score presented in Table 2 suggests that regional and remote LGAs rely to some degree on external resources to augment their internal capacity. However, regional LGAs exhibit a slightly lower reliance on external ability than remote LGAs, as depicted in Figure 8.

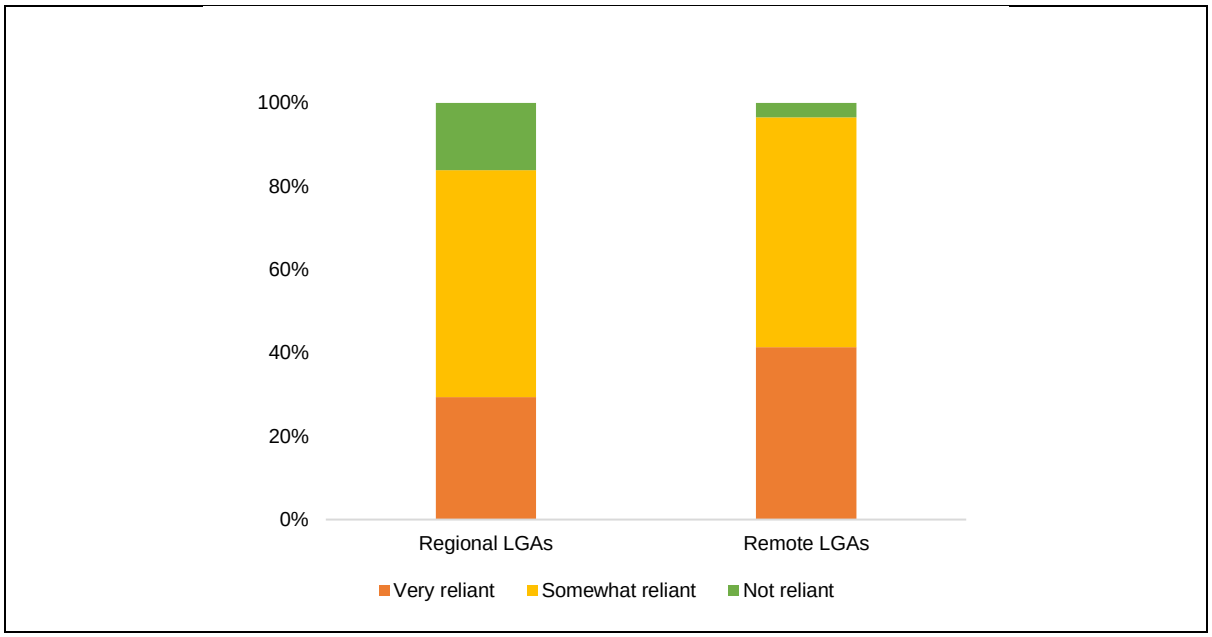
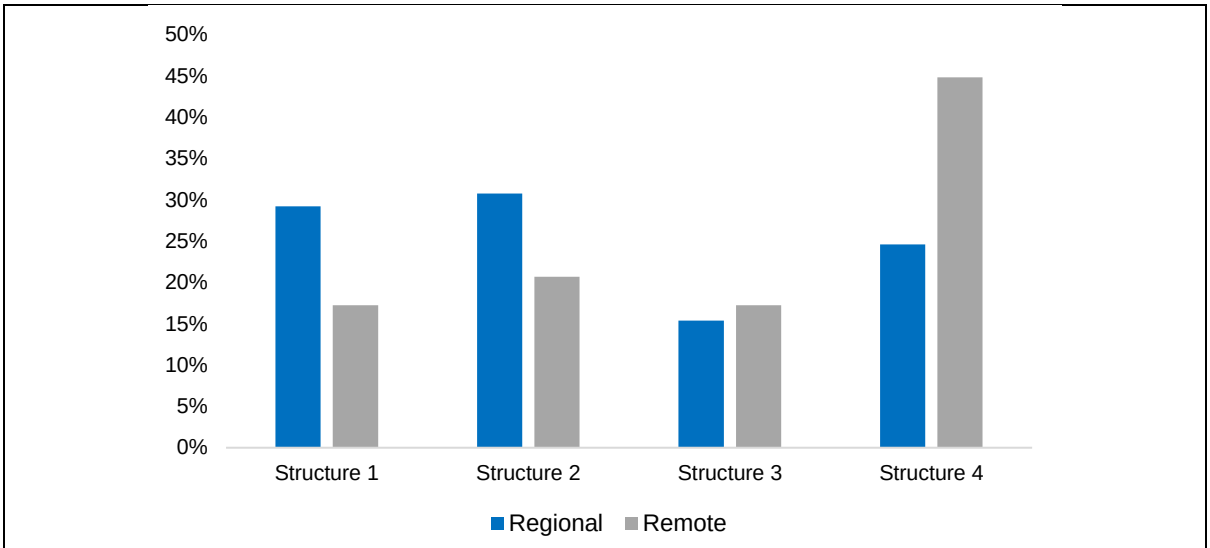


Figure 8: Reliance of LGAs on external capacity

Regarding the specific categories, a few LGAs indicated that they are more inclined to seek external support for water management initiatives. Conversely, these LGAs reported primarily handling land use planning functions internally. This means a strategic approach where LGAs leverage external expertise for certain aspects while maintaining control over other critical planning responsibilities.

4.3.3 Land use planning and urban water management functions in LGAs

Regarding departmental structure, a notable proportion of regional LGAs (31%) reported a high level of integration between their water management and land use planning functions. Conversely, a similar number of regional LGAs (29%) mentioned a low level of integration between these departments (Figure 9). On the other hand, it is observed that remote areas often have a single department dealing with both water management and land use planning functions.



Structure 1 = Separate departments for each function with a low level of integration between departments
Structure 2 = Separate departments for each function with a high level of integration between departments
Structure 3 = Single department with separate line management for each function
Structure 4 = Single department with single line management for both functions

Figure 9: Land use planning and urban water management functions in LGAs

Remarkably, it has been observed that specific LGAs assign drinking water, recycling, and wastewater management responsibilities to their water division. In contrast, stormwater management falls under the jurisdiction of the transport division. This division of duties may result in limited integration of water management practices within these LGAs, as synergies between different aspects of water management still need to be fully realised. Consequently, a fragmented approach to water management could ensue, potentially affecting the overall effectiveness and efficiency of water management efforts in these areas.

Furthermore, a few LGAs have indicated the significant role played by the State Government, where planning and decision-making processes are predominantly centralised at the state level, with local councils having minimal involvement. This centralised approach to decision-making can pose challenges in addressing local water management needs and tailoring solutions to suit the unique characteristics and demands of specific regional and remote contexts.

4.4 Urban water management situation in LGAs

The analysis reveals that a significant majority, over 90%, of regional LGAs have access to safe and reliable stormwater and wastewater management services. All LGAs also reported meeting the necessary standards in providing safe and secure drinking water services to their urban settlements. The situation is similar in remote areas, where access to safe and secure water services is also reported. However, more than 60% of LGAs indicated the absence of an integrated water management plan, highlighting a potential area for improvement. On the other hand, there are noticeable differences in instrumental aspects of water management. Approximately 58% of regional LGAs and 77% of remote LGAs reported the absence of an active collaborative network of institutions for shared responsibilities. Moreover, a significant

number of LGAs, 60% of regional LGAs and 87% of remote LGAs, reported needing an active project or plans for stormwater harvesting. This highlights a need for more emphasis on sustainable water management practices in these areas, indicating the potential for greater attention to promoting water conservation and resilience.

4.4.1 Wastewater recycling

A significant finding is that half of the remote LGAs reported the absence of a wastewater management scheme, resulting in no water recycling practices (Figure 10). Residents typically rely on onsite systems, such as septic tanks or leach drains, in these areas, for managing wastewater. In regional LGAs, individuals residing in rural areas still depend on septic tanks, while larger towns benefit from a sewerage network. Notably, one council in the restricted regions highlighted the existence of an eco-village where residents have independently developed their own wastewater management and water supply system. A committee also reported that they had legalised the system for an environmentally sensitive settlement to receive a confirmation from a certified plumber biannually that the onsite sanitation system has been performing satisfactorily and update the report in the system.

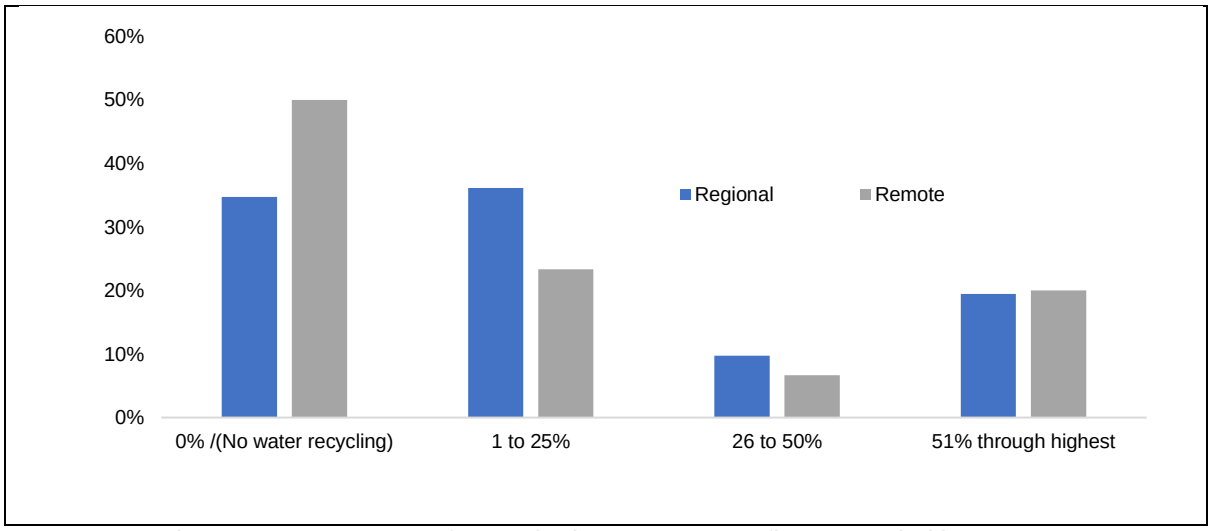


Figure 10: Percentage of annual urban wastewater flows recycled by LGAs.

4.4.2 Rainwater tank installed in residential dwellings

Residents in rural and remote areas often need access to town water supply and instead rely on rainwater as their primary water source. Figure 11 confirms that most settlements in remote LGAs have installed rainwater tanks. In regional towns, there is generally better access to piped drinking water supply; however, LGAs still encourage residents, especially those in smaller towns, to install rainwater tanks.

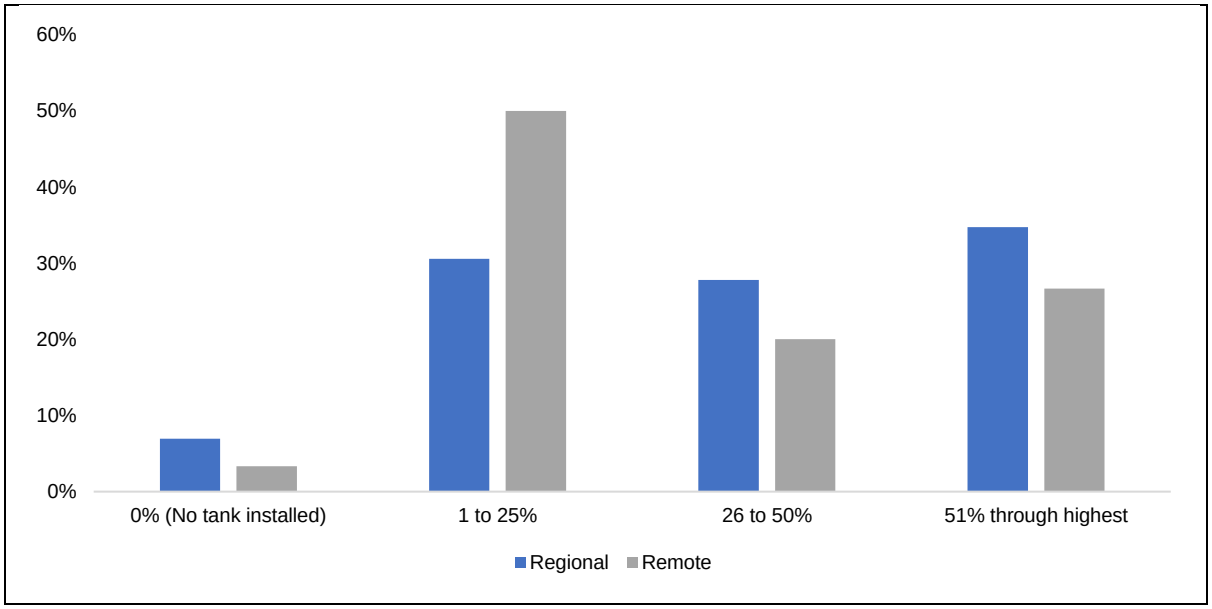


Figure 11: Percentage of residential dwellings with rainwater tanks installed by LGAs.

