CRC for
Water Sensitive Cities

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

CRCWSC Integrated Research Project 1:
WSC Visions and Transition Strategies

Australian Government
Department of Industry, Innovation and Science
Business Cooperative Research Centres Programme

Benchmarking, Envisioning and Transition Planning for a Water Sensitive Bendigo: Final Case Report
Water sensitive city visions and transition strategies (IRP1)
IRP1-4-2018

Authors
Briony Rogers[1,2], Alex Gunn[1,2], Emma Church[1,2], Katie Hammer[1,2], Jo Lindsay[1,2]
[1] School of Social Sciences, Monash University
[2] CRC for Water Sensitive Cities

Publisher

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

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

Date of publication: September 2018

An appropriate citation for this document is: Rogers, B.C., Gunn, A., Church, E., Hammer, K., and Lindsay, J. (2018). *Benchmarking, Envisioning and Transition Planning for a Water Sensitive Bendigo: Final Case Report*. Melbourne, Australia: Cooperative Research Centre for Water Sensitive Cities.

Acknowledgements

The authors thank the project participants for bringing their enthusiasm, creativity and strategic insight to the workshop series and for their input into the development of this report. We also acknowledge the significant input of the project's local steering committee in Bendigo.

The authors would also like to thank David McCubbin for providing the illustrations in this report. His contribution to this project is greatly appreciated. We also thank Professor Nigel Bertram, Catherine Murphy and the Monash Art Design and Architecture team for their contributions to the community workshop series and the spatial representations of Bendigo's water story and vision in this report.

Finally, we greatly appreciate the expertise, advice and support on community engagement from Associate Professor Kelly Fielding and Dr Angela Dean at the University of Queensland.

Table of contents

Glossary / List of Abbreviations

Council, COGB	City of Greater Bendigo
CRCWSC	Cooperative Research Centre for Water Sensitive Cities
Dja Dja Wurrung	Used as an entity, referring to the Dja Dja Wurrung Clans Aboriginal Corporation, which is recognised as the Traditional Owner Group for the area comprising Bendigo
Djandak	Dja Dja Wurrung Enterprises Pty Ltd, trading as Djandak, is the commercial arm of Dja Dja Wurrung Clans Aboriginal Corporation (DDWCAC), which represents the Traditional Owners of the region, covering North-Central Victoria.
IRP1	CRCWSC Integrated Research Project 1 *Water Sensitive City Visions and Transition Strategies* (https://watersensitivecities.org.au/content/project-irp1/)
IWM	Integrated Water Management
NCCMA	North Central Catchment Management Authority
Transition	A fundamental shift in cultures, structures and practices as society changes from one pattern of socio-technological development to another usually more sustainable pattern
Transition Dynamics Framework	A framework that conceptualises how system-wide changes in practice (e.g. the transition to water sensitive practices) unfold over time, based on the establishment of key enabling factors: individual and organisational champions, platforms for connecting, science and knowledge, projects and applications, and tools and instruments
WSC	Water Sensitive City; a WSC provides water system services in a way that reflects an integrated approach to infrastructure, the built form, the environment, governance and community, in order to deliver outcomes that support the enduring sustainability, liveability, resilience and productivity for a place's community and ecosystems
WSUD	Water Sensitive Urban Design; an approach to the planning, design and maintenance of urban landscapes that will deliver WSCs through protecting and enhancing natural water systems and integrating the management of the total water cycle
WSC Index	A tool to benchmark and diagnose the water sensitive performance of a place (from the municipal to metropolitan scale), based on 34 indicators; good water sensitive governance, community capital, and equity of essential services, productivity and resource efficiency, ecosystem health, quality urban space, and adaptive infrastructure.

1. Introduction

1.1. Background

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

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

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

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

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

1.2. About this report

The Cooperative Research Centre for Water Sensitive Cities (CRCWSC) was invited to develop a water sensitive city vision and transition strategy for Bendigo as part of its Integrated Research Project 1: Visions and Transition Strategies. The project aims to develop tools and processes for bringing city stakeholders together to create strategic alignment and partnerships for transitioning to their envisioned water sensitive future.

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

Bendigo is one of five case studies conducted as part of the *Water Sensitive City Visions and Transition Strategies* project (along with Perth, Adelaide, Townsville and Sydney). The CRCWSC has also undertaken a similar project for Gold Coast outside the IRP1 project structure. These cases collectively provide strategic insights about the agenda of transitioning to a water sensitive Australian cities more broadly.

The report brings together the results of approximately 50 one-on-one interviews and 5 workshops with industry, government, non-government stakeholders, 3 workshops and 3 focus groups with community participants, as well as analysis by the project team. Some examples of the evidence accumulated in the form of quotes of participants or photographs of workshop outputs have been included throughout the report to support the presentation of findings. Perceptions expressed in the quotes or images should not be interpreted as representative of the views of the whole participant group, organisations represented in the workshop series, or of the authors.

A companion report, “Vision and Transition Strategy for a Water Sensitive Bendigo”, consolidates these findings into an executive summary that is intended for broad circulation.

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

This report is structured as follows:

Section 1 following this introduction presents the case methodology, involving system analysis through desktop review and participant interviews, the workshop processes themselves and the focus group engagements conducted in parallel to the workshops.

Section 2 details the results of the exploration of Bendigo's water story – its history, contemporary issues and future drivers.

Section 3 articulates the water sensitive city vision developed by participants across the course of the workshop series and discusses how this vision should be further communicated and evolved through engagement with Bendigo's wider community.

Section 4 presents the results of WSC Index benchmarking process, which took place in the first Industry workshop.

Section 5 introduces transition theory and the key analytical tool used to interpret Bendigo's transition progress towards its water sensitive vision to date. This section also presents the results of the transition analysis and corresponding strategies that are recommended in the short- to medium-term to achieve each of the six outcomes of Bendigo's water vision. It presents the actions developed by participants as critical to operationalising the enabling strategies, as well as related ideas for action implementation. The section also provides further detail about actions for supporting community engagement to drive the WSC transition.

Section 6 reflects on Bendigo's transition progress to its overall vision identify overarching strategies and core actions that should be pursued in the short- to medium-term to make further advancements. It also outlines principles of transition governance that informed participant discussions about a governance model that would support Bendigo's ongoing water sensitive city transition. Specific ideas and proposals by the participants are presented as a base for further consideration of Bendigo's water sensitive transition governance model.

Section 7 provides concluding remarks.

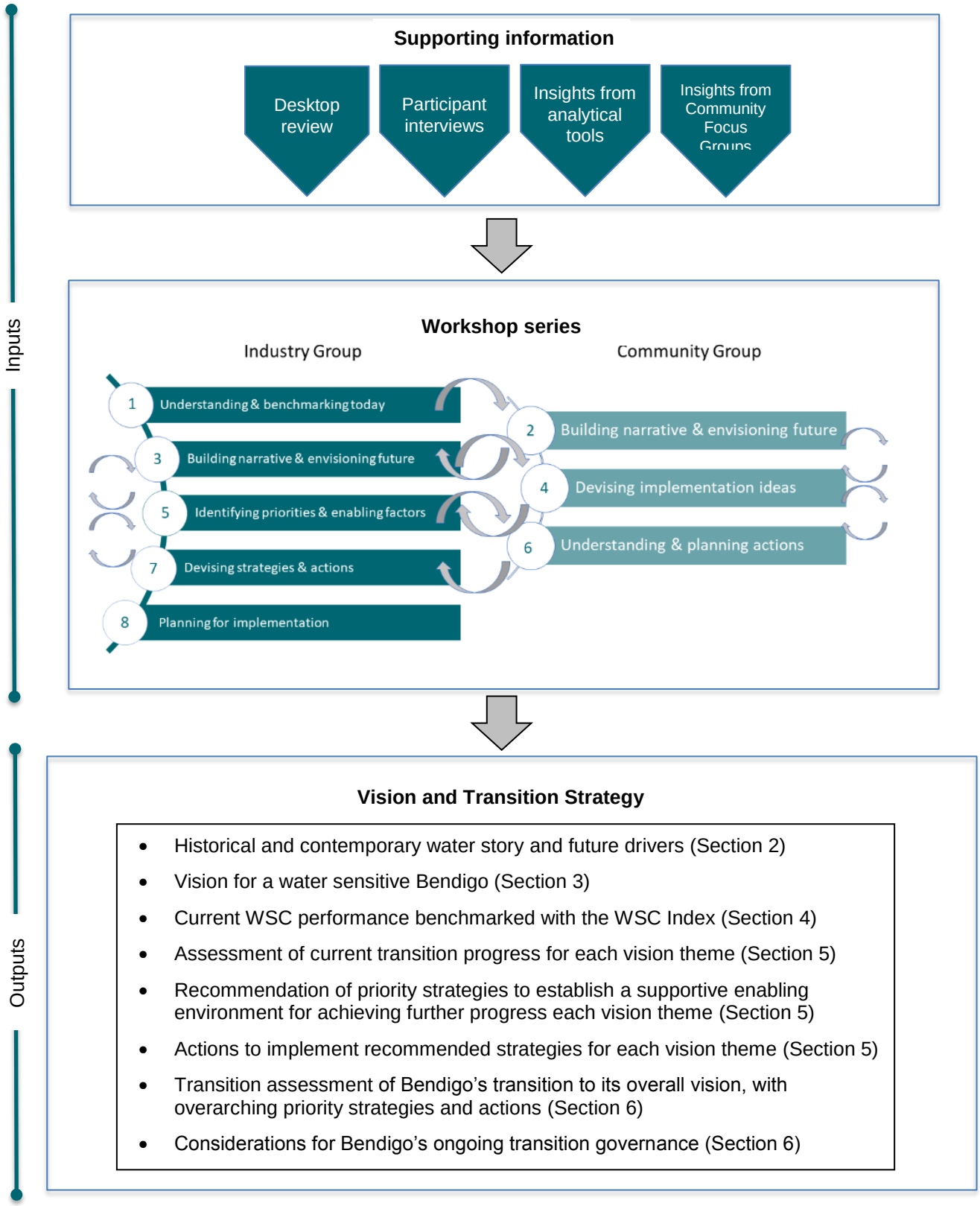


Figure 1. Bendigo case: Development process and key outputs

1.3. Case methodology

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

Bendigo is the only one of the six cities in the IRP1 project that engaged with community participants in a dedicated process. This builds on previous CRCWSC research focused on community visioning and transition planning in Elwood, a suburb of Melbourne. For Bendigo, community participants were engaged in a parallel process to and industry, government and non-government organisation representatives, with a small group of people attending both processes. The content developed and insights gained from each parallel process were reported to both groups and built upon iteratively, such that the case findings presented in this report are a synthesis and integration of outcomes from both processes.

Workshops were designed to facilitate open and in-depth discussion among the respective stakeholder groups, and were tailored to their engagement needs. The engagement process was conducted over an 8-month period between September 2017 and April 2018, and involved desktop review by the project team, individual interviews with workshop participants, a series of five one-day workshops for industry participants, a series of three three-hour workshops for self-selected community participants, and three two-hour focus groups with segments of the community that were underrepresented in the core workshop series (recruited through a market research firm). Iterative synthesis and analysis by the research team across these sources of data produced key elements of Bendigo's vision and transition strategy. Details of the individual activities are provided below.

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

A local steering committee was established at the beginning of the case to guide the Bendigo activities. This helped to ensure the project would have impact locally through alignment with current and upcoming opportunities, effective strategic positioning and targeted communications with key agencies that would support broader endorsement and support of the project activities and outcomes. Appendix 1 lists the steering committee members.

Desktop review

A desktop review of relevant literature was conducted to examine key themes and developments that have been significant for Bendigo's water system and identify evidence important for benchmarking the city's current water sensitive performance and transition progress. Key sources of secondary data included Victorian Government policy documents, key Victorian acts and regulations, department and agency websites and organisational materials relevant to water policy, strategy and programs in the Bendigo region.

Participant recruitment

Participant recruitment varied by group. Water, planning, development and environment sector representatives (Industry Group) drew from water, government and non-government organisations

that are relevant to Bendigo's governance, culture, economy or environment. Participants were personally invited to ensure a rich mix of organisations, disciplines and perspectives. The Industry Group included 47 participants, though individuals' attendance varied from workshop to workshop.

Community participants were recruited into the Community Group by self-selection based on their interest in the topic. A variety of approaches to publicise the project were used, including social media campaigns, regional newspaper advertising, council newsletters and direct correspondence to community groups in the conservation and sustainability domain. Recruitment was supported by a project website for communication and registration, www.watersensitivebendigo.org. The website also featured an interactive map application to collect ideas about improving Bendigo's built and natural environment.

There were 31 participants in the Community Group. Half of the group were female. Just over two-thirds of participants were aged between 36 and 64 years of age (the most common age range was 46-64, which comprised about 43% of participants). Most participants had a minimum of a Bachelors Degree qualification. About half of the participants in the Community Group had an interest in participating due to paid or volunteer work in the water sector or natural resource management. Several other participants appeared motivated by particular water management issues, including Bendigo Creek, groundwater management, or management of water bodies for recreational use. The remainder of participants reported a general interest in sustainability, the natural environment, or the future of Bendigo.

There was a small degree of overlap between the Community and Industry Groups; some industry participants attended some of the community workshops to support cross-fertilisation of ideas between the two groups. This was made transparent to the participants during each workshop. Two participants recruited through the community process attended the last industry workshop.

Interviews and surveys

Interviews with 25 people in the Industry Group were conducted prior to the first workshop. Interviews examined participants' understanding of Bendigo's water management issues, major challenges and opportunities, and professional and organisational culture, systems and processes. The interview questions were open-ended to allow for in-depth narratives about personal experiences and perceptions. Workshop participants also completed a quantitative baseline survey to complement the data provided in the interviews and to inform a national evaluation of the processes implemented as part of the project.

Participants from the Community Group were asked to complete a 25 minute telephone-based survey that included open-ended questions about their interest in water management issues and a range of multiple-choice questions that addressed their knowledge and attitudes to water sensitive transitions, trust in government decision-making and demographic factors. 29 community participants were interviewed.

Workshop 1: Benchmarking – Industry Group's first workshop

A full day workshop was held at the Capital Theatre, Bendigo on 27 October 2017, involving 36 industry participants. This workshop focused on applying the Water Sensitive Cities Index tool to benchmark Bendigo's current water sensitive performance and diagnose key areas of strength and weakness in relation to the water sensitive city goals of good governance, community capital, equity of essential services, productivity and resource efficiency, adaptive infrastructure, ecological health and quality urban space.

Workshop 2: Narrative building and envisioning – Community Group's first workshop

The first community workshop was held on the evening of 7 December 2017 at the offices of the City of Greater Bendigo on Littleton Terrace, involving 29 participants from the Bendigo community. This workshop served to introduce the project to a largely new set of participants, as well as begin the narrative building and envisioning process. The first major activity for participants involved identifying key moments that have shaped Bendigo's water story, whether in the form of changes to technical systems, developments in policy, programs or laws, environmental events, community trends, or personal milestones.

Envisioning started with a group discussion of what participants loved about Bendigo, then explored the possible futures for Bendigo through a creative activity involving writing newspaper headlines to accompany a profile of Bendigo. These headlines were either positive and desirable, or undesirable and were grouped into themes by the facilitators as they were submitted. The final activity of the workshop involved expanding on the positive thematic vision statements of the previous activity with annotations regarding what the daily experiences of living in this image of the future might be.

Workshop 3: Narrative building and envisioning – Industry Group's second workshop

The second industry workshop was held on 13 December 2017 at the Capital Theatre, Bendigo, involving 40 industry participants. The first session reviewed the work undertaken to date, including feedback from the first report and reflections from the first community workshop. It then developed a collective water story for Bendigo by looking to the past and exploring how certain events and trends have shaped how water is managed today, mirroring the community water story activity.

The late morning session focused on beginning to develop a shared 50-year vision for Bendigo as a future water sensitive city. Similarly to the first community workshop, this activity began with a general discussion about what participants love about Bendigo, then a headline writing activity at tables. The headlines were grouped by the facilitators as they were submitted, with approximately 40 headlines formed into several aspirational themes, and a further 10 categorised as undesirable or dystopic images of the future.

The next session expanded on the vision themes with more detailed discussion of the outcomes for Bendigo implied by the headline statements, beginning with the undesirable visions. In this activity, participants were asked to move into groups to develop a narrative about how the undesirable future of Bendigo unfolded through a range of causes. Participants then worked on the aspirational vision themes in small groups, focusing on expanding on the ideas within the headline themes.

Workshop 4: Validating water story and vision, and exploring ideas and solutions – Community Group's second workshop

This workshop was held at the Bendigo Library on 7 February 2018 and involved 16 participants. The first part of the workshop was dedicated to presenting and exploring the water story and vision that had been synthesised from the previous community and industry workshops. An overview of the water story was presented, along with the negative future drawn from previous workshops followed by a brief group discussion. Bendigo's WSC vision was then presented as 7 elements, followed by small group and whole group discussion to refine and validate the ideas presented. There was also discussion of the overarching vision statement as a whole group.

The next part of the workshop focused on how to turn the vision into a reality, by exploring tangible solutions that could be implemented in Bendigo. To introduce this topic, participants received a stimulus presentation of examples of innovative and inspiring biophysical and sociocultural solutions that have been implemented elsewhere. Participants were encouraged to 'think big'.

During the activity, participants were asked to brainstorm solutions individually, then share and expand their ideas through small group discussion. Similar ideas were grouped together. Participants were prompted to consider different scales of change – system-wide, street or neighbourhood, and household – and different precincts of Bendigo. Participants were prompted to consider urban design ideas, infrastructure solutions and community initiatives. Participants could then make use of mixed media (text, drawing, collage) to develop the detail of their ideas and solutions that would translate the vision themes into reality.

Workshop 5: Validating water story and vision, and exploring enabling conditions, priorities ideas for Bendigo – Industry Group's third workshop

The next workshop was held on 15 February 2018 at the Capital Theatre, Bendigo, involving 33 participants. Bendigo's water story was first presented, followed by a high-level summary of the dystopian future vision and a whole-group discussion and reflection. Each of the 7 initial elements of the vision was presented, as well as the overarching statement, in conjunction with some of the feedback received at the previous community workshop. The participants were asked whether the presented work captured their vision, whether it resonated for Bendigo as a place, and if there was anything missing.

The next activity focused on refining and adding detail to the vision elements in small groups. Tables were asked to consider different vision elements to ensure a broad spread of discussion, and asked specifically whether the statements were aspirational and inspiring, relevant enough for Bendigo and whether there was any repetition or overlooking of ideas.

The afternoon session was largely dedicated to exploring the barriers and opportunities for Bendigo's WSC transition. Participants were also asked to spend some time exploring tangible ideas and solutions that could translate the vision into reality. Some of the community's ideas were presented as examples.

Workshop 6: Priorities, strategies and actions – Community Group's third workshop

This final workshop for the Community Group was held at the Bendigo Library on 14 March 2018, involving 18participants. In the first hour, participants were updated on the work undertaken by the project team since the previous workshop, including discussion of the results of the focus group sessions with randomly selected members of key population segments. There was also a short discussion of refinements made to the vision to incorporate feedback from the previous community and industry workshops.

The second hour aimed to explore the actions that could help implement the vision. This activity was structured around themes that emerged from the solution brainstorming activities in the previous workshops. These 8 themes largely reflected the different vision outcomes that had emerged in workshop discussions so far. During this activity, participants were prompted to consider different scales of action (e.g. household, neighbourhood and system), and different types of action (e.g. cultural, technical, economic).

The third part of the workshop was primarily devoted to discussing the community's role generally in making change and the type of involvement the participants specifically see for themselves in shaping the next stage in Bendigo's water sensitive transition. During the discussion of the community's role in driving change, participants allocated themselves to a table considering one of four community segments that participants decided were helpful to distinguish for engagement purposes: young people; special interest groups; families; and low-income earners.

The workshop closed with discussion of how participants would like to take this process forward, as well as activities the project team will be planning for later in 2018.

Workshop 7: Advancing Strategies & Actions – Industry Group's fourth workshop

27 participants attended the fourth industry workshop, held on 20 March 2018 at the Capital Theatre, Bendigo. The first session of the morning started with an update on research activities. The purpose of this presentation was to inform participants of the process and results of three community focus groups conducted by the research team and the outcomes of the final community workshop. Participants were invited to reflect on the implications of these results on their own process and outputs, and to specifically consider the community's role in driving transitions towards a water sensitive future.

The second session of the morning was about presenting, refining and finalising the vision. Refinements made to the vision since the last workshop were presented and time was allocated for whole-group discussion and reflection.

The next activity revisited the Transitions Dynamics Framework (TDF) to consider Bendigo's transition progress towards its envisioned state as a water sensitive city. First, the research team presented results of their analysis that drew on workshop, interview and secondary data to assess Bendigo's current transition progress and recommended strategies for the short- to medium-term. Participants were then invited to reflect on and refine these strategies, and brainstorm actions for progressing the strategies to achieve the vision.

Next, an activity to identify priority areas of focus across the WSC index indicators was conducted. Interpretation of the WSC Index scores and results was presented before the activity commenced to provide participants with the necessary background information. Each participant received 10 dots. Participants were invited to review the 34 WSC index indicators and Bendigo's scores and use their dots to cast a vote for the indicators the felt needed priority attention in on-ground actions to improve Bendigo's water sensitivity (Appendix 3). The results of this exercise were not a statistically reliable test but rather an activity to seed participants' thinking about prioritisation in a resource-constrained context.

The afternoon session started with a presentation that delivered a snapshot of Bendigo's transition progress towards its vision overall, and four corresponding overarching strategies that were recommended by the research team as necessary to maintain momentum and drive short-term action. The recommended strategies aim to progress Bendigo's transition as a whole city towards its envisioned water sensitive future. The remainder of the session was dedicated to developing actions to implement these overarching strategies.

The workshop concluded with a discussion to inform scoping of the final workshop, which would be focused on implementation planning. Participants were asked what was required bring closure to this process and what is necessary to maintain momentum beyond the completion of the research.

Workshop 8: Towards Implementation – Industry Group's fifth workshop

There were 22 participants at this workshop held on 18 April 2018 at the Capital Theatre, Bendigo.

Following a short introduction and review of the vision, participants were invited to share reflections from discussions with their organisations and networks about strategy implementation to set the scene and key considerations for the day's discussions.

In the mid-morning session, participants separated into groups to review the actions developed in the two previous workshops with the Community Group and Industry Group and subsequently synthesised by the research team. Participants were tasked with reviewing the text of each action for relevance to the strategies and potential for complementary action.

In the late morning and early afternoon, participants were asked to return to the same groups they had formed in the previous activity to examine the feasibility and importance of the actions. This was not designed as a full-feasibility analysis, but as a means to deepen the enquiry into the actions. Participants were asked to discuss the likely benefits each action, both in terms of direct impacts and as a potential enabler of other actions. For feasibility, participants were invited to comment on the potential financial cost, any social or technical challenges and capacity to implement. For each action, a rating of benefit and feasibility was decided by consensus along a two-point axis.

In the final session, discussion centred on the formal and informal governance arrangements that would help Bendigo stakeholders maintain momentum as they implement the strategies developed in this project. The research team gave an initial presentation on the latest transition governance research and experiences elsewhere in Australia, particularly Perth, which is well advanced in its establishment of a Transition Network. This provided general principles and real life examples for the participants to consider as they explored how Bendigo can proceed with its transition planning and actions.

Additional Community Focus Groups

The inclusion of community perspectives in the IRP1 Bendigo case study made it the most extensive of all the six case study sites for the Visions and Transitions Strategies Project (IRP1).

Since the community group of participants were self-selected, in that they responded to an open invitation to participate, inevitably the sample was not representative of the broader Bendigo community and, in fact, were generally knowledgeable about water and the environment. This was a deliberate methodological choice, since it is well-recognised in studies of transitions that a group of passionate champions who have the opportunity to strengthen relationships and establish collective commitment to action are critical drivers of transitional change. This process therefore presented an opportunity to mobilise such a community network in the hope that it will lead to ongoing momentum and partnerships.

Nonetheless, it was important from both a research and industry perspective to understand the broader community aspirations for their water future and how they relate to the water sensitive vision for Bendigo developed by the participants, so that agencies could have confidence in using it as an orienting framework for action planning. Engaging with community members who may not often be represented in participatory forums was also a valuable opportunity to seek ideas and feedback on how they could be part of Bendigo's water sensitive city transition.

Three focus groups were therefore conducted, targeting groups not well-represented in the main community workshop series: low socio-economic status (renters), young persons aged 18-35, and people who were active gardeners. Each focus group included ten individuals who were randomly selected by a recruitment agency.

The focus groups each ran for 2 hours and covered five topics. For consistency, the process for each discussion topic was based on activities undertaken by participants in the main workshop sessions:

1. What they love about Bendigo
2. Their knowledge of water sensitive city concepts
3. Their 50 year vision for Bendigo's water future
4. Their reflections on the draft vision for Bendigo's water future
5. How they would like to be involved in guiding Bendigo's water future

Each focus group started with group introductions and a discussion of what participants loved about Bendigo. Participants were then shown a short video explaining the core concepts of a water sensitive city followed by a group discussion to understand the water literacy of participants in the room.

The next activity explored the possible futures for Bendigo through a creative activity involving writing newspaper headlines to accompany a profile of Bendigo. These headlines were either positive and desirable, or undesirable and were grouped into themes by the facilitators as they were submitted. Participants then expanded on the positive thematic vision statements of the previous activity through group discussion regarding what the daily experiences of living in this image of the future might be.

The focus group participants were introduced to the draft WSC Bendigo vision in a short presentation and were asked to rate the vision themes with a 1-5 rating. Ratings were recorded individually on a score sheet. Participants were asked to share their rationale for their own scores, prompted with questions such as: Is this vision useful? Is it a worthy goal to aim for? Does the vision reflect your desires and hopes for a future Bendigo? Does the vision meet your priorities?

The final activity was a facilitated group discussion designed to understand if and how participants would like to be engaged in future decision making in Bendigo.

Insights from the focus groups were presented to the main industry and community workshop participants during relevant discussions to provide opportunities for the perspectives of this broader community sample to inform their thinking and creation of vision and transition strategy content.

2. Bendigo's water story

2.1. Looking from the past to today

When preparing for future changes, it is helpful to look to the past and learn from patterns of change and previous responses to trends and events. Engagement with participants focused on building a collective timeline of people's historic knowledge and experiences with water management in Bendigo. Participants were asked to populate a timeline ranging from pre-history to the present, identifying key events and changes according to the categories of technical systems, governance, environment, community, and personal experiences. This subsection is a synthesis of the activities and discussion of participants from both the Community and Industry Groups, supplemented by further literature review, to present Bendigo's historical and contemporary water story.

Pre-1850: Dja Dja Wurrung country

Prior to the colonisation of Victoria and the migration of people from the United Kingdom and other parts of the world, the Bendigo country was under the stewardship of the Dja Dja Wurrung people. The Dja Dja Wurrung, using a system of cultural governance, managed water and land for the benefits of its people. Caring for Country, for the people, meant treating the landscape as more than the sum of its parts, and with its own spirit and stories to be honoured and protected. The effect of this was to consider waterways as an integrated part of the whole; not just considering waterways as sources of water, but as contributing to the greater health of the landscape.

In this time it is believed that Bendigo had relatively reliable water. Reports of early pastoralists remarked on what became known as Bendigo Creek forming a chain of ponds, with early sights of platypus. However, it is likely that drought was an ever-present threat. The Dja Dja Wurrung is understood to have relied on wells they had dug to provide safe travel during drought. The arrival of pastoralists from the 1830s began Dja Dja Wurrung dispossession from their traditional lands.

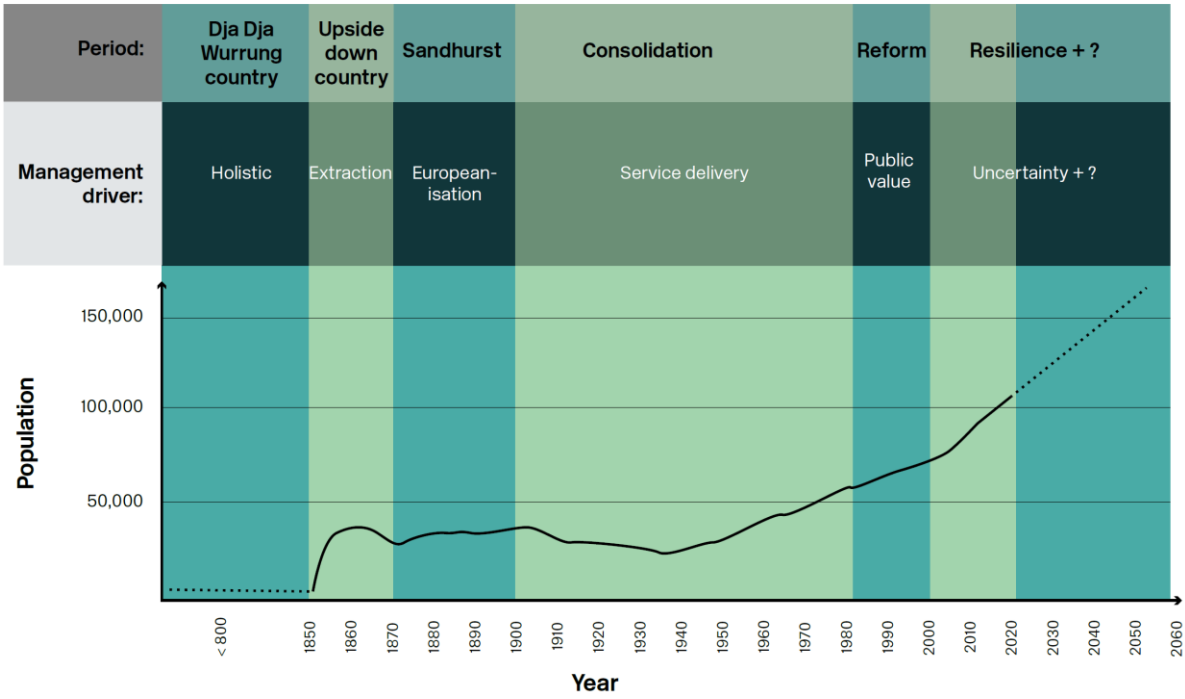


Figure 2. Bendigo's water story

1850 – 1870: Upside-down country

"In 1851, there was just a fracturing of whatever existed before. It was just totally overwhelmed… It wasn't even on anyone's radar, [the natural environment] was just cast aside. To rebuild it was such a long slow process because it was just tossed aside as if it didn't exist!"

From the time gold is discovered in 1851, Bendigo's traditional landscape appears to have been tossed aside. Waterways in the region were overwhelmed by deforestation, dredging and mining. One Tree Hill was named for the extent of deforestation – it hosted the only remaining tree in the area. Bendigo Creek was relocated to facilitate gold extraction and began to accumulate sludge from mining and human waste. The impacts of digging and erosion led to Bendigo being known as 'upside-down country' by the Dja Dja Wurrung.

Migrants flocked to the Victorian Goldfields, with Bendigo receiving a large share of the new population. The settlement of Bendigo (named for Bendigo Creek) grew into the township of Sandhurst in 1854 State Library of Victoria, 2013). Early efforts to provide water to the Bendigo goldfields were made by the private Bendigo Water Works Company, which was established in the late 1850s to provide reliable water supplies for mining and domestic use, as well as to extract gold from the land acquired for water supply purposes. The engineer Joseph Brady was appointed by Bendigo Water Works Company to design a water supply system for Bendigo, including a series of eight reservoirs, the designs for which he submitted in 1858. Not all of these planned reservoirs were constructed. The No. 7 Reservoir, built in 1861, was the most effective of these. It used sand filtration and an underground cistern for clean water storage, which was a first in Australia (Coliban Water, 2014). Though a reticulated water supply system was constructed in the 1860s, many miners and residents still relied on domestically collected water (from roofs) or carted water, either because they were outside the supply area, or because they wished to avoid the high water prices charged by Bendigo Water Works Company (Russell, 2009).

"A lot of buildings only exist in Melbourne because of Bendigo gold."

From the late 1860s, the Water Supply Department was responsible for supplying water to the goldfields and managing stormwater (Public Records Office of Victoria, 2016). This operated within the Department of Mines and Water Supply, the combination of which showed the degree to which these two activities were linked in colonial Victoria. Each town water supply scheme was managed by its own waterworks trust or local governing body.

These early mining years were beset by drought and water shortages (e.g. 1861-2, 1865), which were often interspersed by wetter-than-average years that resulted in flooding (e.g. 1863) (Russell, 2009). The downpour of rain created sludge. The community was aware of the drought-flood cycle and understood the unreliability of water supplies. There was political pressure for solutions, which included the Coliban scheme to divert water from the Coliban River at Malmsbury to Bendigo's reservoirs. At an early stage it was believed that Bendigo's future could not be fulfilled with its own water resources. Joseph Brady was also appointed by the Victorian Government to survey and design the Coliban scheme. The Malmsbury Reservoir was completed in 1877 along with the 70 km long Coliban Main Channel to convey water to Bendigo (Coliban Water, 2014).

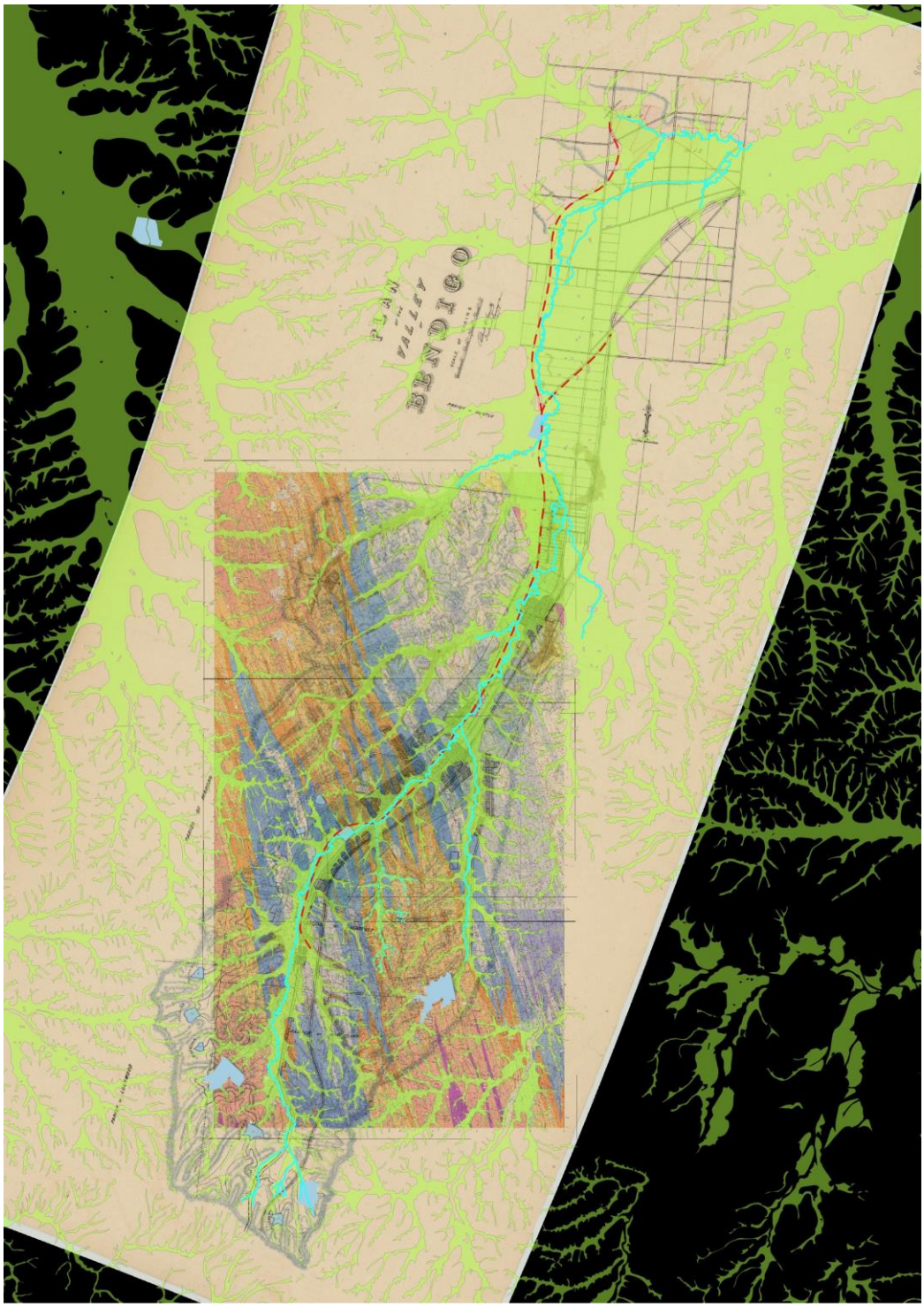
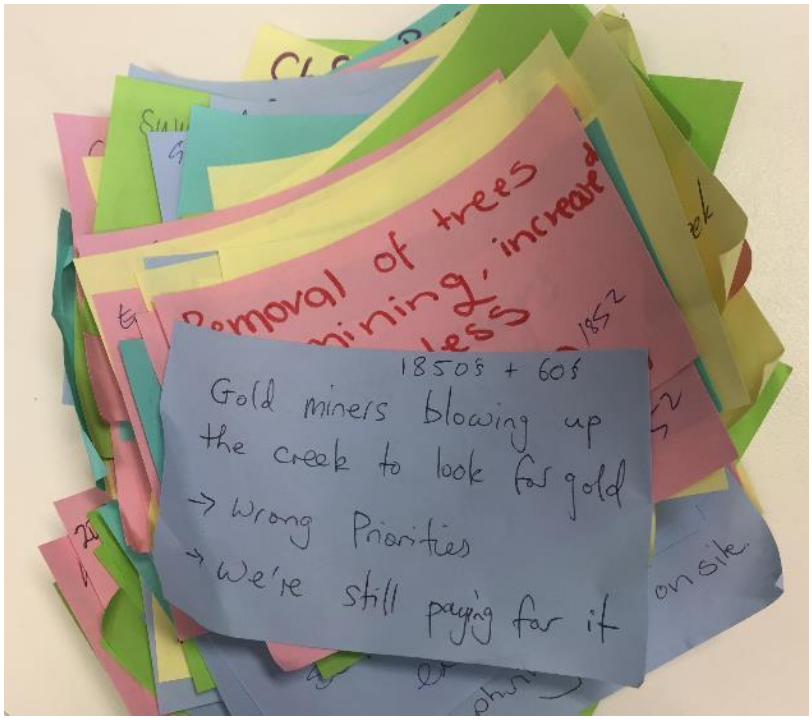


Figure 3. Historic; 1:100,000 Historic alignment of the Bendigo Creek (cyan) and proposed 'sludge channel' (dotted red) drawn from Plan of the Valley of Bendigo 1858 map underlay (shown), with both current and historic (1858) waterbodies and reservoirs, and colluvial geological underlay (light green).Existing geological maps (1988, 1992) are also overlaid atop the historic map, and reveal how deeper geological moments influence waterways, infrastructural systems and developments at the surface. This spatial representation of Bendigo provided by MADA.

1870 – 1900 Sandhurst (Bendigo's Europeanisation)

"There was obviously a period where people said we actually need water in this place, in terms of a physical part of the urban form."

In the 1850s, Bendigo was renamed Sandhurst, a name which was to last until 1891. In this period, the Bendigo Goldfields were key to Victoria's prosperity, more important than Melbourne at the time. In fact, many historic buildings in Melbourne owe their origin to the wealth generated from Bendigo's gold. Naturally, the settlement grew and established itself around the mining industry. The deforestation in the region prompted the planting of European trees in the township. The botanic gardens were established in the White Hills Township in 1857 near Bendigo Creek (Bendigo Botanic Gardens, 2015). Lake Weeroona was conceived of in the early 1870s to rehabilitate a barren mining site and to bring water into the urban form. The original plans were more extensive than what was eventually delivered (City of Greater Bendigo, 2017). The lining of Bendigo Creek with stone in the late 1800s to improve drainage was also significant to Bendigo's urban planning. Some of Bendigo's connection to water from its early years has now been lost – few people may know that present-day Bath Lane was a washing site for early settlers. In the early 1870s, the Sandhurst Town Council purchased the Bendigo Water Works Company (Context, 2007).



1900 – 1980: Consolidation

"The vast majority of the wealth was exported to the UK."

The replacement of alluvial mining by quartz mining in the 1860s drove more substantial growth and development in Bendigo. Although production was occasionally affected by the lack of water for ore processing, such as during the mid-1860s drought, infrastructure development generally kept pace with demand. The innovative Crusoe water treatment plant, with its three concrete settling ponds and underground cistern, was designed by Joseph Brady and completed by 1873. It was designed to remove impurities from the system by allowing sediment to settle (Russell, 2009). The Upper Coliban

Reservoir was completed in 1903 to 'drought-proof' the Coliban scheme. Bendigo received reticulated sewerage in the early 1920s.

This growth slowed by the 1880s as investors became harder to attract to riskier, deeper mines (Fahey, 2001). Another slump in Bendigo's fortunes occurred after World War I, although there was some small-scale agricultural development around Bendigo to employ returned soldiers. These developments led to the construction of the rural water channel system still in use today.

The work of the Water Supply Department was taken up by the State Rivers and Water Supply Commission from 1906, which managed the supply of water to Bendigo. Bendigo Sewerage Authority was established in 1916, the first sewerage authority established after the passing of the Sewerage District Act 1915. The Authority built Bendigo's sewerage system (completed in 1931) and levied rates on connected properties (Neville, 1934). The Bendigo Pottery Company successfully tendered to supply pipes and other equipment, though with some controversy over the favouring of local interests (Parliament of Victoria, 1925).

Pollution into local waterways from mining activity was an issue that that resulted in the establishment of a Sludge Abatement Trust for Bendigo. This regulated disposal of sludge and debris from mining.

By the late 1930s Bendigo had started to recover from depression. Following World War II, its population expanded. With this new population growth, the need to again augment water supplies to Bendigo came to the fore. Malmsbury Reservoir's capacity was increased in 1940 and Lauriston Reservoir was completed in 1944. Lake Eppalock commenced operation in 1964 to supply irrigators and to 'drought-proof' Bendigo (Mitchell, 2010). The 1960s also saw the expansion of the sewerage network. Bendigo was an important site for the manufacture of water supply infrastructure for use around the state. The taste of the water provided to Bendigo residents and businesses was not appealing, with high chlorine levels. In November 1949 Bendigo's most damaging flood occurred, with many shops and businesses as well as the law courts flooding when Bendigo Creek burst its banks at Charring Cross. Other wet years occurred in 1955-56 and 1973-74. Levy banks were created along Bendigo Creek when this flooding was recognised as a recurring problem.

"The taste of water was terrible - just shocking!"

Environmental health began to receive greater attention across Victoria and Australia more broadly in the 1970s. The Environment Protection Act 1970 (Vic) was passed, and a regional office of the Environment Protection Authority was located in Bendigo. In the mid-1970s, biological nutrient removal was introduced into the wastewater treatment process by the Bendigo Sewerage Authority. Water quality for residents also improved with the commissioning of Sandhurst Reservoir and new chlorination processes in 1985 (Rural Water Commission, 1985). However, the proliferation of stock and domestic dams in the Coliban and Campaspe catchments impacted on the volume of water available in storages.

