



# Water Sensitive Cities Benchmarking and Assessment

City of Cockburn Council Area



E2DESIGNLAB



FOUNDRY  
FORGE AHEAD



CRC for  
Water Sensitive Cities

**Document Title**

Water Sensitive Cities Benchmarking and Assessment: City of Cockburn Council Area

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**Workshop facilitation**

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# 1. Introduction

*Water sensitive cities are resilient, liveable, productive and sustainable. They interact with the urban hydrological cycle in ways that: provide water security for economic prosperity through efficient use of diverse water resources; enhance and protect the health of watercourses and wetlands; mitigate flood risk and damage; and create public spaces that harvest, clean and recycle water. Its strategies and systems for water management contribute to biodiversity, community health and wellbeing, carbon sequestration and reduction of urban heat island effects.<sup>1</sup>*

Through the planning and delivery of a Water Sensitive Cities (WSC) conceptual framework, urban areas can exploit the synergies between local water management and urban greening while creating resilient and liveable neighbourhoods. This is achieved by strengthening governance arrangements, building community capital, and investing in multifunctional adaptive infrastructure. This is complemented by the provision of high quality and connected open spaces, protecting and enhancing the ecological values of the urban landscape, providing a diversity of water supply options and recreating a more natural water cycle that restores soil moisture while reducing stormwater runoff.

The Cooperative Research Centre for Water Sensitive Cities (CRCWSC) is an Australian research centre that brings together many disciplines, world-renowned subject matter experts, and industry thought leaders to revolutionise urban water management in Australia and overseas.

The CRCWSC has developed a tool driven by the best research to understand how far towards a water sensitive city places are so they can take steps and track progress toward that goal. Communities expect efficient, water-supported, vibrant cities and this is a great way to see how we are doing in delivering those outcomes. The purpose of the WSC Index Tool is to guide governments and organisations to transition cities into liveable, resilient, sustainable and productive places through water related actions.

The City of Cockburn Council (Council) area was benchmarked using the WSC Index Tool in February 2018 with the participation of Council staff, and participants from other external councils and organisations. The goal was to share knowledge across organisations and come to an understanding of how far towards a water sensitive city the Council area is now.

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<sup>1</sup> <http://watersensitivecities.org.au/>

## 2. WSC Index Tool

*Water Sensitive Cities are a way of understanding water's role in place-making through a broad understanding of the way it contributes to the identity and liveability of a city. People need water for drinking and washing, but also for cool, healthy, green places to live, work and play.*

The WSC Index Tool has undergone multiple development phases including a co-design process with industry partners. Its application relies on cross-organisational knowledge sharing and collaboration that strengthens broader industry relationships to deliver commitment to action.

The WSC Index aims to:

- Provide a communication tool for describing key attributes of a Water Sensitive City;
- Articulate a shared set of goals of a Water Sensitive City;
- Provide benchmarking for a city's water-sensitive performance;
- Measure the progress and direction towards achieving Water Sensitive City goals; and
- Assist decision-makers prioritise actions, define responsibility and foster accountability for water-related practices.

The WSC Index Tool identifies all the key components (indicators) of a Water Sensitive City. The Tool covers 7 goals and assesses 34 indicators that represent important attributes of a Water Sensitive City. It is designed to benchmark cities based on water sensitivity

performance and provides users with the capacity to monitor and evaluate potential management actions against performance to make the most impact with available resources. It enables users to explore measures that deliver improvements in liveability, sustainability, resilience and productivity.

A summary of the goals and indicators of the WSC Index Tool are listed in the following section.

It is anticipated that subsequent benchmarking would be undertaken every two to three years in order to track progress and achievements.

The CRCWSC, E2Designlab and Foundry have partnered to apply the Index across various scales and locations throughout Australia.

Further reading regarding the design and application of the WSC Index Tool can be found here:

<https://watersensitivecities.org.au/solutions/wsc-index/>

## Summary of Goals and Indicators

Ensure good water sensitive governance	Increase community capital	Achieve equity of essential services	Improve productivity and resource efficiency	Promote adaptive infrastructure	Improve ecological health	Ensure quality urban space
Knowledge, skills and organisational capacity	Water literacy	Equitable access to safe and secure water supply	Maximised resource recovery	Diversify self-sufficient fit-for-purpose water supply	Healthy and biodiverse habitat	Activating connected urban green and blue space
Water is key element in city planning and design	Connection with water	Equitable access to safe and reliable sanitation	Low GHG emission in water sector	Multi-functional water infrastructure	Surface water quality and flows	Urban elements functioning to mitigate heat impacts
Sound institutional arrangements and processes	Shared ownership, management and responsibility of water assets	Equitable access to flood protection	Water-related business opportunities	Integration and intelligent control	Groundwater quality and replenishment	Vegetation coverage
Public engagement, participation and transparency	Community preparedness and response to extreme events	Equitable and affordable access to amenity values of water-related assets	Low end-user potable water demand	Robust infrastructure	Protect existing areas of high ecological value	
Leadership, long-term vision and commitment	Indigenous involvement in water planning		Benefits across other sectors because of water-related services	Infrastructure and ownership at multiple scales		
Water resourcing and funding to deliver broad societal value				Adequate maintenance		
Equitable representation of perspectives						