In South Australia (SA), the statewide representation of installed rainwater tanks is higher than in other territories (Figure 12). This emphasis on rainwater harvesting is driven by the water crisis and drought, identified as significant challenges by the LGAs in the region.

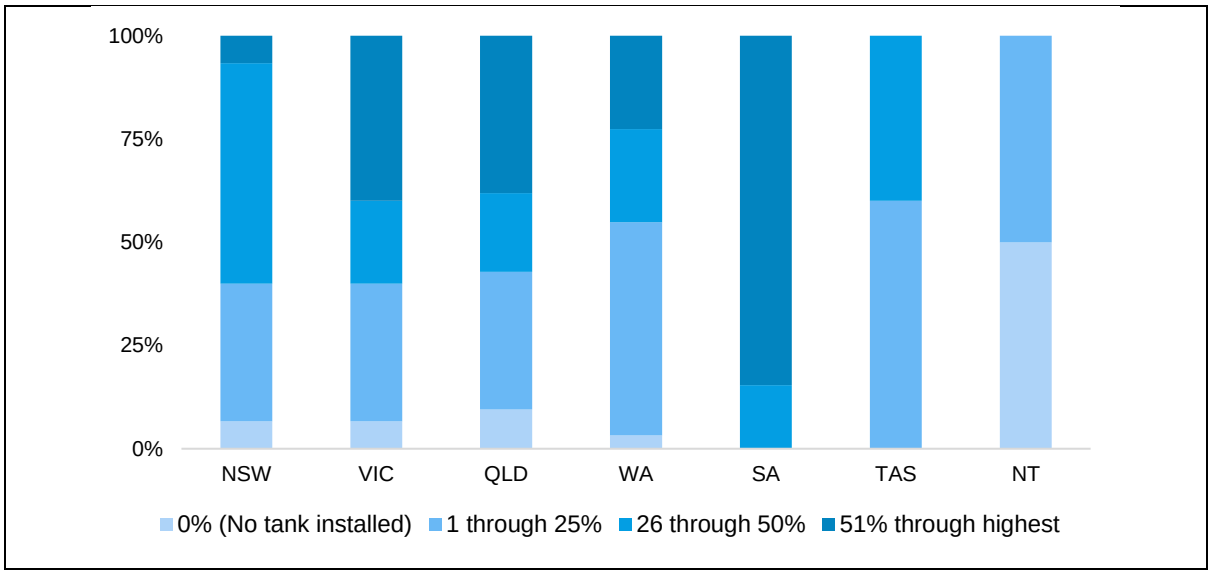


Figure 12: Rainwater tanks installed in residential dwellings (Statewide)

4.4.3 Residential dwelling with tank water for drinking water needs

The analysis indicates that tank water is more prevalent in regional towns than in remote LGAs. All remote LGAs reported having tank water coverage for less than 50% of residential dwellings (Figure 13). In remote areas, access to tank water is primarily limited to individuals living in or near towns. In contrast, others rely solely on untreated rainwater.

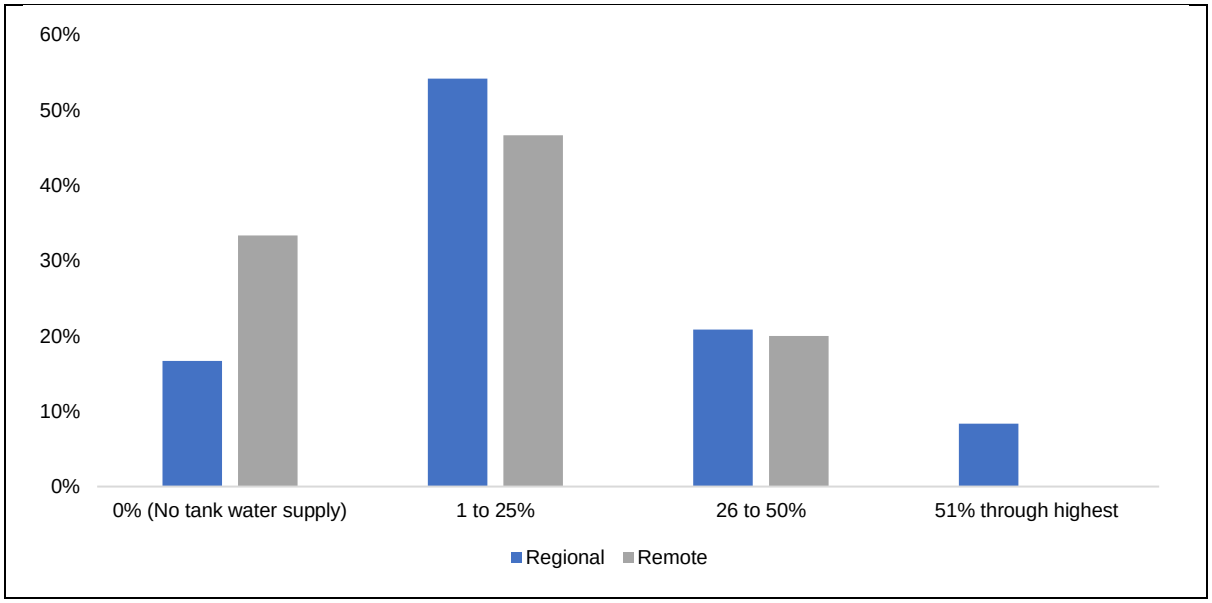


Figure 13: Percentage of residential dwellings relying on tank water for drinking by LGAs.

Although regional towns have better access to tank water, maintaining water quality and meeting the required standards pose challenges. LGAs specifically mentioned aging water infrastructure that needs upgrading to ensure water quality and safety. However, one regional council said they had adopted a drinking water improvement strategy to ensure that all the residents have access to safe drinking water while maintaining the health and safety standard.

Regional towns generally have better access to tank water as a water source. However, ensuring water quality and compliance with the required standards presents significant challenges for LGAs. Specifically, LGAs have mentioned that aging water infrastructure is a primary concern that necessitates upgrading to ensure water quality and safety. This underscores the importance of addressing infrastructure issues to maintain a reliable and safe water supply in these areas.

Despite the challenges, one regional council has proactively addressed the situation. They have adopted a drinking water improvement strategy to ensure that all residents have access to safe drinking water while adhering to the highest health and safety standards. Such initiatives are crucial in enhancing water management practices and promoting the community's well-being.

4.4.4 Stormwater management

An overwhelming majority of regional LGAs, around 90%, and a significant portion of remote LGAs, about 83%, have reported having operational stormwater drainage systems (Figure 14). Most LGAs in both remote and regional areas manage this service independently. However, rural areas tend to need help in terms of coverage area. Typically, town areas have piped network systems, while larger rural areas rely on roadside swales to drain stormwater. This difference in infrastructure highlights the varying approaches taken in managing stormwater drainage based on the size and characteristics of the areas.

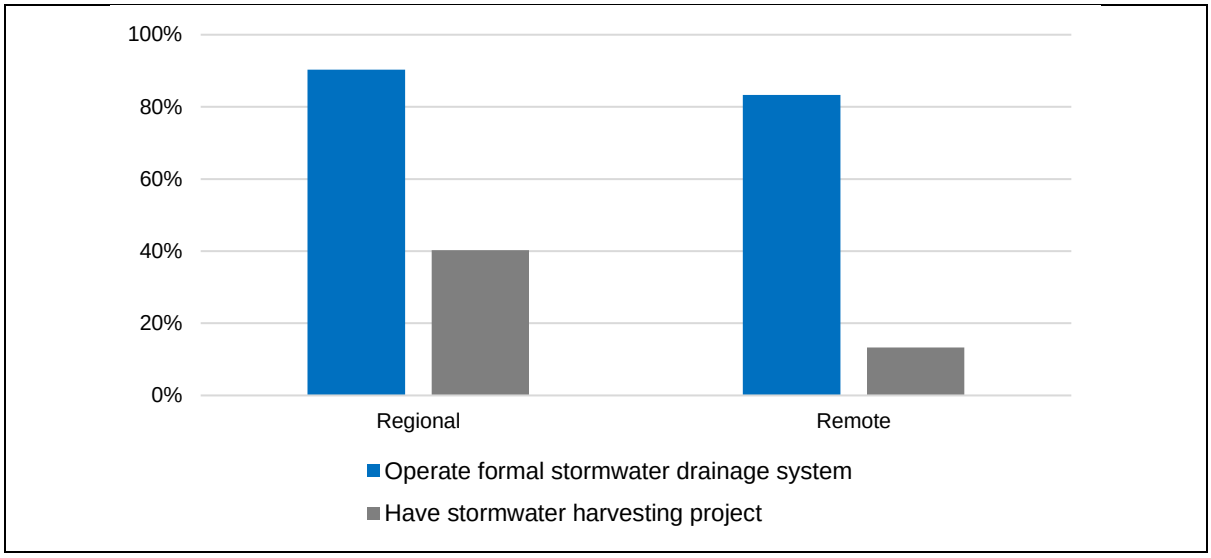


Figure 14: Stormwater management system in LGAs

Many LGAs have raised concerns regarding the functionality and maintenance of these stormwater drainage structures as they age and may need refurbishment to perform optimally. Ensuring that these structures meet relevant standards and continue functioning effectively is paramount.

In remote areas, there is a need for improvement in the presence of stormwater harvesting projects. Only a mere 13% of remote LGAs engage in stormwater reuse. Encouraging and expanding stormwater harvesting initiatives can contribute to more sustainable water management practices and enhance water availability in these regions. The situation in regional areas shows some improvement, as approximately 40% of LGAs have implemented stormwater harvesting projects. In many cases, the harvested stormwater is being reused to irrigate plants in parks and open spaces, demonstrating a sustainable approach to water management. Additionally, some LGAs have constructed dams to store stormwater, which is then utilised in hydrants for firefighting purposes or in agricultural land during the dry season. This highlights the innovative use of stormwater to meet specific needs within the community.

One LGA stands out with an impressive accomplishment, as 50% of their irrigation demand is met through stormwater harvesting. This exemplifies the potential of such projects to contribute significantly to water resource sustainability. Furthermore, a few LGAs have expressed their intention to implement stormwater harvesting projects in the future but are currently seeking funding or in the planning stages. This proactive approach demonstrates the willingness of LGAs to adopt environmentally friendly practices and explore ways to improve water management.

4.5 Urban heat management situation in LGAs

A noteworthy finding from the survey is that most participating regional and remote Local Government Areas (LGAs) across Australia need comprehensive heat management or urban greening policies. Approximately 20% of rural LGAs reported having an urban greening policy in place. This observation highlights a prevailing need for developing and implementing

comprehensive procedures and initiatives that address heat management and promote urban greening practices across the country's LGAs.

The limited presence of urban greening policies indicates a gap in these regions' environmental planning and sustainable development strategies. Urban greening, including initiatives like tree planting, green spaces, and sustainable landscaping, plays a crucial role in mitigating urban heat and enhancing urban areas' overall liveability and ecological balance. The low adoption of such policies suggests room for improvement in prioritising and incorporating these essential measures into the planning and management practices of LGAs.