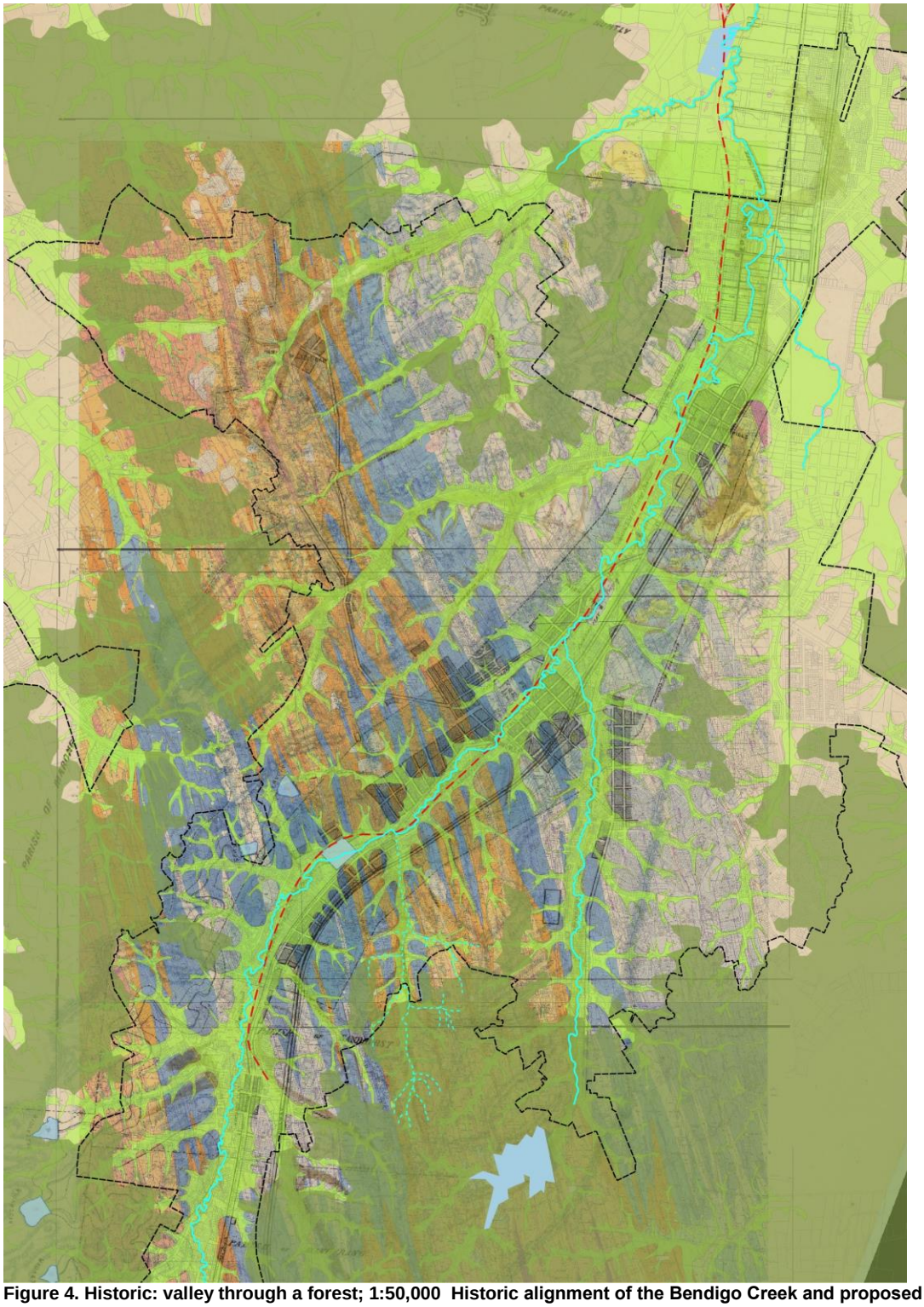


Figure 4. Historic: valley through a forest; 1:50,000 Historic alignment of the Bendigo Creek and proposed 'sludge channel' drawn from Plan of the Valley of Bendigo (1858) map underlay (shown), emphasising the relationship between the colluvial geological underlay (light green) with the historic creek alignment and surrounding forests. Existing geological maps (1988, 1992) are overlaid atop the historic map, revealing the anticlines and seams that provided access to the hidden folds of precious metals below. This spatial representation of Bendigo provided by MADA.

1980 – 2000: Government reform

"These were exciting times! People all around state were displaced and put into other roles. But things started to get over the inertia to make change."

The late 20th century saw major change devoted to more efficient governance. Rural water supply was still managed by a statewide authority up until 1994 (the State Rivers and Water Supply Commission being replaced by the Rural Water Commission, then the Rural Water Corporation), but responsibilities for headworks and bulk water distribution were given to regional rural water authorities, with Bendigo falling within the Goulburn-Murray region. Locally, the Bendigo Water Board replaced the Bendigo Sewerage Authority in 1984 (Coliban Water, 2014). However, throughout the 1980s, the highly fragmented regional urban water supply industry was being amalgamated to improve management capability and accountability. For urban water services such as potable water supply and sewerage, the Coliban Region Water Authority was established in 1992. The passing of the Water Act 1989 was a key part of the water reform and modernisation process.

To improve the sustainable management of land and water resources and drive more coherent planning at the catchment level, the Victorian Government established Catchment Management Authority (CMA) boards in 1997, with the North Central CMA responsible for Bendigo's region. Bendigo showed considerable leadership in catchment-based planning. These changes were also accompanied by substantial investment in infrastructure, and services improved.

In the early 1990s, there were five municipalities in and around Bendigo. In 1994 these were amalgamated to form the City of Greater Bendigo. Gordon McKern, a local manufacturer, was one of the commissioners for the City of Greater Bendigo when it was established, and also a champion for water planning, going on to lead the Coliban Water Board for 14 years until 2007.

A growing environmental awareness evident in some regions was slower to awaken in Bendigo. Landcare became an influential force in land conservation, though the mechanisms linking catchment health and water quality were not widely known in the community.

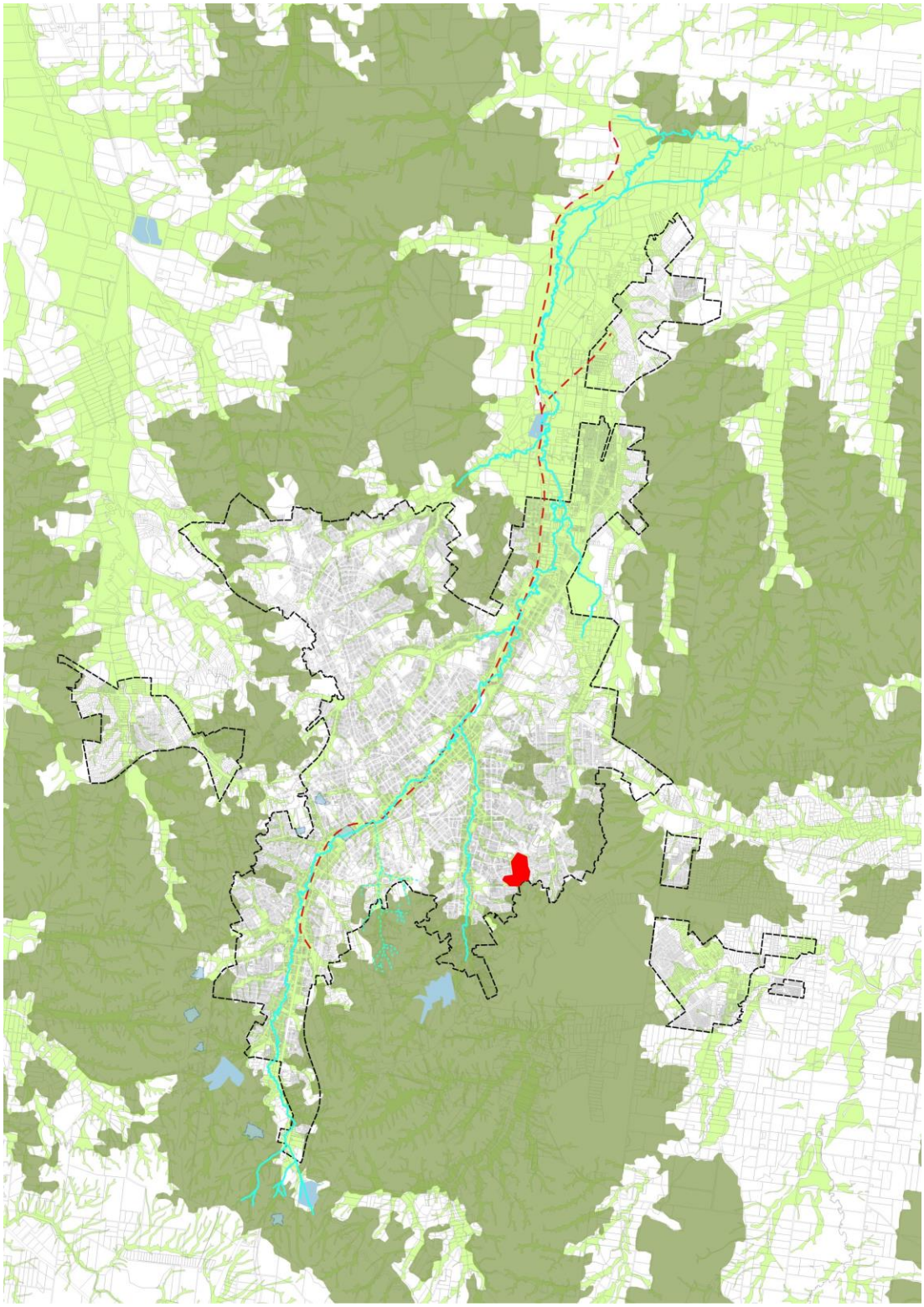


Figure 5. Town in forest; 1:100,000. Historic alignment of the Bendigo Creek (cyan) and proposed 'sludge channel' from 1858 (dotted red), with current property boundaries and urban extents of Bendigo, La Trobe University (red), surrounding forested areas, current and historic (1858) waterbodies and reservoirs, and colluvial geological underlay (light green). This spatial representation of Bendigo provided by MADA.

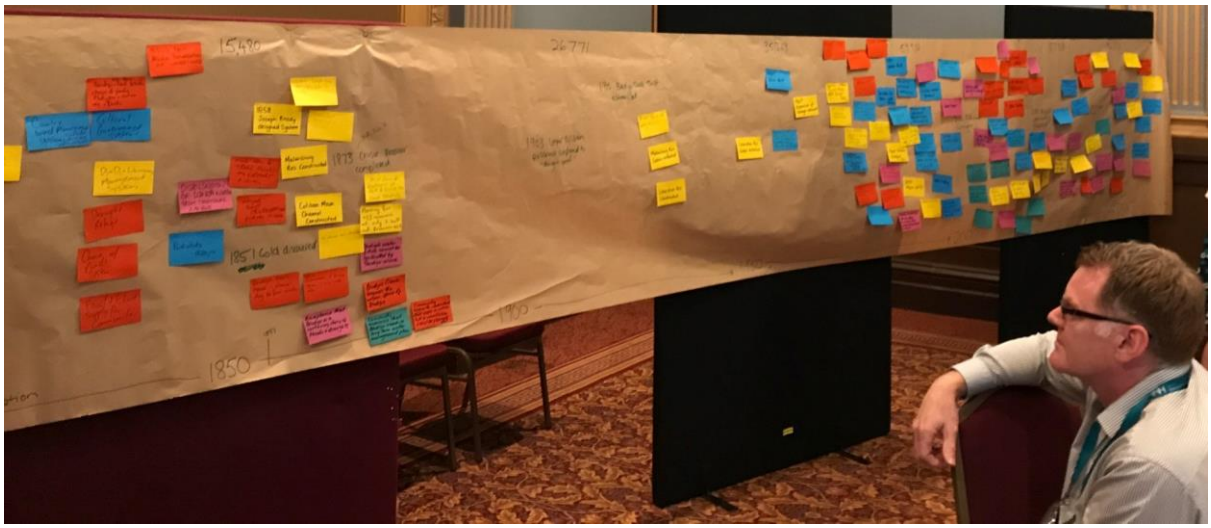
2000+: Resilience

"People recognised this as a different type of drought."

The Millennium Drought (1997-2009) made a dramatic change to Bendigo's relationship to water. The community experienced mounting anxiety as water restrictions escalated quickly, Lake Eppalock fell to less than 10% of its capacity and Bendigo nearly ran out of water. During this time there were many conversations about water and the need for resilience across the broader community, not just people in the water industry. It was very dry, particularly in the period 2004–08. Sports fields and parks turned brown, water features were switched off, and recreation was constrained.

"Water was the conversation; everyone was an expert."

Fortunately, the institutional response was effective, perhaps aided by the national and state reforms in the decade before the drought hit. There was a united approach across local government and key water agencies. Bendigo was on Stage 4 water restrictions for three straight summers. Generally, the community rose to this challenge. Many conventions were broken during this time; for example, there was greater acceptance of grey water use.

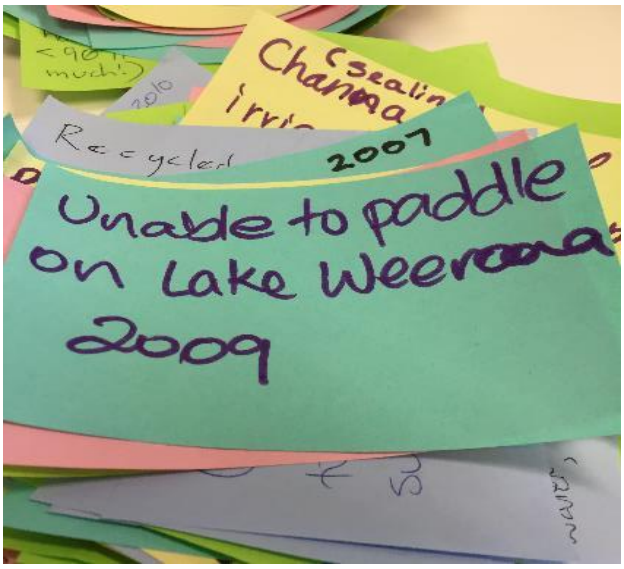


People bucketed excess water from household use onto their gardens. Many gardens were transformed by the planting of drought-tolerant plants such as succulents and grasses, and there was new appreciation for native and indigenous flora. Permanent water saving rules were also introduced across the state. Bendigo was well-advanced in adapting water use practices to these new rules, despite the alleviation of water shortages with new infrastructure such as the Goldfields Superpipe and the Recycled Water Factory and recycled water pipeline. Bendigo's first residential development with a third pipe system to supply recycled water for garden irrigation was built in Jackass Flat in 2010-11.

Unrelated to drought, another infrastructure change that occurred in this *resilience* period was the installation of a new wastewater treatment plant for Bendigo at Sandhurst Reservoir. The Aqua 2000 project was completed in 2002 and made a substantial difference to the drinkability of Bendigo's water. The trunk sewer main along Bendigo Creek also saw capacity improvements in 2006 and 2011.

Governance and planning changes during this period included the introduction of WSUD requirements in the Victoria Planning Provisions in 2006, and the release of the Northern Region

Sustainable Water Strategy in 2009 (Department of Sustainability and Environment, 2009), which attempted to set a long-term plan for securing the region's water security and healthy ecosystems. In 2013 the state Government entered into the Recognition and Settlement Agreement with the Dja Dja Wurrung in accordance with the Traditional Owner Settlement Act 2010 (Vic). Other recent developments include the release of a new long-term statewide water plan, Water for Victoria (Department of Environment, Land, Water and Planning, 2016a), the IWM Framework (Department of Environment, Land, Water and Planning, 2017), and amendments to the Water Act 1989 (Vic) to reflect Traditional Owner cultural values of water. Water for Victoria was accompanied by a $30.8 million investment in Bendigo's groundwater management to address groundwater infiltration of historical mine shafts in parts of Bendigo. Nationally, the Murray Darling Basin Plan was signed into law in 2012.



The breaking of the Millennium Drought in 2010 was accompanied by flooding in Bendigo and across the region. There were two flash floods in Bendigo within 5 months in 2010-11. Lake Eppalock went from 17% of its total storage capacity to 100% in 24 hours. Water supplies were replenished, but the extreme level of inflows degraded the system's water quality. In 2011, the North Central CMA commenced a flood study of Bendigo. This study, which has now been adopted by the Council, improved the understanding of the extent of land subject to flooding.

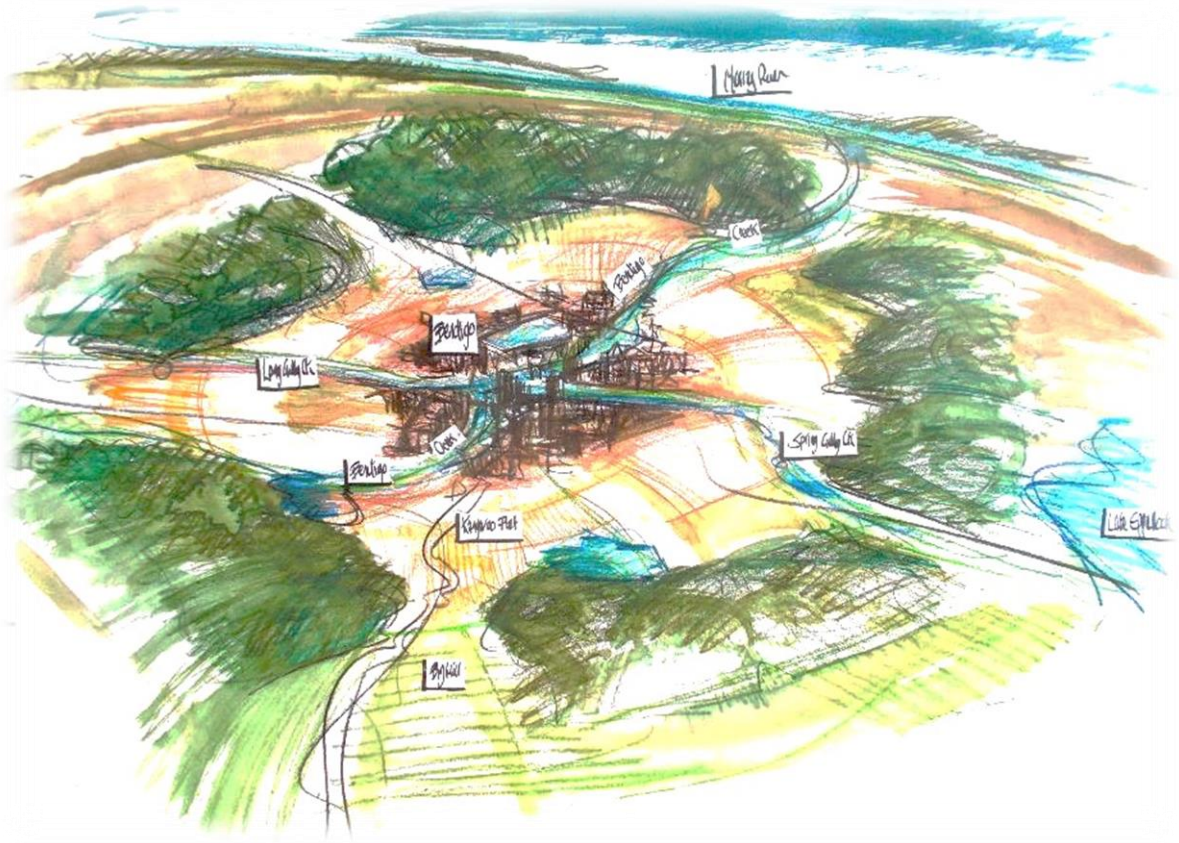
2.2. Why we love Bendigo today

Participants were asked what they loved about Bendigo wanted to be preserved in the face of challenging future contexts of climate change and population growth.

Participants in the workshops loved Bendigo's community spirit. A common sentiment was that Bendigo fits the 'sweet spot' size; it is small enough to support a cohesive, friendly community, but large enough to have city-scale services and cultural facilities. Bendigo's unique identity, history and culture, demonstrated by the grandeur of some of its architecture and the presence of indigenous and Chinese heritage, give people a sense of pride in their city. People also thought that Bendigo has a diverse economy, with a mix of service industries, light manufacturing, agricultural services and education. This was appreciated for providing employment diversity, sustaining a youthful population and creating a history of innovation.

"[Bendigo] can be what I want it to be."

Participants in both workshops also loved Bendigo's lifestyle. Bendigo has good food, wine and coffee, and healthy arts and music scenes. There is also a strong sporting focus and good cycling culture. It is also well connected to the Melbourne and central and north-west Victoria, with good transport options like a regular rail service.



Bendigo's urban environment is also an important attraction. It doesn't have the congestion and poor air quality of larger cities, and it has relatively accessible and well-preserved suburbs. With very few multistorey buildings, it's possible to see across the town and into open space. Bendigo Creek was

loved mainly for its potential. The Box-Ironbark woodlands that surround the urban area are also considered a special feature of the city's geography. It also has an attractive climate.

"Bendigo Creek – it's not yet pretty, but it's a creek of opportunities"

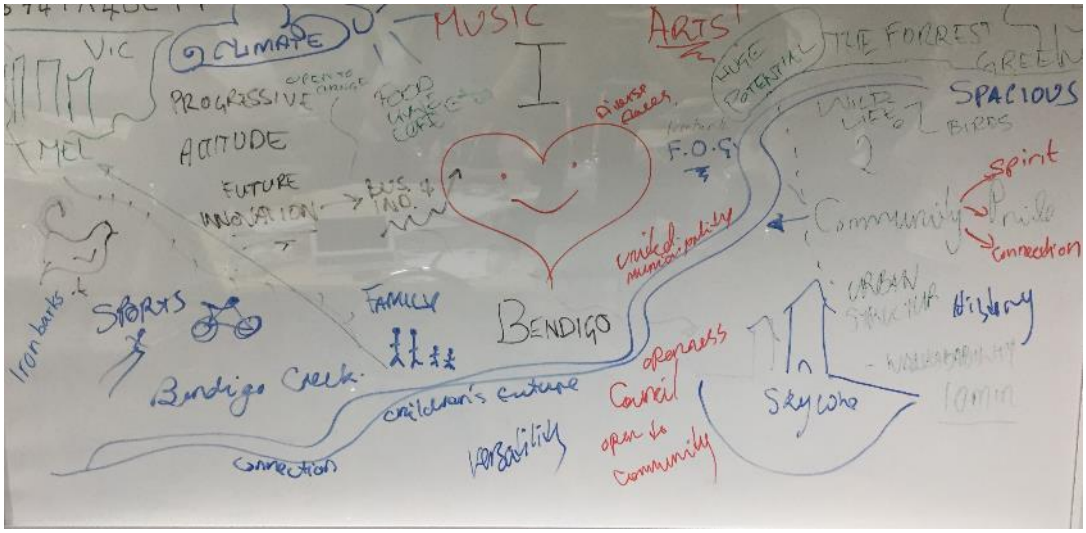


Figure 6. "Why I love Bendigo" discussion notes (Community Group)

2.3. Towards 2068

After considering Bendigo's water narrative up to the present day, it is then natural to turn to the future. This section explores trends and drivers that were briefly discussed in the workshops and further detailed through desktop review of policy and scientific literature. This section also sets these trends in the context of the concerns expressed for Bendigo in participants' undesirable future scenarios.

Population

"We have an established conservative population that is slowly being complemented by residents moving from other places like Melbourne and other areas… But there is that tension of what size and how Bendigo should grow."

By the standards of most of the twentieth century, Bendigo's population growth in the last two decades has been rapid (refer to Figure 2). Bendigo currently has over 93,000 people based on the 2016 census. On the basis of its recent growth, Bendigo's population is forecast to grow at a rate of 1.7% per year, exceeding 120,000 by 2031 and possibly exceeding 170,000 by 2051 based on forecasts for the region (Department of Environment, Land, Water and Planning, 2016b). Net migration is expected to be the significant driver of Bendigo's population growth, being nearly 3 times the contribution of the natural increase (births over deaths). If past trends continue, most of this migration will be from other regions of Victoria and southern New South Wales. The Loddon Mallee

South Regional Growth Plan (2014) has an aspirational population target for the Greater Bendigo Local Government Area of 200,000 people by 2041.

In the medium term, the Ascot-Eaglehawk area is anticipated to have the highest population growth (nearly 3% annually compared to 1.5% for the Bendigo-Kangaroo Flat district). The East Bendigo-Strathfieldsaye district is expected to have the lowest population growth to 2031 (Department of Environment, Land, Water and Planning, 2016b). Official population forecasts for the Bendigo region do not extend beyond 2051, with uncertainty about immigration levels and land availability likely to be a factor.

Bendigo's population will also be aging as lifespans in regional Victoria increase over the coming decades. In the Bendigo region, the proportion of the population aged 65 and over is forecast to be 24.4% by 2051, up from 16.6% in 2011 (Department of Environment, Land, Water and Planning, 2016b). This population growth is anticipated to place unprecedented demands on services for health, family, community and disability (City of Greater Bendigo, 2011). Traditionally Greater Bendigo's residential growth has been outward into greenfield areas, but recent strategy promotes a compact urban form and delivering housing diversity to cater to smaller households.

Population growth will require expanding or rethinking Bendigo's service provision. Connections to the water supply and wastewater sewerage system are likely to double by the mid-2060s, creating challenges for water and wastewater infrastructure and water resources in meeting potential demand (Coliban Water, 2017). Bendigo is car dependent, with 94% of all journeys to work by car. There will therefore be challenges for the road network should population growth occur under the current paradigm. The built environment impacts on people's health and wellbeing and there is a concern that Bendigo's built environment does not encourage active lifestyles (Greater Bendigo Planning Scheme, Clause 21.02). Inactivity is causing a rise in the incidence of diabetes, obesity and cardio-vascular disease with the potential to overwhelm Bendigo's health services.

Most participants view this forecast population growth positively. Their fears for the future are more about Bendigo not having the amenity and affordability to attract newcomers. They also fear that the lack of accessible and attractive open space will reduce the population's mental and physical wellbeing and increase inequality. Participants consider that the availability of sufficient affordable water in homes and businesses and for the environment is critical to supporting healthy transport and recreation options, such as walking and cycling to work, outdoor sport, and urban agriculture.

Climate

Australia has been getting warmer as the climate changes in response to greenhouse gas emissions from human activity. Very warm months have increased by a factor of 5 in the past 15 years in Australia, and the frequency of very cool months has declined by around one-third (CSIRO and Bureau of Meteorology, 2015). Over the last 60 years, the increase in the number of hot days (>35°C) per decade has increased by a factor of 2.5 or 250%.

Figure 7 shows modelled projections for long-term temperature changes in the Murray Basin, near to Bendigo, under future climate change scenarios. By 2067 the temperature is expected to increase nearly 2°C from the average for the period 1986-2005 under moderate global greenhouse gas emissions scenarios. However, if greenhouse gas emission abatement around the world is unsuccessful, the average temperature is expected to be 3°C above the 1986-2005 average.

Bendigo is also likely to experience an increased incidence of extreme heat days. Modelling by CSIRO suggests that, by the end of the century, Mildura could experience 20 more days of severe heat (a maximum temperature exceeding 35°C) and 8 more days of extreme heat (greater than 40°C) (CSIRO and Bureau of Meteorology, 2015).

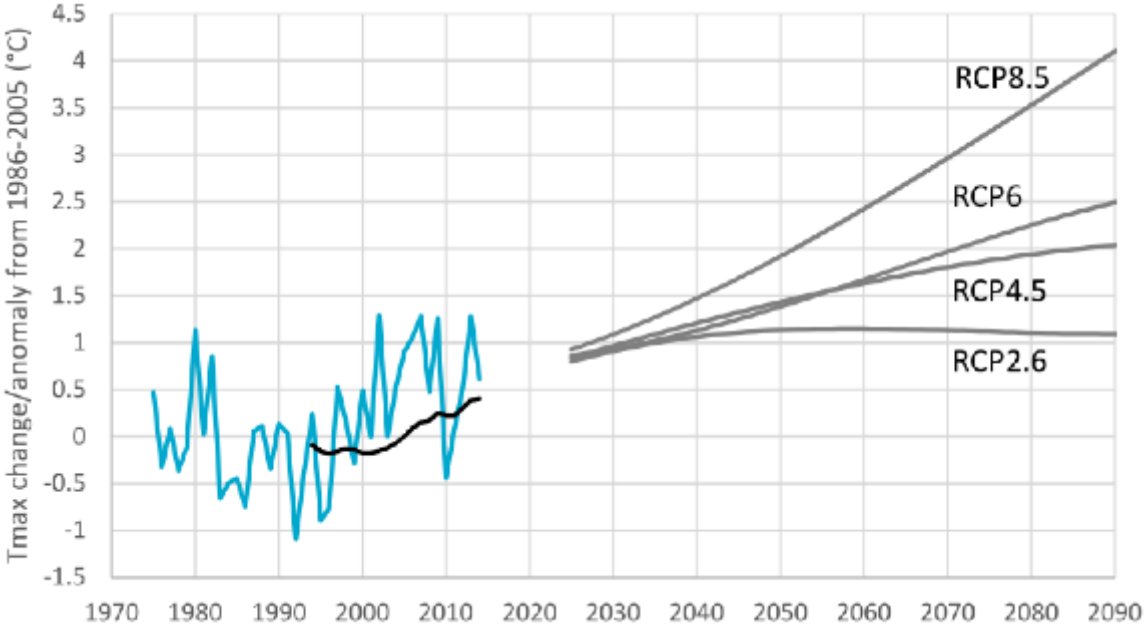


Figure 7. Observed warming relative to 1986-2005, and projected mean warming in the Murray Basin under different emissions scenarios in the 21st century (Potter et al., 2016)

Due to forecast declines in rainfall across the catchments, streamflow in the Campaspe and Loddon Rivers is expected to decline significantly. By 2065, the Campaspe River is projected to have a 21% decrease in runoff relative to 1974-2014, and the Loddon is projected to have an 18% decrease in runoff, among the worst affected catchments in Victoria (Figure 8). More recently published modelling of streamflow estimates for the end of this century reports a decline from the historical mean in the Loddon and Campaspe catchments of 74% and 76% respectively. These are larger streamflow deficits than experienced during the Millennium Drought (Fiddes & Timbal, 2017). The incidence of drought is also likely to be much more common in the second half of this century, as well as lead to much larger changes in water availability. Across Victoria, the driest 10-year period during 2051-2100 has been projected to be between 41.5% and 56% (depending on global greenhouse gas emission pathways) less than the late 20th century average. This is reported to be much worse than the extent of the Millennium Drought, which involved a decline in average streamflow of 31.3% (Fiddes & Timbal, 2017). The forecast long-term declines will be greatest in the cool season, when reservoirs have historically been replenished (Potter et al., 2016).

"Our towns, being north of the divide, we have even more extreme weather conditions."

Although there is uncertainty associated with these projections, they point to the importance of planning for the potential of significantly less surface water available to supply Bendigo's homes and businesses than historically was the case. One of the impacts of a warming and drying climate is that demand on the centralised water supply system may increase. Coliban Water projected that under baseline conditions (no climate change), water demand in the Bendigo region would increase 233% between 2016 and 2065 due to population changes. Under conditions of high climate change, water demand is expected to increase 290%, nearly three times the current demand (Coliban Water, 2017). At the same time, Coliban Water is planning for inflows into Bendigo's water storages to fall by more than half the historical average.

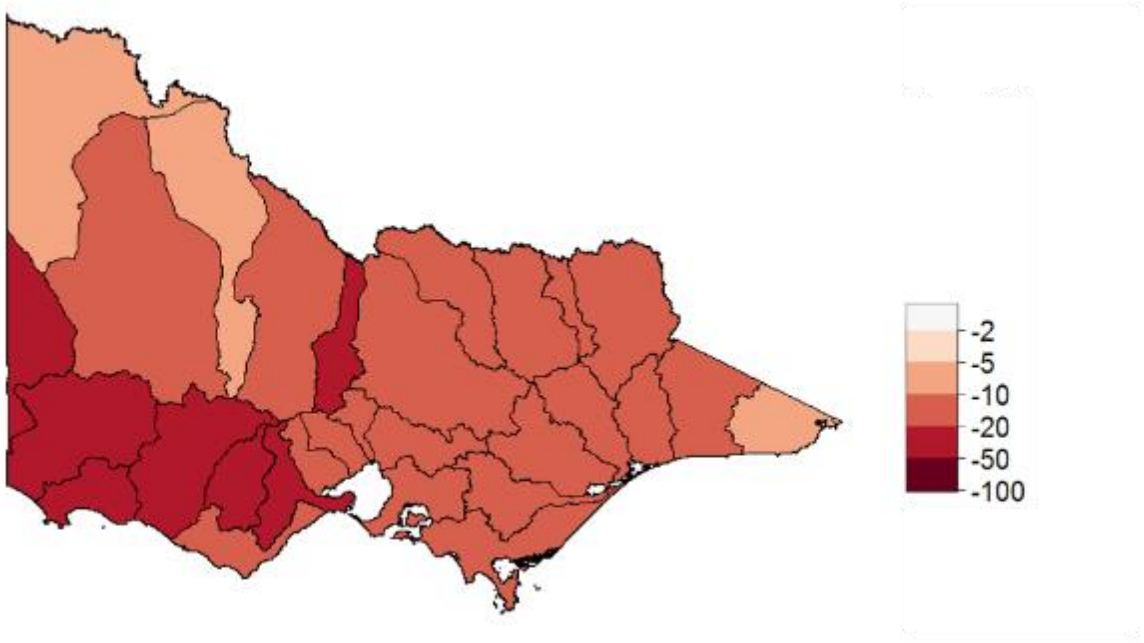


Figure 8. Percentage changes to basin-aggregated mean annual runoff under the medium-impact scenario by 2065 (Potter et al., 2016)

Participants in both Community and Industry groups are concerned about the warming and drying climate in southern Australia and the impacts on Bendigo's catchments. Many worry that the conventional service provision, reliant on surface water storages, will not be sufficient to satisfy Bendigo's water needs. If the responses to future water scarcity were to be water restrictions and rising water prices as a percentage of household income, and no other measures are taken to meet residents' needs for private and public gardens, outdoor recreation and cooling of the built environment, then Bendigo's status as a liveable city would be threatened. Participants also see the link between the wider affordability and availability of water and social equity, as many are concerned that many in the community will miss out on the benefits of water either for personal use or for the neighbourhood amenity.

Environmental threats to safety and liveability

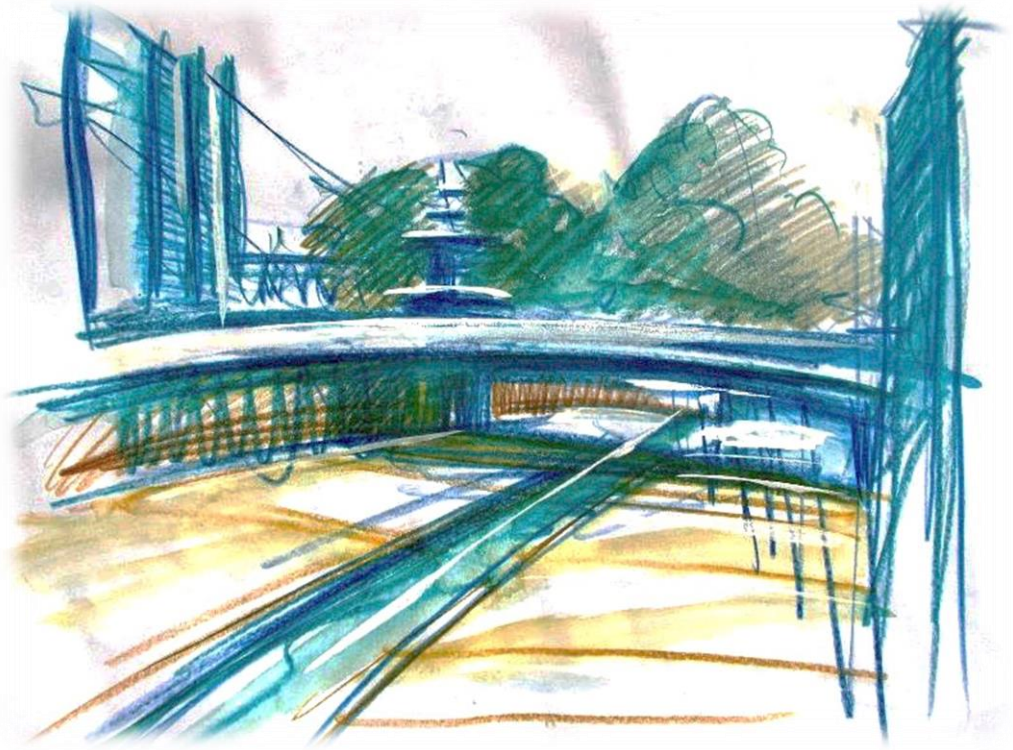
Looking to the future, the management of environmental risk will be critical to realising Bendigo's water sensitive aspirations. The City of Greater Bendigo has identified the key risks as being bushfire, flooding and public health issues such as on-site wastewater management in its long-term planning strategy. Added to these risks might be heatwaves and drought. Should water sensitive planning and management approaches not be taken, Bendigo would likely be a less desirable and fair place to live. Flooding, extreme heat and drought are environmental threats identified by numerous participants and discussed in more detail below.

"Water security is always going to be a hot topic."

Currently, flooding has huge economic and social impacts in Australia. In the Port Phillip and Westernport region of Victoria, it is estimated that the tangible cost of floods is $399 million per year, with 232,000 properties considered to have at least a 1% chance of flooding in any year (Melbourne Water, 2015). The biophysical impact of flooding is unlikely to be eliminated entirely, as in many

locations the cost of works would be far greater than the value of the properties protected (Melbourne Water 2015).

For Bendigo, the current annual cost of flood damage – to Bendigo's roads, bridges, and residential and commercial buildings – has been estimated at $68 million, with damage from a large flood (at least a 1% chance of occurring in any year) costing an estimated $424 million (Water Technology, 2013). The speed at which flooding is expected to occur in Bendigo will leave households and business with little time to defend their properties, unless suitable planning steps are taken. Communities that are aware of flood hazard are more capable to respond effectively to flood warnings and recover from the experience of flooding.



Extreme heat impacts affect all in the community by limiting daytime activity, but it particularly impacts on the health of the elderly. Nicholls et al (2008) estimated there is a 15-17% increase in average daily mortality of people aged 65 years or more in Melbourne when the mean daily temperature exceeded a threshold of 30°C. In the heatwave of 2009 (including three consecutive days of maximum temperatures above 43°C) there were 374 excess deaths in Melbourne over what would be expected: a 62% increase in total all-cause mortality, with the majority of deaths occurring in those 75 years or older. In addition, there was a 12% overall increase in presentations to emergency departments (Department of Human Services, 2009). Although the impact of the urban heat island (UHI) effect on Bendigo has not been studied, the UHI effect is considered a particular issue for Melbourne, as it increases temperatures 2-4°C, with daily peaks as high as 7°C depending on location. Workshop participants expressed the concern that outdoor temperatures in summer would be less bearable if green infrastructure to provide cooling of the immediate surrounds was not supported by water sensitive city planning.

"We all build houses that don't have any eaves and put in great big air conditioners and run them all the bloody time. And they use water and power, but if we water some nice trees around our house than that would provide some cooling as well."

Bendigo is dependent on surface water supplies that are expected to diminish in the long-term, and the incidence and scale of drought has a strong likelihood of increasing by 2068. Bendigo will need to introduce water sensitive approaches into the fabric of the city. Many of the agencies operating in Bendigo have been effective in instilling a water conservation mindset into the population, but this will need continual emphasis, particularly to prevent the devaluing of water for green infrastructure and the environment, which alongside water supplies are also critical for supporting Bendigo's capacity to cope climate extremes.

"Water facilities such as the new swimming pool and parks and gardens will be very important part of the health of the community. To have these amenities in a town without a river we will need recycled water."

Having a garden and experience of environmental risks such as drought are key drivers of behaviours that are connected to higher resilience. For example, workshop participants that had gardens and remembered the Millennium Drought were more active in water conservation now and possessed good knowledge of water efficiency in households. Young participants typically remembered the environmental education they had been given at school.

All members of the community should be able to participate in solutions to reinforce resilience. There are likely to be barriers to further participation, however. In the community focus groups conducted, participants with a lower socio-economic status and/or were in a youth demographic were more likely to feel alienated from planning. Nevertheless, there are some groups in the community with greater capacity to be part of resilience solutions, such as those with higher education, higher-paid jobs or in older age groups. Gardeners were found to be most positive about their involvement in planning. They also appeared to have the highest level of knowledge of WSUD concepts (e.g. water recycling).

Pathways to a dystopian water future for Bendigo

The participants' concerns about the future, broadly canvassed above, were captured through headline envisioning activities for both the Industry and Community groups. The Industry Group further elaborated these undesirable futures by developing a narrative about how four consolidated dystopian scenarios came to be. The results of that activity have been consolidated into a single narrative below.

A warming and drying climate in southern Australia caused lower rainfall in Bendigo's catchments. Large-scale water shortages started to occur, with poorer parts of the community being worst-affected. A series of extreme weather events sent the landscape out of equilibrium, and bushfires began to burn almost annually. Emergency management became an ever-increasing drain on government budgets and volunteer capacity.

The hot climate and lack of water turned people away from Bendigo. Investment declined and the economy stagnated. There was not enough demand for the visionary changes in direction needed to make living in Bendigo affordable. Soon, there were too few people to pay for the conventional infrastructure to keep water quality to a reasonable standard. Reliance on bottled water entrenched environmental and social problems.

People stopped preparing for environmental threats. Planning became reactionary, crippled with complexity and uncertainty. There was a failure to extend the protection of forests around Bendigo; box-ironbark forests were turned into wood pallets and fuel for export. The loss of trees in the catchment due to their inability to recover from repeated fires increased runoff, and flooding also became common. The environment was just seen as a 'dump'. The noticeable fall in ecological health caused the community to become disengaged, and in a vicious cycle withdraw even more funding from potential solutions. Bendigo was confronted with the impact of the decimation of its biodiversity, with plummeting bee populations and pest invasions wiping out agriculture and causing a dependence on imported food.

The health of urban areas was also allowed to collapse, too. There was no drive to increase green, cool spaces, no investment in active travel, and new housing was not suited to keeping energy and water costs down. As water became less affordable, its use in outdoor irrigation (private and public gardens and recreation areas) declined. The lack of connection to place and a negative outlook affected community cohesion. Bendigo was in a major physical and mental health crisis because people no longer enjoyed the outdoors. Regional Victorians preferred Geelong to Bendigo for access to water and a healthier climate.

3. Bendigo's water sensitive vision

Against the backdrop of the future drivers, trends and dystopian possibilities presented in the previous section, Community and Industry group participants iteratively developed their vision for Bendigo as a water sensitive city over the workshop series. Initial brainstorming was structured around a visioning activity in which participants prepared headlines for a special future edition a newspaper or magazine that was profiling Bendigo. An example headline described Bendigo in 2068 as "the world's most water sensitive city". Vision themes emerged from the headlines and were grouped to provide a framework for further elaboration of concerns and aspirations. These ideas were then consolidated into a series of outcomes statements and narrative text that provides a rich description of the aspired future water sensitive Bendigo in 2068. Presented alongside the vision narratives below are some of the ideas that participants raised in later workshops to realise the vision.

The 50-year water sensitive vision for Bendigo aims to orient and align the actions of stakeholders over the long-term. The timeframe enables people to stretch their ambitions beyond today's systems and constraints to reflect on the transformative change that is possible over such a period. The high-level vision is presented in Figure 9 and elaborated in the following paragraphs. Key ideas for achieving the vision that resulted from workshop discussions are provided in the boxes.