## 2.1 1 Process for Rating Indicators

A full day workshop was held at City of Cockburn (Council), on the 6th of February 2018. Participants included internal stakeholders from a range of council departmental units and external stakeholders. 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. Reaching 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 attribute a score of 1-5 to each rating which showed the collective results in real-time. These results were then discussed, with evidence identified (e.g. policy documents, organisational materials, expert views, etc.) to support the various scores attributed to the indicators before reaching consensus on a given rating and level of confidence.



Figure 1. Council benchmarking workshop

## 2.1 Interpreting WSC Index Scores

Four analytical frameworks support interpretation of the index scores and provide insight into the management responses that should be prioritised to advance water sensitive practice. There are (1) water sensitive city goals (2) city state benchmarking (3) principles of water sensitive practice and (4) water sensitive outcomes. For reporting in this document, the water sensitive city goals and city state benchmarking are used.

### Water Sensitive Goals

The 34 indicators are analysed against the 7 goals of a Water Sensitive City and the goals include:

- Ensure good water sensitive governance
- Increase community capital
- Achieve equity of essential services
- Improve productivity and resource efficiency
- Improve ecological health
- Ensure quality urban space, and
- Promote adaptive infrastructure.

### City State Benchmarking

The Urban Water Transitions Framework identifies evolving socio-political drivers and service delivery functions as six distinct developmental states that cities may fulfill in response to society's expanding objectives for urban water management. The city state benchmarking provides the first analytical lens, based on a subset

of all indicators that are rated above or equal to the threshold values associated with each idealised city-state.

### Principles of Water Sensitive Practice

The three pillars of practice that are essential to deliver water sensitive services are:

- Water-Sensitive Communities where people engage in water-conscious behaviours, feel connected to their water environments and appreciate the many values of water;
- Cities as Catchments to provide resources at different scales in fit-for-purpose applications; and
- Cities providing Ecosystem Services to integrate water sensitive practices into the urban landscape, providing multiple benefits such as heat mitigation, ecological health and landscape amenity.

### Water Sensitive Outcomes

Water sensitive outcomes assesses 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.

### 3. Evaluation of Performance

#### 3.1 Water Sensitive Goals

Figure 3 summarises the performance of the Council area against the 7 goals of a Water Sensitive City. The overarching goals include:

- Ensure good water sensitive governance;
- Increase community capital;
- Achieve equity of essential services;
- Improve productivity and resource efficiency;
- Improve ecological health;
- Ensure quality urban space; and
- Promote adaptive infrastructure.

The results for the Council area (shown by the shaded light blue area) are compared to an idealised Water Cycle City (dashed green line). For the goals of water sensitive governance, equity of essential services, and adaptive infrastructure the results exceed the Water Cycle City benchmark.

A deficit in attaining key attributes of a Water Cycle City is most evident across the goals of community capital, productivity and resource efficiency, ecological health, and quality urban space. An overview of the indicators that fall short of attributes for a Water Cycle City are listed below.