4.5.1 Capacity of heat management and urban greening

An assessment of the overall capacity of LGAs in heat management and urban greening was conducted, considering various factors, such as the availability of planning policy, targets and planning instruments. Five key factors were considered and utilised to calculate an overall score that reflects their current capacity, as outlined in Table 3[2]. These factors were carefully chosen to capture the essential components influencing heat management and green performance across LGAs.

Table 3: Calculation of aggregated urban heat management and greening score

Factor	Presence	Absence
F1. Have an urban heat mitigation policy/strategy	1	0
F2. Have an urban greening policy/strategy	1	0
F3. Have a tree canopy target for its urban settlements	1	0
F4. Have an urban heat map	1	0
F5. Have an urban heat vulnerability assessment	1	0

Each of the five critical factors in the study was assigned a score on a scale ranging from 0 to 1, where a higher score indicated a more substantial capacity of the LGAs in that aspect. The scores of these five factors were summed up to obtain a comprehensive and quantitative representation of the power of the regional and remote LGAs, leading to the calculation of an aggregate score (Equation 3).

This aggregate score was a valuable metric allowing standardised and meaningful comparisons among the studied LGAs. It provided a clear and objective assessment of their heat management and greening practices performance.

$$LGA\ Score = \frac{\sum(F_1 + F_2 \dots\dots\dots + F_5)}{N} \dots\dots\dots\dots\dots\dots\dots\dots (3)$$

Where, F = Factor value; N = Total number of factors

The computed score indicates that a significant proportion of Local Government Areas (LGAs) in regional and remote areas received a score of '0', as depicted in Figure 15. This low score

[2] The overall performance of the LGAs against each factor can be found in Appendix 2

implies that urban heat management and the greening scheme are currently not considered significant priorities by these LGAs.

The '0' score suggests that these LGAs may still need to implement or prioritise initiatives related to urban heat management and greening practices. This could indicate that other pressing issues or competing priorities have taken precedence over environmental considerations in their planning and decision-making processes.

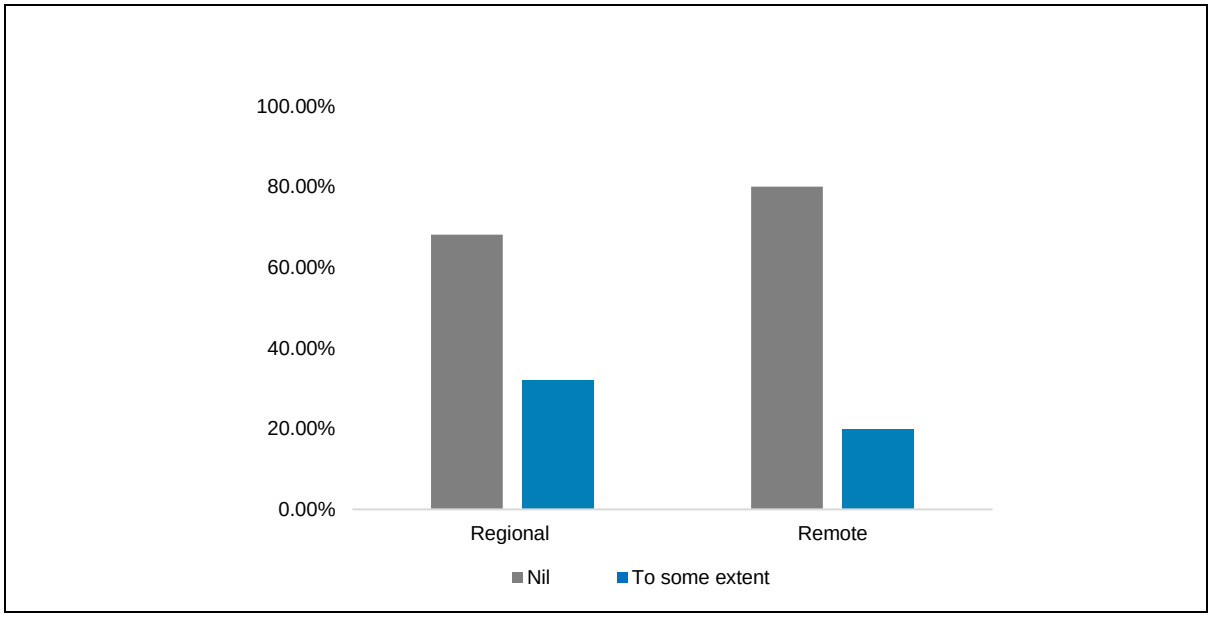


Figure 15: Existence of urban heat management policy instruments by LGAs

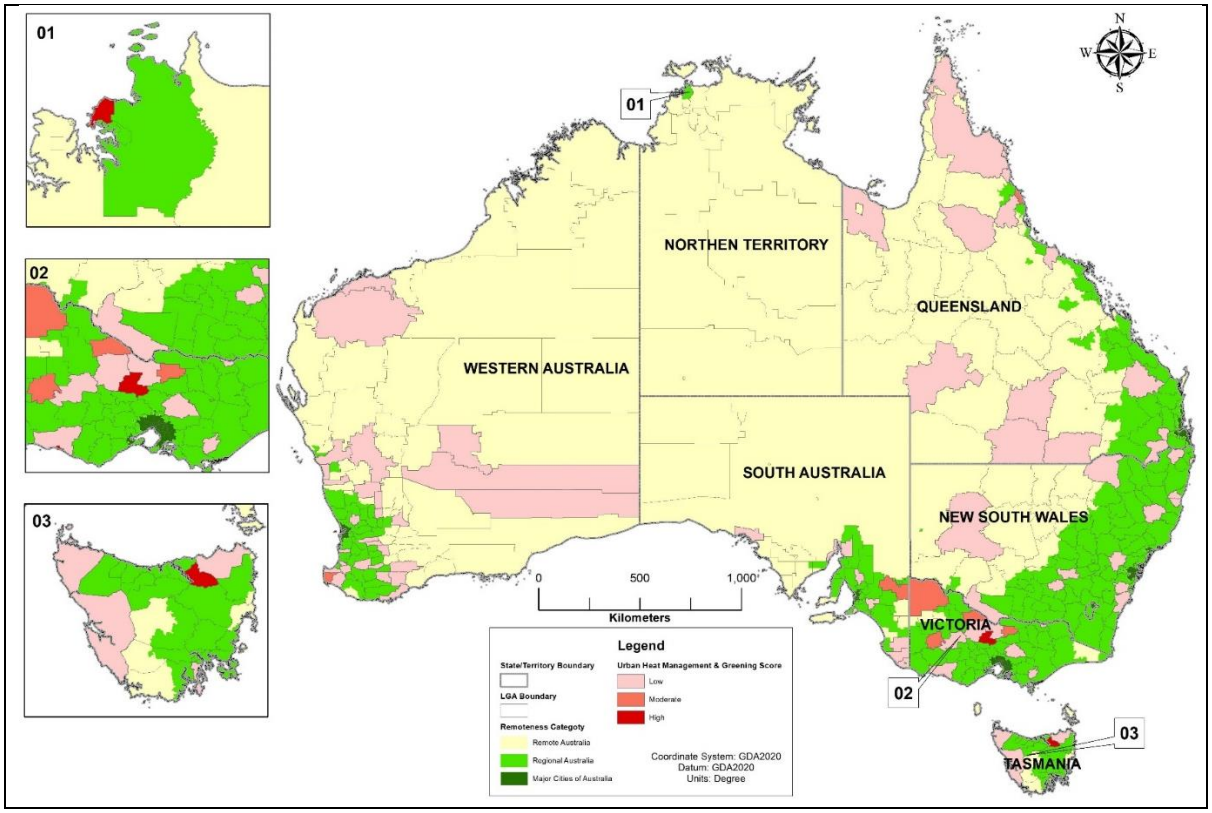


Figure 16: Spatial distribution of urban heat management score

Figure 16 visually represents the spatial distribution of urban heat management scores among the Local Government Areas (LGAs) across the states. The figure reveals no significant concentration of LGAs with better capacity for urban heat management across most states, except for Victoria.

It is essential to acknowledge that many remote towns face the challenge of lacking industrial infrastructure and instead rely on existing bushlands for their survival. Consequently, their interest in prioritising heat management issues may need to be improved. Nevertheless, a few LGAs have informally demonstrated a commitment to tree plantation targets, albeit without formal policies or strategies. These LGAs have initiated community-level tree-planting programs primarily focusing on parks and open spaces. However, some LGAs are willing to achieve more ambitious greening targets. Unfortunately, the shortage of accessible irrigation water has hindered their ability to initiate tree plantation projects effectively. This water scarcity presents a significant obstacle to achieving greening goals and underscores the need for innovative approaches to ensure sustainable water usage in these areas.

In certain regional LGAs, climate change adaptation plans have been developed, incorporating specific targets for heat management and canopy improvement. These plans outline actionable steps to address extreme heat management and reduce heat island effects through place-based management approaches. Despite including these targets within the broader climate change adaptation plans, there is no separate policy under development specifically aimed at addressing urban heat management.

These findings highlight the varied approaches and challenges LGAs face in addressing urban heat management and promoting greening initiatives. The presence of informal commitments and community-level efforts demonstrate a potential for progress. Still, barriers such as water scarcity and lack of formal policies require further consideration to advance these endeavours. Encouraging sustainable practices, innovative solutions, and strategic planning can enhance urban heat management and greening practices in regional and remote LGAs across Australia.

4.5.2 Community adaptation to extreme heat condition

During extreme heat conditions, people employ various strategies to cope with the challenging weather, with water-based activities emerging as particularly popular among citizens (Figure 17). Sea beaches, swimming pools, and water recreation centres receive a surge in visitors during such periods. To accommodate the increased demand for comfort, local councils extend the opening hours of these areas, allowing more people to enjoy the relief of water-based activities.

In addition to water-based activities, many individuals prefer to stay at home or seek out shady places like parks or streets with a canopy cover to shield themselves from the sun's intensity. Home air conditioning is another standard measure taken during hot summer seasons. Recognising the importance of access to cooling facilities, councils provide air conditioning at public places such as pubs, community halls, or shopping malls, extending their operating hours beyond the usual to accommodate more visitors seeking respite from the heat.

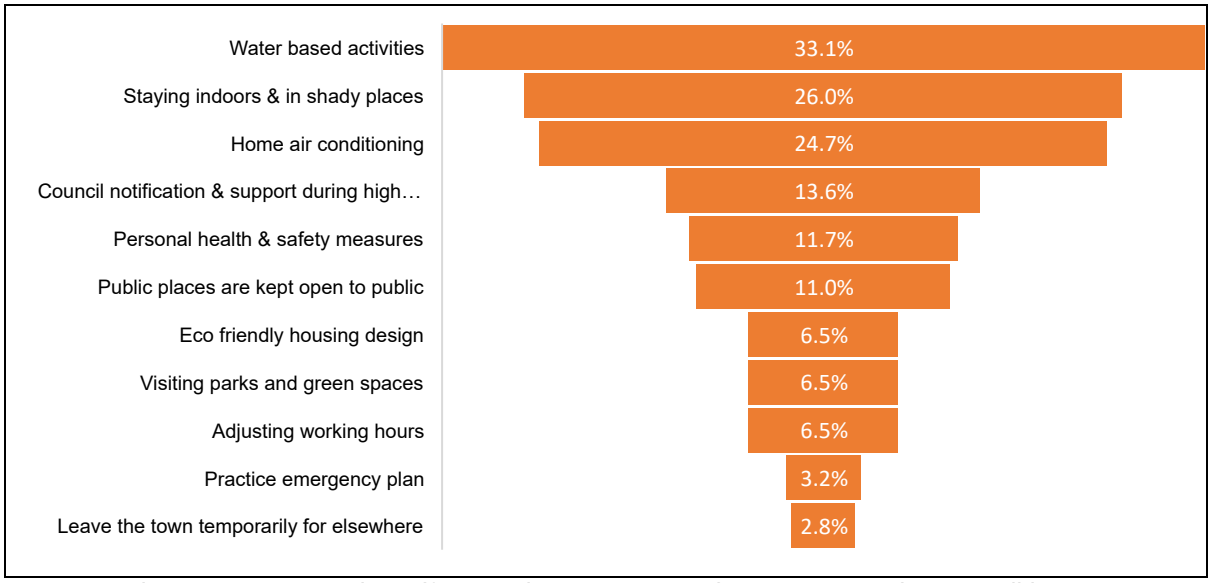


Figure 17: Community self-protection measures taken at extreme heat conditions.