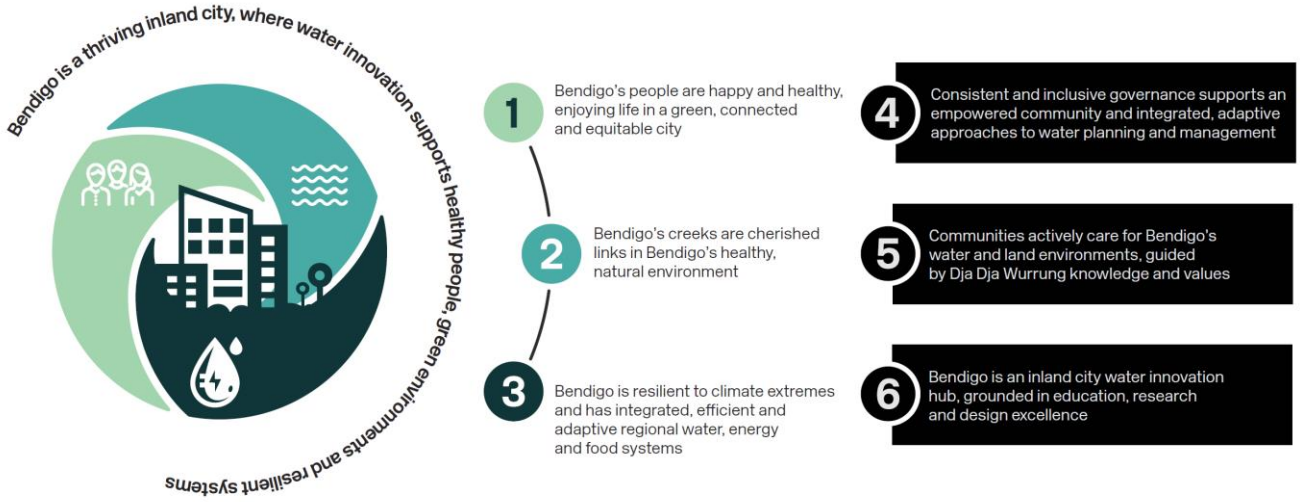


Figure 9. Bendigo's vision for a water sensitive future.

Vision Outcome 1. Bendigo's people are happy and healthy, enjoying life in a green, connected and equitable city

Wise use of available water resources ensures Bendigo is a green, liveable community. People's health benefits from the green active spaces and corridors along creeks are used to connect the community. Bendigo's extensive tree canopy – the shadiest city north of the divide – provides relief during the heat of summer. Bendigo's walkability means there is low reliance on cars and more space for shade trees on every street. Most neighbourhoods have wetlands or waterways, and stormwater is retained in the landscape. Despite the generally drier climate, the community has created a rich mix of adaptive indigenous and non-native vegetation to provide amenity. They have also created new space for greening Bendigo, as vertical and rooftop gardens are common.

Water is acknowledged for its fundamental links to people's mental and physical wellbeing through sustaining a healthy natural environment and supporting recreation. These recreation options include fishing, kayaking and rowing in local water bodies. Urban food gardens support healthy and active lifestyles. It is also important that Bendigo's fun and active lifestyle can be enjoyed by everyone. Fences, even backyard fences, are rare in this well-connected community. Fit-for-purpose water is affordable enough for residents to embrace.

Vision Outcome 2. Bendigo is resilient to climate extremes and has integrated, efficient and adaptive regional water, energy and food systems

Bendigo has achieved sustainability in regional water, energy and food systems by maximising use of diverse water resources. The water supply is secure and safe, with integrated water management that directs the most appropriate water supply to the end use. Bendigo has achieved full reuse of water. Recycled wastewater also supplements water used for drinking purposes.

The community has flexibility and choice in sourcing water at the required quality to suit the end use, and households, businesses and neighbourhoods are also an important source of water. Rainwater is retained and used wherever possible. Groundwater is integrated into the portfolio of water supply options. All water resources and products are backed by legal property rights providing security of supply and access. Water and energy solutions are linked at the planning stage.

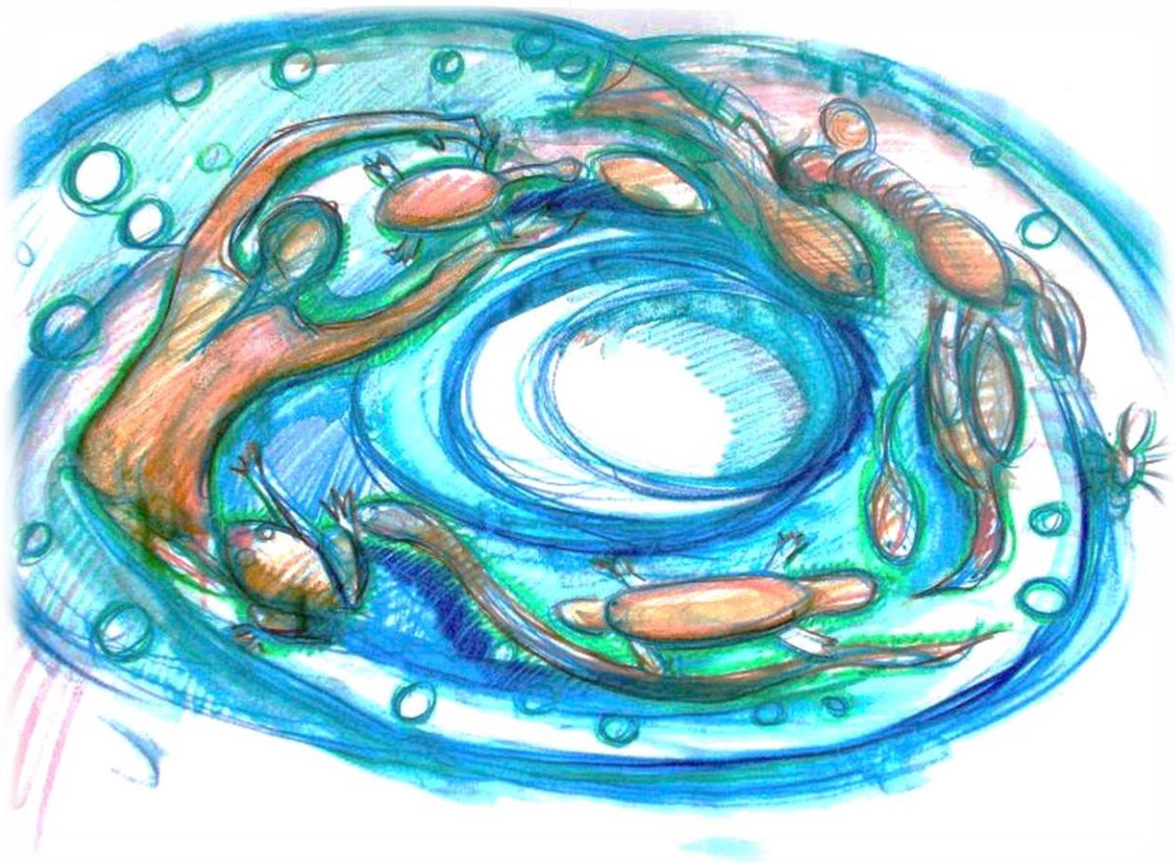
Leakage and waste from the water system is minimised, irrigation efficiency has been optimised, and high efficiency building standards have become the norm. There is a clear framework for using resources for productive and efficient outcomes, but the water system also enhances environmental values and provides new opportunities for water use. For example, the affordability of water enables residents to embrace urban agriculture.

The way Bendigo's water resources have been secured for the very long-term and the way it has been integrated into the urban landscape mean that the community is prepared for climate extremes, such as drought, heatwave and flood. Emergency response systems and social resilience networks ensure all of Bendigo's communities are cared for in extreme weather events.

Vision Outcome 3. Bendigo's creeks are cherished links in Bendigo's healthy natural environment

Bendigo's creeks form a network of healthy waterways that make use of integrated natural processes for water quality and flow. All Bendigo waterways are free of pollution and weeds, and native flora and fauna are supported by more connected habitats that link the surrounding forest to the urban areas. Bendigo Creek marks a 'green spine' that is embraced by residents. Native fauna inhabit the urban environment, such as platypus and ibis in waterways and possums in parks. A regional biolink spans from Bendigo's southern margins to the Murray River.

People understand that Bendigo's long-term amenity is linked to the healthy ecological functioning of Bendigo's landscape. Groundwater is considered valuable resource and used in ecologically beneficial ways. Residents enjoy the tranquillity of their environment, swim in water holes throughout summer, and are stimulated by water to make art and to learn and play.



Vision Outcome 4. Communities actively care for Bendigo's water and land environments, guided by Dja Dja Wurrung knowledge and values

The community is active in caring for the broader ecological health of Bendigo's landscapes. This behaviour is driven by a sense of pride in the land irrespective of its ownership – residents care for public land as well as their own. The community's participation in Caring for Country reimagines traditional Dja Dja Wurrung culture to meet the needs of the future.

Bendigo Creek and other special locations are considered places for ceremony, where songs tell their story in traditional and contemporary terms, as well as places for informal meeting and reflection. Enjoyment of Bendigo's natural environment encompasses the sustainable harvesting of plants for traditional uses – plants may be harvested for ceremony, picnics or basket-weaving workshops. There is pride in the indigenous Jaara language, which is reflected in the names of places, buildings and organisations.

Vision Outcome 5. Consistent and inclusive governance supports an empowered community and integrated, adaptive approaches to water planning and management

The community and government are united in sharing responsibility for Bendigo's water resources and environmental health. Many people in Bendigo have good knowledge of the urban water cycle and how water is managed, and natural resource education is a core part of the curriculum. Community is empowered to participate in government processes to set priorities that accommodate diverse interests in sometimes complex local issues. Overall, the broader community and traditional owners are equal partners in responsibility for water, and traditional owner rights to water are accepted and accommodated.

Decisions about development and the management of Bendigo's resources are consistent, strategic and integrated, and all disciplines are 'at the table' from the start. Decisions are underpinned by sound knowledge of water resources, the capabilities of system infrastructure, and contingency planning. There is shared understanding across all levels of government of social, economic, environmental and cultural benefits of good water stewardship.

Vision Outcome 6. Bendigo is an inland water innovation hub, grounded in education, research and design excellence

Bendigo is a learning city, a hub of research and innovation in ecology and landscape restoration and adaptation, water sensitive technology and biotechnology. People in Bendigo are knowledgeable, connected to Australia and the world, and able to build on its history of innovation. It is where new water practices, technologies and initiatives can be explored before having influence throughout Australia and the world. Investment is attracted to Bendigo as a liveable, sustainable and resilient city. This has led to ample job opportunities in the knowledge, culture, building, solar, and transport sectors. Bendigo supports the services and infrastructure of an international city.

Reflections on the water sensitive vision by representatives of Bendigo's broader community

The focus group discussions with community segments not well-represented in the main workshop series canvassed their aspirations for the future and sought their feedback on an early version of the vision developed by the workshop participants. Feedback from the focus groups were then provided to the workshop participants to reflect on and address (where desired) in further iterations of the vision, to ensure the vision (and messaging about the vision in future communications) would have the best prospect for resonating with the broader community and inspiring action for change.

The focus group participants were broadly supportive of the water sensitive city vision. Most themes rated highly and were considered important and worthy goals. Two key discussion points warrant note.

First, the focus group participants were not as connected with the vision and narrative about the natural environment as the workshop participants. For example, workshop participants said they *"cherish the creek"* while some of the focus group participants *"just don't think about it"*. Similarly, the links between a healthy environment and a healthy community were not as understood or valued by some focus group participants, particularly the low socio-economic status group. This insight emphasises the need for the water sensitive vision to be conveyed through a range of narratives that will resonate with different segments of the community.

Second, the concept of *stewardship* was challenging for some participants of the low socio-economic status and youth focus groups to understand and engage with. However, gardeners were positive about stewardship as a concept and their role to play as active stewards. This insight reinforces the need for more community education about the possible actions citizens, householders and business owners can take to help achieve Bendigo's water sensitive vision.

4. Assessing Bendigo's current water sensitive performance

Planning actions to reach Bendigo's water sensitive city vision requires an understanding of today's water system with respect to the broad future aspirations set out. The Industry Group participated in a workshop activity to benchmark Bendigo's current water sensitive performance using the CRCWSC's Water Sensitive Cities Index tool, following the process described in Appendix 2. The WSC Index framework, key results and analyses are presented here, with further discussion provided in Appendix 2. It is recommended that subsequent benchmarking would be undertaken every few years in order to track progress and achievements.

4.1. WSC Index Framework

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

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

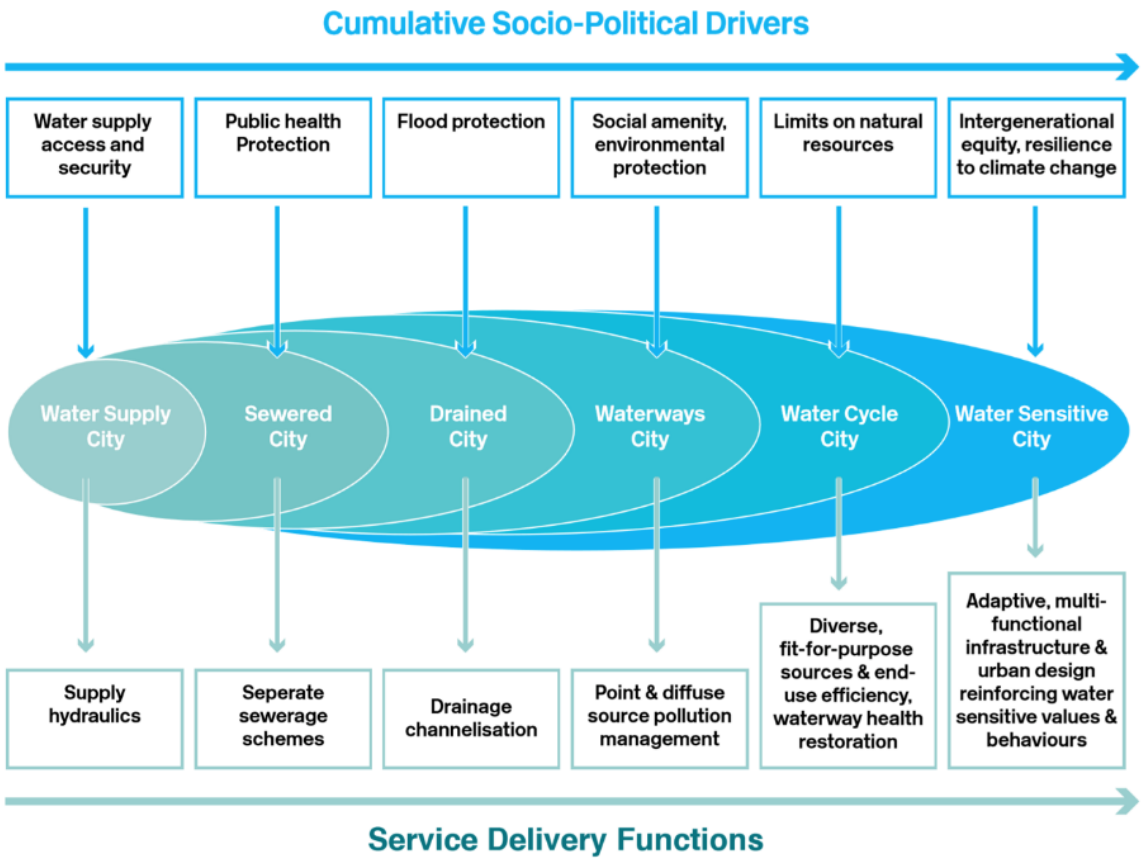


Figure 10. Urban Water Transitions Framework (Brown et al., 2009)

As cities seek to adopt this approach, they need to understand both its present status with regard to urban water management and define their short and long-term sustainability goals. An analytical tool has been developed specifically for this purpose: The Urban Water Transitions Framework (Brown, Keath & Wong, 2009) (Figure 10). The framework identifies six distinct developmental states that cities may move through on their path toward increased water sensitivity.

Figure 11 describes each of the city-states in more detail. This understanding can help urban water strategists define the attributes of more sustainable cities and identify the capacity needs and institutional changes required for more sustainable water management.

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

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

Water supply city	The most basic state of modern water management, whereby a centralised system provides water to a growing urban population that expects cheap and equitable for all. Large quantities of water are extracted from the environment using infrastructure such as pipes and dams. The public expects that water is cheap, harmless to the environment, and limitlessly available.
Sewered city	Building on the previous state, the Sewered City is driven by a desire for better public health and hygiene. Diseases caused by domestic and industrial waste effluent leads to the development of sewerage systems that divert effluent away from housing and into waterways outside of cities. As in the earlier state, it is assumed that the discarding of effluent does not harm the environment.
Drained city	A need to protect homes and infrastructure from flooding is the driver behind the Drained City. The channelling of rivers enables the development of floodplains for housing and rapid urban growth. Like effluent, stormwater is directed away from urban areas and into waterways, generally thought of as dumping grounds for waste. The community expects water supply, sewerage and drainage services to be provided cheaply.
Waterways city	The environmental impacts of both water extraction and waste processing are taken into account for the first time. As the social and aesthetic values of clean waterways are extolled, urban planning begins to integrate water as an important consideration. The unfettered extraction of fresh water is now being curbed, and receiving waterways are protected by filtering stormwater through bio-filtration systems such as rain gardens and artificial wetlands distributed throughout the city.
Water cycle city	In this state, water is actively conserved and supplies from diverse sources such as stormwater, greywater, and recycled wastewater are used in a fit-for-purpose manner. Sustainability is now widely embraced, and the former hydro-social contract, in which government was expected to deliver risk-free water supply services, has been replaced with co-management arrangements between government, business, and community.
Water sensitive city	Based on holistic and integrated water cycle management that meets the city's water needs while also delivering a range of associated liveability benefits. A Water Sensitive City manages water in a way that protects the health of recieving waters, mitigates flood risk and creates green public spaces that also harvest and recycle water. Infrastructure, technology, and urban design will be flexible, recognising the link between society and technology. The community is actively engageed with water, through receretional enjoyment of irrigated green spaces throughout the city, and have opportunties for more active involvement in the water system.

Figure 11: Descriptions of each state in the Urban Water Transitions Framework (Brown et al., 2016)

4.2. WSC Index indicator scores

The WSC Index was applied to Bendigo to benchmark current water sensitive performance. Table 1 shows the scores agreed to by participants to each of the WSC Index Indicators and scores for the goals that represent the average of component Indicator scores.

Table 1. WSC Index scores (Goals and Indicators) for Bendigo

WSC Index Goal and Indicators	Score /5	WSC Index Goal and Indicators	Score /5
1. Ensure good water sensitive governance	**2.8**	**4. Improve productivity and resource efficiency**	**2.4**
1.1 Knowledge, skills and organisational capacity	3.0	4.1 Benefits across other sectors because of water-related services	3.0
1.2 Water is key element in city planning and design	2.5	4.2 Low GHG emission in water sector	1.0
1.3 Cross-sector institutional arrangements and processes	2.5	4.3 Low end-user potable water demand	3.0
1.4 Public engagement, participation and transparency	3.0	4.4 Water-related commercial and economic opportunities	3.0
1.5 Leadership, long-term vision and commitment	3.0	4.5 Maximised resource recovery	2.0
1.6 Water resourcing and funding to deliver broad societal value	3.0	**5. Improve ecological health**	**2.0**
1.7 Equitable representation of perspectives	2.5	5.1 Healthy and biodiverse habitat	2.0
2. Increase community capital	**2.8**	5.2 Surface water quality and flows	2.0
2.1 Water literacy	3.0	5.3 Groundwater quality and replenishment	2.0
2.2 Connection with water	3.0	5.4 Protect existing areas of high ecological value	2.0
2.3 Shared ownership, management and responsibility for water assets	2.5	**6. Ensure quality urban space**	**2.2**
2.4 Community preparedness and response to extreme events	2.5	6.1 Activating connected urban green and blue space	3.0
2.5 Indigenous involvement in water planning	3.0	6.2 Urban elements functioning as part of the urban water system	1.5
3. Achieve equity of essential services	**4.0**	6.3 Vegetation coverage	2.0
3.1 Equitable access to safe and secure water supply	5.0	**7. Promote adaptive infrastructure**	**2.8**
3.2 Equitable access to safe and reliable sanitation	4.5	7.1 Diverse fit-for-purpose water supply system	2.5
3.3 Equitable access to flood protection	4.0	7.2 Multi-functional water system infrastructure	3.0
3.4 Equitable and affordable access to amenity values of water-related assets	2.5	7.3 Integration and intelligent control	2.0
		7.4 Robust infrastructure	3.0
		7.5 Infrastructure and ownership at multiple scales	3.0
		7.6 Adequate maintenance	3.0

Figure 12 summarises the performance of Bendigo, averaged for the seven goals of a water sensitive city. *Achieve equity of essential services*, *Promote adaptive infrastructure, Ensure good water sensitive governance*, and *Increase community capital were the highest average scores, while Improve ecological health, Ensure quality urban space*, and *Improve productivity and resource efficiency* achieved lower average scores.

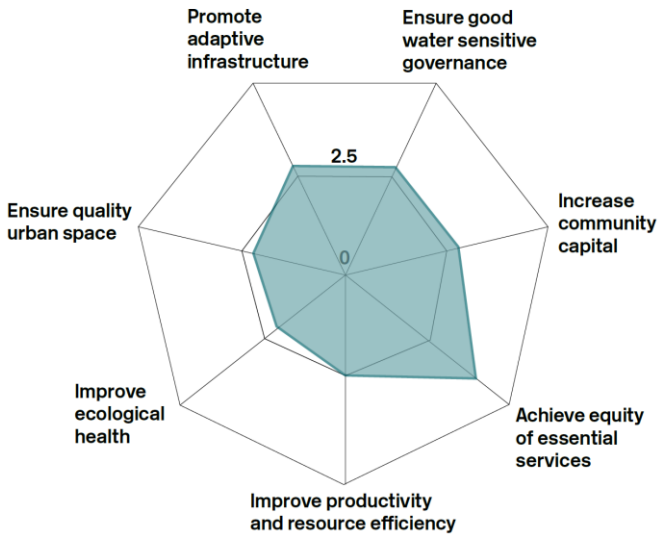


Figure 12. WSC Index footprint for Bendigo

Preliminary discussions about priority indicators

Industry participants reflected on the WSC Index scores at different points in the workshop process, and in Workshop 4, did a prioritisation exercise to refine key areas of focus for improving Bendigo's progress towards a water sensitive future. The results of this exercise are presented in Appendix 3.

In summary, *Ensure good water sensitive governance* had the most indicators identified as needing attention, reflecting the participants' awareness of the importance of establishing a conducive enabling environment for driving change. The following indicators received 10 or more votes in the exercise:

- *Goal 1. Ensure good water sensitive governance*
  - 1.1 Knowledge, skills and organisational capacity
  - 1.2 Water is key element in city planning and design
  - 1.5 Leadership, long-term vision and commitment
  - 1.6 Water resourcing and funding to deliver broad societal value
- *Goal 3. Achieve equity of essential services*
  - 3.4 Equitable & affordable access to amenity values of water assets
- *Goal 5. Improve ecological health*
  - 5.1 Healthy and biodiverse habitat
- *Goal 6. Ensure quality open space*
  - 6.2 Urban elements functioning as part of the urban water system
  - 6.3 Vegetation coverage

4.3. Bendigo's benchmarked city state

Figure **13** summarises the city-state benchmarking results for Bendigo. Percentage attainment for each city-state ranged from 100% as a Water Supply City, Sewered City and Drained city, through to 8% as a Water Sensitive City. This section summarises the key elements that contribute to the overall percentage attainment of each city state.

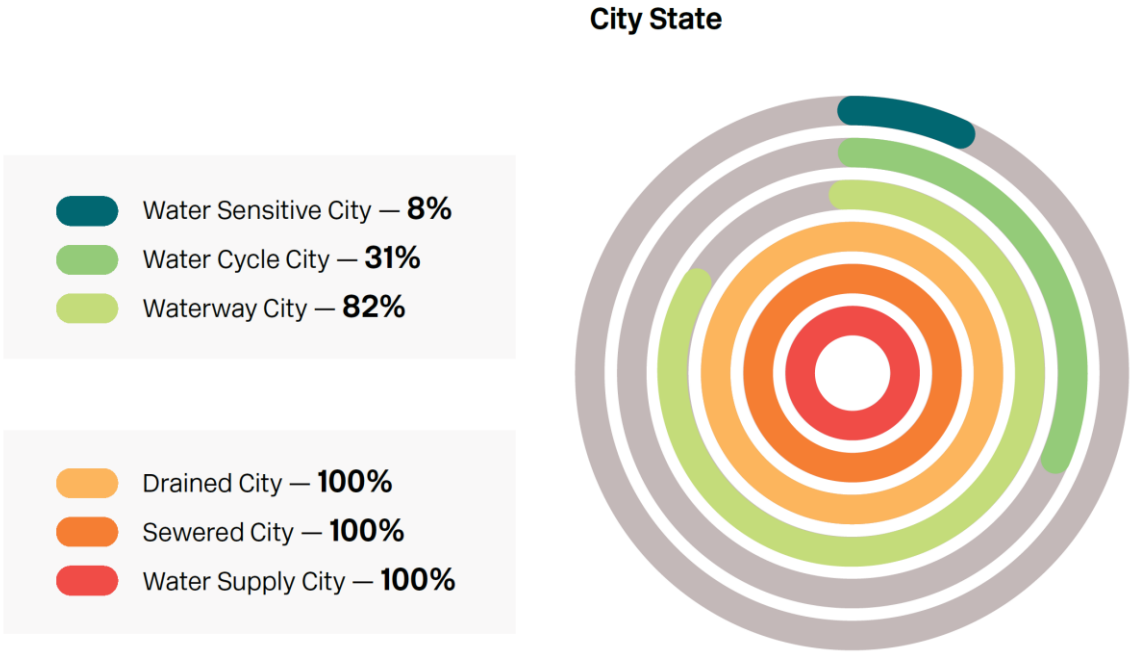


Figure 13. Summary of Bendigo's performance against each city state.

100% Water Supply City and Sewered City

"The public perception is that Bendigo doesn't have a secure water supply, but public perception hasn't caught up to reality."

Bendigo is well regarded by participants for water security due to its connection to the Goulburn system via the Goldfields Superpipe, which contributed to Bendigo rating 100% as a Water Supply City. Water supply is managed centrally, provided at an affordable cost to end users and with reliable public health outcomes. Coliban Water reported having met the Safe Drinking Water Regulations 2015 and Australian Drinking Water Standards for E. coli, trihalomethanes, turbidity and other parameters (Coliban Water, 2017a). However, Bendigo's reliance on water obtained from other regions will generate additional costs in periods of widespread drought, which are likely to be more frequent in the long-term.

Similarly, Coliban Water provides wastewater services to nearly 41,000 residential properties and over 3,000 non-residential properties in Bendigo, ensuring safe and reliable sanitation and 100% attainment of a Sewered City. Coliban Water consistently meets Essential Services Commission service standards across its network for sewerage collection and treatment.

100% Drained City

"We've got access to much much better modelling tools to help understand how Bendigo floods."

Bendigo rated 100% as a Drained City. Drainage services, primarily the responsibility of the City of Greater Bendigo, are managed to a standard befitting the City's dry climate. The system operates effectively on a day-to-day basis. Small-scale flash flooding events have the potential to occur from extreme local rainfall events in some areas.

The Planning Scheme has recently been amended to update flood controls to reflect the more accurate modelling of flood risk undertaken in recent years. There is a project to investigate options to reinforce flood management on Bendigo Creek.

82% Waterway City

"I'd really like to see the [Bendigo] Creek addressed as the elephant in the room. It's so undervalued. We have the capacity to think about it differently."

Bendigo rated 82% as a Waterway City. Bendigo has high amenity and liveability values, with good accessibility to water-related and green infrastructure assets. Residents generally value waterways for amenity and recreational purposes.

The delivery of broader societal value is a key driver of water infrastructure projects. Point-source pollution is well-managed and there is growing recognition of the importance of addressing diffuse-source pollution. New developments are being constructed with WSUD features, but WSUD is lagging in established suburbs. Nevertheless, there are strong industry guidelines and programmes in place to promote take-up of WSUD and build professional capacity.

Although Bendigo has few waterways, and those present have been assessed as being in poor condition (DEPI, 2013), there has been action recently to improve the quality of Bendigo Creek and Ironbark Gully through revegetation and weed control. There has been extensive community participation in this activity.

31% Water Cycle City

"There's a need to recognise that the black boundaries between stewardship [of different elements of the water cycle] can actually be blurred a bit."

Bendigo rated 31% as a Water Cycle City. Bendigo's water supply has a fair degree of diversity, with potable water being sourced from the Coliban and Goulburn systems and non-potable water sources such as rainwater tanks, bores and wastewater recycling and reuse.

Permanent water saving measures are in place. Following the Millennium Drought, a number of education and incentive programs supported a reduction in demand. Since the end of the Millennium Drought, there has been a gradual increase in potable water demand in Bendigo. Considering Bendigo's reliance on water from outside its catchments, it has fairly high end-user potable water demand.

A principle of the Water Cycle City is co-management of water system by government, business and the community in order to facilitate access to water sources at local scales as part of an integrated

system. This necessitates broadening of participation in water management beyond traditional groups and disciplines. There are several formal engagement and transparency policies in place for the water sector, from the State Government through to the City of Greater Bendigo, NCCMA and Coliban Water. Indigenous knowledge is considered important to water system planning and management in Bendigo, and there is active involvement of the Dja Dja Wurrung traditional owner group in management.

8% Water Sensitive City

"The transformation that we need is in the perception of the broader public that water sensitive cities should be a core part of infrastructure and a core part of business."

Bendigo rated 8% as a Water Sensitive City, achievement of which is largely attributed to equity of essential services of water supply and sanitation. Both supply and sanitation services are accessible to everyone; they are safe, secure and affordable.

The Council has begun to plan urban space to function as a part of the water system, with preparation of a Greening Greater Bendigo strategy and funding for two stormwater harvesting projects to irrigate public land. However, there are few other examples of water sensitive infrastructure such as raingardens or stormwater harvesting. Although there is irrigation of many green spaces and some examples of multifunctional water infrastructure, most residents would not yet draw benefit from green infrastructure's potential to mitigate the urban heat island effect. Tree canopy cover for Bendigo as a whole is thought to have reduced.

Urban habitats in Bendigo are thought to be patchy and with low biodiversity. Nevertheless, there are areas of protected forests on the periphery of Bendigo in good condition. There are some threatened species found in urban areas, which suggests that in general, the ecological functioning is fair given the development context. While Bendigo has begun to make strides towards a Water Sensitive City, significant action is still needed in order to transition current water management practices to water sensitive practices.

A review of Bendigo's benchmarking results indicate that for Bendigo to become a Water Sensitive City, Bendigo will need to fulfil the multiple objectives of ecosystem protection and restoration, security of supply, flood control, public health, amenity, liveability and economic sustainability, among others.

5. Advancing Bendigo's transition to individual vision outcomes

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

5.1. Analysis of Bendigo's current transition progress to vision outcomes

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

5.1.1. A brief introduction to transitions theory

Bendigo's transition towards its water sensitive city vision will require significant changes across the structures, cultures and practices of urban and water system planning, design, management, engagement and decision-making. Transitions theory is a body of interdisciplinary research that studies how these changes are driven and enabled over time. CRCWSC research that draws on this work has identified six distinct phases of change during a city's water sensitive transition (Figure **14**). As a city moves through each phase sequentially, enabling conditions are established to support its trajectory towards its water sensitive city vision and avoid the risk of change pathways that reflect lock-in, backlash or system failure patterns (Figure **15**).

Figure 14. Six phases of change that occur in the transition to a new practice

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

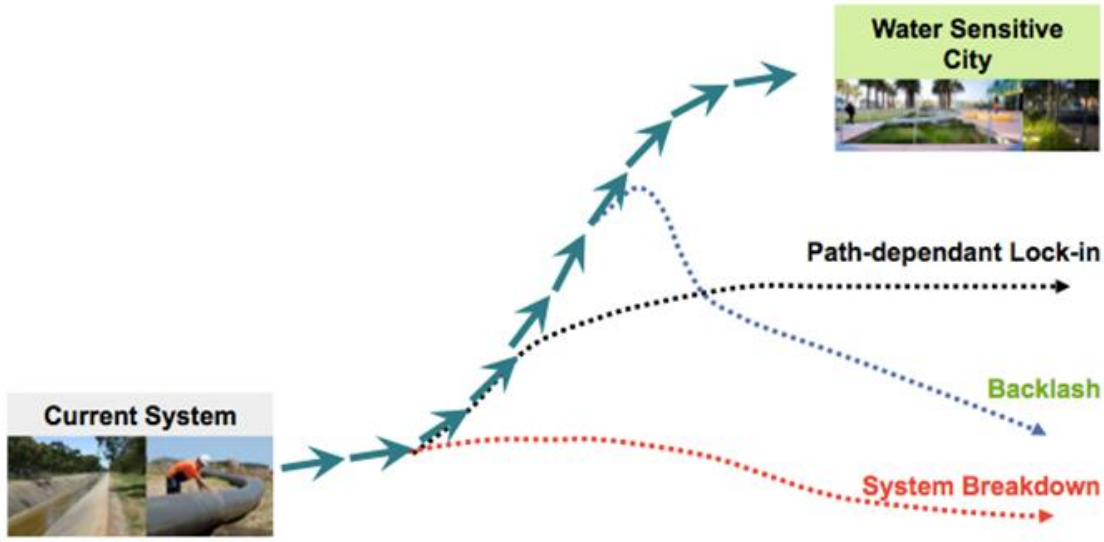


Figure 15. Transition pathways: successful transition, lock-in, backlash and system breakdown

5.1.2. Assessment of Bendigo's enabling conditions for transitioning

The Transition Dynamics Framework (Brown et al. 2016) outlined in Figure 16 below is an analytical framework that outlines the enabling conditions needed to progress a transition to a new practice. The framework sets out five broad factors that have been found to enable transitions: champions, platforms for connecting stakeholders, knowledge, projects and applications, and policy and guidance instruments. The matrix is a diagnostic tool that assesses the presence or absence of enabling factors as an indicator of the current phase of change in relation to its aspired change in practice. It provides a checklist of the factors that should be deliberately and sequentially built up to inform the prioritisation of strategies and actions.

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

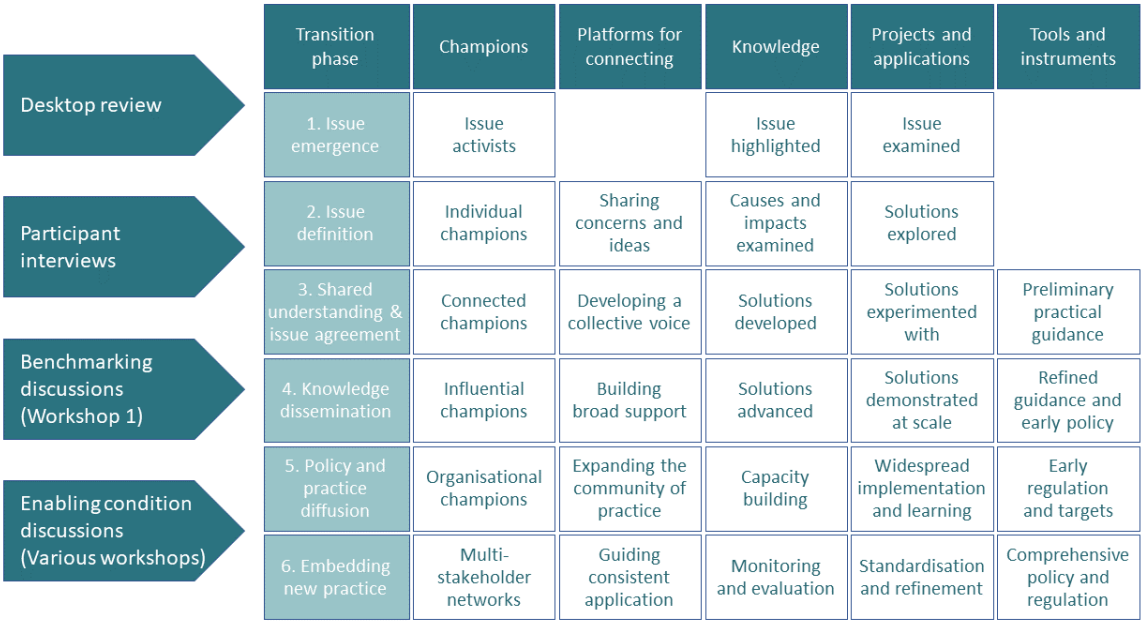
Analysis of the enabling conditions currently present for each WSC Index goal using the Transition Dynamics Framework revealed which factors need attention in the short to medium term. This analysis has guided the development of the priority objectives and strategies for overcoming the

transition barriers and establishing the enabling environment for Bendigo's water sensitive city transition.

This section analyses Bendigo's current transition phase for each of the vision themes to identify a suite of strategies that should be addressed through strategic action in the short to medium term. These strategies are designed to establish the enabling environment necessary for driving change.

5.1.3 Bendigo's transition progress for each vision theme

Figure 17 below summarises the current transition progress for each individual vision theme. Vision themes early in their transition will require different types of strategies to progress further change than later in their transition. As most of the vision themes have been assessed as being in the *Shared understanding and issue agreement* phase some parallels in the strategic recommendations across themes is to be expected. The remainder of this section discusses the transition assessment for each outcome theme and the strategies recommended to enable transition within the theme.



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

Figure 16. Transition Dynamics Framework - assessing the enabling conditions potentially present during transition phases

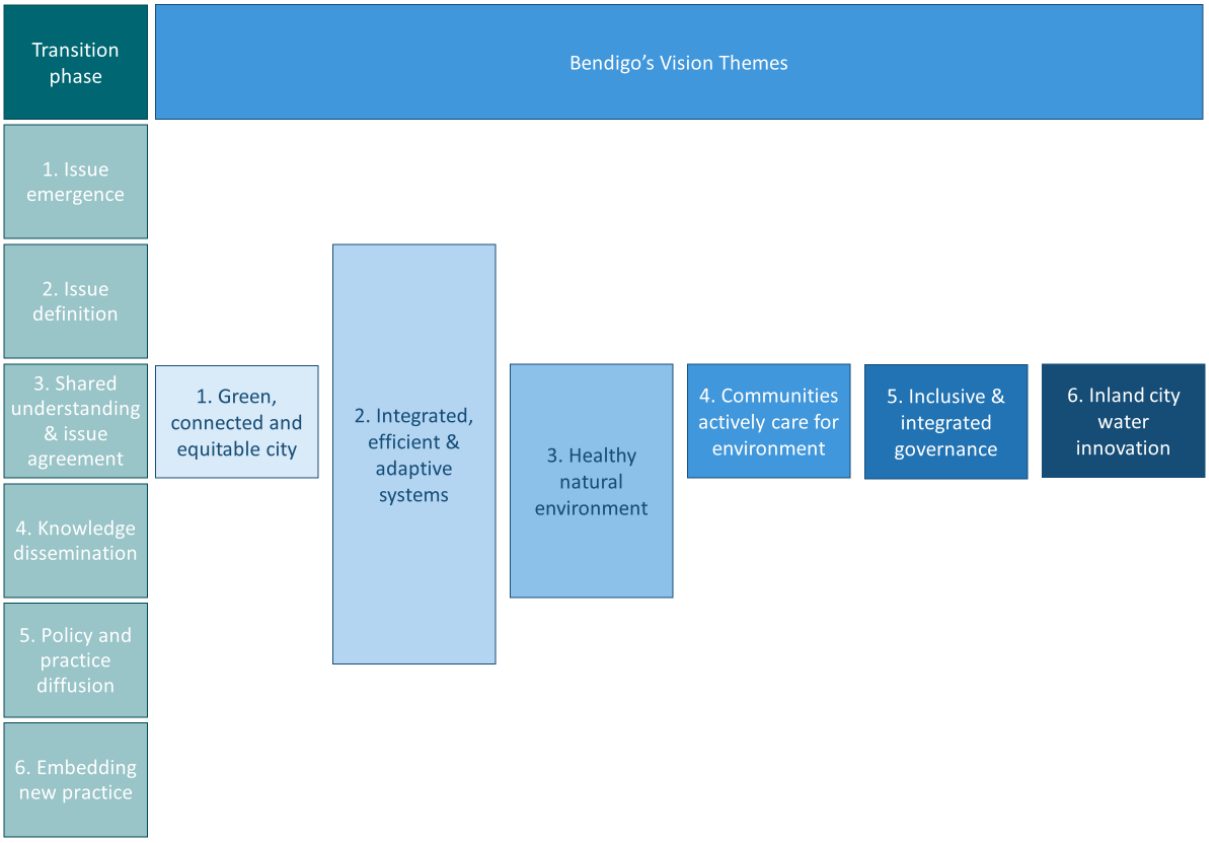


Figure 17. Summary of transition phases for each of the vision outcomes

Vision outcome 1: Bendigo's people are happy and healthy, enjoying life in a green, connected and equitable city

Required changes in practice

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

A central aspiration of Bendigo's vision of a water sensitive future is quality urban space, including public and private spaces that are connected, comfortable and healthy. Achieving this will require the practices of water system planning and urban planning to be more integrated and collaborative so that standards and service outcomes that link to a broader vision of urban liveability and environmental health can be achieved.

Assessment of Bendigo's enabling conditions

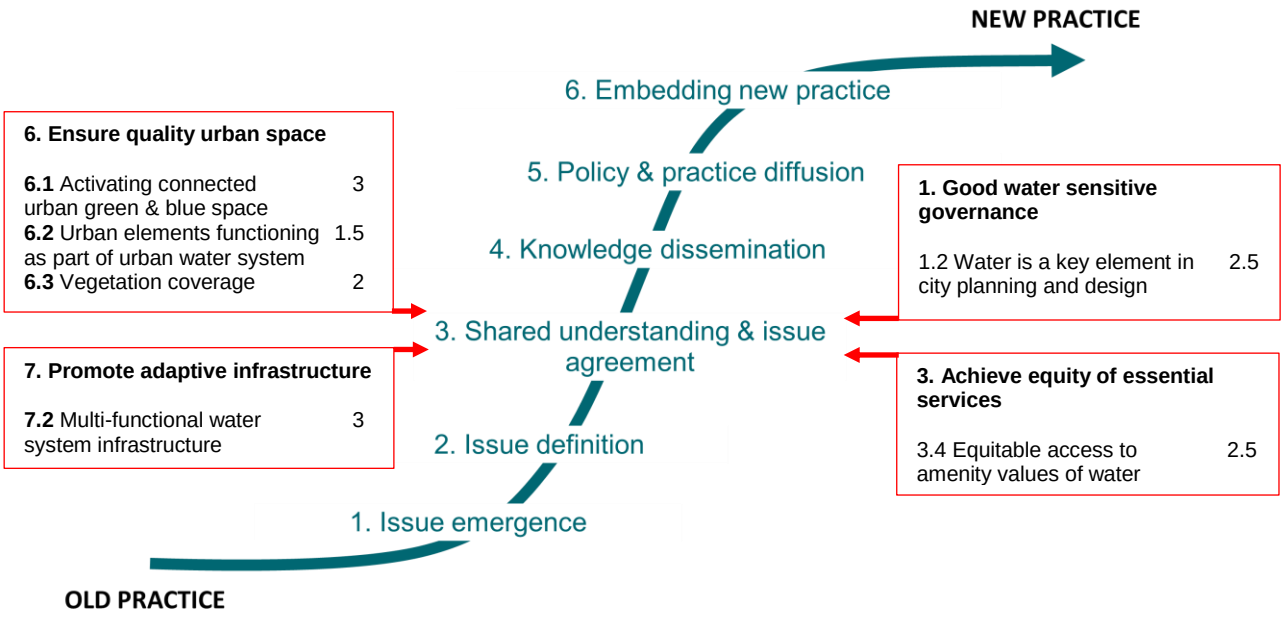


Figure 18. Current transition phase for WSC Index indicators that relate to vision outcome 1

Bendigo is home to a reasonable number of individual champions advocating for integrated water system and urban planning and design. These champions operate in a range of sectors, including local government, development, consulting, and the community. The City of Greater Bendigo has vision documents and processes such as Plan Greater Bendigo and the Public Space Plan, both currently in draft stage, that indicate a sound direction for water sensitive urban space and walkability. Council has also identified the importance of addressing the urban heat island effect through

improved vegetation coverage. Coliban Water is required in provisions of the Water Act to explore measures to deliver integrated water cycle management in the planning system. Local community groups have also been critical to advancing improvements in their waterways. The health sector within Bendigo has also started to foster champions for better-connected urban space. Many participants observed that because of the scale of the city, most water sensitive champions know one another through professional or personal connections.