Moreover, councils play an active role in climate awareness and adaptation. They release climate notifications to inform people about temperature projections and potential heat waves. Some councils even take proactive steps, such as shifting working hours to nighttime or cooler seasons of the year, particularly for those whose jobs require extended exposure to the sun. Additionally, a few LGAs have expressed the practice of leaving peoples' residences during extreme heat times to avoid the high temperatures altogether, seeking refuge in cooler locations.

4.6 Population size and its impacts on LGAs' service delivery performance

The population size of LGAs varies significantly, with some LGAs having a population of less than one thousand while others represent more than one hundred thousand residents. Due to this diversity in population size, it is reasonable to expect variations in capacity and service levels among these LGAs. Our analysis aligns with this expectation and demonstrates a positive relationship between population size and LGAs' urban water and heat management scores, as depicted in Figure 18.

The positive relationship indicates that larger LGAs with higher population sizes generally exhibit better urban water and heat management capacities than smaller LGAs. This correlation could be attributed to several factors. Larger LGAs often have access to more resources and financial capabilities, allowing them to invest in infrastructure, technology, and sustainable practices to effectively address urban water and heat management challenges.

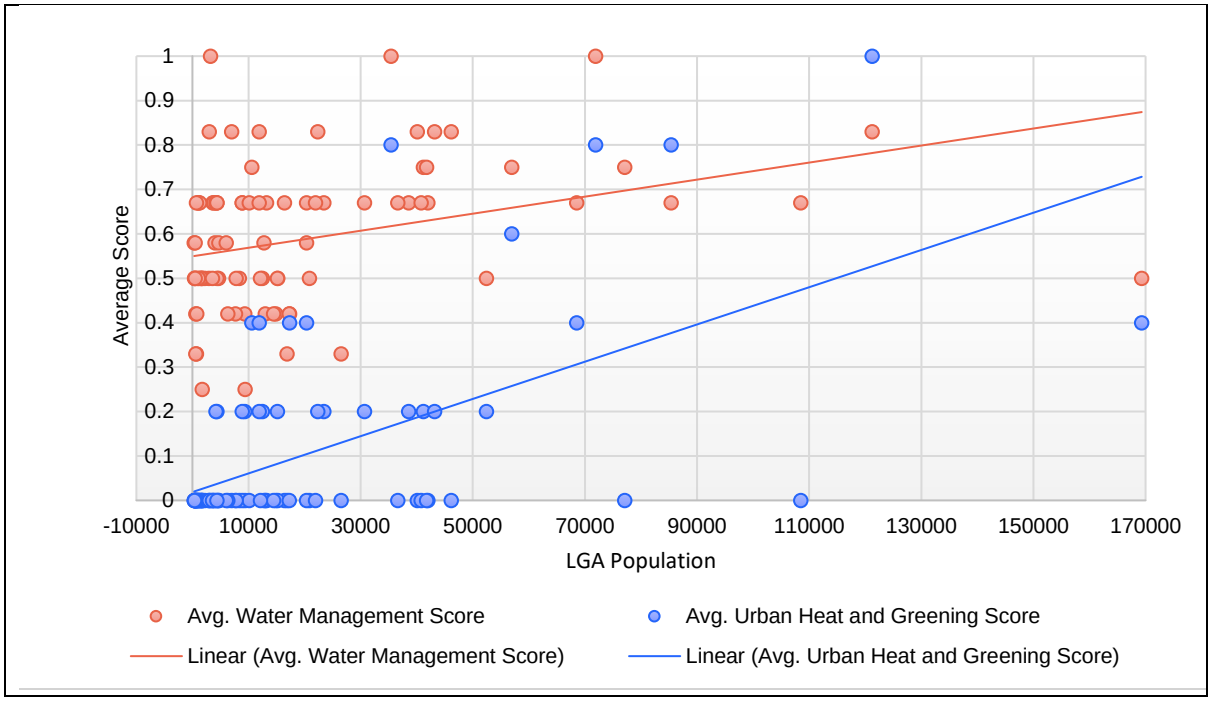


Figure 18: Correlation between LGAs population size and its service management score

Moreover, larger populations may increase awareness and community engagement in sustainability initiatives, motivating the local government to prioritise and implement relevant policies and projects. Additionally, larger LGAs may have a more complex and interconnected urban environment, necessitating a more robust and comprehensive water and heat management approach.

Conversely, smaller LGAs with limited population sizes might need more resource availability and funding support, which can impact their capacity to invest in advanced water and heat management solutions. Based on the analysis, it can be inferred that the provision of water and heat management services is often demand-driven. LGAs tend to initiate more programmes and allocate resources to support better their larger communities, with higher demand for such services.

4.7 LGA's experience, perspective and familiarity at local level on current methods, tools and research developed for water sensitive cities and urban heat mitigation

Over nine years, from 2012 to 2021, the CRCWSC assumed the role of a trusted advisory partner for the Australian Government. As part of its mandate, the CRCWSC spearheaded an interdisciplinary and cross-sectoral research program to foster the development of safer and more sustainable water sensitive liveable cities. The insights from this research were then translated into practical and innovative tools, methods, and guidelines to support cities in their journey towards enhanced climate resilience and greener urban environments. Consequently, numerous significant large cities have already embraced and implemented these practices, effecting a transformation towards more sustainable and water-sensitive communities.

However, the smaller regional and remote towns often need help embracing and adopting the CRCWSC tools and approaches. This section of the study seeks to identify and assess the current state of these Local Government Areas (LGAs) in remote and regional settings concerning their familiarity, applicability, and willingness to adopt the knowledge products the CRCWSC offers. Understanding the readiness and receptiveness of these LGAs is crucial to devising inclusive strategies and interventions that can facilitate their integration into the broader water sensitive cities initiative, thus fostering a more equitable and sustainable future for all communities across Australia.

4.7.1 Familiarity with research in water sensitive cities

Numerous research outputs and tools have become available, offering valuable insights into a broad spectrum of sustainable urban water management practices contingent upon various water servicing variables. During this survey, the participating LGAs were asked about their familiarity and user experience with water-sensitive city tools. Upon analysing the survey responses, it was noted that over 75% of remote LGAs and 55% of regional LGAs expressed a need to become acquainted with the recently conducted research funded by the Australian Government on water sensitive cities, specifically addressing heat mitigation through blue-green infrastructure (Figure 19).

The geographical distribution of the responses displayed a distinct pattern, as only a limited number of LGAs from Western Australia reported needing to be more familiar with these tools. In contrast, approximately 70% of the LGAs from Victoria stated they were somewhat familiar with the knowledge products related to water sensitive cities (Figure 20)[3].

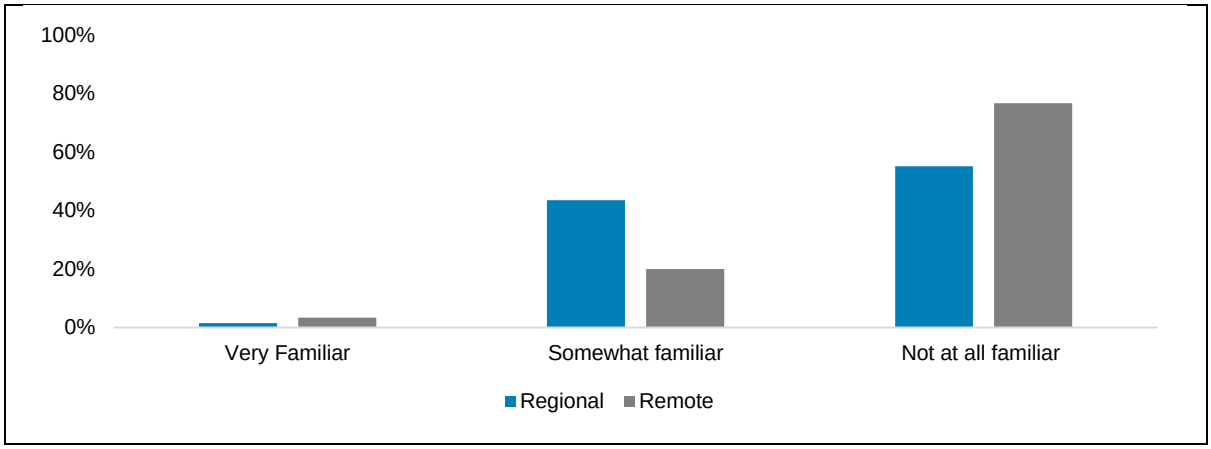


Figure 19: Familiarity with research on water sensitive research

[3] The overall performance of the LGAs against each factor can be found in Appendix 3.

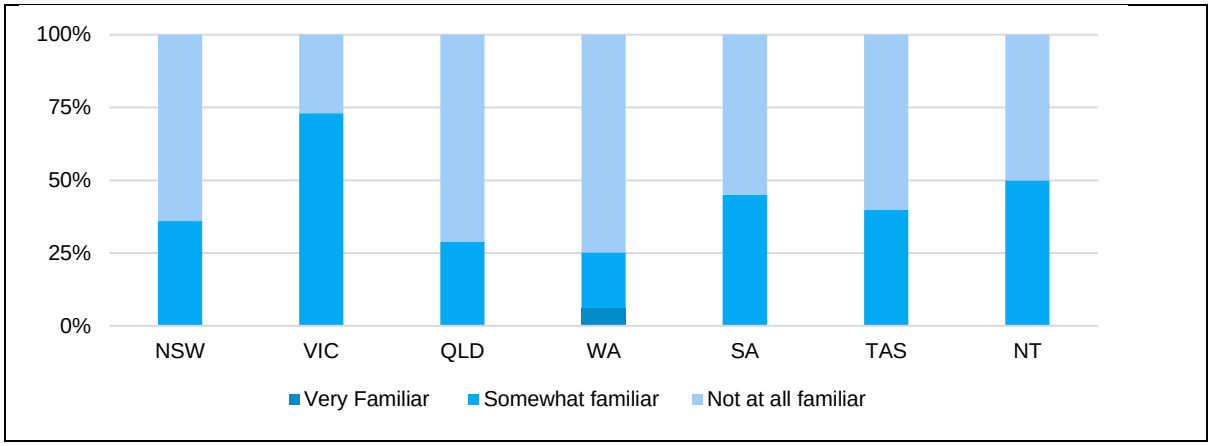


Figure 20: Familiarity with water sensitive cities research across Australian States

These findings underscore the importance of promoting awareness and accessibility of research outputs and tools across different regions and states in Australia. Certain areas, such as Victoria, have a relatively higher level of familiarity with these resources, potentially benefiting from their implementation of water management strategies. Conversely, there is a significant opportunity to enhance the uptake of these valuable tools in remote and regional LGAs, where more incredible acquaintance and utilisation of water sensitive city knowledge products can lead to improved and sustainable urban water management practices.

The Water Sensitive Cities Benefit-Cost Analysis Tool (INFFEWS) has been predominantly applied by regional LGAs, with approximately 10% of them utilising it for their water management assessments. On the other hand, remote LGAs have shown a greater preference for the Water Sensitive Cities Index Tool, with around 7% indicating its application or willingness to apply it in their respective areas. Among the LGAs familiar with the CRCWSC research outputs, the general sentiment was that the tools and approaches provided by the CRCWSC were indeed valuable in ensuring the development of resilient, water-sensitive, and green cities for their citizens (Figure 21). These tools have been perceived as beneficial aids in enhancing urban water management and promoting sustainability.

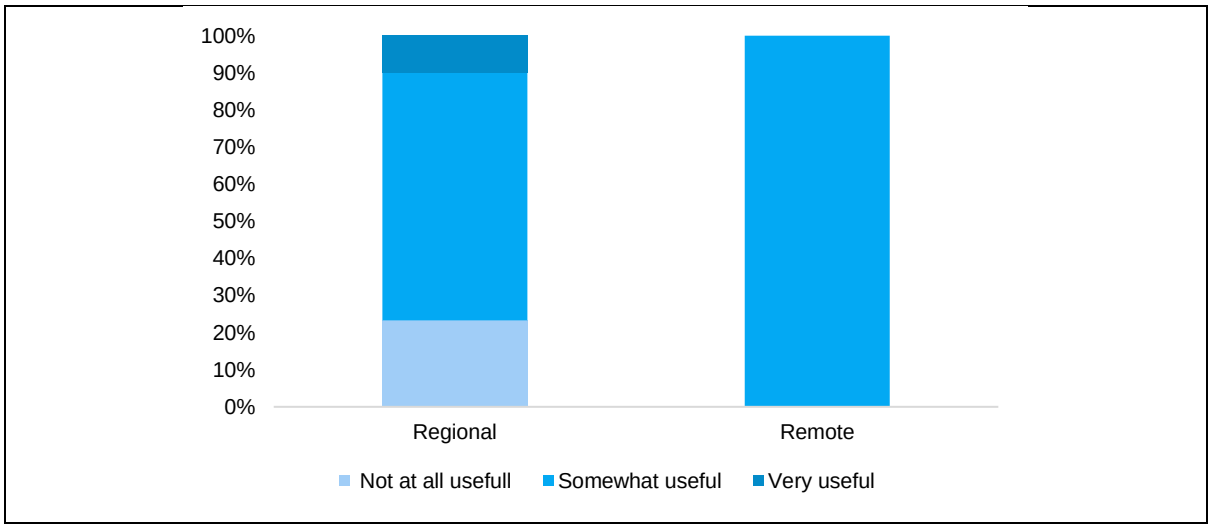


Figure 21: LGAs perspective on research output

However, some LGAs mentioned needing more financial resources and access to skilled staff, which commonly hindered their adoption of these inclusive approaches. Despite recognising the potential benefits of the CRCWSC research outputs, these resource constraints present challenges for several LGAs, particularly in remote and regional settings, to fully embrace and implement the tools and strategies provided by the CRCWSC.

4.7.2 Familiarity with research in urban heat mitigation

Various tools are available to aid local governments in making well-informed decisions regarding low carbon living and urban heat mitigation. Regrettably, the survey results indicate that approximately two-thirds of the LGAs surveyed reported needing to familiarise themselves with the Australian Government-funded research focused explicitly on low-carbon living (LCL), which also encompasses urban heat mitigation (Figure 22).

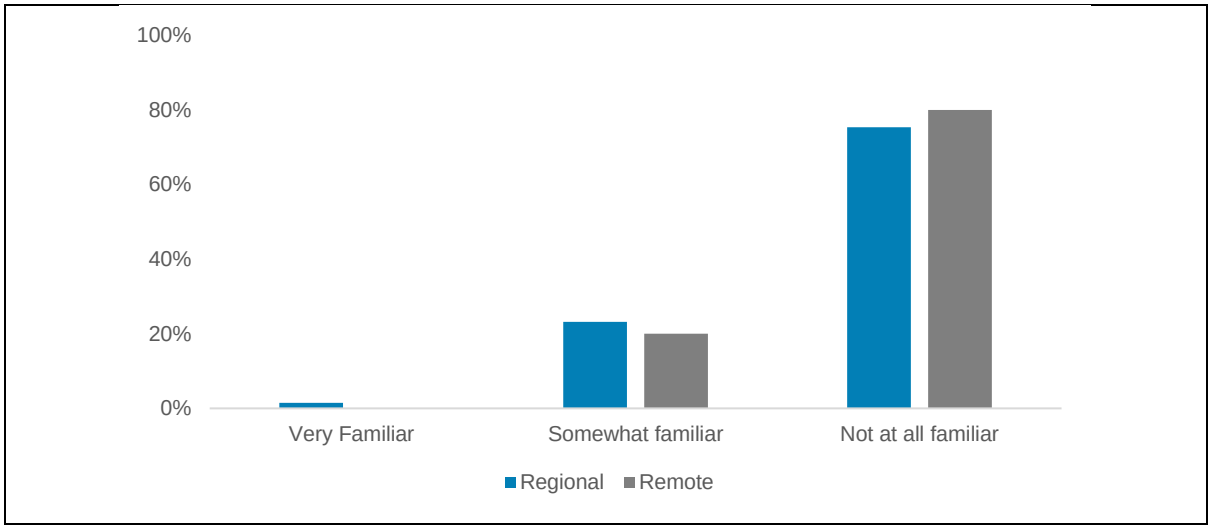


Figure 22: Familiarity with low-carbon living, including urban heat mitigation research across Australian States

Nonetheless, among the LGAs familiar with this research, some expressed knowledge about a tool called the "Guide to Urban Cooling Strategies." These LGAs indicated they have already implemented or are willing to incorporate this tool into their town planning strategies. The limited awareness among the surveyed LGAs highlights the need for greater dissemination and communication of research findings and tools related to low-carbon living and urban heat mitigation. By enhancing familiarity with such valuable resources, local governments can make informed decisions and effectively address climate challenges in their respective areas. The "Guide to Urban Cooling Strategies" has shown promising traction among the LGAs familiar with it, suggesting its potential to be a valuable asset in promoting sustainable and climate-resilient urban planning and development. Ensuring broader accessibility and awareness of these tools can empower LGAs to play a more active role in fostering low-carbon living and sustainable urban environments for the benefit of their communities.

4.8 Future priorities for LGAs to achieve more sustainable water management and improved liveability

LGAs in regional and remote areas face diverse pressing issues that they consider crucial for delivering equitable, reliable, and resilient urban services. Considering this, the primary aim of this research was to gather insights directly from LGAs, gaining an understanding of their specific challenges and priorities. The ultimate objective was to inform and initiate future research projects that address the identified needs.

Within this context, the following section provides a comprehensive summary of the perspectives, visions, and requirements articulated by LGAs, all of which contribute to shaping future priorities. These priorities are centred on achieving more sustainable water management practices and enhancing liveability outcomes.

4.8.1 Prioritised urban water management issues

LGAs have compiled a list of major urban water issues that require attention. To prioritise these issues, LGAs have assigned a 5-point scale, ranging from priority 1 to priority 5. A weighted average scale, calculated using Equation 4, was then applied to gauge the relative importance of each identified issue. Priority 1, receiving the highest value of 5, indicates the most critical concern for LGAs, while priority 5, assigned the lowest value of 1, denotes a relatively lower significance level.

Table 4 provides a concise summary of the essential aspects. Through this prioritisation process, LGAs aim to emphasise the urgency and importance of each issue, enabling effective resource allocation and targeted strategies to address the most pressing urban water challenges.

$$WI\ (Weighted\ Index) = \frac{\sum(n_1 f_1 + n_2 f_2 \dots\dots\dots\dots + n_n f_n)}{N} \dots\dots\dots (4)$$

Where, n = rank order; f = frequency and N = total number of responses

Table 4: Prioritised urban water management issues

Priority Issues	Weighted Index	
	Regional	Remote
Urban water supply	3.4	4.0
Climate change and extreme weather events	3.9	4.5
Irrigation management	4.0	0.0
Groundwater usage	3.2	3.1
Water Reuse	3.3	3.2
Integrated planning	3.4	4.0
Resource constraints	2.7	3.1
Upgrade aged infrastructure	3.4	3.0
Wastewater management	2.9	3.0
Stormwater system	3.6	3.6

One of the primary urban water management challenges identified by regional LGAs is the need to ensure proper irrigation on agricultural land. To address this concern, they have emphasised the importance of constructing more waterways or developing alternative water sources to support agrarian activities effectively, especially during dry seasons. Managing the impacts of climate change and extreme weather events is considered a significant challenge for both remote and regional areas. This includes addressing flood and drought management issues, coping with excessive rainfall, and managing increased farmland salinity. LGAs in these areas seek plans and approaches to help their cities adapt to changing climatic conditions and build resilience against extreme weather events.

In remote LGAs, ensuring an adequate urban water supply following established standards poses a significant challenge. They have urged for the construction of new water supply plants or upgrading existing ones to meet the water demand of their communities. Integrated planning is crucial for many LGAs at regional and remote levels. They prefer a holistic approach for the entire city rather than subdividing plans focusing only on specific regions. Adopting an integrated system for all aspects of water management has been proposed to ensure comprehensive and practical solutions.

Furthermore, the participating LGAs have highlighted the limited integration and coordination with State Government or higher authorities as an area that needs improvement. Addressing this issue is seen as crucial to enhance water management efforts. Resource constraints, including financial resource availability and a shortage of skilled staff or consultants, hinder the LGAs from adopting water-sensitive planning approaches effectively. These limitations must be addressed to enhance their capacity to implement sustainable water management practices.

4.8.2 Future research priorities

The LGAs were asked to rank three potential research topics based on their preferences. These topics were as follows:

- Topic 1: Adapting existing CRCWSC and CRCLCL methods and tools for regional and remote area applications.
- Topic 2: New methods and tools relevant to regional and remote communities' local context and capacities.
- Topic 3: An authoritative national platform for hosting nationally endorsed, locally validated methods and tools for shared learning.

To determine the relative importance of each research topic, a weighted average score was computed using the responses received from the survey (as shown in Table 5). The weighted values assigned were 1 for lower and 3 for higher.

Applying this approach, the research topics were evaluated based on the preferences expressed by the LGAs.

Table 5: Weighted index calculation to identify future research priorities

Level of reliance (Weight	Response			Weighted Value = Weight* Response		
	Topic 1	Topic 2	Topic 3	Topic 1	Topic 2	Topic 3
Lower Importance (1)	37	19	38	37	19	38
Moderate Importance (2)	23	35	30	46	70	60
Higher Importance (3)	22	33	24	66	99	72
Total	82	87	92	149	188	170
Weighted Index (WI)				1.82	2.16	1.85

According to the findings in Table 5, all three topics were perceived as essential by the LGAs. However, "Topic 2: New methods and tools relevant to the local context" received comparatively higher importance than the other two topics. This indicates that the LGAs prioritise the development of innovative and context-specific methods and tools that can effectively address the unique challenges and capacities of regional and remote communities. The emphasis on locally relevant solutions reflects the LGAs' desire for research and initiatives that align with their needs and circumstances.

4.8.3 Other research topics

Table 6 presents a summary of research suggestions proposed by the LGAs to support their transitions towards water-sensitive and liveable communities in their local contexts. These research topics were identified as critical needs that best aid the regional and remote organisations in achieving more sustainable water management and improved liveability outcomes.

Table 6: Other research topics proposed by LGAs

Themes	**Research Topic**
Funding arrangements	Adequate funding and resources support small & poor LGAs Funding for water sensitive investments & greening infrastructure
Climate resilient planning	Implement best planning methods to address the climate change challenge. Explore the impacts of climate change on human health. Flood management
Water sensitive urban landscape	Eco-house design Integrated environmental planning Use water sensitive native plants in urban landscaping.
Ensure water sensitive good governance.	Reformed and updated state planning procedures Prioritise water and environment at local, state and national levels, planning Lack of coordination with higher authorities. Understand the barrier to implementing best practices.
Sustainable urban water management	Urban stormwater management Alternative scheme water source Desalination of seawater Extensive research to explore more water reuse options
Innovation and capacity building	Upscale the consultants and council staff.

The challenges smaller LGAs face, especially in rural areas, in managing adequate funds and insufficient staff to adopt new tools and approaches are noteworthy. As discussed earlier, these LGAs heavily rely on external consultants or advisors for various water management and land use planning services. Therefore, upscaling access to consultants becomes crucial to ensure that these rural areas can stay updated on recent research outcomes and effectively implement sustainable practices.