The next step for Bendigo's champions is to align their actions more effectively to establish a united position in advocating for water systems to better support urban amenity that improves people's quality of life, particularly among different arms of organisations and between organisations. Participants commented that coordination between organisations occurs occasionally, particularly in significant projects and often led by a single agency. Significant projects that have promoted higher levels of coordination include examples such as State-mandated regional plans and large-scale water supply augmentations. Bendigo now needs greater emphasis on operational alignment across multiple agencies and their units to embed water sensitive solutions in practice. To achieve this, there needs to be champions with influence throughout key organisations – not just in the sustainability space – to drive implementation of the water sensitive agenda across all operations. To underpin this effort, it is recommended that a **compelling narrative of the liveability and health benefits of multi-functional and connected water sensitive urban form in Bendigo be developed and communicated** (Strategy 1.1) to organisational leaders and the broader Bendigo community. This would help provide an authorising environment that supports the implementation of land use planning policies and urban design demonstrations that can drive the adoption of water sensitive outcomes.

> *"[On meeting different Referral Authorities' permit requirements] sometimes you'll get situations where the various requirements to meet regulations perfectly actually [you] end up with permit conditions that contradict each other and are not viable."*

Bendigo's water security crisis in the later stages of the Millennium Drought (2006-08) showed that organisations in Bendigo were willing to take a leadership role in the water space and work together to make change happen. However, achieving long-term transformational change necessary to reshape Bendigo's urban landscape for healthier living presents a different challenge. To further support alignment towards healthier, connected urban space, it will be important to build on collaborations that have emerged in the delivery of individual projects to achieve more strategic outcomes. **A platform for connecting and aligning stakeholders and promoting a collective strategic voice across a broad range of stakeholders** (Strategy 1.2) is recommended. This platform can have a strong advocacy role and lay the groundwork for water sensitive solutions across all aspects of Bendigo's urban form. There are a number of existing partnerships – including GREATER, Wanyarram Dhelk, Plan Greater Bendigo, and the Ironbark Gully trail – that may be valuable foundations to build upon in formalising this collective voice. In addition to such a platform, it will be important to seek buy-in from senior leadership of key government organisations. This will be helped by **embedding the water sensitive vision of a healthy Bendigo based on a compact, connected and green urban form across organisational strategies** (Strategy 1.3), drawing explicit links across diverse objectives to a uniting water agenda. This will help ensure that ownership for delivery of water sensitive outcomes is shared across different operational units of organisations.

"People need to be committed to designing projects together and then following through on project management."

Beyond a vision, strategies and plans, on-ground implementation of water sensitive urban form varies across Bendigo. In the outer areas, most retarding basins provide public space. Many areas prone to flooding are protected as open space and include walking and cycling paths. The channel system also includes bike paths. In recent years a number of projects with a water sensitive focus have been implemented in Bendigo on creeks and some prominent sites. However, there are relatively few examples of small-scale water sensitive solutions such as raingardens or stormwater harvesting schemes. Several developers appear ready to implement small-scale water sensitive street infrastructure, but participants have not observed particular advocacy for non-traditional solutions for Bendigo.

"If a lot of the stuff is to do with health benefits, who should pay for the solution?"

This was in part attributed to the perception that solutions appropriate to Bendigo's climate, topography and soil morphology were not sufficiently developed to fully realise the integration of water into city planning and design. For some aspects of this vision – access to connected green and blue space and vegetation coverage – there is more confidence in the suitability of basic solutions. However, to gain support for implementation, there is a need for more understanding of the social and environmental benefits to support the business case for their adoption. In addition, the links between green infrastructure and the urban heat island effect have not been acknowledged in operational decision-making. As a result, the benefits of water sensitive solutions have not been adequately recognised to overcome higher economic costs when compared to conventional solutions. It is recommended that there should be a **detailed evaluation of the evidence to quantify the value of social and environmental benefits of water sensitive urban form** (Strategy 1.4). In addition, **a broader range of solutions, particular those that involve governance interventions to support water sensitive urban forms, needs exploration** (Strategy 1.5).

"[Water in the urban environment] helps people to connect with water to provide a constant reminder of the importance of water to their lives in general"

"[On urban design and health integration] there's great underlying community momentum for this, but we just need the right demonstration."

Finally, there are promising instances of water sensitive urban form that have been implemented in Bendigo. However, there has been limited development and refinement of solutions for the Bendigo context. There is a particular need to implement significant demonstrations of solutions for connected blue and green space that are being promoted in long-term planning processes. It is therefore recommended that **trials and significant demonstrations of water sensitive urban solutions are implemented, with explicit incorporation of a learning agenda** (Strategy 1.6) in order to refine solutions and develop practical guidance for their implementation in Bendgo's specific conditions**.** Identification and consolidation of lessons from existing projects should form part of this learning agenda.

Table 2. Recommended strategies to advance a green, connected and equitable city

No.	Strategies	Outcome
1.1	Develop and communicate a compelling narrative of the liveability and health benefits of multi-functional and connected water sensitive urban form in Bendigo	Broad support exists from across private developers, organisational leadership the general public
1.2	Develop a platform for connecting and aligning stakeholders and promoting a collective strategic voice advocating the health and wellbeing benefits of water sensitive solutions	A broad range of stakeholders understand and are able to communicate the benefits of water sensitive urban design solutions
1.3	Embed the water sensitive vision of a healthy Bendigo based on a compact, connected and green urban form in all strategies under development.	There is commitment, action and leadership from agencies and other organisations in driving the implementation of water sensitive urban form solutions
1.4	Evaluate the available evidence to quantify the social, environmental and economic benefits of water sensitive urban form to build a business case and inform a compelling narrative.	The costs, benefits and risks of quality urban space solutions are understood and communicated to a broad range of stakeholders
1.5	Develop a broader suite of solutions for water sensitive urban forms, with particular attention to governance processes and structures.	A comprehensive suite of solutions is developed ready for testing, refinement and widespread implementation
1.6	Implement trials and significant demonstrations of water sensitive urban space solutions, incorporating an explicit learning agenda	Water sensitive urban form solutions are demonstrated to provide evidence of their costs, benefits, and risks, and to learn about the capabilities needed for their effective implementation to inform the development of practical guidance

Vision outcome 2: Bendigo is resilient to climate extremes and has integrated, efficient and adaptive regional water, energy and food systems

Required changes in practice

Traditional water system services are typically designed to meet singular objectives (e.g. water supply, sanitation, drainage) that have prioritised cost efficiency over resource efficiency and externalised environmental costs. Services are delivered through traditional systems and methods that tend to isolate and separate these objectives, rather than consider the entire water cycle. Delivery systems offer consumers limited choice or flexibility in infrastructure or pricing options.

As cities and towns around the world are growing and diversifying, ensuring equity amongst all residents will likely remain a key concern of water services. Water supply options will need to be optimised in order to provide water for growing cities without depleting natural resources or degenerating the environment. Communities are starting to become aware of the natural limits in the availability of water, energy and nutrients and the need for more sustainable water systems. In the water sector, the potential for water system services to reduce resource consumption, pollution and waste, as well as create new resources through alternative modes of service provision, is being explored and experimented with (for example, through wastewater recycling, nutrient recovery and biogas production).

It is also possible to make systems that are more efficient and adaptable to reinforce the community's safety and resilience. For example, through better coordination and integration of urban and water systems, nearly everyone can be protected from the effects of flooding. Community can also be better prepared to respond to crisis such as storm, drought or heatwave should it eventuate.

Assessment of Bendigo's enabling conditions

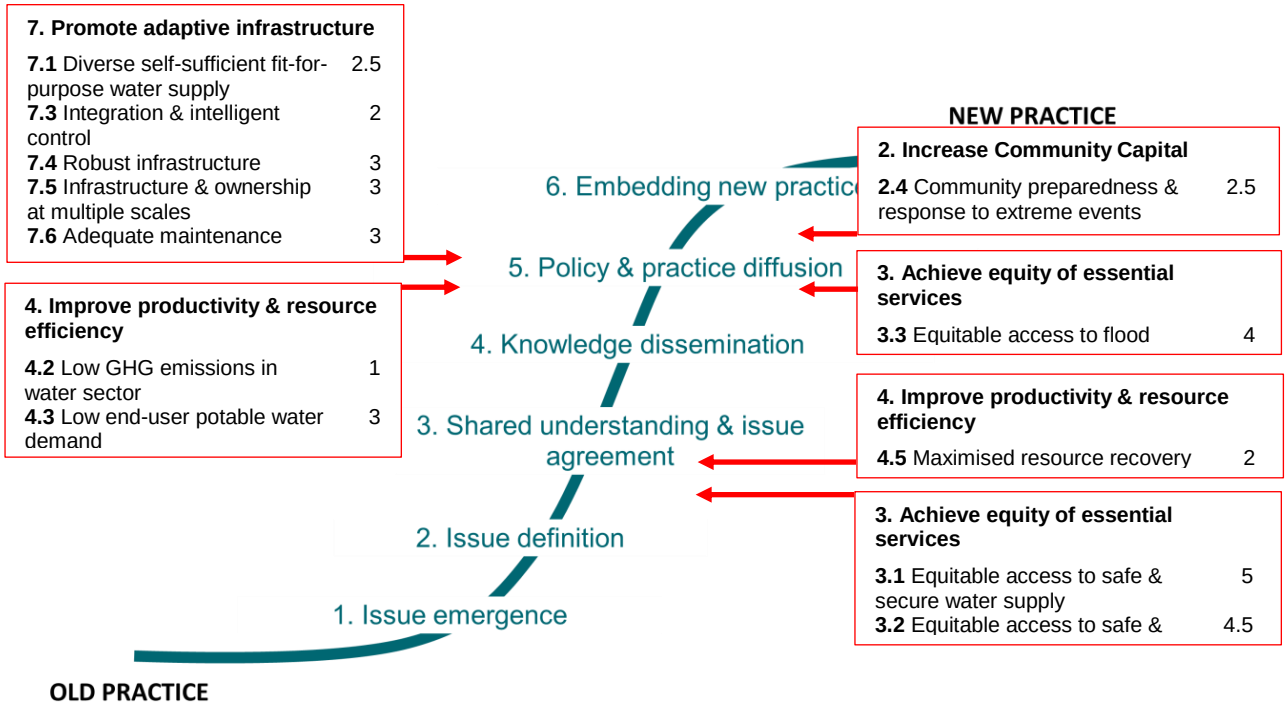


Figure 19. Current transition phase for WSC Index indicators that relate to vision outcome 2

To improve the sustainability of water systems and long-term reliability of water sources, water system services could be designed as regenerative or 'net-positive' – for example, in terms of their effect on resources such as energy and materials – to take advantage of the synergies and connections between water, energy, food and land resources. Options for water service delivery will need to take into account broad social, environmental and economic benefits in order to deliver Bendigo's water sensitive city vision.

While a safe and secure potable water supply is provided to Bendigo's residents, this is through the traditional centralised system with limited flexibility for service delivery. While there are benefits to this approach in terms of universal quality management, it is reliant on large-scale infrastructure that is costly to upgrade and can cause service disruptions. In addition, residents in Bendigo are either provided with connection to the centralised sewerage system or are dependent on onsite treatment that is recognised as a threat to the environment. Solutions such as alternative potable water sources and sanitation options are being considered, but there is uncertainty over their long-term financial viability and the environmental and social benefits. The implications for community equity, flexibility and choice also need further exploration. To raise awareness around these issues and consider whether and how they should be addressed, **evidence about the need for flexibility and choice in delivering water supply and sanitation services will need to be examined and evaluated** (Strategy 2.1).

"We massively subsidise potable treatment, yet recycled water is expected to pay for itself. We need to lead in recycled potable water."

Similarly, solutions for energy and nutrient recovery are being considered as part of a more sustainable water system for Bendigo, however these types of innovations are in their infancy in the local context. While biosolids are recovered from Coliban Water's wastewater treatment process, there has not been detailed investigation into biogas or heat recovery, and the market for recycled water does not appear sufficient to enable the upgrade of infrastructure for recycling to occur at scale. To raise the profile of energy and nutrient recovery as part of a sustainable resource management approach, **evidence about the need for a holistic approach to nutrient and energy recovery will need to be examined and evaluated** (Strategy 2.2).

Coliban Water is a champion with respect to many of the adaptive infrastructure and resource efficiency practices needed as part of Bendigo's water sensitive transition. Coliban Water's operations are governed by a statement of obligations, which currently requires it to plan for integrated water cycle management, investments across the urban water cycle, and demand management. It is also expected to adopt emissions reductions targets. Though Coliban Water is now well-placed to provide secure water supply into the near future based on a diversity of surface water sources for operational flexibility, there are additional resources that have potential for inclusion in its portfolio, including stormwater, groundwater and more efficient use of the rural water supply system. The City of Greater Bendigo has also recognised the importance of water in planning and supported the development of Bendigo's first residential estates that made use of Coliban Water's recycled water network. It also accesses this recycled water network and intelligent control systems to irrigate many areas of open space under its management. The State Government also champions these practices, and it uses its funding power to leverage outcomes that are consistent with this theme, though this influence is on a project-by-project basis. These demonstrations of leadership in integrated water cycle management are promising. To facilitate further progress, it is recommended that key agencies **strengthen organisational culture, systems and processes to promote integrated, efficient and adaptive water system solutions** (Strategy 2.3), for example through frameworks, programs and investments.

"In our projects, we're starting to get some [recognition among stakeholders of] mutual benefits."

Workshop participants consider Bendigo to have a good capacity for connecting stakeholders at the operational level due to its size. Solutions that support adaptive infrastructure and energy and water efficiency have generally been embraced, and Bendigo was effective in managing water demand during the Millennium Drought. Currently, Coliban Water is introducing digital metering solutions and is developing an energy and emissions management strategy. Beyond Coliban Water, Bendigo Health has implemented a range of water sensitive measures in the hospital redevelopment. Increased uptake of solutions for more efficient and adaptive systems, particularly in the business and residential sectors would be supported by **an integrated water strategy that spans across organisations, sectors and scales to assess and facilitate opportunities for implementation throughout Bendigo** (Strategy 2.4). Such a strategy would identify opportunities for demonstrations of adaptive infrastructure, energy efficiency, and water demand management, and help open projects to broader evaluation in their planning phase. The development and implementation of this integrated strategy would also provide a valuable platform to bring stakeholders together to broaden and strengthen support for water sensitive solutions and eventually expand the associated community of practice. **Embedding this integrated city-wide water strategy in policy and establishing targets to drive its implementation** (Strategy 2.5) would strengthen its ability to deliver on Bendigo's water sensitive city vision.

"[In Bendigo] you can't have the green stuff without stormwater and recycled water."

In addition to a top-down guiding strategy, a bottom-up approach to learning and innovation is important. Some significant projects on system integration and efficiency have yielded valuable lessons, but several participants reported that smaller-scale projects are rarely reviewed to build on successes or failures. It is therefore important to **consolidate existing knowledge and data from trials and demonstrations of water system innovations in Bendigo, as well as from projects and insights elsewhere** (Strategy 2.6) in order to advance local solutions and refine practical guidance. In addition, **new significant demonstration projects of integrated and adaptive solutions are needed, integrating an explicit learning agenda** (Strategy 2.7) that captures lessons about implementation and evidence of costs, benefits and risks.

"I like the idea of direct and indirect potable reuse because you don't need to duplicate systems."

For example, in the case of flood resilience, solutions need to be demonstrated at scale to support their mainstream receptivity and adoption. While flood risk in Bendigo is generally well understood, informed by the North Central Catchment Management Authority's extensive flood risk modelling, the vulnerability of existing dwellings and business premises to unpredictable flash flooding remains an issue, as well as Bendigo residents who have no previous experience of flooding. There are several influential champions for flood management in key organisations and among affected residents, and established platforms for developing a collective approach to flood management and emergency preparedness, such as the Northern Victoria Emergency Management Cluster, a flood mitigation advisory committee for Bendigo, and annual disaster awareness and preparedness events. These provide valuable enabling conditions to support the implementation of solutions as significant demonstrations. The need for a more integrated and multifunctional landscape response to flood risk is addressed in the assessment of enabling conditions for vision outcome 1 above.

Parts of Bendigo are vulnerable to stormwater flooding and wild fire, and the whole of the city is vulnerable to extreme heat though its impacts vary across the population. There are strategies in place to mitigate these threats led by the responsible agencies, but the scale of threats also requires households to plan strategies to manage their risk. This is relatively advanced for bushfire planning, but for stormwater flooding and heatwaves, community awareness and preparedness need to be improved. To address emergency preparedness, Council has collaborated on an Integrated Municipal

Emergency Management Plan and is promoting increased awareness of environmental risks, including bushfire and extreme heat. It is recommended that Bendigo takes an all-agency approach to supporting community resilience by developing **a Bendigo-wide community resilience strategy that drives coherent and proactive community responses to water-related climate risks such as flooding and extreme heat** (Strategy 2.8). This could form part of broader agency planning captured by the Integrated Municipal Emergency Management Plan.

Table 3. Recommended strategies for enhancing climate resilience and advancing integrated, adaptive and efficient systems

No.	Strategies	Outcome
2.1	Examine and evaluate the evidence about the need for flexibility and choice in delivering water supply and sanitation services	The costs, benefits and risks (including avoided costs and risks) are understood for service providers and customers in providing flexibility and choice for customers in their water system services
2.2	Examine and evaluate evidence about the need for a holistic approach to nutrient and energy recovery	An understanding of the costs, benefits, risks and potential of nutrient and energy recovery solutions
2.3	Strengthen organisational culture, systems and processes to promote integrated, efficient and adaptive water system solutions	Integrated, efficient and adaptive water system solutions are consistently reflected in policy and practice
2.4	Develop an integrated water strategy that spans organisations, sectors and scales to assess and facilitate opportunities for adaptive and efficient solution implementation throughout Bendigo	Direction, support and guidance exists for cross-sectoral organisations to approach water system servicing in integrated ways
2.5	Embed an integrated water strategy in organisational policy and establish targets to drive its implementation	An integrated framework exists to support organisational alignment, widespread implementation of solutions and transparent monitoring and evaluation of progress
2.6	Consolidate existing knowledge and data from trials and demonstrations of water system innovations in Bendigo, as well as from projects and insights elsewhere	Solutions are refined and inform the development of practical guidance for the local Bendigo context
2.7	Implement significant demonstrations of adaptive infrastructure, resource efficiency and flood resilience solutions, incorporating an explicit learning agenda	All parts of Bendigo benefit from flood resilience measures, an understanding of how these solutions can be delivered, evidence of their costs, benefits and risks, and an understanding of the capabilities needed for their effective implementation
2.8	Develop a Bendigo-wide community resilience strategy that drives coherent and proactive community responses to water-related climate risks such as flooding and extreme heat	There is implementation support and guidance for communities to be empowered in supporting system resilience

Vision outcome 3: Bendigo's creeks are cherished links in Bendigo's healthy natural environment

Required changes in practice

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

Improved ecological health therefore requires substantial shifts in water management practice. The characteristics, functions, conditions and values of ecosystems need to be better understood and respected, and controls are needed to manage the impacts of urbanisation and pollution. Achieving these outcomes will require natural assets to be integrated into the water management system so their management can be adequately planned and resourced.

Assessment of Bendigo's enabling conditions

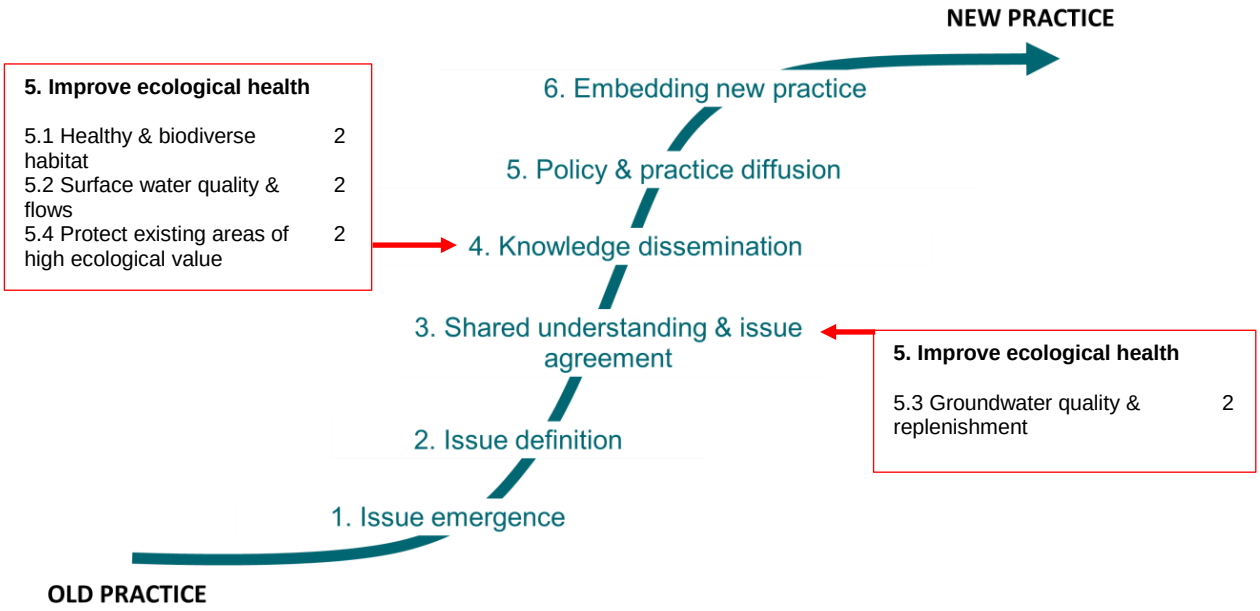


Figure 20. Current transition phase for WSC Index indicators that relate to vision outcome 3

Bendigo is in phase 4 of its transition to more water sensitive practices for improving ecological health, except for groundwater management, which is in phase 3. The return of groundwater to its natural levels within the historical mine shafts and tunnels in central Bendigo has prompted the state government to fund a short-term response to the water quality problems this creates. Waste streams

(brine and heavy metal-rich sludge) that are a by-product of most treatment options pose a long-term management issue that needs further investigation. Although there is currently multi-stakeholder action around the issue of managing Bendigo's groundwater, a long-term sustainable management plan has yet to be developed. In the broader urban area, there is limited groundwater management; seepage of brackish/saline groundwater is known to occur in low-lying creeks and gullies. It is recommended that agencies continue to **examine and evaluate the evidence for potential groundwater management options** (Strategy 3.1).

The other dimensions of ecosystem health that underpin this Vision theme share similar enabling conditions. There is diverse, broad and influential advocacy for ecosystem health among Bendigo's institutions and community organisations. Parts of Council have developed several strategic and long-term vision initiatives in recent years, including promoting the "City in the Forest, Forest in the City" concept and Bendigo Creek restoration. Council has also championed the revitalisation of the botanic gardens. Although primarily having focus outside urban centres, the NCCMA has recently increased attention to urban waterways and catchments. Active community groups with an environmental focus include Northern Bendigo Landcare, Bendigo & District Environment Council and the Bendigo Field Naturalists Club.

There are also several platforms enabling development of a collective voice advocating for solutions to improve environmental outcomes, including informal alliances of community groups as well as formal collaborations between organisations. Bendigo is also focusing on expanding the community of practice for surface water management. Wanyarram Dhelk, which is delivering ecological improvement works on Bendigo Creek and its tributaries, is a leading example as a joint project of Djandak and NCCMA, is supported by Council, DELWP and Coliban Water, and has also leveraged community action. Other examples include Spring Gully and Ironbark Gully Creek projects, which have aimed to enhance the ecological and recreational values of creek sections.

> *"From an aesthetic point of view, Bendigo has no river. But almost the entire urban area, 85% of the population, is contained in the catchment of Bendigo Creek. This can be a huge experiment [in water sensitive living]."*

Broad support for Bendigo's water sensitive city vision and its environmental aspirations is now needed to build an authorising environment that will commit to long-term funding for ecosystem health solutions, particularly as it faces development pressure on forest boundaries. To build on the range of successful programs to date and connect individual projects and achievements to a broader strategic agenda for Bendigo's creeks that aligns with the city's water sensitive vision, it is recommended that **an integrated implementation strategy for Bendigo's creeks as linking corridors to support healthy ecosystems and biodiversity** (Strategy 3.2) be developed. This strategy should focus on identifying opportunities for on-ground interventions to connecting Bendigo's creeks, expanding the community of practice for ecosystem restoration and building support and partnerships for implementing solutions.

> *"Until we developed a holistic approach, there was a lot of lost time. There was an inability to see the totality of the water system, only to see it from the perspective of engineering solutions."*

There is good knowledge of habitat quality and extent, and stream condition, in and around Bendigo. Council plans to undertake a comprehensive review of water quality monitoring to inform future infrastructure planning. However, the solutions for preventing decline in ecosystem health that results from urban development are unclear and there have been insufficient trials or demonstrations to test the viability of alternative forms of low impact development or management approaches. As a significant step towards consolidating ecosystem management knowledge in Bendigo, it is

recommended that **lessons from existing projects for improving ecosystem health be collected and communicated** (Strategy 3.3). There is also a need to **implement significant demonstrations of water system solutions for improving habitat and biodiversity and increasing waterway corridor connections** (Strategy 3.4), incorporating an explicit learning agenda. Demonstration scales should encompass the household, such as gardens that incorporate water treatment or native fauna supporting gardens, as well as precincts, such as a demonstration of a fully ecologically sustainable neighbourhood.

"You can't do anything with the creek until you have a much better understanding of the urban watershed and how it operates."

Table 4. Recommended strategies for enhancing Bendigo's creeks as part of a healthy natural environment

No.	Strategies	Outcome
3.1	Examine and evaluate the evidence for potential groundwater management options	An understanding of the potential costs, benefits and risks (including the avoided costs and risks) of groundwater management solutions
3.2	Develop an integrated implementation strategy for Bendigo's creeks as linking corridors to support healthy ecosystems and biodiversity	An integrated catchment-wide approach to the management of Bendigo's creek network and surrounding ecosystems
3.3	Collect and communicate lessons from existing community and agencies projects that identify opportunities to advance this part of the vision	Existing knowledge to advance ecosystem management knowledge is consolidated and shared
3.4	Implement significant demonstrations of innovative water system solutions for improving habitat and biodiversity and increasing waterway corridor connections, incorporating an explicit learning agenda	An understanding of how ecosystem management solutions can be delivered, evidence of their costs, benefits and risks, and an understanding of the capabilities needed for their effective implementation

Vision outcome 4: Communities actively care for Bendigo water and land environments, guided by Dja Dja Wurrung knowledge and values

Required changes in practice

Conventional water servicing defines the role for the community as customers who pay central utilities to provide water system services such as water supply, sanitation and drainage. This relatively simple transaction between provider and end-user has been effective for services that are delivered through the single-objective large-scale centralised infrastructure that characterises most Australian water systems to date.

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

Bendigo's Traditional Owners, the Dja Dja Wurrung, and other Aboriginal communities share unique cultural, spiritual and economic values of water that form a critical part of the city's historical, contemporary and future waterscape. Their water knowledge, values and ways of thinking offer significant promise in guiding community stewardship in Bendigo. Harnessing this potential will require greater inclusion of Dja Dja Wurrung perspectives in processes, along with opportunities to share cultural values and connections to ensure a full diversity of values is considered and incorporated in decision-making. Cost-benefit analysis tools and frameworks would need to incorporate these broad values. Beyond formal planning processes, opportunities to communicate diverse values amongst the greater community would encourage harmonious co-existence. Languages and ideas could be embedded in mainstream life through visible representations and symbols. Practices that encourage a deeper cultural and spiritual connection to water and place would enhance wellbeing and influence peoples' behaviours as stewards of the city's water sensitive future.

Assessment of Bendigo's enabling conditions

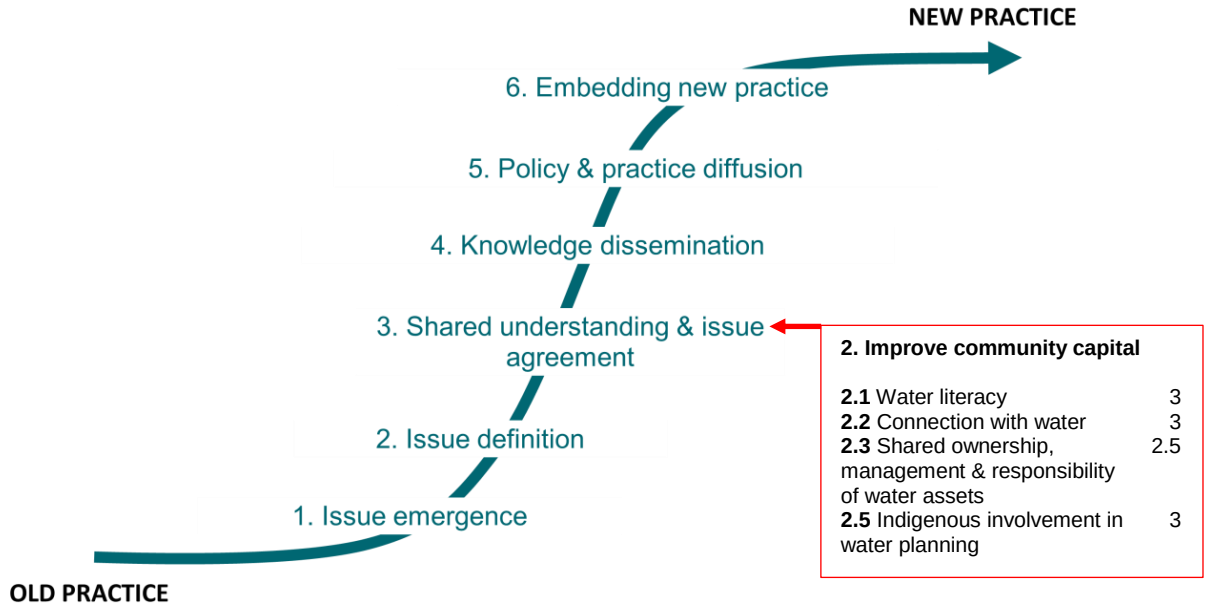


Figure 21. Current transition phase for WSC Index indicators that relate to vision outcome 4

Bendigo is relatively well-advanced with respect to indigenous involvement in water planning. This is helped by the involvement of Djandak in management activities and the requirements of the Settlement Agreement between the Dja Dja Wurrung and the State Government. There are champions for indigenous involvement throughout local government, water authorities and DELWP, though there is still a need for deeper connection between them.

A range of national and state engagement frameworks have established platforms for developing alignment, including the COAG National Indigenous Reform Agreement, the Victorian Aboriginal Affairs Framework, the Inclusion Framework and the Economic Strategy. Wanyarram Dhelk is a practical example of collaboration, as it has involved the NCCMA and Djandak working closely together and also attracted funding from Council and Coliban Water. However, these opportunities are largely framed by the State Government directives and there still needs to be a broader embrace of indigenous cultural and economic associations with water planning in the local context. Therefore, it is recommended that Bendigo **develop and communicate a compelling narrative of the benefits of involving Dja Dja Wurrung in water planning and decision-making** (Strategy 4.1).

"There's not enough thinking about, from a large-scale urban planning point of view or even a small scale personal garden point of view, the idea that water will always be provided and it's someone's else's responsibility."

There is a related need to **develop and communicate a compelling narrative of the benefits of increasing community participation in water sensitive management more broadly** (Strategy 4.1) to establish the authorising environment for coordinated action across multiple institutions. There is a

strong foundation on which to build, however. Many organisations champion a community connection with water in the landscape when it coincides with natural environment values (e.g. Bendigo Field Naturalists, Bendigo Sustainability Group, City of Greater Bendigo, Friends of Ironbark Gully, and NCCMA). More generally, Coliban Water promotes water literacy through school tours, awareness campaigns and publications. Coliban Water's focus is primarily water conservation. Dja Dja Wurrung Enterprises include in their mission raising broader community awareness for healing country and waterway health. There is also teaching of indigenous cultural values in schools.

In addition to this, it has been observed by participants that the solutions involving indigenous water planning are relatively new, with Wanyarram Dhelk, which commenced in 2017, the first of a potentially new model of water management. To build on the effort to date and develop solutions that affect water planning in the integrated way envisaged in the water sensitive city vision, it is recommended that Bendigo **explore and pilot solutions for indigenous involvement in water planning and community water stewardship** (Strategy 4.2), incorporating a clear learning agenda. This will help maintain progress in developing a suite of effective and appropriate engagement solutions within a complex, dynamic operating environment.

Bendigo now needs to build up and formalise connections between these individual champions, community groups and innovative projects to develop a shared focus for implementing solutions that can engage community in water sensitive planning or management. This would help develop a more strategic and consistent approach to engaging with the community about water, regardless of organisational boundaries. It is therefore recommended that Bendigo **establish a platform that brings focus to community messaging and engagement in relation to the water system and Bendigo's water sensitive city vision** (Strategy 4.3).

> *"How do we create spaces to be enjoyed regardless of what the conditions are? …Because people can enjoy dry and dusty places as much as they can enjoy green and lush places… That's where I think Dja Dja Wurrung and Djandak can play a role in messaging, in creating places to make you feel good."*

In practice, water engagement tends not to reach the groups in the community that are not already well-engaged. Education campaigns, for example, typically find an audience with reasonably high water literacy. The need to build a community water management culture is well-recognised, though knowledge of potential solutions is not yet strong in Bendigo. A number of community-driven projects designed to achieve tangible environmental outcomes, such as those for Long Gully, Spring Gully and Bendigo Creeks, have created direct and indirect benefits for community stewardship. However, without an explicit focus on engendering follow-up action, the lessons of these projects have not been fully realised. In addition, participants are aware of potentially effective stewardship solutions applied in other places that may be applicable to the Bendigo context. Therefore, it is recommended that Bendigo **consolidate lessons from existing projects with good community stewardship principles in Bendigo and elsewhere** (Strategy 4.4).

Table 5. Recommended strategies for advancing communities actively caring for Bendigo's environments

No.	Strategies	Outcome
4.1	Develop and communicate a compelling narrative of the benefits of involving Dja Dja Wurrung in water planning and decision-making and of community participation in water sensitive management more broadly	There is broad support for indigenous involvement in water governance and broader community participation in water stewardship initiatives.
4.2	Explore and pilot solutions for indigenous involvement in water planning and community water stewardship, incorporating a clear learning agenda	A suite of engagement solutions is developed and demonstrated to provide evidence of their costs, benefits, and risks, and to learn about the capabilities needed for their effective implementation
4.3	Establish a platform that brings focus to community messaging and engagement in relation to the water system and Bendigo's water sensitive city vision	Key agencies communicate a coherent suite of messages and commit to a shared agenda for community engagement in water stewardship
4.4	Consolidate lessons from existing projects with good community stewardship principles in Bendigo and elsewhere	Local water stewardship solutions are developed and practical guidance is created to support a more strategic and consistent approach to community engagement

Vision outcome 5: Consistent and inclusive governance supports an empowered community and integrated, adaptive approaches to water planning and management

Required changes in practice

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

In the face of pressures from climate change, population growth and urbanisation, the community's expectations for outcomes delivered by the water system are evolving further, and now reflect a broader agenda for water to support a city's liveability and resilience. This shift is becoming well recognised in water policy in jurisdictions around Australia.

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

Assessment of Bendigo's enabling conditions

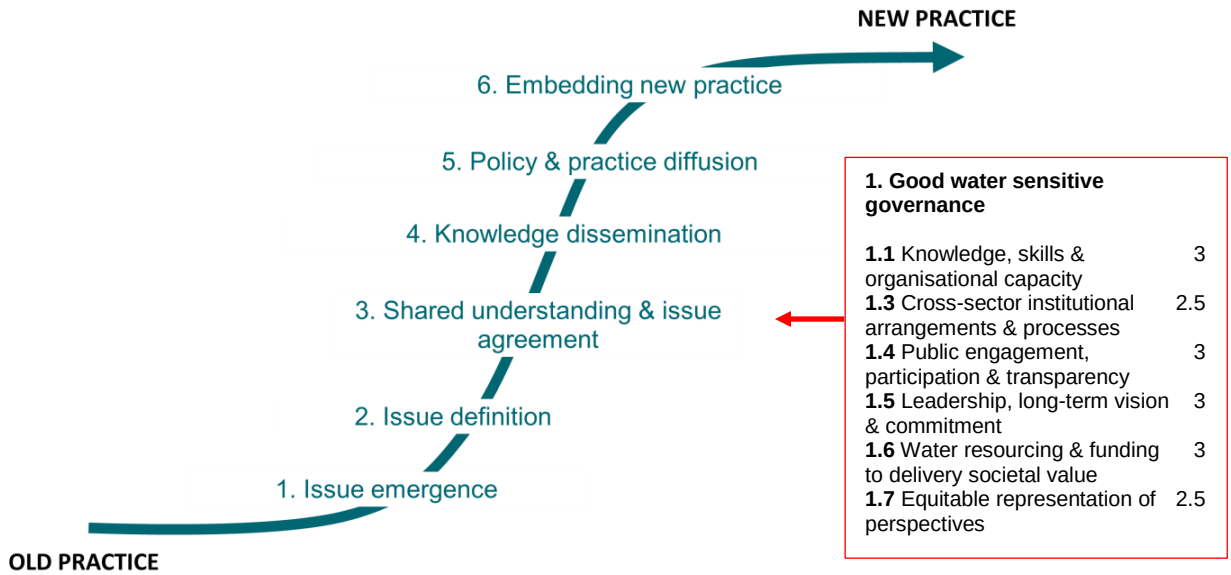


Figure 22. Current transition phase for WSC Index indicators that relate to vision outcome 5

There are numerous organisations and individuals in Bendigo that acknowledge the importance of leadership, vision and public engagement in water governance. Council have adopted a range of high-level strategies that align with the water sensitive vision and are committed to working with other organisations to deliver the aspired outcomes through the intervention of senior decision-makers. Council has a strong focus on cross-institutional strategic processes to achieve more integrated and efficient planning processes. Plan Greater Bendigo has also featured extensive stakeholder consultation. DELWP champions cross-sector institutional processes and the incorporation of community values in its Integrated Water Management Framework (2017). Coliban Water has developed an integrated water management planning process in collaboration with NCCMA and Council, and has also invested in new community engagement processes in the last year. Coliban Water has also initiated an open forum with Bendigo land developers in collaboration with the Urban Development Institute of Australia.

There have been regional-based collaboration platforms that could inform collaborative water governance in operation since 2009-10. The Loddon Campaspe Regional Partnership is a model for broader regional cooperation and long-term planning. Plan Greater Bendigo, guided by a Steering Committee chaired by the Mayor and a Technical Reference Group that includes representatives from local agencies and non-government and private sector organisations, may support strategic alignment across organisations.

> *We're all coming from different disciplines and we've got slightly different outcomes and needs. It is difficult but I think if you want to make [collaboration] work, you've got to think long-term and you've got to be making decisions that consider all aspects.*

This positive recent progress needs to be embedded institutionally, as many organisations appear to be struggling to adequately resource cross-sector collaboration and integration processes for water governance. This is in part due to water being less prominent on the agenda of many organisations since drought conditions ended more than five years ago. High-level strategies are in place but in practice, cross-institutional coordination is less likely to occur in smaller projects or at an operational level. Some of the frameworks for community participation in water governance appear to be prescriptive and intended to manage organisational risk rather than empowering of active and inclusive involvement.

Securing the endorsement of organisational leaders, customers and the broader citizen base for transformational governance initiatives that will support further progress towards integrated, inclusive and collaborative water governance approaches will require an explicit understanding of the benefits of such changes. It is therefore recommended that Bendigo **develop and communicate a compelling narrative of the need for and benefits of an integrated and aligned approach across stakeholders in water planning and decision-making** (Strategy 5.1).

> *We're not just coming from a water perspective [exclusively], but water is the tool by which you can get a lot of the other outcomes.*

Bendigo's water sensitive city vision helps to articulate these benefits and may form a powerful mechanism for establishing broad support for the governance arrangements and approaches that will be needed to achieve it. **Embedding the vision in organisational policies, plans and strategies** (Strategy 5.2) will therefore be important for growing water sensitive governance at all levels of relevant organisations in Bendigo.

"Staff need to be given a licence to explore new collaborative approaches… systems are geared towards the default approach."

The drought, floods and major projects such as the Goldfields Superpipe, Recycled Water Factor and Bendigo Urban Flood Study saw a spike in collaborative governance activities that were initiated in response to particular urgent needs or short-term issues. The next challenge is for Bendigo to build on these successful initiatives to establish longer-term structures and processes that will enable consistent, inclusive and collaborative water governance that can drive integrated, adaptive planning and management approaches. Two strategies are recommended to help with this agenda. First, **establishing a platform that brings focus to collaborative approaches to achieving water sensitive planning objectives and operations** (Strategy 5.3) will help develop a collective commitment to effective operational collaboration and knowledge sharing across stakeholders. Second, **consolidating the lessons from Bendigo of successful collaborative (water) governance initiatives that have emerged in response to specific issues** (Strategy 5.4) will help reinforce Bendigo's capacity for collaborative and inclusive governance. Both of these strategies will support Bendigo's practitioners to develop a more strategic outlook to opportunities for partnering, multi-stakeholder collaboration and community engagement.