In recent times, eco-friendly house designs have gained popularity in many areas. Some LGAs have piloted such projects within their council and received positive feedback from residents. These eco-friendly settlements are well-equipped to adapt to extreme climatic conditions, with their wastewater, stormwater management, and drinking water facilities in place. As a result, several councils have expressed interest in implementing similar eco-friendly water-sensitive urban settlements to promote resilience and improve overall liveability.

Addressing the funding and staffing constraints in smaller LGAs and promoting the adoption of eco-friendly and water-sensitive urban designs can play a significant role in fostering sustainable water management and improved liveability outcomes in regional and remote areas. By sharing experiences and best practices, these LGAs can collaborate to overcome challenges and collectively work towards achieving more sustainable and resilient communities.

5. Discussions

The purpose of this research was to understand the factors that impede Sustainable water management and achieve liveability outcomes in regional and remote areas. The work conducted by the CRCWSC has focused on urban areas, and it would be valuable to ascertain how its findings and approaches can be applied to regional and remote areas.

The survey report revealed a clear distinction between the service level requirements of regional and remote local governments compared to urban local governments like Perth, WA, where the Water Corporation handles primary water services such as drinking water and wastewater management. Regional and remote areas often demand more significant stormwater, drinking water, and wastewater management services, necessitating different planning and management strategies.

Figure 23: Characterising a water sensitive city (CRCWSC, 2021).

The results also highlighted that many rural and remote local governments need more familiarity with CRCWSC research and water sensitive cities issues, including urban heat management. This lack of awareness suggests that the concepts and solutions developed by CRCWSC may have yet to resonate with the daily challenges faced by regional and remote local governments. The critical attributes of water sensitive cities through the CRCWSC perspective are Liveable, Resilient, Sustainable, and Productive (Figure 23). However, the survey indicated a need for further exploration to define specific criteria for these attributes in regional and remote towns. Nonetheless, some initial observations from the survey suggest that additional research is necessary to tailor water-sensitive solutions to the unique challenges of managing water in regional and remote local governments. This will help ensure that the concepts and strategies developed by CRCWSC can effectively address these areas' specific needs and contexts, fostering more sustainable and liveable communities in regional and remote Australia.

5.1 Cities and towns reported similarities

Local governments play a vital role in delivering services directly to the community, and they are often referred to as the level of government "where the rubber hits the road." As the closest governing body to the citizens, local governments uniquely understand their communities' specific needs, challenges, and priorities. This proximity to the community enables them to respond promptly and effectively to local concerns and implement strategies tailored to meet their residents' unique requirements. Given their strong connection to the community, local governments are in an advantageous position to mobilise resources, foster collaborations, and engage stakeholders effectively. They can drive meaningful change through proximity and responsiveness, creating more sustainable, resilient, and people-oriented urban environments.

In analysing the survey results, it becomes apparent that regional and remote councils reported similar concerns and challenges to what would typically be expected for urban councils. Some of the key observations are as follows:

5.1.1 A reliance on consultants for supplemental capabilities

Regional and remote councils, including those in Perth, often rely on external consultants to supplement their technical knowledge and capabilities in WSC. This approach offers advantages, such as creating a shared knowledge base that can benefit multiple LGAs. It is noted that the use of consultancies in and of itself is an agnostic business tool, which can be employed to enhance service delivery throughout the year or address non-repeatable activities. However, caution must be exercised when consultants become the primary tool for responding to WSC, as this may result in the exportation of learning and decision-making capabilities outside local government organisational knowledge. While achieving integration of the total water cycle in cities often requires a collaborative approach involving multiple agencies, larger and centrally located agencies possess economies of scale relative to land areas, enabling them to provide more comprehensive outcomes.

5.1.2 Stormwater management is a wicked problem

Stormwater management, particularly when considering WSC principles, necessitates a multiagency approach. The complexity of managing water is well-documented in the literature, and part of this complexity arises from the involvement of numerous agencies responsible for various aspects of the water cycle. These agencies' coordination and collaboration become crucial in effectively addressing stormwater-related challenges.

One notable response from councils to tackle reduced water availability is the exploration of stormwater harvesting projects. As urban populations grow, existing water supplies diminish, and declining rainfall patterns further exacerbate the issue. Local governments are increasingly compelled to respond by enhancing existing assets' water efficiency and seeking alternative water sources, such as reclaimed or reused water. This dual approach reflects the growing priorities of local governments to ensure a sustainable and resilient water supply while concurrently expanding green services for their communities.

5.1.3 Funding mechanisms

The challenge of funding climate change adaptation, mitigation, and other sustainability outcomes can be traced back to the historical structure and revenue sources of Local Governments, which were initially developed to provide traditional services like 'roads, rates, and rubbish.' The evolving expectations of local governments, as documented by organisations such as ALGA, now encompass a wide range of additional services. Concurrently, sustainability considerations have often been considered external to the market, regulations, and governance frameworks.

As local governments strive to enhance WSC services, they encounter the reality that it entails providing a new or emerging service, requiring a reassessment of funding models. This may involve exploring novel ways of generating revenue, reallocating resources from existing services, or seeking external funding to maintain a balanced local budget while accommodating the increased service level required for WSC initiatives.

5.2 Cities and towns observed differences

The observed differences between Regional/Remote and Urban Local Governments can be attributed to the well-reported challenges that regional/remote LGAs face. These challenges include limited job opportunities, difficulties retaining residents, concerns about population sustainability, housing issues, safety, and health considerations. These challenges arise due to the unique characteristics of regional and remote areas, such as their geographical remoteness, smaller population sizes, and lower population densities. In contrast, urban cities experience different drivers and priorities due to their higher population densities, larger populations, and more extensive infrastructure and service networks. The challenges faced by regional and remote LGAs often result from the inverse of the factors that drive development and growth in urban cities.

Whilst the increased population density in the city can provide added services and job opportunities, it also comes with its set of challenges related to liveability. These challenges

can be seen as an inverse of the benefits experienced by regional/remote local governments. For instance, urban WSC issues such as urban heat, health risk factors, and the loss of functional ecosystem services, like air and water quality improvement through the natural environment, become more prominent in densely populated cities. Considering the inverse planning form and results, it is reasonable to acknowledge that what is deemed necessary for liveability, resilience, sustainability, and productivity in regional/remote areas may differ from that of urban cities. This aligns with the survey results that identified unfamiliarity with resources like the CRC and issues like urban heat, as these may not resonate with local WSC priorities in regional and remote areas. This difference in preferences and familiarity may present a potential barrier to effectively implementing Water Sensitive Cities approaches in these regions.

The survey results further support unfamiliarity with urban heat and related issues, emphasising the need for tailored and targeted approaches to address the unique challenges faced by regional and remote local governments. Understanding and addressing these differences are vital for bridging the gap and ensuring that the knowledge and resources available for WSC are effectively translated and applied in regional and remote areas, leading to more sustainable and liveable communities in these regions.

Similarly, on-ground solutions for greening initiatives in urban and rural areas often demonstrate distinct characteristics. In urban environments, strategies such as guerrilla gardening, pop-up parks, parklets, and a notable emphasis on individual street trees have gained popularity, contributing to urban greening efforts. These interventions aim to create green spaces within the built environment, enhancing urban liveability and mitigating the urban heat island effect. In contrast, greening approaches in rural areas follow a different trajectory. For instance, while applicable and beneficial in urban settings, the parklets may hold other relevance in rural areas. Instead, rural communities often prioritise more traditional Landcare activities such as tree planting, erosion control, and habitat restoration. In rural regions, the emphasis lies on preserving and restoring natural ecosystems, supporting sustainable agriculture, and safeguarding biodiversity.

The conventional definition of the urban heat island (UHI) phenomenon primarily focuses on the differences in heat retention between rural and urban areas, with cities experiencing higher temperatures, particularly at night. However, in the contemporary context, the UHI effect only uniformly applies to some regional and remote local governments; it is more prevalent in larger urban centres. Nevertheless, the impacts of heat on people and communities may exhibit similarities in practical responses between regional/remote and urban local governments. These shared responses include how LGAs address challenges related to warm environmental temperatures, rising temperatures attributed to climate change, and housing/buildings and urban environments that may not be thermally suitable for their respective regions. Both regional/remote and metropolitan areas may confront similar issues concerning heat-related discomfort, health risks, and increased energy demands for cooling during hot periods. Thus, regardless of the presence of a traditional UHI effect, the need to adapt to and mitigate the adverse effects of heat remains relevant in both settings. Strategies to improve thermal comfort, enhance building design, create shaded and green spaces, and implement climate-resilient urban planning can benefit urban and rural communities, ensuring they are better equipped to cope with rising temperatures and climate challenges.

6. The Way Forward

6.1 A changing climate

The survey responses from regional/remote LGAs have highlighted a strong preference for future research topics that specifically cater to these communities' unique local contexts, capabilities, and capacities. While it may not be feasible to accommodate the needs of every individual town, there is an apparent demand for a better understanding of the differences between regional and remote LGAs and their specific requirements.

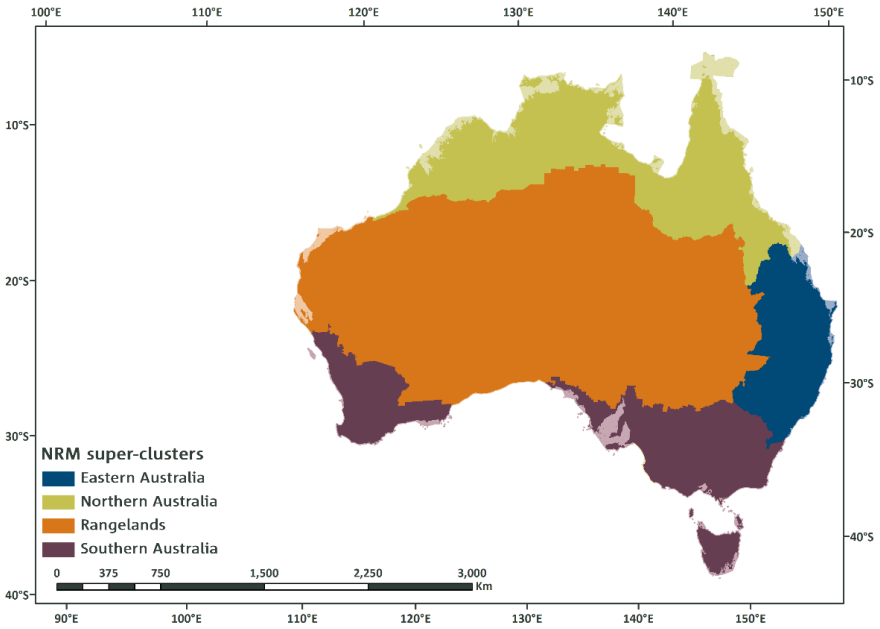


Figure 24: A broad-scale regionalisation of Australia by amalgamating the NRM clusters into four super-clusters.
(Source: https://www.climatechangeinaustralia.gov.au/en/overview/methodology/nrm-regions/*)*

In this context, the 'Climate Change in Australia' tools were developed to support the planning needs of Australia's natural resource management sector. The government organisation has established four NRM super-clusters (Figure 24). Integrating the Australian Standard Geographical Classification (ASGC) remoteness structure, as identified at the beginning of this report, with the NRM super-clusters could be a viable approach to address the local governments' needs more effectively.

By utilising this integration, regional/remote LGAs can benefit from more tailored and appropriate tools and methodologies that align with their specific geographical and environmental characteristics. This approach would better match the research outputs and the practical needs of the LGAs, facilitating more effective and relevant support for water-sensitive and liveable communities in regional and remote areas.

The survey results have highlighted various models for providing essential services like drinking water, sewerage, and drainage within rural local governments. Challenges in delivering these services are attributed to capability, capacity, and associated costs. In some instances, it may be more feasible for these services to be provided by larger water utilities,

such as Water Corporations, as they expand their support to meet the water service needs of regional and remote communities.

To support the objectives of this research and better understand the diverse needs of regional/remote councils based on their existing water services model, mapping the towns that are currently or will be supported by larger utilities, and identifying those that may need to provide these services themselves, would be beneficial.

By analysing these patterns, the research can gain insights into the varied requirements and appropriate tools needed for regional/remote councils, depending on their water service arrangements. This approach can aid in formulating more tailored and practical strategies to enhance water-sensitive and liveable outcomes in these areas, considering their unique contexts and existing water service structures.

6.2 Transition towards a water sensitive town

The CRCWSC Water Indexing Tool has proven to be a valuable set of tools extensively used by most urban local governments to assess their maturity and transition towards becoming Water Sensitive Cities (Beck et al., 2016). For urban local governments, the first 3-4 phases (e.g., up to the waterways city) are well developed (Figure 1). However, the initial survey results suggest that rural towns may exhibit lower maturity levels for the initial phases of this tool. It is worth noting that this tool is resource-intensive and typically requires the integration of various stakeholders, including the community, the private sector, and multiple tiers of government.

The potential applicability of critical insights from other CRCWSC tools, such as the transition dynamic framework, to rural settings has been acknowledged (Wong et al., 2020). However, the survey results also highlighted that the scrutiny and rigour required by these tools could be excessively burdensome and unattainable for many local governments due to their existing capacities and capabilities. The findings further indicated that rural towns may need more resources and the ability to undertake such extensive assessments, diminishing the emphasis on utilising this specific tool. Nevertheless, it is essential to underscore the continued significance of assessment tools, including the transition dynamic framework, especially in supporting government policies and making funding decisions. These tools play a critical role in ensuring a comprehensive understanding of the needs and challenges faced by rural communities. As such, they remain indispensable for formulating well-informed policies and effectively allocating resources to address the unique requirements of regional and remote areas.

To address rural towns' challenges, there is an opportunity to scale down the Water Indexing Tool into a rapid assessment tool designed explicitly for water-sensitive towns in rural settings. This streamlined version of the assessment tool can still provide essential insights and support for decision-making, albeit with less resource-intensive requirements. Moreover, the discussion highlighted the differences in perceptions of liveability, resilience, sustainability, and productivity in rural settings, raising the research question of an appropriate definition and criteria for identifying a water-sensitive rural town. By exploring this question, the research can develop tailored approaches and standards that resonate with rural communities' unique

characteristics and priorities, thus promoting more effective water-sensitive strategies and outcomes in these areas.

6.3 Traditional owners' knowledge

The paramount step towards fostering water-sensitive and liveable communities in regional and remote areas lies in re-establishing the cultural significance and rights of the First Nation Australians. Historically, both the cultural importance and traditional water knowledge of the First Nations have been disregarded during the development of towns and cities across Australia. However, comprehending the implications of this oversight and according to proper recognition of First Nation Australians' cultural significance and water knowledge will be pivotal in supporting the objectives of this research. In this regard, Nelson et al. (2018, p. 3) summarise the centrality of water to Indigenous people:

> *"For First People, water is a sacred source of life. The natural flow of water sustains aquatic ecosystems that are central to our spirituality, our social and cultural economy and wellbeing. The rivers are the veins of Country, carrying water to sustain all parts of our sacred landscape. The wetlands are the kidneys, filtering the water as it passes through the land. First Nations Peoples have rights and a moral obligation to care for water under their law and customs. These obligations connect across communities and language groups, extending to downstream communities, throughout catchments and over connected aquifer and groundwater systems".*

By acknowledging and incorporating the rich cultural heritage and traditional water practices of First Nation Australians, local governments can pave the way for more inclusive and sustainable water management approaches. This process of reconciliation and collaboration can lead to the creation of resilient and harmonious communities that honour the land's original custodians and embrace water-sensitive principles rooted in cultural wisdom. Emphasising the cultural significance and rights of First Nation Australians within the context of water management will contribute significantly to achieving the research's objectives of promoting sustainable water practices and enhanced liveability outcomes in regional and remote areas.

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Wong, T. H., Rogers, B. C., & Brown, R. R. (2020). Transforming cities through water-sensitive principles and practices. *One Earth, 3*(4), 436-447.

Wong, T. H. F., Allen, R. A., Brown, R. R., Deletic, A., Gangadharan, L., Gernjak, W., Jakob, C., Reeder, M. J., Tapper, N. J., & Walsh, C. J. (2013). Stormwater management in a water sensitive city: blueprint 2013.

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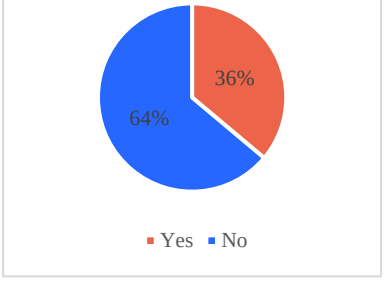
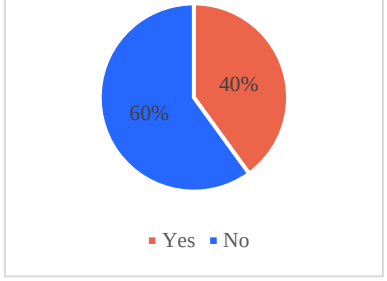
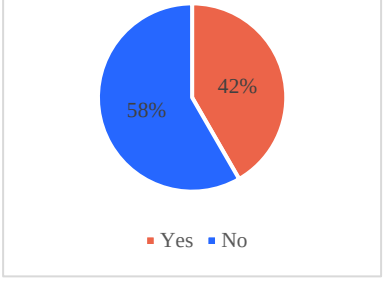
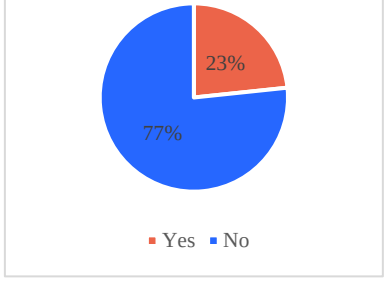
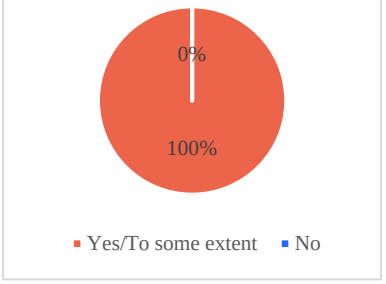
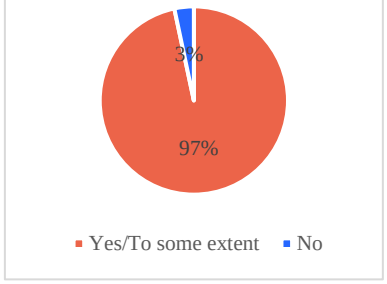
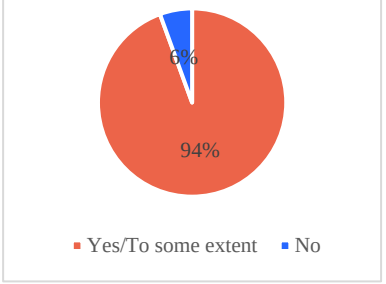
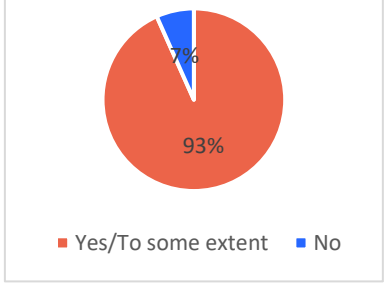
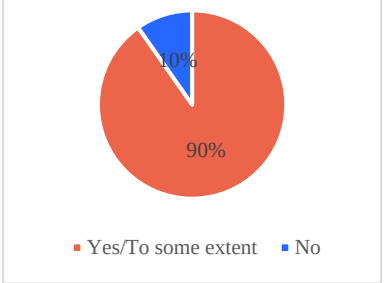
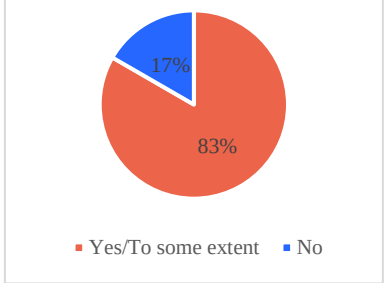
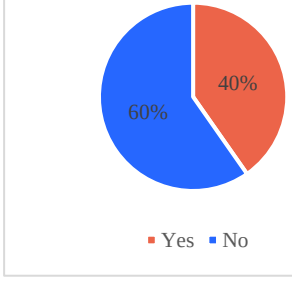
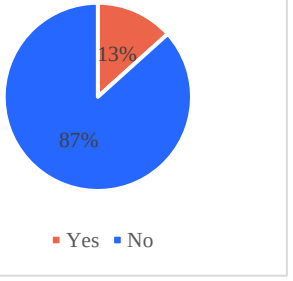
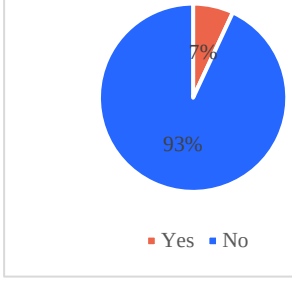
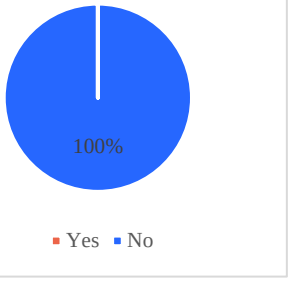
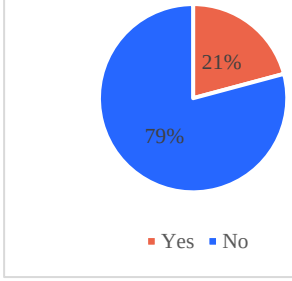
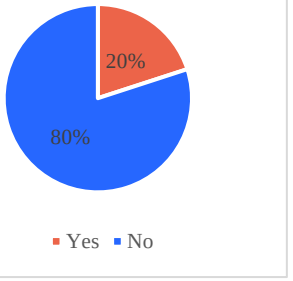
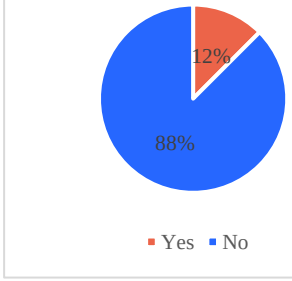
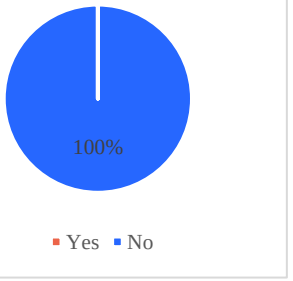
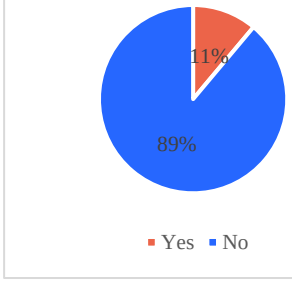
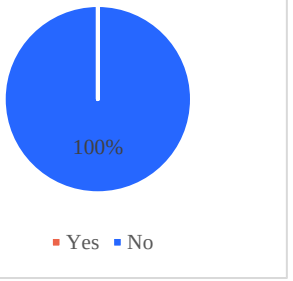
Appendices

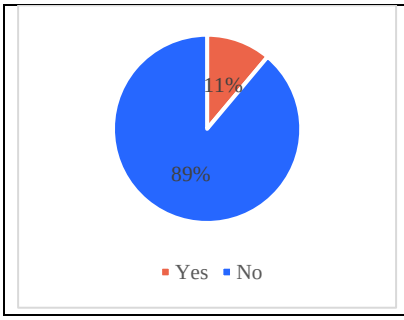
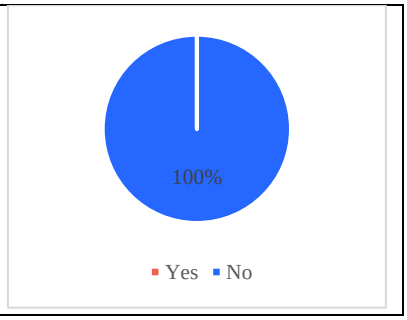
Appendix 1: Current urban water manageemnt status in regional and rural LGAs