Table 6. Recommended strategies for advancing consistent and inclusive governance

No.	Strategies	Outcome
5.1	Develop and communicate a compelling narrative of the need for and benefits of an integrated and aligned approach across stakeholders in water planning and decision-making	There is support from the leadership of key agencies and broader public to drive innovation and long-term transformation in water governance to achieve water sensitive outcomes
5.2	Embed Bendigo's water sensitive vision in organisational policies, plans and strategies	There is a framework to support organisational alignment and widespread implementation of water sensitive solutions
5.3	Establish a platform that brings focus to collaborative approaches to achieving water sensitive planning objectives and operations	There is a collective voice and strategic approach guiding effective operational collaboration and knowledge sharing across stakeholders
5.4	Consolidate the lessons from Bendigo of successful collaborative (water) governance initiatives that have emerged in response to specific issues	Previous experiences of water governance collaboration inform the development and refinement of solutions for long-term and consistent partnerships

Vision outcome 6: Bendigo is an inland city water innovation hub, grounded in education, research and design excellence

Required changes in practice

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

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

Assessment of Bendigo's enabling conditions

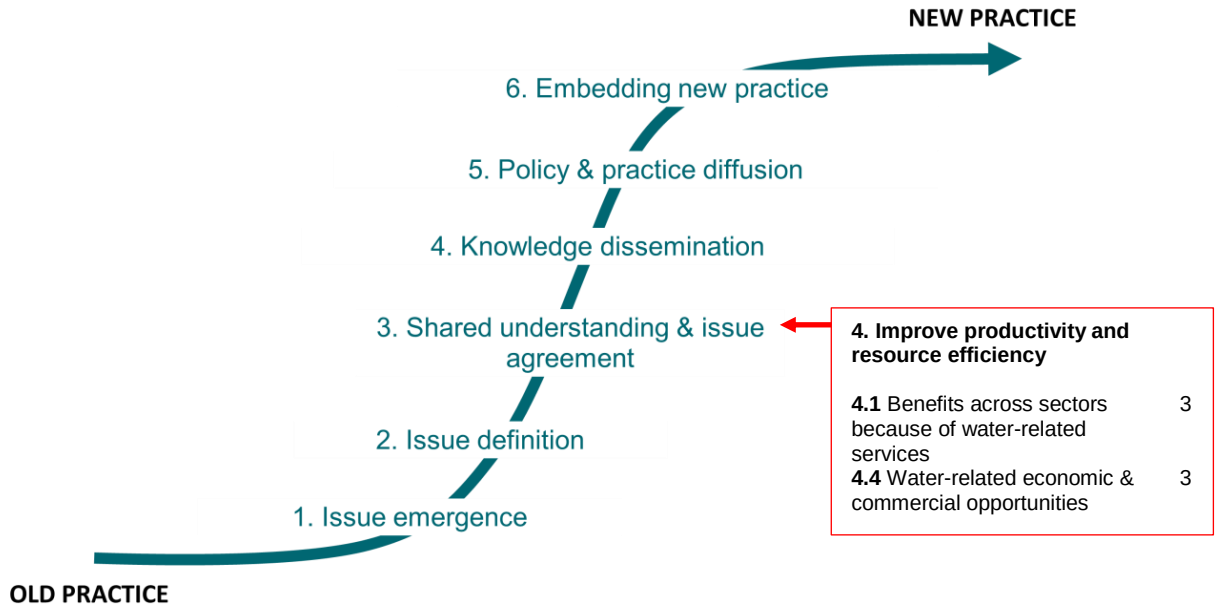


Figure 23. Current transition phase for WSC Index indicators that relate to vision outcome 6

Bendigo has a history of innovation in the water sector and in the city more generally. Early water examples include the Coliban Scheme of the 1860s to transport water to Bendigo, filtration-based treatment built into Crusoe Reservoir in the 1870s. The investment in the Aqua2000 treatment plant and efficient irrigation technology for sports and recreation assets in the early 2000s indicates water innovation is present in the modern era as well. These initiatives have typically been driven by internal champions and a strong business imperative, though were not without risk. Beyond water, innovation is seen in entrepreneurial business ventures such as Bendigo Bank, the activities of a number of universities and a range of cultural and creative festivals. For example, La Trobe and Monash

University's and the University of Melbourne offer clinical training for medical students at a dedicated health and research precinct near Bendigo Health.

This citywide culture of, and commitment to, innovation provides a strong foundation for achieving Bendigo's aspiration to be an inland city water innovation hub. To promote focus on this aspiration and gain explicit support from a broad range of stakeholders to drive action for water innovation, it is recommended that **a narrative of the economic benefits of water sector innovation be developed and communicated to other public sectors and the private sector** (Strategy 6.1).

Innovation should not be isolated or 'one-off'. The pathway to Bendigo's vision will require significant upscaling of innovation as new solutions and practices move beyond trials into widespread roll-out. Within relevant organisations, this will require large-scale commitment and systematisation of learning and improvement over the long-term, supported by a culture that is willing to take appropriately-managed risks and embrace the opportunity to learn from failure. It is recommended that Bendigo organisations foster **organisational culture, systems and processes that enable and encourage uptake of water innovations** (Strategy 6.2).

Table 7. Recommended strategies for advancing water innovation in Bendigo

No.	Strategies	Outcome
6.1	Develop and communicate a narrative of the economic benefits of water sector innovation for other public sectors and the private sector	The importance of water sector innovation for achieving Bendigo's broad city aspirations for long-term prosperity is communicated to a broad range of stakeholders to begin building their support
6.2	Enable and encourage innovation uptake through organisational culture, systems and processes	Innovative ideas are trialed, demonstrated and then integrated as mainstream parts of the water system

5.2. Transition strategies and actions to achieve vision outcomes

Industry and community workshops developed a wide range of actions that would help advance Bendigo's water sensitive transition process and enable delivery of the enabling strategies identified in Section 5. Post-workshop analysis processed these actions to distinguish between higher level actions and implementation guidance that captures the further details identified by participants.

This section presents a synopsis of actions identified by participants organised by vision outcome and enabling strategy. Where particular outcomes were specified as being the target of action, these are also noted. Implementation guidance takes the form of local opportunities that could be leveraged in the short- to medium-term, or of needs that should be addressed to support the implementation of the identified actions.

The action tables are intended to help guide further action development through activities beyond this project and do not reflect any organisational commitment. Further planning is needed to develop these actions into an operational plan that defines roles, responsibilities, targets and timeframes.

Table 8. Enabling strategies and actions for achieving vision outcome 1: Bendigo's people are happy and healthy, enjoying life in a green, connected and equitable city

Strategies	Actions	Importance / Feasibility	Ideas for implementation
1.1 Develop and communicate a compelling narrative of the liveability and health benefits of multi-functional and connected water sensitive urban form in Bendigo *Immediate outcome:* Broad support exists from across private developers, organisational leadership, and the general public	**1.1.1** Gain state government support (including VPA and DELWP) for reforms to deliver more multi-functional and connected water sensitive urban form	High / High	*Opportunities:* - Local council connections to state government Bendigo groundwater project - Use pending community engagement around urban greening projects to support the narrative - Water for Victoria policy provides mandate for the water sensitive Bendigo vision - Stay apolitical, but adopt state government policy directions where relevant *Needs* - Identifying impacts for local community – what does this mean at the household level? - What motivates community, what resonates with residents?
1.2 Develop a platform for connecting and aligning stakeholders and promoting a collective strategic voice advocating the health and wellbeing benefits of water sensitive solutions	**1.2.1** Link with GREATER, a platform for promoting health in Bendigo area	High / High	*Opportunities:* - Link with Plan Greater Bendigo, Open Space Plan, Bendigo Health and Wellbeing Plan, and Greening Greater Bendigo - Healthy Bendigo coalition members include Council and Coliban Water

Table 8. Enabling strategies and actions for achieving vision outcome 1: Bendigo's people are happy and healthy, enjoying life in a green, connected and equitable city

Strategies	Actions	Importance / Feasibility	Ideas for implementation
Immediate outcome: A broad range of stakeholders understand and communicate the benefits of water sensitive urban design solutions			*Needs:* - GREATER has core funding but will need support for scaling up implementation
1.3 Embed the water sensitive vision of a healthy Bendigo based on a compact, connected and green urban form in all strategies under development. *Immediate outcome*: There is commitment, action and leadership from agencies and other organisations in driving the implementation of water sensitive urban form solutions	**1.3.1** Undertake collaborative multi-stakeholder planning involving city planners to assess Bendigo's planning frameworks for integration and alignment with the vision and transition strategy in the context of the whole water cycle	High / Medium-High	*Opportunities:* - Form a network of planners from utilities, land use, infrastructure, health etc. - Create a shared 'city shaping' vision and strategy - Convene knowledge sharing events every 3-6 month - Bring multiple stakeholders into the Greening Greater Bendigo strategy development process *Needs:* - High-level buy-in - Solutions for disconnect at operational level of implementation
	1.3.2 Amend existing and/or implement new planning regulations and design standards to connect people to water and Bendigo's creeks	High / Medium	*Opportunities:* - Develop standards to cover construction materials and design options for reducing urban heat island effect - Require a water sensitivity score threshold for new developments

Table 8. Enabling strategies and actions for achieving vision outcome 1: Bendigo's people are happy and healthy, enjoying life in a green, connected and equitable city

Strategies	Actions	Importance / Feasibility	Ideas for implementation
Long-term outcomes: - Reducing heat through WSC principle street planting funded through "value capture" - Using unstructured passive or active recreation to optimise the potential of limited water assets - Embedding community connections with water			- Prioritise urban greening, active transport and user safety in road design (e.g. divert the highway around the city to make room for a triple canopy of trees and pathways) - Identify state level champions for regulatory change - Explore the potential of an urban design rating scale, applying defined standards to Bendigo streets or neighbourhoods. *Needs:* - Regulation change is challenging. Relaxation of existing constraints at a local level may be easier but requires trust between state and local agencies - Develop and promote WSC standards for rental properties to support uptake of water sensitive behaviours by renters
	1.3.3 Develop a water sports strategy	High / Low	*Opportunities:* - Link in with Council aquatic facilities strategy - Consider indirect or informal sports connections to water - Connect with other regions - Key water bodies such as Crusoe Reservoir could be water sports hubs *Needs:* - Significant investment may be needed to rehabilitate water bodies for safe access

Table 8. Enabling strategies and actions for achieving vision outcome 1: Bendigo's people are happy and healthy, enjoying life in a green, connected and equitable city

Strategies	Actions	Importance / Feasibility	Ideas for implementation
1.4 Evaluate the available evidence to quantify the social, environmental and economic benefits of water sensitive urban form to build a business case and inform a compelling narrative. *Immediate outcome*: The costs, benefits and risks of quality urban space solutions are understood and communicated to a broad range of stakeholders *Long-term outcomes:* - Changing the mind-set of what a healthy landscape or garden looks like	**1.4.1** Map Bendigo streets to assess where new green infrastructure would provide highest return for public benefit.	High / High	*Opportunities:* - Embed vision and transition strategy within Bendigo Public Open Space Strategy and capital works plans, Bendigo Council Urban Canopy Cover and Heat Vulnerability Mapping Project (both commenced 2018), and Victorian Green House Alliance
	1.4.2 Learn from the healthiest cities in the world about the key ingredients for successful implementation of a compact, healthy built form	Medium / High	*Opportunities:* - Link to Action 1.2.1 'planners network' - Link-in with Council aspirations to be 'the world's most liveable community' to re-define what success looks like for the city (success indicators currently under review)
1.5 Develop a broader suite of solutions for water sensitive urban forms, with attention to governance processes and structures.	**1.5.1** Use multi-stakeholder planning to identify how and where areas of public open space can be most efficiently supplied by nonconventional, sustainable and 'smart' sources of water	High / High	*Opportunities:* - Include key agencies Coliban Water and Bendigo Council - Link in and learn from existing initiatives including recycled water supply to the Botanic Gardens *Needs:*

Table 8. Enabling strategies and actions for achieving vision outcome 1: Bendigo's people are happy and healthy, enjoying life in a green, connected and equitable city

Strategies	Actions	Importance / Feasibility	Ideas for implementation
Immediate outcome: A comprehensive suite of solutions is developed ready for testing, refinement and widespread implementation			- New supplies of recycled water - Stronger business case in current economy and climate
	1.5.2 Provide industry capacity building on approaches to reducing the urban heat island effect	High / Medium	*Opportunities:* - Redesign business models / business case to ensure value capture of initiatives currently considered corporate social responsibility - Identify incentives and disincentives for practitioners - Develop and implement a builder and landscaper education program to support multi-functional design solutions *Needs:* - Mechanisms to share responsibility and distribute cost
	1.5.3 Undertake integrated planning to investigate cost-benefit and risk profile of consolidating infrastructure and utilities, e.g. undergrounding power lines for the benefit of tree canopy	High / Low	*Opportunities:* - Be ready to link in with staged asset lifecycle assessment *Needs:* - Strategies to influence existing private assets

Table 8. Enabling strategies and actions for achieving vision outcome 1: Bendigo's people are happy and healthy, enjoying life in a green, connected and equitable city

Strategies	Actions	Importance / Feasibility	Ideas for implementation
1.6 Implement trials and significant demonstrations of water sensitive urban space solutions, incorporating an explicit learning agenda. *Immediate outcome*: Water sensitive urban form solutions are demonstrated to provide evidence of their costs, benefits, and risks, and to learn about the capabilities needed for their effective implementation to inform the development of practical guidance. *Long-term outcomes:* - Cool, shady and vegetated spaces that attract people are created - Existing pathways are connected and ensure access to all - Tiered creek banks are created	**1.6.1** Leverage funding and resources through other sectors (e.g. health, tourism, insurance industry) and developer contributions	High / Medium	*Opportunities:* - Scale dictates feasibility; start small *Needs:* - Multi-stakeholder partnership and opportunistic approach - Strong business case required in highly competitive market - A compelling WSC message for greater visibility for existing projects
	1.6.2 Build prominent demonstrations of water sensitive landscapes in private and public open space to change expectations of the appearance and functionality of liveable urban form	High / High	*Opportunities:* - Identify opportunities for linkages and aligning efforts and resources across projects (e.g. Rosalind Park, Lake Weeroona, Gateway Park and the Botanic Gardens, Greater Bendigo Food Hub, Gardens Of The Future, Sustainable Open House Day, Bendigo Sustainability Group, Business Innovation Awards, Friends of Ironbark Gully) - Implement interactive and educational stormwater capturing and treatment devices with interpretive signage - Establish community gardens along creeks and pathways - Establish frameworks or legal mechanisms to enable creative solutions for how public and private space is used - Make it easier for community to navigate requirements for grassroots demonstration projects (e.g. pop up parks in Melbourne)

Table 8. Enabling strategies and actions for achieving vision outcome 1: Bendigo's people are happy and healthy, enjoying life in a green, connected and equitable city

Strategies	Actions	Importance / Feasibility	Ideas for implementation
			- Increase access to garden landscapes within and around hospitals
	1.6.3 Link with education institutions for the design, implementation and evaluation of projects	High / High	*Opportunities:* - Bendigo Council's aspiration to be an 'Education' city - La Trobe University Engineering School and design studio project for Bendigo Creek - Consider business case for education institutions whose funding is linked to student demand for courses and the training market e.g. Contribute to 'career ready students'

Table 9. Enabling strategies and actions for achieving vision outcome 2: Bendigo is resilient to climate extremes and has integrated efficient and adaptive regional water, energy and food systems

Strategies	Actions	Importance / Feasibility	Ideas for implementation
2.1 Examine and evaluate the evidence about the need for flexibility and choice in delivering water supply and sanitation services	**2.1.1** Investigate the feasibility of a flexible water grid throughout Bendigo that accommodates fit-for-purpose water supplies	High / High	*Opportunities:* - Link in with existing work explored by Coliban Water

Table 9. Enabling strategies and actions for achieving vision outcome 2: Bendigo is resilient to climate extremes and has integrated efficient and adaptive regional water, energy and food systems

Strategies	Actions	Importance / Feasibility	Ideas for implementation
Immediate outcome: The costs, benefits and risks (including avoided costs and risks) are understood for service providers and customers in providing flexibility and choice for customers in their water system services			*Needs:* - Further investigate regulatory environment for onsite wastewater treatment
	2.1.2 Evaluate evidence of the on-going role of water pricing in influencing consumer demand of fit-for-purpose water including quality, value for money and level of treatment	High / Medium	*Opportunities*: - Local case could support solutions for state-wide issue *Needs*: - Mechanisms for pricing transparency - Reviewing price settings for potable water and recycled water
2.2 Examine and evaluate evidence about the need for a holistic approach to nutrient and energy recovery *Immediate outcome*: An understanding of the costs, benefits, risks and potential of nutrient and energy recovery solutions	**2.2.1** Investigate business case for black and grey water utilisation and waste to energy options	High / Medium	*Opportunities*: - Link in with existing work by Coliban Water - Promote uptake of multiple water sources for best fit - Encourage innovation and benefits in the energy sector from opportunities in the water system *Needs:* - Robust business case methodology (past models unsuccessful) - Clarify regulatory impact for onsite wastewater treatment

Table 9. Enabling strategies and actions for achieving vision outcome 2: Bendigo is resilient to climate extremes and has integrated efficient and adaptive regional water, energy and food systems

Strategies	Actions	Importance / Feasibility	Ideas for implementation
Long-term outcomes: - Multiple fit-for-purpose water solutions are used and supported by the community - Bendigo's ground water provides a renewable energy source	**2.2.2** Investigate carbon offsetting in the water industry across Bendigo	High / Low	*Opportunities:* - Consider energy recovery for emissions offsetting - Other actions may support feasibility *Needs*: - Mechanisms to simplify collaboration - Investigating technical challenges - Relationship between cities, growth and food consumption needs global solutions
2.3 Strengthen organisational culture, systems and processes to promote integrated, efficient and adaptive water system solutions *Immediate outcome*: Integrated, efficient and adaptive water system solutions are consistently reflected in policy and practice *Long-term outcomes:* - Enabling innovative projects	**2.3.1** Develop capacity to implement the State Government Integrated Water Management framework for integrated assessment across all Bendigo projects	High / High	*Opportunities*: - Link in with DELWP IWM forums existing work *Needs*: - Identify Bendigo specific needs
	2.3.2 Link integrated water system solution planning into organisational leadership processes	Medium / Low	*Opportunities*: - Support a position to drive WSC initiatives and provide on-going coordination of implementation

Table 9. Enabling strategies and actions for achieving vision outcome 2: Bendigo is resilient to climate extremes and has integrated efficient and adaptive regional water, energy and food systems

Strategies	Actions	Importance / Feasibility	Ideas for implementation
			Needs: - Recognition that organisational change can be slow – manage expectations
2.4 Develop an integrated water strategy that spans organisations, sectors and scales to assess and facilitate opportunities for adaptive and efficient solution implementation throughout Bendigo *Immediate outcome*: Direction, support and guidance exists for cross-sectoral organisations to approach water system servicing in integrated ways	**2.4.1** Develop a collaborative program to facilitate Bendigo's unique nexus between water, energy and food	High / Medium	*Opportunities*: - Investigate key opportunities for local sustainable food systems - Understand relationship with urban growth and food consumption for global systems *Needs*: - Starting with compartmentalised tasks, e.g. project scope
	2.4.2 Use residential and commercial digital water meters to inform a data-driven water management strategy	High / High	*Opportunities*: - Compose State Government submission to authorise and fund a data sharing and management platform - Link in with health and weather station data - Articulate narrative of opportunities to unlock value from data, facilitate education and water efficiency *Needs:* - Identify funding opportunities - Identify relevant local indicators and comparisons to create meaningful targets for behavioural change

Table 9. Enabling strategies and actions for achieving vision outcome 2: Bendigo is resilient to climate extremes and has integrated efficient and adaptive regional water, energy and food systems

Strategies	Actions	Importance / Feasibility	Ideas for implementation
2.5 Embed an integrated water strategy in organisational policy and establish targets to drive its implementation *Immediate outcome*: An integrated framework exists to support organisational alignment, widespread implementation of solutions and transparent monitoring and evaluation of progress	**2.5.1** Develop adaptive water plans integrating public space and recreation that consider projected infrastructure needs based on community, wellbeing and economic needs	High / Variable	*Opportunities*: - Link in with existing framework - Consider a 'Bendigo Master Plan' to integrate agency and community activities - Develop a project pipeline for public space *Needs*: - Mechanisms to embed into practice - Map potential projects; consider cost-benefits, feasibility and scale - Consider potential gap between community expectations and modelled benefit - Opportunities for community fund raising - Consider current and projected demand - Consider site versus scale issues
2.6 Consolidate existing knowledge and data from trials and demonstrations of water system innovations in Bendigo, as well as from projects and insights elsewhere *Immediate outcome*: Solutions are refined and inform the development of practical guidance for the local Bendigo context	**2.6.1** Implement an open community-driven knowledge sharing platform	High / High	See action 2.4.2

Table 9. Enabling strategies and actions for achieving vision outcome 2: Bendigo is resilient to climate extremes and has integrated efficient and adaptive regional water, energy and food systems

Strategies	Actions	Importance / Feasibility	Ideas for implementation
2.7 Implement significant demonstrations of adaptive infrastructure, resource efficiency and flood resilience solutions, incorporating an explicit learning agenda *Immediate outcome*: All parts of Bendigo benefit from flood resilience measures, an understanding of how these solutions can be delivered, evidence of their costs, benefits and risks, and an understanding of the capabilities needed for their effective implementation *Long-term outcomes:* - Innovative technologies are used to improve efficiency	**2.7.1** Investigate opportunities for demonstrating flood mitigation infrastructure at various scales	High / High	*Opportunities*: - Link in with projects on Bendigo Creek tributaries (e.g. Wanyarram Dhelk) - Incorporate levies at Epsom into a broader resilience and habitat restoration vision - Consider the use of retarding basins and permeable surfaces to slow water *Needs*: - Mapping and understanding existing initiatives - Leverage potential for shifting impact and status quo overall
	2.7.2 Implement demonstrations of adaptive infrastructure and resource efficiency solutions	High / High	*Opportunities*: - Hold an open-day for water sensitive buildings, homes and gardens with self-guided or virtual tours - Install surface films on reservoirs to manage evaporative losses - Map and understand existing initiatives - Prepare business case and narrative to promote best practice and justify potential increased costs

Table 9. Enabling strategies and actions for achieving vision outcome 2: Bendigo is resilient to climate extremes and has integrated efficient and adaptive regional water, energy and food systems

Strategies	Actions	Importance / Feasibility	Ideas for implementation
2.8 Develop a Bendigo-wide community resilience strategy that drives coherent and proactive community responses to water-related climate risks such as flooding and extreme heat *Immediate outcome*: There is implementation support and guidance for communities to be empowered in supporting system resilience	**2.8.1** Develop community supported water-saving targets and education program for all seasons	High / High	*Opportunities*: - Consider past work when developing a programme and community engagement - Use water to illustrate the importance of past and present relationships with and reliance on other places (water flows from and to neighbours in the Campaspe River and Murray River systems) - Run neighbourhood competitions to incentivise water efficiency in households *Needs:* - Leveraging existing high-level community buy-in
	2.8.2 Develop a community education program on the importance of, and processes for direct and indirect potable water reuse	High / High	*Opportunities*: - Cost is variable, and there is potential for efficiency if the most effective campaign strategy is chosen - See action 2.8.1

Table 10. Enabling strategies and actions for achieving vision outcome 3: Bendigo's creeks are cherished links in Bendigo's healthy natural environment

Strategies	Actions	Importance / Feasibility	Ideas for implementation
3.1 Examine and evaluate the evidence for potential groundwater management options *Immediate outcome*: An understanding of the potential costs, benefits and risks (including the avoided costs and risks) of groundwater management solutions. *Long-term outcomes:* - Bendigo's relationship to groundwater is reframed from a problem to a resource - A long-term solution to address groundwater needs is identified	**3.1.1** Continue to evaluate results of current processes and potential solutions arising from pre-existing assessment processes	Medium / High	*Opportunities*: - One agency or cross-agency body to take the lead - Link in with existing state government program developing innovative solutions for groundwater
	3.1.2 Develop understanding of the broader role of groundwater integrated system in the context of the vision	High / High	*Opportunities*: - Link WSC vision for Bendigo Creek with current strategy work - Leverage DELWP IWM Forum and groundwater project - Identify goals and definition of 'management' - Celebrate Bendigo's unique topography and geology and incorporate the legacy of "Upside down country"
	3.1.3 Strengthen formal mechanisms to make catchment-based decisions (e.g. offsets) on WSUD and stormwater quality around best value investment	High / High	*Opportunities:* - Review approaches from other locations to gather lessons for implementation (e.g. Melbourne Water)

Table 10. Enabling strategies and actions for achieving vision outcome 3: Bendigo's creeks are cherished links in Bendigo's healthy natural environment			
Strategies	**Actions**	**Importance / Feasibility**	**Ideas for implementation**
	3.1.4 Review plans (e.g. stormwater management plan) in context of Bendigo's water sensitive vision and strengthen planning scheme amendments and regulations (e.g. creek setbacks)	High / High	*Opportunities:* - Necessary inputs already exist; requires commitment and action - Embed onsite water storage and recycling in urban design regulation for residential and industrial areas
3.2 Develop an integrated implementation strategy for Bendigo's creeks as linking corridors to support biodiversity and healthy connected ecosystems *Immediate outcome*: An integrated catchment-wide approach to the management of Bendigo's creek network and surrounding ecosystems *Long-term outcomes*: - On-ground delivery of WSC outcomes on waterways - Bendigo Creek system as a vehicle for engagement,	**3.2.1** Formalise an agency alliance including Dja Dja Wurrung, Parks Victoria, NCCMA, DELWP, Coliban Water and Bendigo City Council	Very High / Very High	*Opportunities*: - Plan inaugural meeting, invite senior management, identify roles and responsibilities - Clearly communicate agencies responsible for creek Crown land, e.g. through a website *Needs*: - Willingness for genuine cooperation - Senior buy-in and broad organisational support - A joint partnership format and process for organisations to share opportunities and lessons and work through conflicting priorities - Estimates of in-time cost for working groups and meetings

Table 10. Enabling strategies and actions for achieving vision outcome 3: Bendigo's creeks are cherished links in Bendigo's healthy natural environment

Strategies	Actions	Importance / Feasibility	Ideas for implementation
forming an engaging narrative that celebrates water - The role the creek in city connectivity and its contributions to livability and health aspirations is valued - Connected green spaces to support wildlife habitats and thriving ecosystems - The different materials of the creek – sandstone, bluestone, concrete – are connected with their cultural histories to create an engaging narrative about past, present and future	**3.2.2** Develop a coherent and compelling strategic vision for Bendigo's creeks	Very High / Very High	*Opportunities*: - Link in with Council planning already underway (plan to set up vision with resources allocated) - Link in with University of Canada City Labs Project focused on community engagement - Undertake multi-stakeholder planning to scope feasibility and map a community engagement plan - To build broader support for the vision among community and agencies compose a compelling narrative that highlights the value of the Bendigo Creek - Explore the feasibility of; o the 'chain of ponds' concept o concrete removal o a linear botanic garden along Bendigo Creek *Needs*: - Building a solid foundation of shared commitment

Table 10. Enabling strategies and actions for achieving vision outcome 3: Bendigo's creeks are cherished links in Bendigo's healthy natural environment			
Strategies	**Actions**	**Importance / Feasibility**	**Ideas for implementation**
			- Identifying roles and timeframes for strategy - Identifying a thorough process for visioning to incorporate diverse views and managing community expectations - Identifying mechanisms to integrate and leverage individual agency initiatives
	3.2.3 Review planning scheme policy, zoning and controls to reflect and deliver the vision for all waterways	Medium / Medium	*Opportunities*: - A valuable enabler over the long term to mainstream changes; a useful tool for land use change (e.g. to reorient housing towards water) - Extend the scattered trees clause *Needs*: - Seek advice from planners - Map challenges of implementation to identify solutions (e.g. how to reorient existing houses / infrastructure towards water)
	3.2.4 Develop a cross agency and community advisory group with a strong remit of support and	Very High / Very High	*Opportunities*: - Critical for driving change and establishing authorising environment

Table 10. Enabling strategies and actions for achieving vision outcome 3: Bendigo's creeks are cherished links in Bendigo's healthy natural environment			
Strategies	**Actions**	**Importance / Feasibility**	**Ideas for implementation**
	enabling to assist Council develop a vision for Bendigo's creeks		- Build on momentum from this CRCWSC IRP1 project - Expand champion base by leveraging existing senior champions already engaged - Seek senior leader permission to contribute time and resources *Needs*: - Strengthening narrative and undertaking advocacy activities to reinforce value proposition - Seeking support of champions from Landcare, health, education (universities and high schools)
	3.2.5 Create a robust business case with financial values to leverage funding opportunities across organisations, particularly linked to health outcomes	High / Medium	*Opportunities*: - Develop non-economic aspects to build a business case e.g. link to the vision - Draw on economics research (e.g. CRCWSC IRP2) and apply to Bendigo to strengthen business case - Focus on a robust business case but not yet comprehensive

Table 10. Enabling strategies and actions for achieving vision outcome 3: Bendigo's creeks are cherished links in Bendigo's healthy natural environment			
Strategies	**Actions**	**Importance / Feasibility**	**Ideas for implementation**
			- Leverage council management policy (of funding individual trees) to support new mental models *Needs*: - Acceptance of change in core business - For future needs, methods to collect data for a comprehensive business case (can be difficult especially for dollar figures on health budgets) - More research to quantify the broad benefits (e.g. return on investment in public spaces) - Identifying easy to handle and accepted algorithms
	3.2.6 Foster champions among senior leadership	High / Low	*Opportunities*: - Align with current focus on liveability (especially at state level) - Consider opportunities to leverage new government commitments (especially with state election coming up) - Leverage Water for Victoria mandate and IWM forum, where Bendigo Creek has been identified as a priority

Table 10. Enabling strategies and actions for achieving vision outcome 3: Bendigo's creeks are cherished links in Bendigo's healthy natural environment			
Strategies	**Actions**	**Importance / Feasibility**	**Ideas for implementation**
			Needs: - Identify requirements to nurture and grow partnerships - Identify funding sources for implementation - Consider implementation challenges and impact of government policy cycles
	3.2.7 Develop new creative and innovative partnerships across agencies to attract funding from diverse sources e.g. DELWP waterway health department, health sector	High / High	*Opportunities*: - Invite potential partners to the strategy launch or showcase event/s and networking opportunities - Understand agency drivers and link in with these - Identify and leverage existing connections between agencies and individuals
3.3 Collect and communicate lessons from existing community and agencies projects that identify opportunities to advance this part of the vision	**3.3.1** Develop an integrated creek GIS across agencies to map existing projects and identify opportunities and communication	Medium / Low	*Opportunities*: - Much data is already publicly available due to open data policies - Potential role for State Government in developing frameworks and protocols to enable data sharing and technical integration - Map wildlife corridors and in-line blocks of land (for buyback) to create a

Table 10. Enabling strategies and actions for achieving vision outcome 3: Bendigo's creeks are cherished links in Bendigo's healthy natural environment

Strategies	Actions	Importance / Feasibility	Ideas for implementation
Immediate outcome: Existing knowledge to advance ecosystem management knowledge is consolidated and shared *Long-term outcomes:* - New understanding of Bendigo's network of waterways across catchments and sub-catchments (including groundwater)			connected biodiversity loop around Bendigo for biolinks, revegetation, active transport networks, habitat protection and WSUD - Harness support from tourism and mining stakeholders and use mining records to develop 3D maps and digital models of underground *Needs*: - Integrated knowledge base for decision-making - Moderate cost, high uncertainty to judge accuracy - Accessing data, strategies, project, initiatives, priorities can be difficult – especially for outsiders - Technical implementation is relatively easy but haven't yet had a purpose to bring it together – will need to work through formatting data
	3.3.2 Gather lessons from Bendigo and other city demonstrations and assess their transferability to the Bendigo context to demonstrate precedence and give confidence in innovative practices	High / Medium	*Opportunities*: - Build on and learn from successes e.g. Wanywarram Dhelk - Potential case study: Wangaratta open space plan (reorientation towards the river)

Table 10. Enabling strategies and actions for achieving vision outcome 3: Bendigo's creeks are cherished links in Bendigo's healthy natural environment			
Strategies	**Actions**	**Importance / Feasibility**	**Ideas for implementation**
			- Leverage new WSC government arrangement to share information - Investigate potential leadership role for state government - Leverage CRCWSC and other research to consolidate lessons - Frame as a valuable resource for national partners e.g. Stormwater Victoria, capacity building organisations *Needs*: - Resources and ongoing work to interpret new information as it becomes available

Table 10. Enabling strategies and actions for achieving vision outcome 3: Bendigo's creeks are cherished links in Bendigo's healthy natural environment			
Strategies	**Actions**	**Importance / Feasibility**	**Ideas for implementation**
	3.3.3 Create a platform for knowledge sharing and collaboration and insight accessible to agency staff and the community e.g. website with maps, info and data at a local, national and international scale	High / Low	*Opportunities*: - Leverage existing connection with CRCWSC to continue work - Clarify goals and objectives, identify necessary tools, information and gaps, identify targets to track in context of the vision - Establish frameworks or legal mechanisms to enable creative solutions for how public and private space is used - Clarify ownership and responsibility for creek works and community involvement (process for engaging with the space should take precedence over ownership). - Leverage resources driven by other organisations to create a platform for Victoria, e.g. CRCWSC's platform development initiative - Knowledge enables new insights and innovations - Knowledge-sharing platforms are efficient and a critical enabler of collective learning

Table 10. Enabling strategies and actions for achieving vision outcome 3: Bendigo's creeks are cherished links in Bendigo's healthy natural environment			
Strategies	**Actions**	**Importance / Feasibility**	**Ideas for implementation**
			- Individuals enlisted to share knowledge can be motivated for deeper participation *Needs*: - Tools to manage complexity: software, data, processes
	3.3.4 Review local planning regulation to identify opportunities to improve implementation of habitat protection and the management of diffuse source water pollution	High / High	*Opportunity*: - Link in with the pending review of state planning provisions for stormwater management
	3.3.5 Develop mechanisms to capture, collate and integrate community derived data (e.g. apps and citizen science opportunities)	Low / Medium	*Opportunities*: - Identify what is important to capture and why

Table 10. Enabling strategies and actions for achieving vision outcome 3: Bendigo's creeks are cherished links in Bendigo's healthy natural environment

Strategies	Actions	Importance / Feasibility	Ideas for implementation
			- Investigate available data and tools (stormwater, water watch, schools program)
3.4 Implement significant demonstrations of innovative water system solutions for improving habitat and biodiversity and increasing waterway corridor connections, incorporating an explicit learning agenda *Immediate outcome:* An understanding of how ecosystem management solutions can be delivered, evidence of their costs, benefits and risks, and an understanding of the capabilities needed for their effective implementation *Long-term outcomes:*	**3.4.1** Develop a strategy and actions to bring community along on the WSC journey	Very High / Medium	*Opportunities*: - Embed water education in school programs (e.g. urban water cycle) - Investigate existing education programs for transferable guidance (e.g. Northern Territory Power and Water) - Explore thematic partnership-based approach to engagement in delivering outdoor education, play spaces and meeting places - Engage experts and organisations, community, and Traditional Owners - Build a citizen science program into existing programs for waterway stewardship; "Global star" is a potential model - Incorporate and embed cultural aspects, education and engagement into creek restoration projects, e.g. through signage

Table 10. Enabling strategies and actions for achieving vision outcome 3: Bendigo's creeks are cherished links in Bendigo's healthy natural environment

Strategies	Actions	Importance / Feasibility	Ideas for implementation
- Biolinks reconnect the city to the surrounding forest forming a continuous link for wildlife and people - Bendigo Creek is reengineered to slow the movement of water and improve aesthetics - Native fauna is encouraged to return to the city with vegetation connectivity along streets, parks and along waterways - Opportunities are provided to connect to local waterways and foster community stewardship - Residents and visitors are reconnected with nature through ecotourism opportunities such as bird-watching and hiking - Community identifies with the vision			- Deploy educational materials, stories of different tribes and regions, and ecosystem indicators to identify seasonal changes - Identify a 'public profile champion' as an ambassador for Bendigo's creeks
	3.4.2 Establish an urban creek care program that can run and support demonstrations; led by agencies as a mechanism for community involvement	Medium / Medium	*Opportunities*: - Formalise a community stewardship program focused on driving demonstration projects in parallel to agency network - Incorporate diverse voices and target disengaged cohorts (e.g. youth) in creative ways - Explore interest across existing smaller community and not-for-profit groups - Provide guidance and structure for specific projects to leverage - Build efficiency of existing community engagement and social capital - Create a Bendigo urban "creekcare" network (in the vein of Landcare) provided with adequate funding

Table 10. Enabling strategies and actions for achieving vision outcome 3: Bendigo's creeks are cherished links in Bendigo's healthy natural environment			
Strategies	**Actions**	**Importance / Feasibility**	**Ideas for implementation**
			- Promote eco-tourism activities in and around Bendigo e.g. establish a Box Ironbark Education Centre and create a destination hike through Bendigo forest *Needs*: - Start small and scaling up to overcome implementation challenges - Build on existing programs
	3.4.3 Implement significant WSUD demonstrations within Bendigo catchment to showcase stormwater mitigation and reuse outcomes	High/ High	*Opportunities*: - Build on small scale pilots (Bendigo creek is a priority for council and an emerging priority for the IWM forum) - Build on commitment from this project to identify locations, parties and funding sources - Seek partnerships with developers and agencies to pursue opportunities - Showcase the benefits of innovation to build visibility and broader buy-in - Develop a learning agenda for past and future projects (e.g. for implementation) - Construct more rain gardens, wetlands and other rainwater diversions to increase infiltration and water retention

Table 10. Enabling strategies and actions for achieving vision outcome 3: Bendigo's creeks are cherished links in Bendigo's healthy natural environment			
Strategies	**Actions**	**Importance / Feasibility**	**Ideas for implementation**
			- Combine WSC stormwater measures with novel or interactive educational material - Target commercial and retail areas to improve pedestrian comfort - Build more localised water treatment plants in new growth areas to irrigate open spaces and sports precincts *Needs*: - Feasibility depends on collective agency commitment - Approach of scaling up to significant impact activities - Willingness to learn from failures and ensure backups are in place
	3.4.4 Establish a deliberate approach learn, document and share lessons to showcase benefits, performance and provide implementation guidance	High / Medium	*Opportunities*: - Use a specific demonstration opportunity to establish a framework for learning - Harness diverse resources to support data collection and implement formal processes - Identify processes to embed innovation in organisations

Table 10. Enabling strategies and actions for achieving vision outcome 3: Bendigo's creeks are cherished links in Bendigo's healthy natural environment			
Strategies	**Actions**	**Importance / Feasibility**	**Ideas for implementation**
			Needs: - Clear and adequately resourced monitoring and evaluation framework

Table 11. Enabling strategies and actions for achieving vision outcome 4: Communities actively care for Bendigo water and land environments, guided by Dja Dja Wurrung knowledge and values

Strategies	Actions	Importance / Feasibility	Ideas for implementation
4.1 Develop and communicate a compelling narrative of the benefits of involving Dja Dja Wurrung in water planning and decision-making and of the community in water sensitive management more broadly *Immediate outcome*: There is broad support for indigenous involvement in water governance and broader community participation in water stewardship initiatives. *Long-term outcomes:* - Improving community knowledge about and connection to local Dja Dja Wurrung cultural knowledge and stewardship practices - Traditional Owner knowledge may be an important enabler of wider stewardship behaviours	**4.1.1** Identify engaging stories portraying Dja Dja Wurrung stewardship of Bendigo's past landscapes that deliver value in a contemporary context	High / High	Opportunities: - Leverage existing resources, such as COGB historical works and early maps detailing the 'chain-of-ponds' - Foster different perspectives of Bendigo's creeks 'ephemeral flows producing new growth' - Value of traditional knowledge and other cultural values of water in contemporary context can mitigate the risk of returning to 'Upside Down Country' - Potential as a powerful cultural exercise to expand the vision around the stewardship theme *Needs*: - Consider timing for implementation
	4.1.2 Embed cultural competencies in all agencies to enable all	High / High	*Opportunities:*

Table 11. Enabling strategies and actions for achieving vision outcome 4: Communities actively care for Bendigo water and land environments, guided by Dja Dja Wurrung knowledge and values

Strategies	Actions	Importance / Feasibility	Ideas for implementation
	representatives to champion aboriginal involvement in organisational processes and projects		- Leverage resources of larger organisations already supporting this action - Highlight this action as a critical first step - create a sense of purpose *Needs*: - Dynamic solutions as this issue evolves - Cultural competency training and awareness is essential within agencies
	4.1.3 Support Dja Dja Wurrung Corporation to take a leadership role in guiding multi-agency waterway management approach	High / Medium	*Opportunities:* - Support Dja Dja Wurrung capacity to lead and consider demands on time - Identify existing work for leverage (e.g. Bendigo Environment Strategy and Dja Dja Wurrung engagement) - Identify strategies to promote cultural awareness within the community and across institutions - Communication at events and tours, traditional and social media *Needs:* - Work with Dja Dja Wurrung to develop processes

Table 11. Enabling strategies and actions for achieving vision outcome 4: Communities actively care for Bendigo water and land environments, guided by Dja Dja Wurrung knowledge and values			
Strategies	**Actions**	**Importance / Feasibility**	**Ideas for implementation**
			- Value Traditional Owner knowledge and promoting the need to incorporate remuneration into projects to reorient predominant expectation of free input from the community - Provide oversight from WSC Network - Identify mechanisms for gaining influence
4.2 Explore and pilot solutions for indigenous involvement in water planning and community water stewardship, incorporating a clear learning agenda *Immediate outcome*: A suite of engagement solutions is developed and demonstrated to provide evidence of their costs, benefits, and risks, and to learn about the capabilities needed for their effective implementation	**4.2.1** Develop mentoring opportunities and indigenous career pathways across all organisations	High / High	*Opportunities*: - Link with Closing the Gap initiatives - Support inclusivity; there are multiple aboriginal groups in Bendigo - Leverage state government support - Investigate existing strategies within organisations - Investigate opportunities for mentoring whole organisations - Mentoring from elders to emerging leaders *Needs*: - Work on structural barriers to indigenous influence - Non-indigenous people need to be receptive - Indigenous employment is still gaining momentum, support people to feel comfortable

Table 11. Enabling strategies and actions for achieving vision outcome 4: Communities actively care for Bendigo water and land environments, guided by Dja Dja Wurrung knowledge and values

Strategies	Actions	Importance / Feasibility	Ideas for implementation
Long-term outcomes: - Sufficient capability for meaningful engagement - Powerful self-sustaining resource for stewardship action	**4.2.2** Ensure environment strategies include Dja Dja Wurrung knowledge and values and actions for participation in implementation	High / High	*Opportunities*: - Use strategies with existing links to demonstrate opportunities (e.g. Council's environment strategy includes Bendigo Creek and the links to Dja Dja Wurrung) - Recognition and Settlement Agreement provides mechanisms for consultation - Recognition and Settlement Agreement mechanisms enable linking - Strategy and policy should also reflect WSC principles and messages *Needs*: - Revisit existing strategies - Identify review periods for policies and strategies for intervention
	4.2.3 Support Dja Dja Wurrung to build a reference base of oral records of water knowledge	High / High	*Opportunities*: - Dja Dja Wurrung are already thinking holistically about country - Highlight that 'water has memory' - Opportunities to inform catchment management

Table 11. Enabling strategies and actions for achieving vision outcome 4: Communities actively care for Bendigo water and land environments, guided by Dja Dja Wurrung knowledge and values

Strategies	Actions	Importance / Feasibility	Ideas for implementation
			Needs: - Access could be challenging
4.3 Establish a platform that brings focus to community messaging and engagement in relation to the water system and Bendigo's water sensitive city vision *Immediate outcome*: Key agencies communicate a coherent suite of messages and commit to a shared agenda for community engagement in water stewardship *Long-term outcomes:*	**4.3.1** Develop, host and promote community water sensitive city campaigns that communicate key message, principals and objectives clearly to empower community involvement	High / High	*Opportunities:* - Establish a knowledge-sharing platform to support coordination and shared understanding - Start with a call out for ideas and projects from community and facilitate two-way dialogue with the community to link with broader concerns (e.g. listening posts at special interest events such as markets) - Use guiding principles - key community messages that every project needs to provide - Create interpretive and educational points along paths to tell cultural, environmental, and Indigenous stories - Plant Indigenous food and medicinal plants in public spaces - Identify and target young champions through universities (e.g. Masters of Architecture design competition) - Consider language in messaging and reports that resonates with young people