Regional	Factor	Remote
	Have integrated Urban Water Management plan (F1)	
	Have an active collaborative network of institutions (F2)	
	Have access to a safe and secure drinking water service designed and operated to the relevant standard (F3)	
	Have access to a safe and secure wastewater management service designed and operated to the relevant standard (F4)	
	Have formal stormwater drainage designed and operated to the relevant standard (F5)	

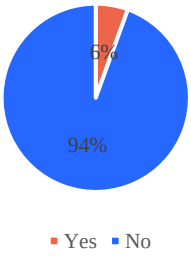
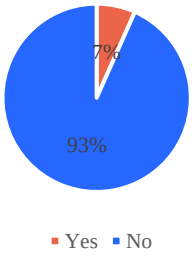
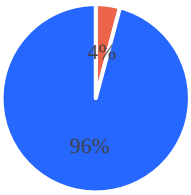
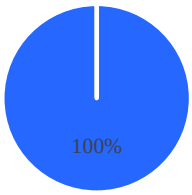
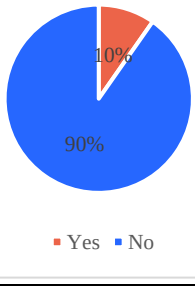
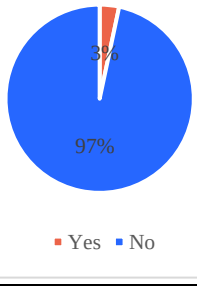
	Have any stormwater harvesting projects planned for and currently operating (F6)	

Appendix 2: Urban heat management and greening score

Regional	Factor	Remote
	Have an urban heat mitigation policy/strategy (F1)	
	Have an urban greening policy/strategy (F2)	
	Have a tree canopy target for its urban settlements (F3)	
	Have an urban heat map (F4)	

	Have urban heat vulnerability assessment (F5)	

Annendix 3: Use of CRC knowledge products

Tool	Regional	Remote
Water Sensitive Cities Index Tool		
Water Sensitive Cities Scenario Tool		
Water Sensitive Cities Benefit-Cost Analysis Tool (INFFEWS)		

Annendix 4: Approved Ethics Application for conducting the study

Curtin University

Research Office at Curtin

GPO Box U1987
Perth Western Australia 6845

Telephone +61 8 9266 7863
Facsimile +61 8 9266 3793
Web research.curtin.edu.au

09-Mar-2023

Name: Mohammad Swapan
Department/School: School of Design and the Built Environment
Email: M.Swapan@curtin.edu.au

Dear Mohammad Swapan

RE: Ethics Office approval
Approval number: HRE2023-0108

Thank you for submitting your application to the Human Research Ethics Office for the project **Water Sensitive and Liveable Communities**.

Your application was reviewed through the Curtin University Negligible risk review process.

The review outcome is: **Approved**.

Your proposal meets the requirements described in the National Health and Medical Research Council's (NHMRC) *National Statement on Ethical Conduct in Human Research (2007).*

Approval is granted for a period of one year from **09-Mar-2023** to **08-Mar-2024**. Continuation of approval will be granted on an annual basis following submission of an annual report.

Personnel authorised to work on this project:

Name	Role
Aktar, Shamima	Co-Inv
Swapan, Mohammad	CI
Zaman, Atiq	Co-Inv

Approved documents:

Document

Annendix 5: Questionnaire utilised for LGAs

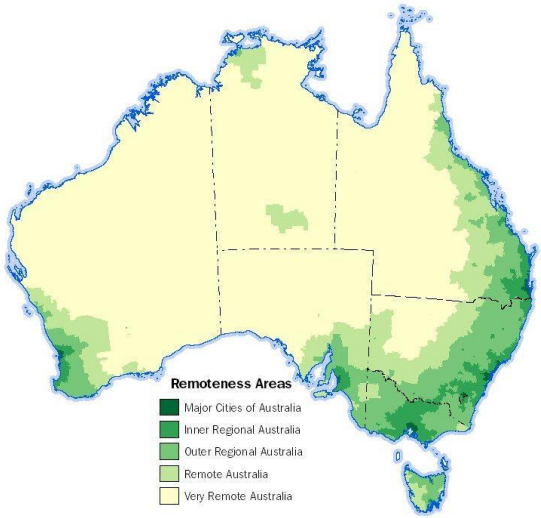
PAGE 1: Tell us a bit about your organisation.
Q1 – Name of organisation (Optional)

Q2 - Which State or Territory is your organisation located in?

☐	NSW	☐	QLD	☐	SA
☐	ACT	☐	NT	☐	TAS
☐	VIC	☐	WA		

Q3 – What locational context best described your organisation (refer to the map below)

- ☐ Inner Regional
- ☐ Outer Regional
- ☐ Remote
- ☐ Very Remote



Australian Statistical Geography Standard (ASGS) Volume 5 – Remoteness Structure (cat. no. 1270.0.55.005)

Q4 - Is your organisation responsible for the planning and provision of urban water services (stormwater, drinking water, recycled water, and wastewater)
Put (√) for "Yes" and (X) for "No"

- ☐ Stormwater
- ☐ Drinking water
- ☐ Recycled water
- ☐ Wastewater

Other (specify which other organisations have responsibilities for urban water in your local area)

Urban Water Services	Name of other organisations that provide services
Stormwater	
Drinking water	
Recycled water	

Wastewater	

Q5 - Which structure best describes how your organisation delivers its land use planning and urban water planning functions?

Structures	Challenges or opportunities you face due to the presence of this structure
1. Separate departments for each function with a low level of integration between departments	
2. Separate departments for each function with a high level of integration between departments	
3. Single department with separate line management for each function	
4. Single department with single line management for both functions	
5. Other (please specify)	

Q6 - How reliant is your organisation on external capacity (consultants/advisors) to deliver its land use and urban water planning functions?

	Very reliant (no or limited internal capacity)
	Somewhat reliant (to augment internal capacity)
	Not reliant (all functions delivered via internal capacity)
	Other (please specify)

PAGE 2: Current situation for urban water management in your local area

Q7 - Is there an integrated urban water management plan (or similar) for your local area?
Yes/No
If YES, can you please mention the name of the plan? Please add the document link here if the goal is available online.
If NO, do you have any scheme to formulate any plan soon?
Q8 - Is there an active collaborative network of institutions and other organisations with shared responsibilities for urban water management in your local area?
Yes/No
If yes, how effective is this network in delivering coordinated urban water services

Q9 - Do urban settlements in your local area have access to a safe and secure drinking water service designed and operated to the relevant standard?
Yes/No
Other (please specify)

Q10 - Do urban settlements in your local area have access to a safe and secure wastewater management service designed and operated to the relevant standard?
Yes/No
Other (please specify)

Q11 - Do urban settlements in your local area have formal stormwater drainage designed and operated to the relevant standard?
Yes/No
Other (please specify)

Q12 - Estimate the current % of annual urban wastewater flows in your local area that is recycled for beneficial uses such as POS irrigation, industrial water, rural land irrigation, and ecosystem restoration.
Insert sliding scale (0 to 100%)

Q13 - Estimate the current % of residential dwellings with rainwater tanks installed.
Insert sliding scale (0 to 100%)

Q14 - Estimate the current % of residential dwellings that rely on tank water for their drinking water needs (i.e. no reticulated town water supply).
Insert sliding scale (0 to 100%)

Q15 - Are there any stormwater harvesting projects planned for and currently operating in your local area
Yes/No
If yes, please tell us how many projects and a brief description of the projects.

Q16 - List the top five urban water management issues for your local area
Priority 1
Priority 2
Priority 3
Priority 4
Priority 5

PAGE 3: Current situation for urban heat management in your local area
Q17 - Does your organisation have an urban heat mitigation policy/strategy
Yes/No
Can you please tell us the name of the policy? Please add the document link here if the policy is available online.
If NO, do you have any scheme to formulate any policy soon?

Q18 - Does your organisation have an urban greening policy/strategy
Yes/No
Can you please tell us the name of the policy? Please add the document link here if the policy is available online.
If NO, do you have any scheme to formulate any policy soon?

Q19 - Does your organisation have a tree canopy target for its urban settlements
Yes/No
If yes, what is the % canopy cover target
Insert sliding scale (0 to 100%)

Q20 - Has urban heat (land surface temperature/air temperature) been mapped for your local area
Yes/No
If yes, has future climate projections been considered

Q21 - Has an urban heat vulnerability assessment been done for your local area
Yes/No
If yes, has future climate projections been considered

Q22 - List the five main ways your community protects itself during extreme heat conditions (e.g. heat waves)

1.
2.
3.
4.
5.

PAGE 4: Familiarity with recent research in water sensitive cities and urban heat mitigation

Q23 - How familiar is your organisation with recently concluded Australian Government funded research into water sensitive cities, including urban heat mitigation using blue-green infrastructure (CRC for Water Sensitive Cities: https://watersensitivecities.org.au/)

Very Familiar (regularly engage with and use the research outcomes)
Somewhat familiar (aware of the research but have had limited engagement with of use of the research outcomes)
Not at all familiar (not aware of the research)
If not at all familiar, proceed to Q26

Q24 - What is your organisation's experience (or perception) of how useful the research outputs from the CRCWSC are for your local context and issues

Very useful (research outcomes and outputs very relevant to your organisation's local context and capacities)
Somewhat useful (some but not all the research outcomes and outputs are relevant to your organisation's local context and capacities)
Not at all useful (none of the research outcomes and outputs is relevant to your organisation's local context and capacities)

If not at all useful, can you give a few reasons why?

Q25 - Select the CRCWSC knowledge products (tools) your organisation has used or would consider using in the future. If you are not familiar with one or all tools, then note this in the "other" comments box

Water Sensitive Cities Index Tool
Water Sensitive Cities Scenario Tool
Water Sensitive Cities Benefit-Cost Analysis Tool (INFFEWS)

“Other” comment box

Q 26 - How familiar is your organisation with recently concluded Australian Government funded research into low carbon living, including urban heat mitigation using building design and materiality and blue-green infrastructure (CRC for Low Carbon Living: http://www.lowcarbonlivingcrc.com.au/)

Very Familiar (regularly engage with and use the research outcomes)
Somewhat familiar (aware of the research but have had limited engagement with of use of the research outcomes)
Not at all familiar (not aware of the research)
If not at all familiar, proceed to Q29

Q27 - What is your organisation's experience (or perception) of how useful the research outputs from the CRC LCL are for your local context and issues

Very useful (research outcomes and outputs very relevant to your organisation's local context and capacities)
Somewhat useful (some but not all the research outcomes and outputs are relevant to your organisation's local context and capacities)
Not at all useful (none of the research outcomes and outputs is relevant to your organisation's local context and capacities)

If not at all useful, can you give a few reasons why?

Q28 - Select the CRC LCL's urban heat knowledge products (tools) your organisation has used or would consider using in the future. If you are not familiar with one or all tools, then note this in the "other" comments box
Urban Heat Island Mitigation Index
Microclimate and Urban Heat Island Mitigation Decision-Support Tool (requires login access)
Guide to Urban Cooling Strategies

“Other” comment box

PAGE 5: Future Research Priorities

Q29 - Rate the relative importance of the following topics for future research (1 is lower importance, 3 is higher importance)

- Adaptations of existing CRC WSC and CRC LCL methods and tools for regional and remote area applications
- New methods and tools relevant to the local context and capacities of regional and remote communities
- An authoritative national platform for hosting nationally endorsed, locally validated methods and tools and for shared learning

Q30 - Please list other research topics you think are important for us to consider.

END OF SURVEY

Thanks for your participation. If you have any queries or other comments, please email Chief Investigator Dr. Mohammad Swapan, M.Swapan@curtin.edu.au or Project Co-lead paul.satur@monash.edu.

Sustainable Communities and Waste

National Environmental Science Program

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