Table 11. Enabling strategies and actions for achieving vision outcome 4: Communities actively care for Bendigo water and land environments, guided by Dja Dja Wurrung knowledge and values

Strategies	Actions	Importance / Feasibility	Ideas for implementation
- Empowered communities who understand and look after their environment and waterways through education and engagement opportunities - More engaged stakeholders creates more possibilities for action through new funding			- Hold competitions for water sensitive neighbourhoods (e.g. most waterwise street or garden, tidy creeks) - Host family-friendly waterwise workshops on household technologies and practices - Run a “gardens for wildlife” program - Run education and interpretive displays tours that support families to experience Bendigo’s creeks and bushland via social gatherings (e.g. Bendigo Family Nature Club) - Create a water sensitive mascot as central personality in city pride campaign - Host free activities and events that provide people with opportunities to connect with their local communities (e.g. tree planting days, community gardens) - Support youth engagement through financial incentives (e.g. resource design competitions so participating students don’t incur costs) *Needs*: - Ensure call to action is clear and simple - Chunk information for effective communication

Table 11. Enabling strategies and actions for achieving vision outcome 4: Communities actively care for Bendigo water and land environments, guided by Dja Dja Wurrung knowledge and values			
Strategies	**Actions**	**Importance / Feasibility**	**Ideas for implementation**
	4.3.2 Inform school curriculum by creating local Bendigo connections to standardised content (e.g. water cycle)	High / Medium	*Opportunities*: - Connect to land and water management - Incorporate systems thinking - Consider a 'mini' urban catchment lesson
	4.3.3 Develop an engagement platform, app or website to support learning and connection to specific projects (e.g. Bendigo creek portal)	High / Medium	*Opportunities:* - Link in with the DELWP Traditional Owner water group - Set up as a platform for calling for and gathering stories - Connect special interest groups with the water sensitive city agenda and each other through presentations across the region and nationally *Needs*: - Investment for school programs and citizen science initiatives - Identify funding and resources to set up and maintain (e.g. administering media platform)
	4.3.4 Develop a small grants program for community projects	High / High	*Opportunities*:

Table 11. Enabling strategies and actions for achieving vision outcome 4: Communities actively care for Bendigo water and land environments, guided by Dja Dja Wurrung knowledge and values

Strategies	Actions	Importance / Feasibility	Ideas for implementation
			- Leverage existing mechanisms (e.g. Environmental Contribution Levy, Aboriginal Water Grants and other targeted programs) - Highlight opportunity for demonstrations for community to 'get hands on' - Several grants programs already exist (CoGB category "environment and arts", CMA land care) - Provide financial support for community water projects through a community grants scheme *Needs*: - Implementation needs to weight WSC outcomes higher
4.4 Consolidate lessons from existing projects with good community stewardship principles in Bendigo and elsewhere *Immediate outcome:* Local water stewardship solutions are developed and practical guidance is created to support a more strategic and	**4.4.1** Consolidate lessons from existing projects to create a compelling business case	High / High	*Opportunities:* - Examine River Detectives, Lake Mokoan, and the pilot study for Yarra community - Leverage existing activities and incorporate a focus on WSC (e.g. Bendigo Open Space Plan) - Link in with Bendigo District Aboriginal Council facilities - Tailor and expand river detectives program to incorporate an urban context

Table 11. Enabling strategies and actions for achieving vision outcome 4: Communities actively care for Bendigo water and land environments, guided by Dja Dja Wurrung knowledge and values

Strategies	Actions	Importance / Feasibility	Ideas for implementation
consistent approach to community engagement *Long-term outcomes:* - Providing confidence in the capacity of Bendigo to manage its problems through the lessons of other cities			- Highlight importance of this action for securing agency support and social benefits *Needs*: - Secure, consistent and long-term funding and support (not just project funding) - Identify working group to implement - Support intercity networking to transfer lessons - Tangible lessons so people can *see* demonstrations of how this has been done
	4.4.2 Support communities to attract funding by highlighting the role of community in delivering public benefits and mapping available grant opportunities to existing community activities	High / High	*Opportunities*: - Link with existing projects (e.g. Friends-Of groups and committees of management) - Calculate unspent funding by grant programs - Work to maintain momentum to achieve long term action - Capitalise on first point of contact with community - Broaden scope to fit in with WSC agenda - Map out existing initiatives to identify opportunities for streamlining - Conduct a volunteer recruitment drive to increase community awareness and recruit local champions

Table 11. Enabling strategies and actions for achieving vision outcome 4: Communities actively care for Bendigo water and land environments, guided by Dja Dja Wurrung knowledge and values			
Strategies	**Actions**	**Importance / Feasibility**	**Ideas for implementation**
			Needs: - Consider implementation challenges - Identify agencies with capability to implement
	4.4.3 Undertake project mapping exercise to identify initiatives with the potential for wider policy learning	Medium / High	*Opportunities*: - Identify state level and local-level initiatives - Include grant programs - Link future WSC activities with existing initiatives in this space - Examples include Bendigo week and the DELWP aboriginal water management group

Table 12. Enabling strategies and actions for achieving vision outcome 5: Consistent and inclusive governance supports an empowered community and integrated, adaptive approaches to water planning and management

Strategies	Actions	Importance / Feasibility	Ideas for implementation
5.1 Develop and communicate a compelling narrative of the need for and benefits of an integrated and aligned approach across stakeholders in water planning and decision-making *Immediate outcome*: There is support from the leadership of key agencies and broader public to drive innovation and long-term transformation in water governance to achieve water sensitive outcomes *Long-term outcomes:* - Initiating cross-institutional coordination of education, innovation, and investment decisions - On-going policy advocacy and funding can be secured through an engaged community	**5.1.1** Engage and inform key organisations' leaders about WSC messages and advocate for potential for collaboration	High / High	*Needs*: - Initiating a consistent cross-agency communications agreement or plan

Table 12. Enabling strategies and actions for achieving vision outcome 5: Consistent and inclusive governance supports an empowered community and integrated, adaptive approaches to water planning and management

Strategies	Actions	Importance / Feasibility	Ideas for implementation
	5.1.2 Prioritise funding for communicating water sensitive stories and engagement within organisations	High / High	*Opportunities:* - Link individual and agency involvement to sectoral recognition or achievement - Highlight degree of community support and political costs of inaction - Illustrate clear benefits with consistent messaging and visual tools - Key agencies to engage organisational communications teams - Align with existing networks and projects - Explore integrated approach for whole of government funding (e.g. drought) - Investigate potential co-funding opportunity - Showcase innovative projects *Needs:* - People relationships are key - Identify opportunities for linkages and aligning efforts and resources across projects - Government funding (impact investing)

Table 12. Enabling strategies and actions for achieving vision outcome 5: Consistent and inclusive governance supports an empowered community and integrated, adaptive approaches to water planning and management			
Strategies	**Actions**	**Importance / Feasibility**	**Ideas for implementation**
	5.1.3 Develop community communications plan to outline how community can be supported for greater understanding and engagement in WSC	High / High	*Opportunities*: - Leverage community education programs - Work to develop the authorising environment necessary for uptake of stewardship behaviours - Investigate community driven place-based investments *Needs*: - Ensure consistency of messaging and timing - Manage risk that the community are not 'ready' for stewardship

Table 12. Enabling strategies and actions for achieving vision outcome 5: Consistent and inclusive governance supports an empowered community and integrated, adaptive approaches to water planning and management

Strategies	Actions	Importance / Feasibility	Ideas for implementation
5.2 Embed Bendigo's water sensitive vision in organisational policies, plans and strategies *Immediate outcome*: There is a framework to support organisational alignment and widespread implementation of water sensitive solutions *Long-term outcomes:* - Planning is integrated across agencies managing development for future water needs	**5.2.1** Embed Bendigo's water sensitive vision in the City of Greater Bendigo Planning Scheme	High / High	*Opportunities*: - Ensure vision can be realised through precinct structure planning - Link with Plan Greater Bendigo and Public Open Space Plan for leverage *Needs*: - Take advantage of timing as planning is already underway - Review and reporting will be important

Table 12. Enabling strategies and actions for achieving vision outcome 5: Consistent and inclusive governance supports an empowered community and integrated, adaptive approaches to water planning and management			
Strategies	**Actions**	**Importance / Feasibility**	**Ideas for implementation**
	5.2.2 Embed the WSC vision, strategies and actions in relevant Coliban Water, Council and State Government strategies and plans	High / High	*Opportunities*: - Highlight benefits of flexibility in green infrastructure development across precincts and the importance of reform *Needs*: - Engage beyond core agencies - Manage the potential cost of revision - Success will require long term action to truly embed WSC vision in agency documents
	5.2.3 Align agency budgetary and delivery targets to common WSC goals	High / Medium	*Opportunities*: - Align with organisational key performance indicators *Needs*: - Careful phase-in to avoid negative impact on growth - Support from leadership (board members and regional directors)

5.3 Establish a platform that brings focus to collaborative approaches to achieving water sensitive planning objectives and operations *Immediate outcome*: There is a collective voice and strategic approach guiding effective operational collaboration and knowledge sharing across stakeholders *Long-term outcomes:* - Structures in place to guide collaboration are critical for enabling the overall WSC agenda - Infill, retrofit and greenfield projects are developed with water objectives in mind	**5.3.1** Establish a Bendigo water advisory committee with representatives from key agencies, industry and community to consistently and collaboratively drive innovation and advocate for and review approaches, policies and major infrastructure projects	Very High / Very High	*Opportunities*: - Leverage allied interests and membership of IWM forums - Use Water for Victoria policy mandate to leverage ministerial support and recognition *Needs*: - Identify the driver and benefit of involvement for each participating stakeholder - Estimate level of commitment and in-time cost to agency leaders - Secure group leadership – rotating chair, knowledge prerequisites - Membership of Coliban, NCCMA, CoGB and Dja Dja Wurrung are critical

Table 12. Enabling strategies and actions for achieving vision outcome 5: Consistent and inclusive governance supports an empowered community and integrated, adaptive approaches to water planning and management

Strategies	Actions	Importance / Feasibility	Ideas for implementation
5.4 Consolidate the lessons from Bendigo of successful collaborative water governance initiatives that have emerged in response to specific issues *Immediate outcome*: Previous experiences of water governance collaboration inform the development and refinement of solutions for long-term and consistent partnerships *Long-term outcomes*: - Supporting broader awareness of future environmental risks and capacity for community resilience - Supporting knowledge about how to plan effectively in the future	**5.4.1** Assess the lessons of collaborative governance during the Millennium Drought	Low / Low	*Opportunities*: - Understand the regulatory response, emergency management response, community education, collective action during the Millennium Drought

Table 12. Enabling strategies and actions for achieving vision outcome 5: Consistent and inclusive governance supports an empowered community and integrated, adaptive approaches to water planning and management			
Strategies	**Actions**	**Importance / Feasibility**	**Ideas for implementation**
	5.4.2 Develop governance options to enable future community and stakeholder stewardship	Medium / Medium	*Opportunities* - Leverage lessons from existing regional and interstate projects, including Melbourne water, Flow Systems, NSW private utility services, community based water providers, Landcare, Dja Dja Wurrung, CMA - Highlight focus on self-determination, not just grant and funding - Investigate cost sharing, collective initiatives and shared land use - Can address costs of maintenance *Needs:* - Build trust in local institutions - Be nimble and minimising disruption - Manage competing interests

Table 13. Enabling strategies and actions for achieving vision outcome 6: Bendigo is an inland city water innovation hub, grounded in education, research and design excellence

Strategies	Actions	Importance / Feasibility	Ideas for implementation
6.1 Develop and communicate a narrative of the economic benefits of water sector innovation for other public sectors and the private sector *Immediate outcome*: The importance of water sector innovation for achieving Bendigo's broad city aspirations for long-term prosperity is communicated to a broad range of stakeholders to begin building their support	**6.1.1** Use CRCWSC project findings to build support for broader discussion of the economic benefits of water sector innovation	High / High	*Opportunities*: - Use existing government land to demonstrate exemplary green landscaping - Support new government buildings to employ closed water system - A new water discovery centre could be a focus
6.2 Enable and encourage innovation uptake through organisational culture, systems and processes	**6.2.1** Identify funding opportunities to support research collaborations with a water focus at a global scale	High / Medium	*Opportunities*: - Fund teaching spaces and scholarships - Hold a national or international conference in Bendigo to initiate new opportunities

Table 13. Enabling strategies and actions for achieving vision outcome 6: Bendigo is an inland city water innovation hub, grounded in education, research and design excellence

Strategies	Actions	Importance / Feasibility	Ideas for implementation
Immediate outcome: Innovative ideas are trialled, demonstrated and then integrated as mainstream parts of the water system *Long-term outcomes:* - Increased uptake and mainstreaming of technologies (e.g. constructed wetlands)	**6.2.2** Promote Bendigo as a 'living lab' for adaptive water sensitive innovation	High / Medium	*Opportunities*: - Groundwater solutions are a potential focus - Bendigo is a single jurisdiction with a population that mostly works within it. *Needs*: - Define the 'living lab' project outline - Compose a compelling narrative to highlight benefits to secure potential stakeholders and funding
	6.2.3 Identify barriers to innovation adoption in service delivery or funding among Bendigo's agencies and Council	Medium / High	*Opportunities:* - Empower local community solutions *Needs*: - Solutions are considered available, but cost barriers need to be overcome

Table 13. Enabling strategies and actions for achieving vision outcome 6: Bendigo is an inland city water innovation hub, grounded in education, research and design excellence

Strategies	Actions	Importance / Feasibility	Ideas for implementation
	6.2.4 Develop industry capacity to apply research and develop the education sector's capacity to integrate with industry for better work-integrated learning outcomes	High / Medium	*Opportunities:* - Many universities operate in Bendigo, particularly within the Bendigo Health precinct - Potential for grants / awards to recognise innovation in industry / education - Provide engagement opportunities that help young people to build up their CVs
	6.2.5 Develop a blueprint for embedding continuous organisational development towards design and innovation excellence	High / Medium	*Needs:* - Navigate complexity of multi-level government collaboration - Stronger support than existing policy provides

5.3 Actions to support community engagement

City transitions involve complex changes over a long timeframe. Bendigo's communities will have a vital role to play in driving change towards a water sensitive future. The community workshop and focus group discussions explored this topic. This section outlines workshop participant ideas about the role of the community in driving change, why it is important, and how to engage diverse communities in Bendigo's transition to a water sensitive future.

Why is community an important part of Bendigo's water sensitive city transition?

The community's role in driving change was vital according to community participants. They recognised that current models or business-as-usual approaches to shaping cities and planning for the future needs improvement and saw that collective ownership and leadership of Bendigo's water sensitive city vision was critical for developing new pathways.

"Communities need to drive change for how they want to live collectively".

In fact, participants identified that community champions, such as those engaged in the workshop process of this project, could provide important grassroots leadership in Bendigo's transition to its envisioned water sensitive future. With strong understanding of the issues of climate change and growth, and possible water sensitive solutions, communities can become important advocates for the vision to politicians, agencies and their fellow citizens.

"This scale of change requires all levels of society… community champions and groups can provide leadership to drive change".

Overall, the community can bring fresh approaches and energy to solving problems as they are unconstrained by expert knowledge of current solutions and common roadblocks. The diversity of perspectives represented in Bendigo's community could be harnessed as an important asset in considering how to achieve Bendigo's water sensitive vision. Listening to these diverse perspectives gives insight into how the community can be re-engaged in the pursuit for people and ecological health and wellbeing. How can Bendigo's community be effectively engaged in water sensitive transition actions?

The community participants, from both the main workshop series and the focus groups with segments of the community not well-represented in the workshops, felt that most members of the community would be interested in being involved in and contributing to the transition to Bendigo's water sensitive future. However, they recognised that different people will have different motivations, constraints and opportunities that will influence their receptivity to different forms of engagement.

The Community Group were eager to continue having the opportunity to actively participate and lead in actions to drive Bendigo's water sensitive transition. They felt that an ongoing combined network of industry and community champions, building on the participant groups established through this project, would be a valuable mechanism to enable dialogue and action planning across Bendigo's community that could lead to implementation of ideas. They were also committed to becoming local community champions dedicated to rally, focus and communicate as advocates, starting by taking the water sensitive vision back to their own networks.

Engaging with the broader community beyond the champion network is clearly critical for Bendigo's water sensitive city vision to be widely embraced. Competing pressures on individuals' time and attention, however, can make it challenging for them to engage meaningfully. It is important to recognise that the community is not homogeneous, comprising a diverse mix of value-sets, interests and preferences for engagement in sustainability and water management. Community participants from both the workshops and the focus groups suggested strategies for connecting to the vision of a water sensitive Bendigo:

- Identify and articulate why a water sensitive Bendigo is important for the community and how it can benefit from water sensitive solutions.

- Employ a targeted approach for effectively engaging with specific community sectors, by identifying a particular 'hook' for each segment and developing associated messaging.

1. Understand the barriers (e.g. time, money, family commitments, language, level of knowledge) and needs (e.g. social interaction, financial incentive, opportunity to contribute) for different community segments in relation to engagement and develop tailored engagement approaches (e.g. surveys, workshops, planning meetings, working bees, and testing or trialling products).

2. Be focused, authentic and transparent about the purpose of engagement and the desired end result (e.g. goals might include public pressure, votes, support, raising awareness through word-of-mouth or fund-raising), and show how people's contributions have been considered..

Community participants suggested a range of ideas for improving engagement of particular segments that have been included in the action tables above. A synthesis is provided here:

- *Engaging young people:* Participants highlighted that young people are eager to contribute meaningfully to community initiatives and may have a wealth of innovative ideas to offer, but they may not feel comfortable in traditional engagement environments. The choice of engagement process, venue and style is therefore likely to influence the quality of the input provided. They emphasised that young people are often focused on establishing a profile, for example in preparation for employment, so recognising their contributions as valuable professional development and CV-building opportunities could be a useful

engagement approach. Connecting with university programs, such as innovation competitions and education curriculum was thought to also be a potentially fruitful mechanism. Social connection was an important driver for engagement identified by the participants; for example providing opportunities to work with friends and participate in networking and pop-up style events that bring people together.

- *Special interest groups:* Participants recognised that Bendigo's community is rich with activity, often centred around groups that share an interest (e.g. "Friends of …" environmental groups, artist groups such as the Bendigo Art Society, retirees, volunteer groups such as the Bendigo Volunteer Centre, the Bendigo Sustainability Group, and incorporated groups). Participants felt there was significant potential to strategically align Bendigo's water sensitive agenda with the objectives of many of these groups. Tapping into this potential would involve articulating how the water sensitive vision and actions would support the special interest group's priorities and identifying what the shared objectives are, as well as being specific about what the groups can do to support the transition (e.g. public pressure, votes, word of mouth, fund raising).

- *Families:* Participants felt that families were a significant source of community capital that could be leveraged to support Bendigo's water sensitive transition, but highlighted particular needs that would need to be accommodated. They identified that families tend to prefer activities that are hands-on, interactive and low-cost, providing opportunity for children to connect with the outdoors and enjoy new experiences. Examples include workshops about water sensitive approaches, working bees and planting days that offer the chance to get dirty, events associated with bike paths and walking trails, and social gatherings such as the Bendigo Family Nature Club for experiencing creeks and bushland.

- *Low-income:* Participants highlighted the need to understand how a water sensitive Bendigo will add value to the lives of low income parts of the community, particularly when they are often faced with many competing stresses and demands. Messaging needs to be carefully developed to resonate with this part of the community. Participants felt that engagement approaches that provide opportunities to connect with the broader community and become part of a social network would be valued, and reinforced the need for such activities to be free to avoid excluding people who would not otherwise be able to participate.

6. Advancing Bendigo's overall water sensitive city transition

This section examines Bendigo's transition to its overall water sensitive vision (in contrast to the previous section, which focused on individual component vision outcomes). It recommends overarching strategies and core actions, and provides reflections on a transition governance model for Bendigo to help maintain momentum for action beyond this project.

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

The strategies and actions presented in the previous section represent the full suite of strategies recommended to progress Bendigo's WSC transition across all elements of the vision. From these, there emerges a suite of high-level or macro issues that require attention in the short-term. **Table 14** uses the CRCWSC's Transition Dynamics Framework to assess the presence or absence of enabling factors as an indicator of the current phase of change in relation to Bendigo's overall transition to a water sensitive city. Using it as a checklist of the factors that should be deliberately and sequentially built up helps to identify these overarching strategic needs for Bendigo.

Table 14. Assessment of Bendigo's overall transition progress

Transition phase	Champions	Platforms for connecting	Knowledge	Projects and applications	Tools and instruments
1. Issue Emergence	Issue activists	N/A	Issue highlighted	Issue examined	N/A
2. Issue Definition	Individual champions	Sharing concerns and ideas	Causes and impacts examined	Solutions explored	N/A
3. Shared Understanding & Issue Agreement	Connected champions	Developing a collective voice	Solutions developed	Solutions experimented with	Preliminary practical guidance
4. Knowledge Dissemination	Aligned and influential champions	Building broad support	Solutions advanced	Significant solution demonstrations	Refined guidance and early policy
5. Policy & Practice Diffusion	Government agency champions	Expanding the community of practice	Capacity building	Widespread implementation and learning	Early regulation and targets
6. Embedding New Practice	Multi-stakeholder networks	Guiding consistent application	Monitoring and evaluation	Standardisation and refinement	Comprehensive policy and regulation
Green boxes indicate the enabling factor is fully present in Bendigo and regression into the previous phase is unlikely. Yellow boxes indicate some presence of the enabling factor, however they are vulnerable to regressing to the previous phase. Red boxes indicate a complete absence of the enabling factor, and that progression is unlikely.					

6.2. Overarching priority strategies to achieve the overall vision

The overall assessment in **Table 14** suggests fairly consistent progression through transition phases across each of the enabling champions, platforms, knowledge, projects and tools that support change in practice.

Champions recognise the need for a water sensitive transition but are not yet firmly connected, aligned and influential to secure greater support at the operational and broader societal level for implementation and collective action. Bendigo currently benefits from informal networks that have provided agility in times of crisis. However, further transition may be vulnerable without institutionalised coherence and alignment across stakeholders. Platforms for connecting stakeholders that create more consistent and coordinated alignment are needed to enable delivery of a cohesive water sensitive agenda that operates at all scales of implementation.

With Bendigo's long history of technological and business innovation across sectors, there is a strong drive for new water approaches. A number of projects have developed and experimented with innovative solutions, particularly in response to challenging environmental circumstances such as during the Millennium Drought. However, this drive to innovate and experiment has not yet permeated all levels of decision-making, scales of implementation or dimensions of water sensitivity. There is also a need to formalise learning from projects to build on past successes and achieve progress towards the vision.

Many organisational policies and issue-specific strategies across Bendigo's key water agencies (Coliban Water, City of Greater Bendigo, NCCMA) reinforce the direction that needs to be pursued to achieve Bendigo's aspirational water future. However, specific strategies and plans are not yet closely tied to the shared water sensitive city vision to provide operational guidance and a cross-organisational framework for collective action.

Based on the assessment of Bendigo's transition progress, the following four overarching strategies are recommended to advance Bendigo's water sensitive transition:

I. Seek broad support from Bendigo's political, organisational, sectoral and community leaders and the general public for the city's water sensitive vision

II. Embed Bendigo's water sensitive aspirations in a broad city vision, organisational frameworks and a cross-agency water sensitive city strategy that promotes integrated water sensitive outcomes

III. Establish a network for endorsing and driving coherent water sensitive action across stakeholders

IV. Learn from and scale innovative solutions to provide on-ground demonstrations and practical guidance for a full suite of water sensitive approaches that suit Bendigo's inland city context

I. Seek broad support from Bendigo's political, organisational, sectoral and community leaders and the general public for the city's water sensitive vision

Bendigo's water sensitive city vision has been co-created by a diverse range of people, representing the water industry, government agencies, local council, Dja Dja Wurrung Corporation, private sector organisations such as consultants and developers, and the community. Such diverse participation in the envisioning process ensures that the vision resonates broadly and will serve to inspire, orient and guide action for achieving it. Dedicated

attention is now needed to seek support from this broader community, starting with leaders from across the professional and general community that will provide an authorising environment for Bendigo's transition.

Engagement with the organisational and elected leaders of key agencies is an important step to establish this support, with a clear articulation of the value of the water sensitive vision for the city's broader aspirations. Increased support from the broader business community and the tertiary education sector could also help utilise untapped innovation capacity to apply to water sensitive solutions, gaining new insights through increased cross-sector collaboration. Key industries that should be targeted to raise support for the city's water sensitive vision include the building, community services and health sectors.

Promoting Bendigo's water sensitive vision in numerous forums will be critical to help gain its broad acceptance. Existing education programs in the primary and secondary school curriculums can be augmented, although new campaigns targeting particular parts of the community will also be necessary.

In the long-term, it is important that communities and businesses endorse and advocate for water system solutions aligned to Bendigo's water sensitive vision. Community ownership of the water sensitive vision will encourage active engagement in water-related dialogue, governance processes and local adaptations. It will also provide endorsement for land use planning policies and strategies that drive adoption of water sensitive design. With support for the vision and increased awareness of urban water challenges, citizens will be more resilient to environmental risk, supporting a wide array of resilience solutions.

II. Embed Bendigo's water sensitive aspirations in a broad city vision, organisational frameworks and a cross-agency water sensitive city strategy that promotes integrated water sensitive outcomes

It is critical to link the narrative of the benefits of the envisioned water sensitive city with the aspirations for Bendigo more broadly, including the city's future prosperity, the health and wellbeing of its people, and the preservation and enhancement of its natural environments. The water sensitive city vision for Bendigo needs to become embedded within the policies, plans and strategies of organisations. This will enable and encourage an integrated, holistic and aligned approach to water management across organisations and support organisational alignment rather than a siloed approach to policy implementation. Through embedding in relevant policies and strategies, regulatory compliance is likely to be reinforced and provide the community with more consistent and effective outcomes in land use and infrastructure planning processes. This will also help take advantage of opportunities when they arise to support multi-functional, healthier and more attractive outcomes across the public and private realms.

In infrastructure provision, Bendigo's water sensitive city vision will be achieved through the design and implementation of urban systems that are multi-functional and provide a range of benefits that deliver Bendigo's ecological, liveability and resource efficiency aspirations. This will need to involve understanding the synergies between natural and engineered water systems, taking advantage of the opportunities across all streams of water (e.g. supplied water, wastewater,stormwater) and working within the interfaces between the water system, the built form and natural landscapes. To achieve this, Bendigo will need to adopt an integrated and strategic approach to managing urban water and landscapes. To this end, developing a cross-organisational water sensitive city strategy that promotes and guides proactivity, opportunism and flexibility to achieve envisioned outcomes would be a valuable endeavour.

III. Establish a network for endorsing and driving coherent water sensitive action across stakeholders

The networks and relationships that must underpin the collective pursuit of Bendigo's water sensitive vision will need to be expanded and supported to drive further transition progress. Champions have advocated for water sensitive solutions in the past, and there are several examples of critical strategic partnerships between agencies. However, collaboration platforms in Bendigo have focused on specific issues such as water security during the Millennium Drought and natural resource management capacity through waterway revegetation, or encompassed broader regional concerns. They provide limited opportunity for exploration of the broad range of outcomes associated with Bendigo's ambition to become a water sensitive city.

Champions would be strengthened through the establishment of an ongoing informal network that focuses on knowledge sharing, collective capacity building and a culture of collaboration. Through such a network, stakeholders would have the freedom to explore issues and opportunities that may sit outside current policy and programs, while maintaining the support and endorsement of the authorising environment whose commitment is ultimately needed.

Bendigo's scale presents both challenges and opportunities for networking: an informal water sensitive city network may be relatively easy to establish because of the existing strong links between organisations, but without strong support from organisations, champions may feel isolated and untethered from existing power structures. Such a network would need clear organisational endorsement, and champions should be supported with relevant training and resourcing to help drive action on the ground and advocate to decision-makers for reforms and investments that will enable changes in practice. This could be complemented by formalised partnerships between key agencies to drive strategic programs and initiatives.

IV. Learn from and scale innovative solutions to provide on-ground demonstrations and practical guidance for a full suite of water sensitive approaches that suit Bendigo's inland city context

Becoming a water sensitive city will require a range of innovative solutions across social, technical and design domains to be developed and mainstreamed. Bendigo has a long history of innovation in in the city, reinforced by the presence of a number of universities and a range of cultural and creative festivals. This citywide culture of, and commitment to, innovation provides a strong foundation for achieving Bendigo's aspiration to be an inland city water innovation hub.

There are many examples of innovation in water sensitive technology and design across Bendigo, from early water treatment plants in the colonial era to more recent applications of treatment technologies and water efficiency. It has been difficult, however, to enable scaling and mainstream uptake of water sensitive innovations. To promote focus on Bendigo's innovation aspirations and gain explicit support from a broad range of stakeholders to drive associated actions, significant upscaling of innovation is needed to advance new solutions and practices beyond trials into widespread roll-out. In addition, some aspects of Bendigo's water sensitive city vision will require new solutions that have not yet been developed or trialled for Bendigo's inland context, which will need explicit investment.

This will require large-scale commitment and systematisation of learning and improvement over the long-term, supported by a culture that is willing to take appropriately-managed risks and embrace the opportunity to learn from failure.

Core actions for implementing the overarching strategies

Delivering the overarching strategies identified in Section 7.2 will require coordination and collaboration across organisations. Workshop discussions canvassed actions that would help to drive this collective momentum in the short- to medium-term to advance the vision. These core transition actions, listed below, provide immediate focus for stakeholders committed to driving Bendigo's water sensitive city transition. In particular, attention should be given to timeframes, resourcing and regulatory and technical requirements associated with their implementation. Note that many of the core actions are linked to and enable actions detailed in Section 6.

a. Establish transition goals and the terms of joint working arrangements with a shared accord between the leadership of key agencies

b. Formalise an ongoing strategic process through regular meetings of agency executives and a monitoring program to support shared commitments

c. Establish a multi-stakeholder network, nominally a Bendigo Water Sensitive Transition Network, comprising executives, practitioners and community representatives, to develop and advise on strategies and opportunities to advance transition actions

d. Undertake a whole-of-system strategic review to identify policy and regulatory gaps with respect to achieving the transition goals and develop an action plan for strategic alignment to the goals

e. Develop and implement a community-wide communication strategy to build the narrative for a water sensitive Bendigo

f. Secure resources from State and Federal grants and organisations' operational budgets to support administration of interagency collaboration

g. Identify and pursue opportunities for community and private sector co-design and co-investment

h. Identify and nurture champions from across organisations with the capacity to work together strategically and tactically

i. Allocate resources to coordinate collaborative learning that will build local capacity for solution implementation

j. Identify implementation opportunities at relevant scales, such as industry capacity-building, homes to showcase water sensitive urban design, sustainability events and education opportunities for the community

k. Identify opportunities for national and international partnerships for research and demonstrations

l. Design a funding program jointly supported by universities and industry to incentivise research in Central Victoria

6.3. Towards a transition governance model

Towards the end of the industry workshop series, participants reflected on the principles, structures and processes that would need to be established for Bendigo stakeholders to maintain momentum and achieve rapid progress in its water sensitive transition journey. These discussions were supported with evidence from transition management literature and water sensitive city transition governance examples from elsewhere in Australia.

6.3.1. General principles for transition governance

The scale of change involved in a water sensitive transition requires the integration of government policies, market forces, and bottom-up initiatives from NGOs and communities. Steering the transition will require the adaptation of existing institutions, systematic experimentation to shape or make innovations, and the inclusion of diverse stakeholders and voices. The importance of networks in supporting and driving these changes is well recognised in transition literature. Key principles articulated in this literature are briefly presented here to inform further discussions amongst Bendigo stakeholders as they consider possible governance models going forward.

Transition networks enable collective action when the public and private sectors and community separately do not have the resources or authority needed to promote broad-based, sustainable change. The success of collaborative networks depends on a number of factors. Leadership is important, as is agreement on the goals for the network. Other dimensions supporting the transition network include trust, local conventions on cooperation, shared beliefs, and degree of interaction. Formalisation of partnership processes and stability of membership can also be helpful.

Potential pitfalls for a transition network include the potential for strong bonds between the individuals in the network to work to exclude outsider views – to resist the input of new individuals or stakeholders. This can lead to 'lock-ins' to inappropriate pathways and missed opportunities for identifying landscape-level change and innovation. Ways to combat this include developing a culture of looking outside the system to foresee new opportunities and solutions, and being open to new members that bring fresh perspectives.

It is also important to bear in mind that network members decide the boundaries of the 'system' under analysis, and this is just one of a number of ways the system could be defined. Network members need to be wary that they may be looking at the system with a narrow agenda that does not consider the full scope of change necessary. Other stakeholders may have a different perspective on what is a relevant focus of action. This is another reason way an inclusive approach to long-term transitioning is advisable.

Transition governance models need to ensure structures are in place to adapt to changing circumstances, including responding to forces that may be countering effective transition. Structures are important for monitoring and revising goals and policies, formalising learning from experiments, and for embedding stakeholder engagement. This also relies on appropriately skilled people to recognise opportunities, and to help select the best levers for guiding change across a portfolio of options.

6.3.2. Ideas for Bendigo's water sensitive transition governance

In reflecting on the principles presented in the previous section, industry workshop participants developed preliminary ideas on the form of a transition governance model for Bendigo's water sensitive city transition.

First, participants recognised that there are formal structures already in place that can provide strong support to Bendigo's water sensitive city transition, with reform embedded in the broader State Government policy agenda. This includes Water for Victoria actions, particularly those in Chapter 5 *Resilient and liveable cities and towns*. The Integrated Water Management Forum for the Coliban Water region has a broader spatial scope than this project, but provides a potential framework for cross-agency collaboration. Support for a place-based integrated approach, without the need to replicate higher-level planning processes, is therefore strong.

Second, participants agreed that Bendigo has strong informal networks that provide a foundation for collaboration, given its relatively small population and a high degree of professional interaction among key people. However, there is a need to formalise a network that has Bendigo's water sensitive transition as its central agenda, avoiding the risk that momentum is lost and practice change is not embedded. This Water Sensitive Transition Network would establish multiple connections between organisations through participating individuals, which is important for driving a long-term agenda and outliving electoral and policy cycles.

Members of the Water Sensitive Transition Network would initially comprise participants from both the industry and the community workshop series in this project interested in further engagement. Membership may expand and change over time. In particular, participants reflected that there may be value in recruiting new corporate and community members from GREATER, La Trobe University, Development Victoria, Department of Premier and Cabinet and Bendigo Bank.

Participants identified potential key roles of the Bendigo Water Sensitive Transition Network; this list provides the starting point for a Charter or Terms of Reference that should be further developed once the Transition Network is established:

- Provide profile, identity and legitimacy for Bendigo's water sensitive city vision and transition efforts
- Organise coherent and collaborative efforts across organisations towards water sensitive outcomes, potentially through the establishment of working groups charged with driving particular sets of actions
- Develop a framework for collective transition action that is supportive of organisational change and innovation
- Inform the development of individual and collective actions that are evaluated and prioritised in the context of the shared water sensitive transition agenda
- Seek funding and support for agreed priorities where collective voice is more influential than any individual
- Identify possible pilot and demonstration projects to showcase water sensitive solutions and outcomes that can be delivered through collaboration
- Share information, knowledge and lessons and promote development opportunities among network members
- Engage with stakeholders beyond the Network to build broad support for the water sensitive vision and transition actions, form strategic partnerships and create opportunities for change.

Participants reflected that the Bendigo's Water Sensitive Transition Network would need to have the freedom and informality to enable robust discussions that may extend or challenge an individual organisation's current policy position so that focus is maintained on the pursuit of transitional change. However, they also reflected on the need for the Transition Network agenda to be legitimised and supported, ensuring there is formal authority and mobilisation of resources to support planning and implementation of transition actions. It was proposed that the Transition Network be complemented by a committee of executive leaders of key agencies (e.g. Coliban Water, NCCMA, City of Greater Bendigo, Dja Dja Wurrung Corporation) that could provide this formal counterpart.

Participants agreed that the Transition Network should be led by an independent Chair who would steer activities and foster a collaborative and innovative culture. Participants also felt it would be important for the Transition Network to be supported financially through the provision of secretarial support that will help maintain momentum, coordinate logistics and drive working group activities. An initial schedule of bi-monthly meetings was thought to be important to maintain momentum on the back of this project, before potentially moving to quarterly meetings.

7. Conclusion

Bendigo's communities are acutely aware of the severe threats that climate change and poorly managed growth are likely to bring to their city: cherished values such as outdoor recreation, green streetscapes, biodiversity, healthy creeks and secure water supplies are at risk. At the same time, Bendigo aspires to be a resourceful, innovative and sustainable city. Ensuring these outcomes over the long term requires action to be taken now to avoid negative trajectories and steer Bendigo's development towards its future water sensitive city vision.

This report marks the culmination of a process that brought 31 community champions together with 47 leaders and strategic thinkers from across Bendigo's water, planning, development and environment sectors to explore these issues and opportunities. Workshop discussions and associated analysis aimed to understand the city's unique water story, envision a future water sensitive Bendigo and identify the transition pathways that will need to be pursued to achieve their vision.

Participants in the project agreed on shared aspirations for Bendigo's water future, with the vision themes of urban liveability, adaptive systems, healthy ecosystems, community stewardship, inclusive and integrated governance, and water innovation receiving unanimous support across both the community and industry participants. Workshop discussions highlighted the pride that Bendigo residents feel for their unique inland environment and the particular challenges and opportunities its context presents in embracing these elements as part of their future aspirations.

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

- Bendigo's historical, contemporary and future water story.
- The benchmark of Bendigo's current water sensitive performance using the WSC Index, highlighting the goals that need focus to achieve the water cycle city benchmark.
- A 50 year vision for Bendigo as a water sensitive city, describing Bendigo as a thriving inland city, where water innovation supports healthy people, green environments and resilient systems
- An assessment of Bendigo's enabling conditions for the transition towards its vision, using the Transition Dynamics Framework to indicate the presence of enabling conditions and its current transition phase for each vision outcome.
- Strategies and actions for accelerating transitions to each of Bendigo's water sensitive city vision themes
- Specific reflections on engaging with communities for driving water sensitive city transitions
- Overarching strategies and core actions for driving change in the short- to medium-term
- Principles and proposals for a transition governance model that will support Bendigo's ongoing water sensitive city transition

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

Bendigo already has many important conditions in place to enable its water sensitive transition. These include a wealth of individual champions who understand the need for change and are well-placed to build further momentum for collective action. The city's regional scale and cohesive community fosters informal relationships and networks, which have provided agility in times of crisis. State Government and Council are establishing a supportive policy and regulatory foundation for making progress towards a range of water sensitive objectives. Many organisational policies and issue-specific strategies across Bendigo's key water-related agencies reinforce the direction that needs to be pursued to achieve Bendigo's aspirational water future.

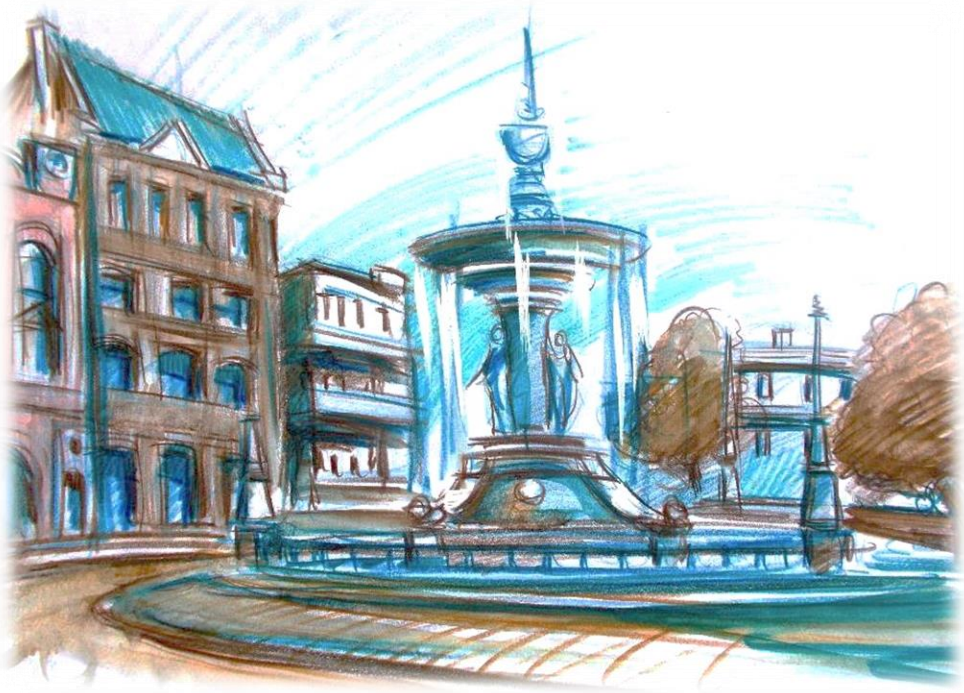
On the ground, there is a strong drive for new approaches to water management among many stakeholders, which has led to the implementation of recycled water distribution, creek revegetation, sustainable gardens and efficient recreation management. Bendigo has a community that is highly invested in its future, with a strong overall commitment to sustainability and the natural environment that has supported the implementation of several innovative projects. The Dja Dja Wurrung Corporation has a clear role in local planning, providing a foundation for engaging Aboriginal communities in water planning and decision-making and guiding community water stewardship.

To capitalise on these promising conditions, a broad embrace of Bendigo's water sensitive vision amongst the wider community is needed. Achieving Bendigo's water aspirations will require distributed leadership across organisations and sectors, as well as grassroots community leadership that can drive local adaptations tailored to Bendigo's needs and enable a more resilient citizenry.

Establishing a Transition Network for endorsing and driving coherent water sensitive action across stakeholders, and embedding Bendigo's water aspirations in a broad city vision, organisational frameworks and a cross-agency water sensitive city strategy, will help bring focus to the structures and processes needed to reinforce collaboration for integrated water sensitive outcomes. These governance arrangements should permeate all levels of decision-making, scales of implementation and elements of the urban water cycle.

As the pathway to Bendigo's vision requires widespread adoption of innovative solutions and practices, a whole-of-system approach to learning is needed to ensure past local experiences, as well as lessons from elsewhere, can be built upon to achieve progress towards its water aspirations. Bendigo therefore needs to maintain focus on a policy, organisational and cultural environment that supports innovation and experimentation.

The 78 workshop participants from both the Industry and Community Groups demonstrated openness, motivation and commitment for water sensitive outcomes and collective action. Building on this momentum and broadening industry and public support will put Bendigo in a strong position to accelerate its ongoing transition to achieve its water sensitive vision and support the city's future liveability, sustainability, productivity and resilience.



8. References

Bendigo Botanic Gardens (2015). http://www.bendigobotanicgardens.com.au/Home/About_Us, Retrieved 20 December 2017.

City of Greater Bendigo (2010). Greater Bendigo 2036: Liveable, Productive, Sustainable. City of Greater Bendigo, Bendigo, Victoria.

City of Greater Bendigo (2015). Wellbeing Survey 2015. City of Greater Bendigo, Bendigo, Victoria

City of Greater Bendigo (2013). Municipal Public Health and Wellbeing Plan: Background Research and Consultation Report. City of Greater Bendigo, Bendigo, Victoria.

City of Greater Bendigo (2014). The Domestic Wastewater Management Strategy. City of Greater Bendigo, Bendigo, Victoria.

City of Greater Bendigo (2016a). Greater Bendigo Environment Strategy 2016-2021. City of Greater Bendigo, Bendigo, Victoria.

City of Greater Bendigo (2016b). GB Magazine. May 2016, City of Greater Bendigo, Bendigo, Victoria.

City of Greater Bendigo (2016c). The Bendigo Municipal Emergency Management Plan. City of Greater Bendigo, Bendigo, Victoria.

City of Greater Bendigo (2016d). The Bendigo Community Engagement Guidelines and Toolkit. City of Greater Bendigo, Bendigo, Victoria.

City of Greater Bendigo (2017a). Greater Bendigo Public Space Plan: A conceptual 50 year vision. City of Greater Bendigo, Bendigo, Victoria.

City of Greater Bendigo (2017b). The Plan Greater Bendigo Discussion Paper. City of Greater Bendigo, Bendigo, Victoria.

City of Greater Bendigo (2017c). Annual Report 2016/17. City of Greater Bendigo, Bendigo, Victoria

City of Greater Bendigo (2017d). Greater Bendigo Health and Wellbeing Plan: Emerging Themes. City of Greater Bendigo, Bendigo, Victoria.

City of Greater Bendigo (2017). https://www.bendigo.vic.gov.au/Things-to-Do/Parks-and-Gardens/Lake-Weeroona, retrieved 20 December 2017

Coliban Water (2014). Joseph Brady's Coliban System of Water Works: An Historical Guide. Coliban Water, Bendigo.

Coliban Water (2016). Annual Report 2015-16. Coliban Region Water Corporation. Bendigo, Victoria.

Coliban Water (2017a). Annual Report 2016-2017. Coliban Region Water Corporation. Bendigo, Victoria.

Coliban Water (2017b). Pricing Submission 2018. Coliban Region Water Corporation. Bendigo, Victoria.

Coliban Water (2017c). Coliban Water Urban Water Strategy 2017. Coliban Region Water Corporation. Bendigo, Victoria.

Context (2007). *Victorian Water Supply Heritage Study Vol 1: Thematic Environmental History*. Heritage Victoria, Melbourne.

CSIRO and Bureau of Meteorology (2015). *Climate Change in Australia Information for Australia's Natural Resource Management Regions: Technical Report*, CSIRO and Bureau of Meteorology, Australia.Dean, A.J., Lindsay, J., Fielding, K.S., & Smith, L.D.G. (2016) Fostering water sensitive citizenship – Community profiles of engagement in water-related issues, Environmental Science & Policy, 55: 238-247.

Dean, A. (2017) Engaging communities in water sensitive cities. Findings from A2. [PowerPoint presentation] CRC for water sensitive cities, Melbourne

Department of Environment, Land, Water and Planning (2014). Loddon Mallee South Regional Growth Plan. Department of Environment, Land, Water and Planning, Melbourne, Victoria.

Department of Environment, Land, Water and Planning (2016a). *Water for Victoria,* State of Victoria, Melbourne.

Department of Environment, Land, Water and Planning (2016b). *Victoria in Future 2016: Population and household projections to 2051*, State of Victoria, Melbourne.

Department of Environment, Land, Water and Planning (2016c). The Victorian Floodplain Management Strategy. Department of Environment, Land, Water and Planning, Melbourne, Victoria.

Department of Environment, Land, Water and Planning (2016d). Aboriginal Inclusion Plan 2016-2020. Department of Environment, Land, Water and Planning, Melbourne, Victoria.

Department of Environment, Land, Water and Planning (2017). *Integrated Water Management Framework for Victoria,* State of Victoria, Melbourne.

Department of Environment, Land, Water and Planning (2017a). Groundwater Resource Reports. Department of Environment, Land, Water and Planning, Available at http://gwv.cloudapp.net/aquiferservice/aquiferMap.htm [accessed 14 Nov. 2017]

Department of Environment & Primary Industries (2013). Index of Stream Condition The Third Benchmark of Victorian River Condition. Department of Environment and Primary Industries, Melbourne, Victoria.

Department of Sustainability and Environment (2003) *Action Statement no. 79: Brush-tailed Phascogale*. State of Victoria, East Melbourne.

Department of Sustainability and Environment (2009). *Northern Region Sustainable Water Strategy*, State of Victoria, Melbourne.

Fahey, C. (2001). Labour and Trade Unionism in Victorian Goldmining, 1861-1915, in *Gold: Forgotten Histories and Lost Objects of Australia*, edited by McCalman, I., Cook, A., and Reeves, A.. Cambridge University Press, Cambridge, UK.

Fiddes, S. and Timbal, B. (2017). Future impacts of climate change on streamflows across Victoria, Australia: making use of statistical downscaling. Clim Res 71:219-236.

Hurlimann, A. (2007). Attitudes to future use of recycled water in a Bendigo office building. Water, Journal of the Australian Water Association, September 2007.

Mitchell, L. (2010). *More Weekend: Eppalock a shore thing again*, Bendigo Advertiser, December 6 2010, retrieved from http://www.bendigoadvertiser.com.au/story/712371/more-weekend-eppalock-a-shore-thing-again/, accessed 12 January 2018.

Melbourne Water (2015). Flood Management Strategy Port Phillip and Westernport.

NCCMA (2017). Corporate Plan 2017-18 to 2021-22. North Central Catchment Management Authority, Huntly, Victoria.

Neville, W. F. (1934). The Water Supply and Sewerage of Country Towns, in *One Hundred Years of Engineering*, Melbourne.

Nicholls, N., Skinner, C., Loughnan, M., and Tapper, N. (2008). A simple heat alert system for Melbourne, Australia, International Journal of Biometeorology, 52(5), 375–384

Parliament of Victoria (1925). *Report of the Royal Commission Respecting the Bendigo Sewerage Authority*. Parliament of Victoria, Melbourne.

Potter, N.J., Chiew, F.H.S., Zheng, H., Ekström, M. and Zhang, L. (2016). *Hydroclimate projections for Victoria at 2040 and 2065*. CSIRO, Australia.

Public Records Office of Victoria (2016). *Agency VA | 744, Board of Land and Works* www.access.prov.vic.gov.au/public/component/daPublicBaseContainer?component=daViewAgency&breadcrumbPath=Home/Access%20the%20Collection/Browse%20The%20Collection/Agency%20Details&entityId=744. Retrieved 18 December 2017.

Rural Water Commission (1985). *Report of the Rural Water Commission of Victoria for the Year ended 30 June 1985*, State of Victoria, Melbourne.

State Library of Victoria (2013). *Bendigo or Sandhurst? History through newspapers*, https://blogs.slv.vic.gov.au/such-was-life/bendigo-or-sandhurst-history-through-newspapers/,

Volunteering Victoria (2015). Key facts and statistics about volunteering in Victoria, available at http://volunteeringvictoria.org.au/wp-content/uploads/2014/12/Volunteering-key-statistics-17-Feb-15.pdf, [accessed 21 Nov. 2017].Retrieved 31 January 2018.

Water Technology (2013). Bendigo Urban Flood Study: Final Report. Notting Hill, Victoria.

Appendix 1: List of Workshop Participants

Table 15. List of Workshop facilitators, steering committee and workshop participants

Workshop Facilitators		
Nigel	Bertram	CRC for Water Sensitive Cities
Chris	Chesterfield	CRC for Water Sensitive Cities
Emma	Church	CRC for Water Sensitive Cities
Jamie	Ewert	CRC for Water Sensitive Cities
Alex	Gunn	CRC for Water Sensitive Cities
Katie	Hammer	CRC for Water Sensitive Cities
Euan	Hind	CRC for Water Sensitive Cities
Jo	Lindsay	CRC for Water Sensitive Cities
Sara	Lloyd	E2Design Labs
Briony	Rogers	CRC for Water Sensitive Cities

Project Steering Committee		
Meg	Caffin	Urban Forest Consultant
Trevor	Budge	City of Greater Bendigo
Christine	Grundy	Coliban Water
Rohan	Hogan	North Central Catchment Management Authority
Anthony	Sheean	City of Greater Bendigo
Elliot	Stuart	Department of Environment, Land, Water and Planning
Damien	Tangey	Birchwood Properties
Natalie	Trotter	Department of Environment, Land, Water and Planning

Industry Workshop Attendees		
Steve	Abbott	City of Greater Bendigo
Roger	Barbetti	City of Greater Bendigo
Linda	Beilharz	GREATER
Mick	Bourke	Chair for the IWM Coliban forum
Peter	Brasier	City of Greater Bendigo
Amy	Brown	City of Greater Bendigo
Emma	Bryant	City of Greater Bendigo
Rodney	Carter	Djandak (Dja Dja Wurrung Enterprises)
Chris	Corr	Bendigo Sustainability Group
Jenny	Dawson	V/Line Chair
Tim	Dunlop	RMCG Consulting
Frances	Ford	City of Greater Bendigo
Steve	Healy	Coliban Water
Darren	Heritage	Coliban Water
Steve	Jackson	Djandak (Dja Dja Wurrung Enterprises)
Matt	Kerlin	City of Greater Bendigo
Karoline	Klein	City of Greater Bendigo
Tania	Macleod	City of Greater Bendigo
Grace	Paisley	City of Greater Bendigo
Neville	Pearce	Coliban Water
Julian	Perez	Villawood Properties
Simon	Perrin	Bendigo District Environment Council
Glen	Pomeroy	City of Greater Bendigo
Scott	Ridges	Goulbourne Murray Water
Robert	Rorke	Department of Environment, Land, Water and Planning
Peter	Sandercock	Jacobs
Marg	Sangalli	Spiire Landscape Architecture
Matthew	Shanahan	RMCG Consulting
Jess	Sherwood	Sport and Recreation Victoria
Jenny	Stewart	Coliban Water
Mark	Stubbs	City of Greater Bendigo
Helen	Symes	City of Greater Bendigo
Andrea	Tomkinson	Urban Development Institute of Australia
Natalie	Trotter	Department of Environment, Land, Water and Planning
Duncan	Wallis	RMCG Consulting
Nathan	Wong	Djandak (Dja Dja Wurrung Enterprises)

Community Workshop Attendees	
Ken	Beasley
Kelly	Button
Brad	Crème
Cass	Davis
James	Gallagher
Britt	Gregory
Russel	Henthorn
Karoline	Klein
Trilby	Langdon
Mick	Lyons
Tania	Macleod
Robyn	Major
Ken	Mann
Lesley	McGrath
Andrea	Metcalf
Peter	Morison
Lynda	Newton
Margaret	Patricia Lenaghan
Julian	Poloniato
Glen	Pomoroy
Keith	Reynard
Natasha	Romas
Colin	Smith
Genevieve	Smith
Jay	Smith
Jason	Waters
Tim	Way
Kerry	Whitfort
James	Williams
Terri	Williams

Workshop Observers		
Christoph	Brodnick	CRC for Water Sensitive Cities
Raul	Marino	Monash Art, Design and Architecture
Dwintanti	Marthanty	Universitas Indonesia
Rutger	Pasman	Monash University
Yuli	Suharnoto	Bogor Agricultural University
Hadi	Susilo Arifin	Bogor Agricultural University
Manuel	Franco Torres	Monash University
Andres	Lopez Gonzalez	Monash University

Appendix 2: WSC Index Scoring Process and Justification of Results

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

Process for scoring indicators

The benchmarking workshop was the first of the Industry Group series. A three-step method for scoring each indicator was used:

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

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

WSC Indicator scores and justifications

Goal 1. Ensure good water sensitive governance (2.8 / 5)

1.1. Knowledge, skills and organisational capacity (3 / 5)

There is a commitment to maintaining and updating integrated water-related skills within key organisations. Coliban Water is a member of several groups that enhance organisational capacity, including: Water Services Association of Australia, Victorian Water Industry Association, and the Australian Water Association (AWA). It is also committed to further collaboration with research institutions to support a learning culture and update knowledge and skills. Although engineering is complemented by other disciplinary skills across the sector (e.g. landscape and ecology), engineering remains a dominant driver in discussions of solutions. Council has recently increased its organisational capacity in integrated water management policy.

Connections with knowledge brokering organisations such as research institutions are increasing. Clearwater, an integrated water management capacity building program, this year extended its operations into regional Victoria. Clearwater also hosts the Smart Water Fund Knowledge Hub.

In general, participants consider there to be a need for stronger links between organisations to support organisational capacity.

1.2. Water is key element in city planning and design (2.5 / 5)

State and regional water policy acknowledges the role of integrated water management in urban planning. The State Government requires all water corporations to consider measures to deliver planning outcomes for "sub-regional" areas - including areas at the scale of Bendigo - and integrate water cycle management with relevant

planning schemes. It also requires water corporations to assess water supply and demand management measures (Minister for Environment, Climate Change and Water, 2016, p. 10).

The Greater Bendigo Planning Scheme recognises the value of water captured at source (e.g. Clause 21.02). However, WSUD lacks integration in the planning of new development areas. Participants agree that integration of water as a key aspect of city planning is valued to some degree (though most participants assume that Bendigo's future water supply will be drawn from outside the Coliban system in the future), they consider that decision-making remains siloed. For example, increased collaboration between the planning and engineering departments is needed to achieve integrated water quality outcomes.

Coordination between organisations occurs occasionally. Strategic alignment and collaboration is seen in some larger projects, often led by a single agency or department. Some Bendigo developments include recycled water however workshop participants felt these early examples do not yet demonstrate WSUD best practice. Monitoring of long-term scenario planning is limited.

1.3. Cross-sector institutional arrangements and processes (2.5 / 5)

There have been some recent instances of cross-sector institutional arrangements being embedded within long-term strategic plans of key organisations, including the Loddon Mallee South Regional Growth Plan, the Loddon Campaspe Regional Partnership, and Plan Greater Bendigo, which have had, or will have, influence at the local government level. In general, Council has a solid focus on cross-institutional strategic processes with a high degree of public transparency. For example, it has more actively engaged stakeholders such as referral authorities (e.g. CFA, Parks Victoria, Coliban Water, NCCMA) in the early stages of planning scheme amendments to support more effective planning processes post-amendment. Plan Greater Bendigo has engaged representatives from state agencies as well as non-government and private sector organisations in the Technical Reference Group.

Other organisations are also formalising collaboration. For example, NCCMA and Coliban Water have signed a Memorandum of Understanding to work on issues of shared interest. NCCMA continues to strengthen partnerships with Council, Landcare groups and Traditional Owners.

Cross-sector institutional collaboration is widely supported, although organisational investment and action to improve arrangements and processes remains varied. Participants commented that recent examples of cross-sector institutional arrangements and processes are forerunners of change. High-level strategies are in place, but in practice cross-institutional coordination is still less likely to occur in smaller projects.

1.4. Public engagement, participation and transparency (3 / 5)

The Millennium Drought and then floods of 2010-11 saw a spike in community engagement in Bendigo due to major water planning and infrastructure, including the Recycled Water Factory, the Goldfields Superpipe, and the Bendigo Urban Flood Study (2013). Sections of Bendigo's public remain active participants in water governance.

There are several formal engagement and transparency policies in place for the water sector. The State Government requires water corporations to consult with the community and key stakeholders, and participate in the development of relevant local and regional plans. DELWP is promoting the incorporation of community values in integrated water management plans (DEWLP, Integrated Water Management Framework, 2017). Community participation on IWM Plans is discretionary, however. Public engagement, participation and transparency are aspirational goals for many of the organisations responsible for delivering water management in Bendigo. The first Key Result Area of the Coliban Water Annual Report (Coliban Water, 2017a, p. 4) is to "engage with the community and stakeholders to understand and meet their water cycle needs". Participants suggest, however, that citizen engagement needs to be more participatory or collaborative in practice.

The NCCMA has a Community Consultative Committee, and Coliban Water has a Water Services Committee, to assist those organisations to maintain links with the broader community.

The Bendigo Community Engagement Guidelines and Toolkit (City of Greater Bendigo, 2016d) is a comprehensive guide for public engagement.

Workshop participants link recent progress in public engagement and participation to specific project campaigns such as the Plan Greater Bendigo and the 2017 Pricing Submission by Coliban Water. Workshop participants noted that some sections of the community remain difficult to reach. Better designed and resourced engagement strategies are considered necessary to lift participation.

1.5. Leadership, long-term vision and commitment (3 / 5)

Strategy leaders consistently endorse water sensitive governance and the concepts of liveability, sustainability and resilience. Official policy support is a recent development and funding remains irregular. Progress has been supported by the efforts of key champions in the community, local government, utilities, NCCMA and development industry. At the state level, there are numerous champions for integrated water management, and there is some recognition of water leadership through the Victorian Water Awards, the VicWater awards and the Premier's Sustainability Awards.

Council has in recent years prepared several long-term plans and visions. These have included *Greater Bendigo 2036: Liveable, Productive, Sustainable* (City of Greater Bendigo, 2010), *Greater Bendigo Environment Strategy 2016-2021* (City of Greater Bendigo, 2016a), *Draft Plan Greater Bendigo – Discussion Paper* (City of Greater Bendigo, 2017b), and *Greater Bendigo Public Space Plan: A conceptual 50 year vision* (City of Greater Bendigo, 2017a). The importance of water resources to Bendigo is a discussion point in these documents, and the emphasis has grown in the most recent publications. The *Draft Plan Greater Bendigo – Discussion Paper* highlighted the need to better manage water through the incorporation of WSUD, and to explore initiatives to minimise water use to ensure Bendigo's long-term growth within its available water resources.

Over the last 18-months Coliban Water, in consultation with other agencies, has been investigating potential integrated water solutions for Bendigo and comparing them to Business-as-usual approaches. This project established a vision in collaboration with the City of Greater Bendigo and the NCCMA.

There are also relatively strong community sector leaders. Bendigo Sustainability Group (BSG), for example, provides guidance and support for volunteer led 'action groups' that focus on a variety of sustainability related topics including renewable energy, waste, active transport, environmental health and education. One such group is the Ironbark Gully Friends, which has recently aimed to construct a shared path and habitat reserve along the gully.

Further progress is thought by participants to require a common vision, a network of connected champions across organisations and secure funding. Incentives that are specific to Bendigo, such as recognition of water leadership, could help foster continuing support and action.

1.6. Water resourcing and funding to deliver broad societal value (3 / 5)

Delivery of social value via water resourcing and funding is supported by state policy vision. The *Integrated Water Management Framework* (DELWP, 2017, p. 5) outlines how "greater community value can be delivered by consistent and strategic collaboration within the water industry". Yet some workshop participants felt restrained by legislation and inconsistent funding.

Traditional delivery of water supply, drainage and sewerage services tends to dominate funding decisions. Budget to support integrated water practice is allocated on an ad-hoc basis. When available, funding is commonly allocated appropriately for construction but remains insufficient for project maintenance.

Water-related resourcing and funding are frequently subject to financial analysis with some consideration given to broader societal or environmental outcomes. Multi-criteria assessments are used to assess the societal value of projects. However, integrated water solutions currently require justification based on the potential to monetize the corresponding environmental and social benefits. Participants suggested that secure funding, better tools and more data are needed to build a robust business case to ensure water resourcing and funding to deliver societal value become core business for more local organisations.

Council has just created a Water Strategy Officer role with the Regional Sustainable Development team to provide advocacy, technical advice and capacity building to Council on a range of water-related issues. This represents an important investment in responsibilities and activities that include developing a strategic water management framework, implementing WSUD, and delivering Council's input into the IWM Plan.

1.7. Equitable representation of perspectives (2.5 / 5)

The objective of ensuring equitable representation of perspectives is embedded in high level strategy. For example, recognising and valuing diverse backgrounds and perspectives is a critical value of the Council (City of Greater Bendigo, 2017c). Coliban Water's first Reconciliation Action Plan outlines their commitment to enhancing relationships with Australia's Indigenous peoples and other Australians (Coliban Water, 2017a).

Recent advances have been made in this space at the policy level (City of Greater Bendigo, 2017b; Coliban Water, 2017a; NCCMA, 2017). Yet workshop participants claimed some marginalised groups of low socioeconomic standing feel unheard and have little trust in water planning and management. Workshop participants also claimed that these groups are often difficult to engage with standard techniques.

Some participants view the recent push for equitable representation of diverse perspectives as not yet having broad organisational support, and as not yet having significant impact on practice. Some organisations remain risk averse and greater support is necessary to embed genuine inclusion in organisational culture across the sector. Workshop participants also felt that greater collaboration is necessary to distribute risk across the sector and to achieve impactful implementation of existing policies.

Goal 2. Increase community capital (2.8 / 5)

2.1. Water literacy (3 / 5)

The Bendigo community is considered to have a general understanding of the water cycle, know what they are paying for and realise water is undervalued. This understanding is considered by participants to be higher following the Millennium Drought.

There are members of the community with a high degree of water literacy. These are often older residents and those with university degrees. For example, in a survey of employees of Bendigo Bank in Bendigo (soon to occupy a new office building with onsite wastewater treatment and direct reuse), it was found that 99% of respondents favoured wastewater treatment and direct reuse for toilet flushing (Hurlimann, 2007). Even indirect wastewater reuse for potable uses was favoured by more than half of the respondents.

The gap in water literacy has proved difficult to close as existing engagement approaches have largely not reached the intended audience. Members of the community who already have a high level of water literacy are often those who are engaged by education campaigns.

Participants suggested that public understanding of basic water cycle elements is far stronger than its understanding of the industry, such as how raw water is sourced and treated, and the treatment of sewage. Primary community concerns are water restrictions, pricing and efficiency. Participants highlighted a few common

misunderstandings within community water knowledge: where Bendigo's potable water supply comes from; where environmental flows of Lake Eppalock go; and, that the city must share the finite supply piped to Bendigo with towns beyond, including Ballarat.

A new Permanent Water Saving Rules (PWSR) education campaign was introduced over March, April and May in 2016 to ready customers for potential new water restrictions.

According to the Water Act (1989) a statutory function of water authorities in Victoria is to educate the public about any aspect of water supply, sewerage, drainage and in some cases waterway management. Coliban Water offers educational activities to Bendigo schools to raise understanding of the water cycle, catchment functions, water efficiency and Bendigo's water history. Coliban Water also sponsors the North Central Water Watch program. This citizen science program led by NCCMA facilitates community water quality monitoring in the Coliban region.

2.2. Connection with water (3 / 5)

Bendigo was settled for its gold deposits, not because it had access to reliable water. Major water bodies are not prominent in the natural environment: 'it is a harsh environment, not a watery place', to paraphrase one participant in the first workshop. Nonetheless the Bendigo community are strongly connected to water-related assets near where they live such as reservoirs and lakes.

Council's *Rate Our Spaces* survey (using the CrowdSpot online mapping tool) received over 700 space ratings and ideas (City of Greater Bendigo, 2016b). Of the locations that drew the most comment, there is a strong connection to green infrastructure and four of the top-ten spaces featured the Bendigo Creek. Greater Bendigo's public spaces (parks, garden reserves, public forests, urban squares, streets, etc) were rated as very important by 65% of respondents in a 2015 survey of locals, and 40% of respondents selected linear parks along creeks as important to them (City of Greater Bendigo, 2015).

Water is recognised as part of what makes Bendigo's neighbourhoods liveable. In background consultation to inform public health and wellbeing planning, community responses discussed the increased likelihood that Bendigo residents would have water efficient appliances and use rainwater or undertake grey water recycling. Generally though, water was not considered a community health and wellbeing priority (City of Greater Bendigo, 2013). More recent engagement around public health did not identify issues connected to water or green infrastructure (City of Greater Bendigo, 2017d). Workshop participants commented that people value green public spaces but few appreciate the role of water in creating this aesthetic; most people don't immediately associate water with a green park.

Community concern for and connection to water increased during the Millennium Drought of the 2000s and many houses still feature the rock-mulch gardens commonly planted in this era to reduce water demand. At this time, sporting clubs were concerned about the risk of injuries due to playing on dry, hard surfaces, and requests for exemptions from water restrictions to fill public swimming pools were put to Coliban Water, indicating a connection between community wellbeing and the use of water. Workshop participants suggested the strength of this connection might have weakened since the end of the drought. Many gardens are returning to water intensive designs, with more installations of turf and box hedges, for example.

Historically Bendigo Creek was not a great point of pride for the community. However there are several plans in place to leverage potential amenity value, many involving community groups.

2.3. Shared ownership, management and responsibility of water assets (2.5 / 5)

Bendigo communities have a role to play in the ownership, operation and maintenance of local water management solutions. They contribute to local water management solutions such as rainwater tanks, septic

tanks and conserving water. There are also individual champions and community interest groups who drive local water management solutions, demonstrate shared ownership and responsibility for water assets.

Residents with easy access to places of high amenity value, such as Spring Gully, often have greater connection to place and informal ownership with the location. Workshop participants noted that interest group members are self-selecting and not representative of the wider community. Nonetheless, a recent proliferation of water oriented community interest groups suggests an increased sense of shared ownership, management and responsibility for water assets.

Bendigo has high rates of volunteerism (25.7%) compared to the state average (19.3%) (Volunteering Victoria, 2015). There are several community groups engaged with water or public green space management, including:

- Dja Dja Wurrung Clans Aboriginal Corporation
- The Ironbark Gully Friends
- Conservation Volunteers Australia
- Bendigo & District Environment Council
- Epsom, Ascot, Huntly Flood Mitigation Advisory Committee
- Northern Bendigo Landcare Group
- Wolstencroft Action Group
- Epsom Huntly Drainage Committee
- Northern Bendigo Landcare Group
- Bendigo Sustainability Group
- Environment and Sustainability Committee (CoGB)

The North Bendigo Landcare Group, in partnership with Parks Victoria and NCCMA (as different parts of Bendigo Creek have different land managers), has been undertaking restoration works along various stretches of the Creek.

Council is keen to work with community groups to increase shared ownership, management and responsibility of water assets. A Shared Vision for Restoring Bendigo Creek is one of four flagships projects detailed in the *Greater Bendigo Environment Strategy 2016-2021*. The strategy states that there is “great support for restoring the Bendigo Creek to a natural waterway…while some great work is being done, it is time to create a shared vision for Bendigo Creek, so we can restore this great community asset”. In the *Plan Greater Bendigo Discussion Paper* consultation, the most important projects to respondents were associated with securing Bendigo’s water supply, managing groundwater (“turning a problem into resource” is the project title in the discussion paper), Bendigo Creek improvements, Bendigo Botanic Gardens Master Plan implementation, and the Bendigo ‘low-line” walking and cycling corridor.

In general, Bendigo appears to have a progressive and enterprising spirit. One participant said during their interview prior to the first workshop, “Bendigo has a progressive, well-connected and motivated community. We want to push the boundaries around sustainable energy and water. We ask for permission, not for handouts, from government as we have the capacity to do it on our own”.

2.4. Community preparedness and response to extreme events (2.5 / 5)

Over the last five years there has also been growing coordination of emergency management planning among Councils and other stakeholders involved in the Northern Victoria Emergency Management Cluster (IMEMPC). The Integrated Municipal Emergency Management Plan (IMEMP) has been developed for all the cluster councils to outline emergency preparation, response and recovery roles and responsibilities for councils and partner agencies. Sub plans of the IMEMP include the Municipal Flood Emergency Plan which was adopted by the IMEMPC in May 2018.

Management and responsibility for water related extreme events including storm, flood and heatwave rely heavily on formal emergency services. State emergency services are responsible for notifying communities of extreme events and implementing the Integrated Municipal Emergency Management Plan Greater Bendigo. Participants believe the State emergency services are equipped to respond to an extreme event.

A number of community education resources have been produced and distributed by Council in partnership with emergency services to support emergency preparedness, e.g. heatwave help resources and the brochure, *In an Emergency what is your plan?*, which was distributed to every household in Greater Bendigo and has recently been re-issued.

Parts of the Bendigo community are well prepared at the household scale and community organisations also contribute to emergency preparedness. There is an increasing focus on emergency preparedness in community plans across the City of Greater Bendigo. For example, the *Are you ready for summer?* community day was led by community planning group Axedale Our Town our Future in partnership with Council to promote community disaster preparedness. It focused on bushfire preparedness, water safety and coping with extreme heat. Some communities are including a focus on emergency preparedness within existing community events with support from Council and emergency services.

Bendigo has one of the largest bushfire management overlays for an urban area in Victoria. Access to water for firefighting is crucial. Participants felt that there is potential for WSUD to play a greater role in protecting the city from bushfire by keeping water in the landscape.

Although 5 out of 10 extreme events since 1974 (City of Greater Bendigo, 2016c) were flood-related, flooding was considered by workshop participants to be less significant from an emergency management standpoint than bushfires.

2.5. Indigenous involvement in water planning (3 / 5)

State policy and frameworks are in place to recognise indigenous economic, cultural and spiritual interests. Indigenous representation in water planning and governance is supported at the state level by the *Aboriginal Inclusion Plan 2016-2020* (Department of Environment, Land, Water & Planning, 2016d), the *Water for Victoria Strategy* (DELWP, 2016b) and the *Integrated Water Management Framework for Victoria* (Department of Environment, Land, Water & Planning, 2017b). Coliban Water recently published their first *Reconciliation Action Plan 2017-2018*. The Council's 20 Year Goals for Sustainable Water emphasise the importance of community and specifically Traditional Owner involvement in water management. The NCCMA are committed to a long-term vision and leadership role in fostering Indigenous involvement in water governance and planning (NCCMA, 2017).

The Dja Dja Wurrung is the traditional owner group for the Bendigo region. Djandak, the commercial arm of the Dja Dja Wurrung Clans Aboriginal Corporation, has robust collaborative relationships with state, regional and local water and land management agencies including DELWP, Goulbourn Murray Water, Coliban Water, EPA, Parks Victoria, NCCMA and the Council. Many of these organisations also fund or plan to fund local water management positions for Dja Dja Wurrung people. The 2013 Recognition and Settlement Agreement between Victoria and the Dja Dja Wurrung is acknowledged by participants as being important for formalising involvement in water resource management.

The Wanyarram Dhelk project is a collaboration between NCCMA and Djandak, funded by NCCMA and State Government. The project provides opportunities for ongoing jobs and training of Traditional Owner (TO) groups Dja Dja Wurrung, Barapa Barapa and Taungurung with NCCMA in natural resources management. These roles include strategic and project management positions to protect and enhance the natural environment and culturally significant areas (NCCMA, 2017).

It is evident Indigenous knowledge is considered important to water system planning and management in Bendigo. However, the level of Traditional Owner participation varies between agencies. Mainstream practice still

needs to move beyond a heritage protection focus to embrace the enhancement of cultural and economic associations.

Goal 3. Achieve equity of essential services (4 / 5)

3.1. Equitable access to safe and secure potable water supply (5 / 5)

There are effective standards for managing safe potable water supply at the national and state level. State regulations, for example, require the effective monitoring of water quality data. There are also State Government obligations to manage risk to protect public safety, quality and security of supply, including managing for the impact of long-term climate change on water supplies. For example, Cl. 56.07-1 of the Victoria Planning Provisions has the objective "to provide an adequate, cost-effective supply of drinking water". This information was featured in Coliban Water's recently published Urban Water Strategy (Coliban Water, 2017c).

A small number of houses are not connected to mains water supply. For these residents who rely solely on tank water, there are affordable and reliable back-up supplies available for purchase. Water is considered affordable at less than 3% of household income. Measures are in place to address affordability for disadvantaged and low-income groups. Coliban Water offer concession rates for water users, internal support for financial hardship and bill relief services.

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

Across the Council area, more than 10,000 households manage wastewater onsite where reticulated sewerage is not available. Areas of Bendigo where there are properties not connected to the reticulated sewerage system include Eaglehawk and Sailors Gully in the north-west, Ascot in the north-east, and Junortoun and Strathfieldsaye in the south-east. Instances of off-site wastewater discharge and pollution have been observed in many of these areas. In 2014, Council developed the Domestic Wastewater Management Strategy. This aims to reduce the negative impacts of poor wastewater management, and protect key environmental assets and the health of communities.

There are several guidelines and regulations applicable to the management of wastewater, at the Commonwealth, state and local levels, including:

- *Australian guidelines for water recycling: managing health and environmental risks (phase 1)* (Cth)
- *National Water Quality Management Systems (WQMS) Auditor Certification Scheme* (Cth)
- *Guideline for Environmental Management (GEM): Use of Reclaimed Water (2003)* (Vic)
- *GEM: Dual pipe water recycling schemes – health and environmental risk management (2005)* (Vic)
- *GEM: Supply of reclaimed water for drought relief (2006)* (Vic)
- Clause 21.08 of the Greater Bendigo Planning Scheme encourages connection to reticulated services as the "preferred method for domestic wastewater management", but supports appropriate onsite domestic wastewater management where required.
- Clause 56.07-3 of the Victoria Planning Provisions (VPPs) is the wastewater management objective, which is "to provide a waste water system that is adequate for the maintenance of public health and the management of effluent in an environmentally friendly manner."
- Standard C24 (within Clause 56.07-3) sets the conditions under which waste water management systems must be designed, constructed and managed.

Measures are in place to address affordability for disadvantaged and low-income groups in Bendigo. There are a relatively large number of utility relief plans - currently three times the state average - provided by Coliban Water.

3.3. Equitable access to flood protection (4 / 5)

Rainfall events generally do not disrupt everyday activities in Bendigo. Everyone is well protected against flood risks to life. Extreme events may affect some properties, but the risks of flooding are well understood by government. The *Bendigo Urban Flood Study* (Water Technology, 2013), commissioned by the NCCMA in collaboration with Council, updated knowledge about the impact of flooding to enable amendments to the Greater Bendigo Planning Scheme. This information is available in an online flood-mapping tool referred to as Flood Eye (floodreports.nccma.vic.gov.au). The amendment to the planning scheme is still under consideration, however.

A coordinated approach to addressing identified flood risks is under way. The Epsom, Ascot, Huntly Flood Mitigation Advisory Committee is jointly funded by Council and DELWP and is designed to bridge government, development and community interests. It is responsible for overseeing the development of a Flood Mitigation Options Report.

The *Victorian Floodplain Management Strategy* (Department of Environment, Land, Water & Planning, 2016c), which is incorporated into planning schemes, provides state-wide policy direction for managing floodplains and minimising flood risks, including guidance on different sources of flood risk and the size of flooding events (e.g. 1-in-100 year events) that influence planning.

Although standards are in place in the Victorian planning system to manage urban stormwater detention (e.g. Standard 25 in Clause 56), and there are several detention measures throughout Bendigo, participants considered there to be a need for a more integrated and multifunctional landscape response to encourage public access use of these water related assets.

3.4. Equitable and affordable access to amenity values of water-related assets (2.5 / 5)

Bendigo's dry climate supports relatively few naturally occurring water bodies, but there are several reservoirs in the southern and eastern parts of the city. Including ephemeral creeks, the available assets are generally accessible, and enjoyment of their benefits is affordable for most households. The need to enhance access to water-related amenity in Bendigo's west has been identified in local government strategy, however.

The Council has committed to the 10-minute neighbourhood. The *Greater Bendigo Public Space Plan* (2017) aims to increase access to quality, connected water related assets. The plan aims to create stronger connections to and between public spaces, with increased shade from tree plantings.

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

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

Bendigo receives benefits to the recreation and tourism industries from water-related services. The irrigation of recreation areas with recycled water promotes the hosting of regional sport, cultural and community events. For example, Crusoe Reservoir, which may be filled by Coliban Water's rural channel system, hosts a triathlon. Lake Weeroona, which receives urban stormwater or recycled water, provides local recreation and amenity benefits and is used by local boating clubs.

Quantitative evaluations of these benefits are rare, although Coliban Water has undertaken evaluations using a willingness-to-pay measure.

There is an awareness in the property industry of the value of water for amenity and liveability. For example, Birchgrove Property champions the use of stormwater in the landscape to provide quality public open space and improve the local amenity for residents of their estates.

4.2 Low GHG emissions in water sector (1 / 5)

Total net GHG emissions for Coliban Water was 782 net tonnes CO_2 equivalents per 1,000 connected water properties in 2015-16. This was a 26% increase on the previous year, and substantially higher than the target set by Coliban Water. This increase was reported to be due to low spring 2015 inflows and the extensive operation of the Goldfields Superpipe to meet water demand. However, for the five years to 2015-16, average GHG emissions were 557 net tonnes CO2-e / 1000 properties.

Coliban Water has begun to develop an Energy Management Strategy, and is engaged in industry-wide energy networks to create opportunities for collaborative energy projects (Coliban Water, 2016, p. 27).

4.3 Low end-user potable water demand (3 / 5)

This indicator takes into account water demand within the home as well as outside the home, such as in places of work and in businesses that serve the community. Bendigo's water demand for all connections (residential and non-residential) was 10,648 ML in 2016-17 (Coliban Water, 2017c). Multiplying the number of residential connections reported by Coliban for Bendigo by the average household size of 2.4 results in a total of 103,615[1] people. This represents a daily drinking water demand of 282 litres/person/day, which means this indicator merits a rating of 3. This figure should be treated as provisional until confirmed by Coliban Water.

Water consumption per residential connection has grown since the end of the Millennium Drought, but remains significantly lower than before the onset of Stage 3 water restrictions in 2003. Contributions to this sustained change include permanent water saving rules, more water efficient appliances, grey-water reuse, increased prices, education, and changed garden types. The Coliban Northern water supply area, comprising Bendigo and its peri-urban area, as well as Heathcote, has one of the lowest consumption rates in Coliban Water's network (Coliban Water, 2017c).

There is high-level support for managing potable water demand, with Coliban Water raising concerns over the long-term capacity of the existing water supply network to meet growing demand at current consumption levels. The Draft Plan Greater Bendigo Discussion Paper identifies water consumption as an issue (City of Greater Bendigo, 2017b).

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

Several participants have observed that while there are few green infrastructure entrepreneurs in Bendigo, there are a large number of water-related service providers that specialise in water efficiency or the use of alternative water sources. The Department of Environment, Land, Water and Planning, Council and the Bendigo Sustainability Group have a working group exploring opportunities for pumped hydro power using groundwater in unused mines.

4.5 Maximised resource recovery (2 / 5)

For the last 10 years, Coliban has reused 100% of biosolids. Sludge has been provided for farming use in the region. The recovery of water resources was not considered by participants to be adequate to justify a higher rating, as it is generally not reused productively.

---

[1] This is approximately 11,000 more people than the Australian Bureau of Statistics reported for the Bendigo urban centre locality in the 2016 census, but this discrepancy would not likely impact the calculation of individual daily demand.

Coliban Water plans to upgrade sludge handling capacity at the Bendigo WRP, to be completed by 2023. This is in part to reduce its carbon emissions footprint (Coliban Water, 2017b).

Policies and instruments promoting the maximising of resource recovery include:

- *Victorian Organics Resource Recovery Strategy (2015)* (Vic). This strategy recognises the significant issue of biosolids from wastewater treatment, but deals more with the recycled organics market as a whole; an example action is to "clarify process and opportunities for energy generation from organic resources for local benefit" (p. 2); the Loddon Mallee Regional Waste and Resource Recovery Implementation Plan does not propose wastewater-specific actions
- Waste to Energy Infrastructure Fund (Vic) is available to water authorities as well as councils and waste management businesses
- *Guide to Best Practice for Organics Recovery (2009)* (Vic)

Goal 5. Improve ecological health (2 / 5)

5.1. Healthy and biodiverse habitat (2 / 5)

Victoria has several databases of biodiversity observations and modelled habitat to assist conservation efforts and to inform planning and development. This includes the Victorian Biodiversity Atlas that collates flora and fauna sightings across Victoria, and NatureKit, which models the strategic biodiversity values for all of Victoria.

A search of the Victorian Biodiversity Atlas shows that since July 2010, there have been sightings of fifteen fauna on the Victorian Advisory List in the Bendigo area (in a polygon between Huntly, Junortoun, Strathfieldsaye, Kangaroo Flat, Maiden Gully and Eaglehawk). This includes seven vulnerable, seven endangered, and one critically endangered fauna, among which are the Barking Owl, Brush-tailed Phascogale, the Australian Painted Snipe, the Growling Grass Frog, and the Pink-tailed Worm-Lizard. Other threatened species thought to be supported in Bendigo's surrounding forests (particularly Greater Bendigo National Park) are McIvor Spider-orchid, Whipstick Westringia, Swift Parrot and Regent Honeyeater (Parks Victoria, 2007). Despite these recent sightings, there is a concern among participants that Bendigo is steadily losing species. The Swift parrot is thought to be very rare in the Bendigo region, and there concerns over the health of local Brush-tailed Phascogale populations, which is listed as vulnerable in Victoria and Bendigo is at the edge of its estimated range (Department of Sustainability and Environment, 2003).

NatureKit facilitates the analysis of modelled biodiversity data. An example of an output of NatureKit is shown in Figure 24.

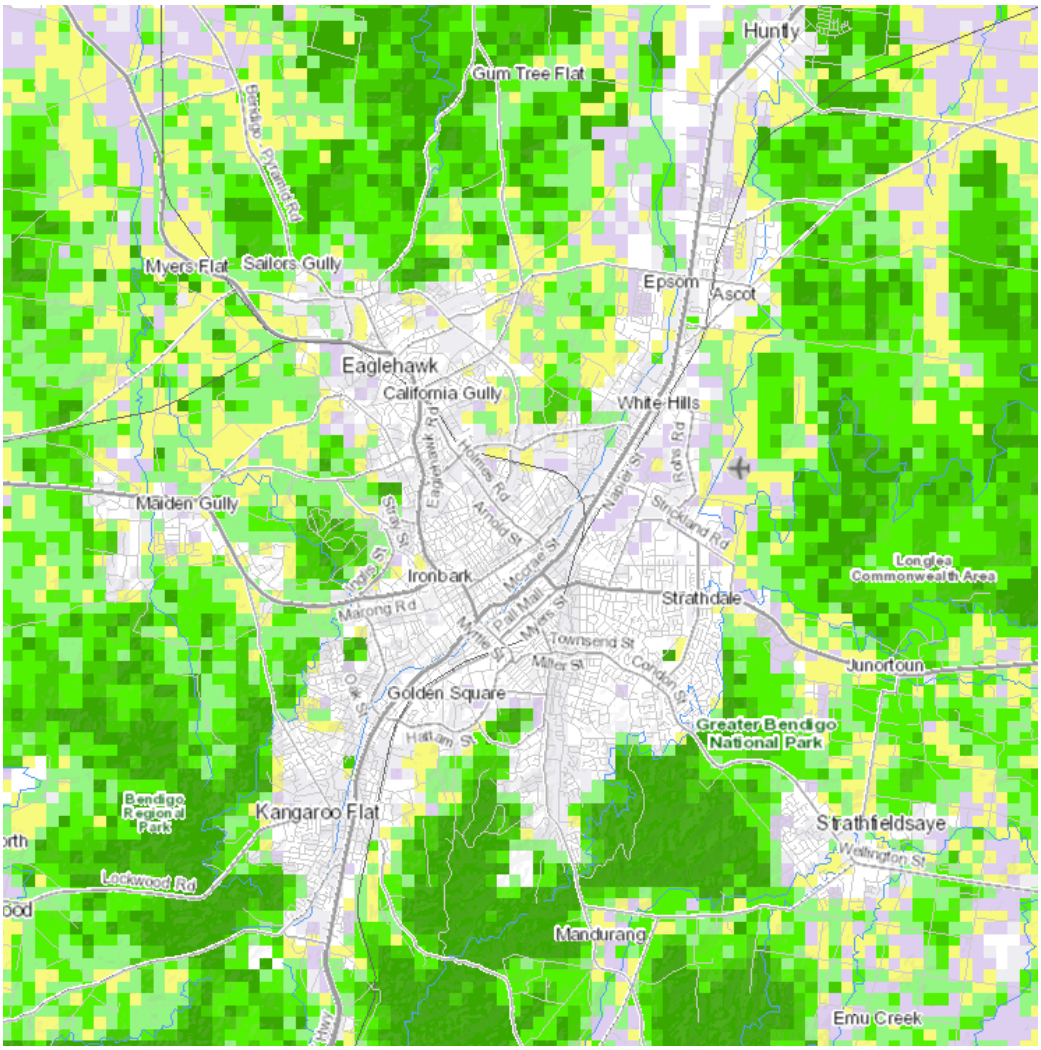


Figure 24. Biodiversity values for the Bendigo region (dark green indicates a value of 100)

Participants believe the urban habitats to be patchy and with low biodiversity, which corresponds with the results presented in Figure 4. For example, the main stream in Bendigo is Bendigo Creek, and there are long sections that are concrete with no biodiversity value. Nevertheless, open areas and forests on the periphery of Bendigo and away from creeks are thought to be in better, though degraded, condition. There are some threatened species found in urban areas, which suggests that in general, the ecological functioning is fair given the development context.

5.2. Surface water quality and flows (2 / 5)

Monitoring of stream conditions has been an element of water management in Victoria since the 1990s. Results of the most recent index of stream condition are show in Figure 5. The environmental condition for the reach of Bendigo Creek located within the urban area, marked as 44 in the figure, was rated as poor. Myers Creek and Sheepwash Creek, whose watershed are within the urban area, were rated as Poor and Very Poor respectively.

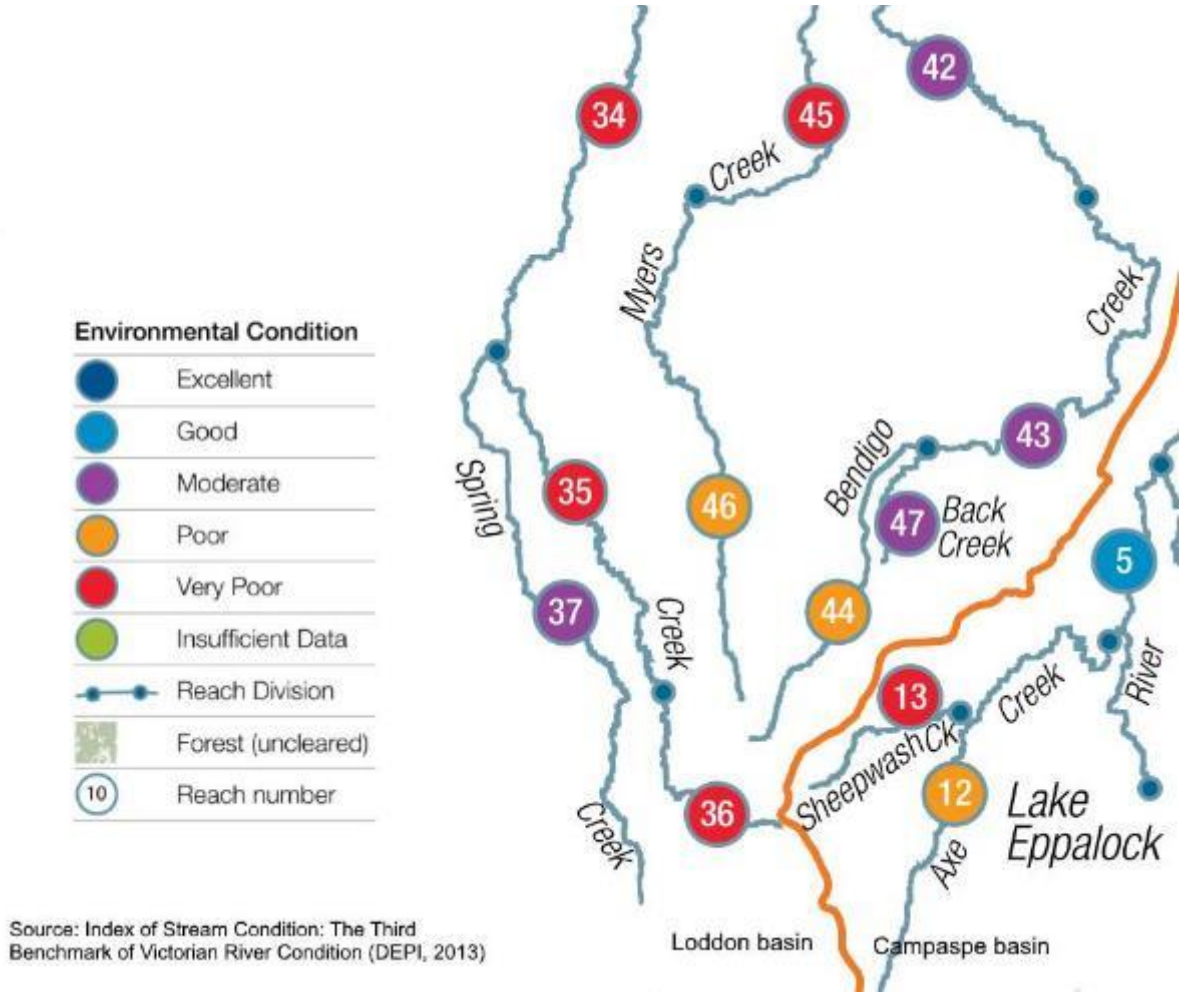


Figure 25. Environmental condition of creeks within and near the Bendigo urban area as summarised in the third Index of Stream Condition (Department of Environment & Primary Industries, 2013).

Council committed to undertake a comprehensive review of water quality monitoring data to inform future infrastructure planning (Urban Stormwater Management Plan, 2013). This would include Waterwatch data, Urban Lakes Monitoring Program data and any data from external organisations such as Coliban Water. The assessment aimed to establish a baseline of water quality at monitoring sites, and identify and quantify water quality threats where possible.

Along Bendigo Creek, there has in recent years been efforts to weed and revegetate, install gross pollutant traps, install educational signage, test water quality and install nesting boxes for wildlife. One of the objectives has been to develop a habitat link between the creek and the Bendigo Water Reclamation site. These works have been undertaken by the North Bendigo Landcare Group, in partnership with Parks Victoria, and the NCCMA (City of Greater Bendigo, 2016a, p. 37). In general, however, there has been insufficient action across the whole of Bendigo to address urban runoff, as new developments requiring WSUD represent a relatively small percentage of the whole. As a result, from an ecological perspective, urban waterways are considered to be in poor condition.

There is treatment of point source pollution, with the majority of wastewater being managed.

5.3. Groundwater quality and replenishment (2 / 5)

Most of the Bendigo urban area is in the Campaspe groundwater catchment. The depth to the water table is predominantly less than 5 metres in the valley of Bendigo Creek, though it can be 10-20 m in Eaglehawk, which is in the Loddon groundwater catchment. Groundwater salinity is 1001-3500 mg/L in much of Bendigo, which is considered acceptable for irrigation, stock and industrial use according to *State Environment Protection Policy (Groundwaters of Victoria)*. In the eastern suburbs such as Strathfieldsaye it can be even higher than 3500 mg/L (Department of Environment, Land, Water & Planning, 2017a).

The discharge of groundwater in areas with high water table is not actively managed, with the exception of the very centre of Bendigo.

Bendigo groundwater has naturally higher concentrations of arsenic than most areas of Victoria. The legacy of mining has enabled groundwater to access arsenic as well as some heavy metals. This has led to groundwater having decreased quality, though due to largely natural processes.

Rising groundwater within the historic mine shafts and tunnels in central Bendigo has prompted the state government to fund a short-term response to the problem, involving the treatment of groundwater at a plant at New Moon Mine (operated by Coliban Water) and storage of the waste brine at a lagoon at the Bendigo Water Reclamation Plant in Epsom. This solution is funded for 4 years (to 2021) while longer term options are investigated. Meanwhile, the Department of Environment, Land, Water and Planning is working with the community, stakeholders and local agencies to identify long-term solutions for managing Bendigo's groundwater in Bendigo's historical mine shafts and tunnels, including how it will be funded and governed.

5.4. Protect existing areas of high ecological value (2 / 5)

Many areas with high ecological value are protected under the public land reserve system. This controls the use of public land. One of the highest forms of protection is offered through the reservation as a National Park, which was granted to much of Bendigo's surrounding Box-Ironbark forests in 2002.

Another form of protection is offered through legislation developed to protect and manage biodiversity, including the *Environment Protection & Biodiversity Conservation Act 1999* (Cth) and *Flora and Fauna Guarantee Act 1988* (Vic). Victoria's *Flora and Fauna Guarantee Act* is currently under review by the State Government. Among other criticisms, it has been suggested that the Act needs to focus more on managing biodiversity at the landscape scale (to support protection of a broader range of species, rather than single threatened species) and needs to provide better support for proactive measures to protect biodiversity. Implementation of aspects of the Act has also been criticised, for example the lack of commitment to declare immediate protection of critical habitat through the Act.

In terms of protection by local regulations, Environmental Significance Overlay Schedule 5 has been applied to parcels of land that "contain depleted native species (under the Flora and Fauna Guarantee Act 1988), rare and vulnerable species within Australia and Victoria, excellent species diversity, shallow gully lines, and excellent connectivity to reserves, National and Regional Parks, vegetation corridors and other public land" (Cl. 42.01 Schedule 5). These parcels are in Maiden Gully, Sailor's Gully, and Mandurang, and either adjoin the Greater Bendigo National Park or Bendigo Regional Park.

Participants raised concerns that permit requirements are not adequately enforced, and penalties are insufficient to deter illegal clearing – "the planning system facilitates clearing rather than prevents it", as one participant phrased it during the first workshop.

There are concerns that the offset system for vegetation clearing is not working well from a consumer point of view or as a way of achieving vegetation gain, as offsets are not required to be located in the same local area as

vegetation removal, there is a lack of consistency with respect to offset application, and a lack of consistency between different offices of the State Government.

The Victorian Environment Assessment Council, which provides the State Government with recommendations about the protection and management of the environmental and natural features of public land, is currently investigating public land in and around Wellsford Forest to the north-west of Bendigo. A draft proposals paper is expected mid-2018.

Goal 6. Ensure quality urban space (2.2 / 5)

6.1. Activating connected pleasant urban green and blue space (3 / 5)

Bendigo has relatively large tracts of native forest, including national park, at its edges, making it the 'city within the forest'. Within the built areas, there are public green spaces for active and passive recreation. Due to the relatively large lot sizes in Bendigo, there is also considerable private land devoted to green space.

Flagship public green spaces such as high use sports grounds and parks are maintained with recycled water. While there are many bike paths, the network has several gaps that hinder connectivity. Overall, maintenance of green spaces is uneven, with some reserves not maintained beyond mowing due to legacy land management issues connected to mining.

Blue spaces are considered to be more scarce (little water in the landscape) or less pleasant (water quality issues) than green spaces, and therefore not as accessible. The most appealing blue spaces such as former reservoirs are not a walkable distance for the majority of Bendigo residents.

6.2. Urban elements functioning as part of the urban water system (1.5 / 5)

Although the Council has identified the need for urban space to function as a part of the water system and the urban heat island effect has begun to be discussed, action is in the early stages.

There are few examples of WSUD such as raingardens or stormwater harvesting, though there is some rainwater use. A combination of typical summer rainfall patterns – prolonged dry spells with occasional intense rain events – and predominantly clay and rocky soils result in rainwater not being retained in the landscape for beneficial use following rain events. Drainage relies on traditional piping to outlet waterways that are generally channelised or heavily degraded. This is true of most new development in addition to established areas. Although there is irrigation of many green spaces, there is little confidence among participants that urban heat island effects in Bendigo are currently being mitigated by green infrastructure.

6.3. Vegetation coverage (2 / 5)

Vegetation coverage across the whole of the municipality is about 30%. Within the urban area of Bendigo, it is believed to be 15%. Some growth areas have even lower vegetation cover.

Tree canopy cover for parts of Bendigo is thought to have reduced in the last 15 years due to new urban development, though it may recover as trees planted as part of new developments grow.

While there are some tree protections in place, there are no policies to promote urban or tree shade. However, there is a policy currently being prepared for inclusion in the Greater Bendigo Planning Scheme that addresses vegetation coverage.

Goal 7. Promote adaptive infrastructure (2.8 / 5)

7.1. Diverse fit-for-purpose water supply system (2.5 / 5)

Coliban Water is the sole provider of potable water supply to Bendigo. Some premises and areas are serviced by a recycled water network by Coliban Water. For example, two new residential estates have third pipe connections to this network. The recycled and raw water supply is approximately 9 ML / day, compared to 35 ML / day of potable water.

There is some diversity of water supply sources, as Coliban's potable water network draws raw water from the Goulburn system via Lake Eppalock and Waranga Western Channel, and from the Upper Coliban catchment. Supply makes use of the water market to meet demand.

There are potential supply options that have not been taken up, including stormwater, rainwater and groundwater. Increased use of decentralised storage and treatment has been assessed by Coliban Water as not economically viable in the Bendigo market (Coliban Water, 2017c).

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

In the outer areas of Bendigo, nearly all retardation basins provide public space, with four or five including playgrounds on higher ground. Some include treatment measures. Many areas prone to flooding are protected as open space and include walking and cycling paths. The channel system also includes bike paths. Headworks storages have open space, but wastewater treatment and water treatment sites are closed to the public.

All Goulburn Murray Water Storages (including Lake Eppalock) have boating access. The Coliban storages are open for onshore fishing only, and Coliban Water policy recognise access.

7.3. Integration and intelligent control (2 / 5)

Many end users, for example rural customers (e.g. wineries, orchards) and urban park and sports ground managers, have intelligent irrigation systems. However, conventional water services have control systems considered to be the industry standard.

There are currently investigations into smart approaches to water system service provision. Coliban Water is exploring the potential application of digital metering, and the Council is preparing municipal emergency plans to incorporate rainfall meters to better pinpoint specific flooding threats, such as bike paths along waterways.

7.4. Robust infrastructures (3 / 5)

Funding for maintenance and renewal is allocated according to risk assessment based on historical performance and very long-term forecasts. There is routine monitoring of water storages and wastewater system. Though the former has a very low failure rate, the latter has a high failure rate – a higher incidence of sewer overflows – relative to other towns in the Coliban Water supply district, despite proactive monitoring of sewer levels. This is largely the result of the age of some of Bendigo's sewerage infrastructure and its use of earthenware pipelines. New or upgraded assets are designed to current national design standards.

There are five-yearly reviews of demand forecasts to ensure sufficient capacity in treatment plants and water and sewer networks to accommodate demand. Augmentation is planned for commissioning as it is needed.

The stormwater system is considered to be less robust at the local scale due to instances of minor blockages, but these are addressed on a case-by-case basis.

7.5. Infrastructure and ownership at multiple scales (3 / 5)

Rainwater tanks are encouraged under State building regulations, though not mandatory. There are some greywater systems in operation. Detention basins are encouraged, but dependent on site assessment. The conditions under which small-scale private collective wastewater treatment systems are price-competitive with community systems appear to be limited. All proposals of this type have been assessed by Coliban Water as requiring subsidisation in the long-term to be acceptable to end users.

7.6. Adequate maintenance (3 / 5)

Every Coliban Water asset is registered in an asset management system and in a GIS, and has an estimated lifespan based on a range of inputs. Coliban Water's maintenance process is audited by the Victorian Auditor-General's Office and the Water Services Association of Australia.

The Council also has a sophisticated asset management system that includes green infrastructure. As a result, there are few instances of a failure to supply water, though not all green infrastructure is maintained at the same level; priorities are balanced according to criteria measuring the quality and amenity value of the infrastructure.

Water Sensitive Outcomes

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

WSC Outcomes

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

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

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

The results shown in Figure 6 indicate how Bendigo scores against the expected Outcomes for the Water Cycle City.

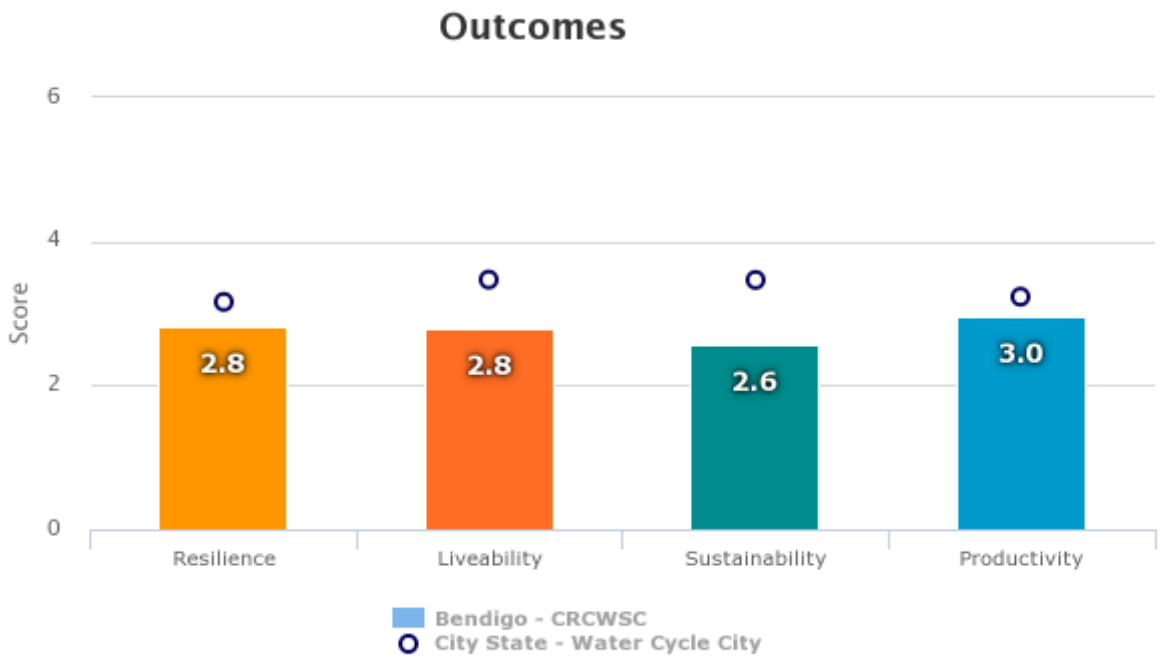


Figure 26. Bendigo WSC Index indicator scores represented by the WSC Outcomes of Resilience, Liveability, Sustainability and Productivity and compared with the ideal Water Cycle City

Appendix 3: Prioritisation of WSC Index indicators

An activity called 'Dot-mocracy' was completed in Workshop 4 (Industry) to consider priority outcomes across the WSC index indicators. Participants were first reminded of the WSC Index scores and results in a presentation before the activity commenced. The 34 index indicators and scores of the WSC Index were arranged on walls. Each participant received 10 dots and were asked to cast votes for indicators according to their priorities.

'Quality urban space' received the most votes, followed by 'Good water sensitive governance'. 'Ecological health', 'Community capital', and 'Equity of essential services' were ranked in the mid range. 'Adaptive infrastructure' and 'Productivity and resource efficiency' received the lowest number of votes. Indicators with a high number of prioritisation votes did not necessarily align with those that received lower benchmark scores.

The prioritisation result is not intended to be used directly in informing the selection of actions for implementation. Instead, it was an activity to get participants thinking about priorities as the process moves towards implementation planning that will need consideration of the allocation of scarce resources (funds, time, human capital). Prioritisation will be further explored in Workshop 5.

Table 16. WSC index goals and indicators prioritised by vote, ranked highest to lowest.

# votes	WSC Index Goal and Indicators	Score /5
12.0	**6. Ensure quality urban space**	**2.2**
15	6.2 Urban elements functioning as part of the urban water system	1.5
15	6.3 Vegetation coverage	2.0
6	6.1 Activating connected urban green and blue space	3.0
8.7	**1. Ensure good water sensitive governance**	**2.8**
18	1.2 Water is key element in city planning and design	2.5
15	1.5 Leadership, long-term vision and commitment	3.0
10	1.1 Knowledge, skills and organisational capacity	3.0
10	1.6 Water resourcing and funding to deliver broad societal value	3.0
5	1.4 Public engagement, participation and transparency	3.0
2	1.3 Cross-sector institutional arrangements and processes	2.5
1	1.7 Equitable representation of perspectives	2.5
6.0	**5. Improve ecological health**	**2.0**
10	5.1 Healthy and biodiverse habitat	2.0
6	5.3 Groundwater quality and replenishment	2.0
6	5.4 Protect existing areas of high ecological value	2.0
2	5.2 Surface water quality and flows	2.0
5.8	**2. Increase community capital**	**2.8**
9	2.4 Community preparedness and response to extreme events	2.5
7	2.3 Shared ownership, management and responsibility for water assets	2.5
6	2.1 Water literacy	3.0
5	2.5 Indigenous involvement in water planning	3.0
2	2.2 Connection with water	3.0
5.0	**3. Achieve equity of essential services**	**4.0**
12	3.4 Equitable & affordable access to amenity values of water assets	2.5
4	3.2 Equitable access to safe and reliable sanitation	4.5

# votes	WSC Index Goal and Indicators	Score /5
2	3.1 Equitable access to safe and secure water supply	5.0
2	3.3 Equitable access to flood protection	4.0
3.7	**7. Promote adaptive infrastructure**	**2.8**
8	7.2 Multi-functional water system infrastructure	3.0
7	7.1 Diverse fit-for-purpose water supply system	2.5
2	7.6 Adequate maintenance	3.0
2	7.3 Integration and intelligent control	2.0
2	7.4 Robust infrastructure	3.0
1	7.5 Infrastructure and ownership at multiple scales	3.0
2.2	**4. Improve productivity and resource efficiency**	**2.4**
7	4.5 Maximised resource recovery	2.0
2	4.2 Low GHG emission in water sector	1.0
1	4.1 Benefits across other sectors because of water-related services	3.0
1	4.3 Low end-user potable water demand	3.0[2]
0	4.4 Water-related commercial and economic opportunities	3.0

Appendix 4: Transition Dynamics Framework Matrices and Evidence

This appendix presents the detailed Transition Dynamics Framework results and evidence that underpin the analysis presented in Section 5.

WSC Index Goal 1 Ensure good water sensitive governance

The following table represents the TDF matrix assessment for WSC Index indicators:

1.1 Knowledge, skills and organisational capacity (3/5)
1.3 Cross-sector institutional arrangements and processes (2.5/5)
1.4 Public engagement, participation and transparency (3/5)
1.5 Leadership, long-term vision and commitment (3/5)
1.6 Water resourcing and funding to delivery societal value (3/5)
1.7 Equitable representation of perspectives (2.5/5)

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

The following table represents the TDF matrix assessment for WSC Index indicator 1.2 Water is key element in city planning and design (2.5/5)

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

The following table summarises the evidence used for TDF analysis of Goal 1

Champions	**Platforms**	**Knowledge**	**Projects**	**Tools**
With range of high level strategies, COGB show vision. Some individuals have seniority and strong connections BSG, Friends of groups Coliban Water established vision for IWM solutions with NCCMA and COGB Some orgs struggling to resource collaboration and alignment, local gov has no dedicated funding for this Alignment varies depending on need (e.g. drought) A network of connected champions across organisations is needed	Higher level decision-makers work together, e.g. IWM Forum. This may have potential, but at a high level. Cross-sector institutional collaboration is widely supported, although organisational investment and action to improve arrangements and processes is varied. Recent examples of cross-sector institutional arrangements and processes are forerunners of change. High-level strategies are in place, but in practice cross-institutional coordination is less likely to occur in smaller projects. Practitioner-level needs a platform Coliban Water restarted a developer forum with the UDIA. It needs more time / meetings to create an effective platform but has potential. Need for a platform for operational cooperation There is a tendency for isolated platforms (e.g. open space strategy) Community-level platforms (e.g. NCCMA's and Coliban Water's) are consultative, COGB uses some community decision-making platforms. Not yet broad support for diverse representation in practice	Commitment to skills and integrated water capacity within Coliban Water and emerging within COGB. Knowledge is still emerging. There is an issues-based approach. There is support for transition but focus needed on building capacity for collaborative governance. Solutions require justification based on the potential to monetise enviro and social benefits. More data needed to build robust business case for WSC Solutions often, remain engineering-focused rather than multi-disciplinary.	The drought, floods and major projects such as the Superpipe, Recycled Water Factor and Bendigo Urban Flood Study saw a spike in community engagement. Recent projects like Plan Greater Bendigo and 2017 Pricing Submission show progress in public engagement. Funding still largely for conventional services. Not yet secure, consistent funding, and incentives that are specific to Bendigo for projects to get off ground.	State and regional water policy acknowledges the role of integrated water management in urban planning. State Government requires all water corporations to consider measures to deliver planning outcomes for "sub-regional" areas and integrate water cycle management with relevant planning schemes. COGB planning scheme recognised value of at-source water capture. Water corps are required to consult community in planning processes. DELWP is promoting the incorporation of community values in integrated water management plans. The Bendigo Community Engagement Guidelines and Toolkit is a comprehensive guide for public engagement. More guidance is needed to support collaboration – how to do it effectively.

WSC Index Goal 2. Increase community capital

The following table represents the TDF matrix assessment for WSC Index indicator/s:

2.1. Water literacy (3/5)
2.2. Connection with water (3/5)
2.3. Shared ownership, management and responsibility of water assets (2.5/5)

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

The following table represents the TDF matrix assessment for WSC Index indicator 2.4 Community preparedness and response to extreme events (2.5/5)

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

The following table represents the TDF matrix assessment for WSC Index indicator 2.5. Indigenous involvement in water planning (3/5)

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

The following table summarises the evidence used for TDF analysis of Goal 2

Champions	**Platforms**	**Knowledge**	**Projects**	**Tools**
Many community groups engaged with water or open space and calling for stewardship or participation, eg: • Bendigo Sustainability Group • Friends of Ironbark Gully • Environment and Sustainability Committee (CoGB) • Make a change – (engaged communities) Coliban Water literacy. Ironbark Gully Friends – funding and joint contributions to Master Plan; but it was about their initiatives rather than shaping a broader conversation around stewardship. DDW are building more champions across orgs, teaching about healing country and embedding culture (not just planting trees). This is reaching critical mass in terms of general awareness. Kinders and schools are strong advocates, and incorporate DDW teaching as standard practice. COGB champions for participation generally	BSG is an existing strong platform but is not embedded with institutions. Collaboration tends to be forced by regulation. There is a reliance on procedural collaboration rather than strategic, and the transaction cost is high. DDW Country Plan's messaging is a start, as is the establishment of a water champions group of Elders. Historically, Bendigo Creek not a source of pride for the community. Wanyarram Dhelk Water Watch Plan Greater Bendigo IWM Forums	There is a recognised need but the solutions or models are unclear for broadening voices Capacity building is a challenge. The Greater Bendigo Public Health and Wellbeing Plan asked community about their priorities. They were not related to water or green infrastructure, but increased levels of service, more accessible active transport options and access to more diverse and sustainable housing. Bendigo community considered to have a general understanding of the water cycle, know what they are paying for and realise water is undervalued. This has increased as a result of the Millennium Drought. Engagement tends not to reach uninformed demographics. High water literate groups often those engaged by education campaigns. Understanding of basic water cycle elements is far stronger than its understanding of the industry, such as how raw water is sourced and treated, and the treatment of sewage Indigenous knowledge is considered important to water system planning and management in Bendigo	Reliance on volunteers & semi-retired limits the capacity to design & demonstrate solutions – "would love to but don't know how, too hard, and it takes too much time". There are many individual physical projects aligned with strategies, but not relating to stewardship. There is a potential to learn from other groups, e.g. Merri Creek, Ballarat Environment Network. Projects: • Permanent Water Saving Rules (PWSR) education campaign was introduced in 2016 to ready customers for potential water restrictions • Wanyarram Dhelk • North Bendigo Landcare partnered with land managers to undertake restoration works along various stretches of the Creek. • Ironbark Gully Trail Concept Plan • Coliban Water - educational activities in schools to raise understanding of the water cycle, catchment functions, water efficiency and Bendigo's water history. • Water Watch • A Shared Vision for Restoring Bendigo Creek is one of four flagships projects detailed in the *Greater Bendigo Environment Strategy 2016-2021*	Potential to use Settlement Agreement as a tool to leverage funding. Water authorities are required to educate the public about any aspect of water supply, sewerage, drainage and in some cases waterway management (Water Act) PWSR Indigenous representation in water planning and governance is supported at the state level by the DELWP Aboriginal Inclusion Plan 2016-2020, the Water for Victoria Strategy (2016) and the Integrated Water management Framework for Victoria (2017) COGB 20 Year Goals for Sustainable Water emphasise the importance of community education to save water and Traditional Owner involvement in management of waterways.

WSC Index Goal 3. Achieve equity of essential services

The following table represents the TDF matrix assessment for WSC Index indicator
3.1 Equitable access to safe and secure water supply (5.0/5)
3.2 Equitable access to safe and reliable sanitation (4.5/5)
3.3 Equitable access to flood protection (4.0/5)

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

The following table represents the TDF matrix assessment for WSC Index indicator 3.4 Equitable and affordable access to amenity values of water-related assets (2.5/5)

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

The following table summarises the evidence used for TDF analysis of Goal 3

Champions	**Platforms**	**Knowledge**	**Projects**	**Tools**
Plan Greater Bendigo includes a Major Project to provide an "alternative cost model for the provision of reticulated sewerage" (2017, p 61). This initiative promotes innovation in wastewater treatment in small towns and outlying suburbs of Bendigo through the installation of compact wastewater treatment systems that collect, treat and reuse wastewater to establish a carbon offset plantation	Coliban Water worked with UDIA on developer forums to address water servicing. NCCMA and Council have introduced new flood extent mapping for Bendigo, more accurately defining flood risk for residents. Council established the Epsom, Ascot, Huntly Flood Mitigation Advisory Committee to bridge government, development and community interests in the management of flooding	Across the whole of COGB, more than 10,000 households manage wastewater onsite. Areas near Bendigo include parts of Eaglehawk and Sailors Gully in the north-west, Ascot in the north-east, and Junortoun and Strathfieldsaye in the south-east. Examples of off-site wastewater discharge have been observed in many of these areas. There is a Flood Mitigation Options Study in development	One of the Major Projects identified in concept-stage in Plan Greater Bendigo is to develop more equitable and affordable sewerage for greenfields and peri-urban areas of Bendigo. The development of the Domestic Wastewater Management Strategy by Council involved engagement with the community and stakeholder organisations, as well as desktop and field investigations. Further community engagement was undertaken during the public exhibition phase of the DWMS prior to its adoption by Council.	At the national level, the NHMRC regulates water quality standards, for example through the Australian Drinking Water Guidelines (2011) and the Australian Guidelines for Managing Risks in Recreational Water. The Safe Drinking Water Act 2003 (Vic) requires monitoring of water quality at raw water sources as well as in treated water through collection of data across numerous water quality parameters. There are several guidelines and regulations applicable to the management of wastewater, at the Commonwealth, state and local levels. NCCMA has an online flood mapping tool referred to as Flood Eye Standard C25 in the Urban run-off management objectives requires stormwater flows in 20% AEP events (1-in-20 year) to be contained within the drainage system.

WSC Index Goal 4. Improve productivity and resource efficiency

The following table represents the TDF matrix assessment for WSC Index indicators:
4.1 Benefits across sectors because of water-related services (3/5) and
4.4 Water-related economic and commercial opportunities (3/5)

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

The following table represents the TDF matrix assessment for WSC Index indicators:

4.2 Low GHG emission in water sector (1.0/5)

4.3 Low end-user potable water demand (3.0/5)

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

The following table represents the TDF matrix assessment for WSC Index indicator 4.5 Maximised resource recovery

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

The following table summarises the evidence used for TDF analysis of Goal 4

Champions	**Platforms**	**Knowledge**	**Projects**	**Tools**
Coliban Water's role as champion is promoted by its Statement of Obligations. Coliban Water supports multiple sources for operational flexibility (recycled water, raw water). COGB recognises importance of water in planning. Coliban Water and others support demand management, e.g. Sport & Rec, COGB (irrigation), ResourceSmart schools There is an effective officer network of champions among many organisations. Bendigo Bank and Birchgrove are innovative private sector champions	Coliban Water and COGB in long-term planning discussions, both informal and formal (through IWM Forums). Coliban Water is in industry-wide energy network. Regional councils' Infrastructure Design Manual Bendigo's scale supports connections. Local media, sporting organisations on board Some community health platforms are ad hoc, though there is more established coordination around emergency management. Bendigo Flood Study and Advisory Committee	There is a good understanding of: impact of price and water restrictions on potable water demand, water and waste recycling, connection between energy & water supply, and flood risk. The lack of groundwater contamination solutions is a gap. This affects aquifer storage potential. Coliban Water has begun to develop an Energy Management Strategy. Clearwater. WSUD guides and manuals (for Melb context) Groundwater and the ability to engage community in solutions are gaps Flood mitigation options less well advanced Less knowledge of heat wave management.	Programs to promote trials and demonstrations include Schools Water Efficiency Program, Rural Water Awards, Premier's Sustainability Awards, Waste to Energy Infrastructure Fund Aqua2000, Superpipe, localised water catchments, water factory, COGB irrigation, Hospital laundry project Community receptive to these innovations	Victorian Organics Resource Recovery Strategy COGB One Planet Framework Climate modelling by Coliban Water Victorian Flood Management Strategy Clauses 14.02, 19.03-2, 55.07, 56.07 of the VPPs. Flood controls, but these advantage new development, leaving existing vulnerability in place. Controls insufficient to prevent increasing stormwater flows from urban development (i.e. increased impervious surfaces). Permanent water saving rules Drought resilience tools & plans Carbon neutrality 2030 targets

WSC Index Goal 5. Improve ecological health

The following table represents the TDF matrix assessment for WSC Index indicators:

5.1 Healthy and biodiverse habitat (2.0/5)
5.2 Surface water quality and flows (2.0/5)
5.4 Protect existing areas of high ecological value (2.0/5)

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

The following table represents the TDF matrix assessment for WSC Index indicator 5.3 Groundwater quality and replenishment (2/5)

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

The following table summarises the evidence used for TDF analysis of Goal 5

Champions	**Platforms**	**Knowledge**	**Projects**	**Tools**
Diverse, broad and significant support. Bendigo Sustainability Group; Subgroups including Bendigo Family Nature Club, Northern Bendigo Landcare (Nicole Howe), the Bendigo & District Environment Council (Simon and Shelley advocate against mining activities in the creek), and Bendigo Field Naturalists Club Friends of: Ironbark gully, Bendigo Botanic Gardens, Long Gully Arts community NCCMA – historically have had only rural focus, have increased urban focus within the last 12 months. Currently run the Water Keepers program and Water Watch in schools Dja Dja Wurrung - Wanyarram Dhelk project– possible connector and lead champion in this space. Coliban Water have financially supported this project Coliban Water and NCCMA partnership on Coliban water storage ecosystem benefits Parts of CoGB are champions, e.g. City Strategy. COGB has high level long-term enviro strategy	Wanyarram Dhelk is comanaged by NCCMA and Dja Dja Wurrung, and funded by COGB, DELWP and Coliban Water. A Joint Management Plan for the GB Nat Park is being developed by Dja Dja Wurrung and Parks Vic. NCCMA River Detectives & Waterwatch programs, working with schools. National Water week has had collaboration by NCCMA, Coliban Water and COGB. Coordination by community environment groups, helped by overlapping membership. NCCMA monthly partners forum, water quality monitoring is comprised of networks of government agencies; water watch, water keepers UDIA meetings are potential platforms BSG – Bendigo family nature club	Victoria has modelling and databases of observations to assist conservation efforts and to inform planning and development. Stream condition is formally monitored every few years, although WaterWatch provides data. COGB has committed to undertake a comprehensive review of water quality monitoring data to inform future infrastructure planning, but unclear if resources are available. Groundwater resources are reasonable well-understood. Recent investigations of groundwater quality indicate the need for careful management. A long-term sustainable solution for managing groundwater quality and depth has not yet been determined. Indigenous knowledge of the creek – Wanyarram Dhelk has capacity building function.	Strategy/vision projects e.g. “City in the Forest, Forest in the City”, and Bendigo Creek restoration. White Hills Botanic Gardens plans to remodel creek DDW Wanyarram Dhelk project – creating a series of billabongs, starting with frog ponds, weed removal, revegetation. There is the desire to expand There is a campaign by community org to change status of Wellsford State Forest to national park. Northern Bendigo Landcare, PV & NCCMA project to weed and revegetate, install GPTs, install educational signage, test water quality and install nesting boxes for wildlife along Bendigo Creek. Groundwater management project. Insufficient action across the whole of Bendigo (particularly retrofit) to address urban runoff	Clauses 52.16 and 52.17 of the Planning Scheme are significant for the regulation of native vegetation removal. COGB has applied land use planning overlays over sensitive areas of the city to protect existing native vegetation, including the Environmental Significance Overlay and Vegetation Protection Overlay. Clause 21.08 of the GB Planning Scheme includes the strategy to ”minimise nutrient discharges and urban drainage that affects the quality of water in the municipality’s streams”. Victoria has databases (e.g. NatureKit) of biodiversity observations and modelled habitat to assist conservation efforts and to inform planning and development. Many areas with high ecological value are protected under the public land reserve system. This controls the use of public land. One of the highest forms of protection is offered through the reservation as a National Park, which was granted to much of Bendigo’s surrounding Box-Ironbark forests in 2002. VEAC, currently investigating Wellsford State Forest, may recommend altering status to national park. Victoria’s Flora and Fauna Guarantee Act is currently under review by the State Government. Concern that permit requirements not adequately enforced.

WSC Index Goal 6. Ensure quality urban space

The following table represents the TDF matrix assessment for WSC Index indicators:

6.1 Activating connected urban green & blue space (3/5)
6.2 Urban elements functioning as part of urban water system (1.5/5)
6.3 Vegetation coverage (2/5)

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

The following table summarises the evidence used for TDF analysis of Goal 6

Champions	**Platforms**	**Knowledge**	**Projects**	**Tools**
COGB has several high-level vision or policy documents, e.g. Urban Stormwater Management Plan, Plan Greater Bendigo Discussion Paper Draft, and the public space plan. COGB has started to plan for urban heat island mitigation, but in the early stages. Coliban Water is exploring integrated urban planning as part of its water supply strategy. In COGB, there is a team that champions WS outcomes, but this has not become operational yet There is a risk of champion fatigue. Several projects have been driven by community. Champions in the health sector are still emerging.	Platforms arose from crisis to 'get things done'. Examples include the Water Factory, recycled water for Roslyn Park. Strategic alignment and collaboration is seen in some larger projects, often led by a single agency or department. Operational decision-making is siloed within council (planning – engineering – city strategy) GREATER is an integrated health platform that COGB has auspiced and involves DHHS and Bendigo Health. It is designed to partner with schools and businesses. Its most recent campaign has been for tap water to replace sugary drinks.	Some Bendigo developments include recycled water however workshop participants felt these early examples do not yet demonstrate WSUD best practice. Monitoring of long-term scenario planning is limited. It is not clear if there are solutions for Bendigo's climate and soil conditions. Bendigo has dry summers with infrequent heavy rain, and predominantly clay and rocky soils, which make natural infiltration challenging. Some benefits need value/costing. Ideas have difficulty in transference. There is difficulty in justifying solutions for Bendigo on economic grounds. The implications of the Murray Darling Basin Agreement are not clear – some projects involving stormwater retention may require GMW approval.	Crusoe Reservoir, Spring Gully Creek, Long Gully are successful projects. Ironbark Gully in planning stages. There are few examples of small-scale WSUD such as raingardens or stormwater harvesting, though there is some rainwater use. There may be a lack of funding for new projects. Although there is irrigation of many green spaces, the links to mitigating urban heat impacts have not been explicitly drawn. Developers appear ready to implement small-scale WSUD, but not enough impetus from authorities due to risk perceptions. There is a need for stronger planning framework to support prioritising WSC.	Planning policies and tools exist, e.g. Clause 11.04 and 55.07 of VPPs, but are not comprehensive. State and regional water policy acknowledges the role of integrated water management in urban planning. COGB planning scheme recognised value of at-source water capture (Cl 21.02). 10 minute neighbourhood early policy. However, WS approaches are underregulated, with no targets for some developments (e.g. car park permeability). There are community and precinct plans that support WSC, but these often fail at the operational stage due to perceptions over feasibility. There is a need for a strategy to drive implementation. While there are some tree protections in place, there are no policies to promote urban or tree shade. There is policy addressing vegetation coverage being prepared.

WSC Index Goal 7. Promote adaptive infrastructure

The following table represents the TDF matrix assessment for WSC Index indicators:

7.1 Diverse self-sufficient fit-for-purpose water supply (2.5/5)
7.3 Integration and intelligent control (2/5)
7.4 Robust infrastructure (3/5)
7.5 Infrastructure & ownership at multiple scales (3/5)
7.6. Adequate maintenance (3/5)

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

The following table represents the TDF matrix assessment for WSC Index indicators 7.2 Multi-functional water system infrastructure (3/5)

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

The following table summarises the evidence used for TDF analysis of Goal 7

Champions	**Platforms**	**Knowledge**	**Projects**	**Tools**
Coliban's Urban Water Strategy supports key strategies for maintaining operational flexibility through multiple raw water sources, and optimising the use of alternative sources of water in fit-for-purpose applications. The City of Greater Bendigo (COGB) is collaborating with DELWP in a project addressing IWCM planning. Coliban Water plans to invest $3.9 million in mains water and $3.3 million in sewer mains network maintenance activities to reduce breaks, leaks and blockages	Coliban Water and COGB in long-term planning discussions, both informal and formal (e.g. through IWM Forums). Regional councils' Infrastructure Design Manual	The drought that afflicted Bendigo between 2004 and 2009 prompted a widespread search for better ways to use existing water reserves in addition to finding new sources. The Bendigo Recycled Water Scheme produces Class A recycled water for large non-residential customers and some residential customers. Victoria has a high degree of skill, knowledge and capacity in delivering multi-function water infrastructure. The existence of capacity-building programmes such as Clearwater, running since 2002, and the publication of several WSUD guides and manuals (e.g. Planning a Green-Blue City, DELWP, 2017; WSUD Guidelines, City of Melbourne; Maintaining water sensitive urban design elements, EPA, 2008), may have driven the acceptance of new solutions, at least in metropolitan areas.	The Peppercorns and Evergreen Waters (700 lots) residential estates are connected to the recycled water network for dual pipe water. COGB is developing a 'Greening Bendigo' strategy to capture and use storm water from public spaces on site to increase their attractiveness. Funding was received for two projects: Stormwater Harvesting at the Bendigo Botanic Gardens and Irrigation for Upper Rosalind Park.	Regulations, policies and programmes to encourage alternative sources of water include: • Clause 55.07 of the VPPs to encourage the use of alternative water sources • Clause 56.07 of the VPPs deals with integrated water management • Clause 19.03-2 of the VPPs encourages the planning of stormwater systems to include measures to reduce peak flows and assist screening and treatment of stormwater • Clause 19.03-2 of the VPPs encourages the reuse of wastewater and urban runoff (Vic) Council committed to developing an Asset Management Plan in its Urban Stormwater Plan to quantify renewal timeframes for stormwater assets, plan infrastructure replacements and upgrades, and detail maintenance requirements.

Cooperative Research Centre for Water Sensitive Cities


Level 1, 8 Scenic Boulevard
Monash University
Clayton VIC 3800


info@crcwsc.org.au


www.watersensitivecities.org.au