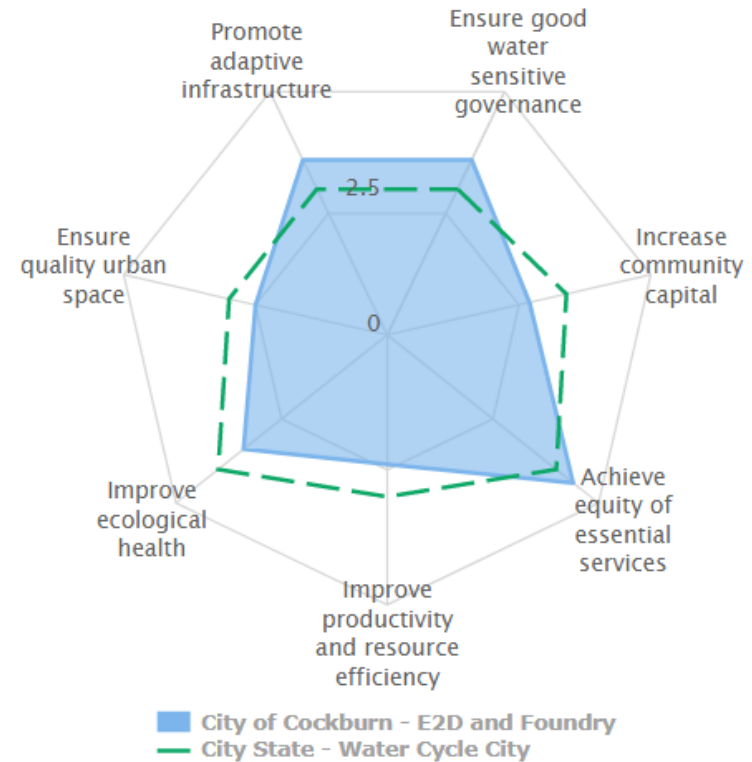


Figure 3. Performance against water sensitive goals



### 3.1.1 Increase community capital

#### **Indicator: Water literacy**

People have an interest in water but may have little knowledge as information is not regularly provided. On the whole there is a need to improve water literacy across the community. Improved literacy is the precursor to greater understanding and involvement in the planning, ownership and management of water related assets (both natural and constructed). This will also strengthen understanding around the importance of water to liveability through contributing to greener, cooler and more pleasant urban spaces.

#### **Indicator: Shared ownership, management and responsibility of water assets**

Management and responsibility of water assets is with formal water governance organisations (Water Corporation, Department of Water and Environmental Regulation (DWER) and Council). Communities play a role in the ownership, operation and maintenance of bores located on private properties. One example funded by Council is for the management of a wetland and is largely directed at tree planting. There is an absence of guidelines to support community ownership of water assets. Formal community based policy will help inform and empower the community to become actively involved in managing water related assets located on private properties (such as, bores, retention and detention systems).

#### **Indicator: Community preparedness and response to extreme events**

Droughts are the most common emergency for the community and Council. Water restrictions and plans to respond to droughts have been in place for a long time and the public accepts them. There was a general sense by workshop participants that citizens are not prepared for other “extreme events” such as heatwaves and floods. Council should improve preparedness and identify appropriate responses to better manage impacts associated with extreme events.

### 3.1.2 Improve productivity and resource efficiency

#### **Indicator: Low GHG emission in water sector**

Majority of power supplied to Perth is sourced from coal and therefore the supply of power to water related services and infrastructure results in high GHG emissions. A total net production of 738 tonnes CO<sub>2</sub>-equivalents per 1000 connected (BOM NWP part B 2015-2016) has been reported.

#### **Indicator: Water-related business opportunities**

Some business opportunities have been created by virtue of changes in water management. Water wise garden design and incentives and grants generate business opportunities for garden designers. New market sectors were identified in intelligent control systems for irrigation schemes with improved systems (closed looped systems) and wastewater technologies for water treatment and disposal technologies.

### 3.1.3 Improve ecological health

#### **Indicator: Healthy and biodiverse habitat**

The Beeliar and Jandakot Regional Parks feature conservation reserves and wetlands. There are isolated pockets of vegetation between wetlands and lakes but overall the sites remain not well connected. The level of biodiversity across the Council area has been shown to be declining. In general biodiversity lack connection across the broader municipality. There is a biodiversity scheme that aims to assist residential property owners to plant native species. The active connection of patches of urban habitat will improve biodiversity whilst progressively linking cooler greener areas across the municipality.

#### **Indicator: Groundwater quality and replenishment**

Groundwater systems are an important component of the urban water cycle. Some monitoring of groundwater is undertaken however a drying climate and increase in water demand has resulted in groundwater levels declining in the area. Lowering groundwater levels has impacts on groundwater dependent ecosystems. Allocation limits are being reviewed to determine sustainable allocation thresholds to 2030. Domestic bores are largely unregulated and there is limited data regarding private use of bore water. Continued monitoring and further demonstration of Managed Aquifer Recharge (MAR) schemes such as the Jandakot Mound will help ensure the long term protection of this precious resource into the future.

### 3.1.4 Ensure quality urban space

#### **Indicator: Urban elements functioning as part of the urban water system**

Although there are a few examples of urban elements providing multifunctional uses, such drainage basins incorporated into public open spaces, there is a lot of opportunities for improvement across the municipality. Some parks are being irrigated with groundwater to deliver greater recreational opportunities and some cooling benefits may occur at these locations. Workshop participants commented that new developments commonly offered end of pipe solutions rather than integrated designs that maximise social and environmental outcomes. This has resulted in disparities developing across the Council area, but changes in planning attitudes are helping to address this. Council should require developers to deliver beautiful, sustainable and liveable lots and precincts.

#### **Indicator: Vegetation coverage**

2020VISION reports a 16.6% loss in shrubbery and 5% loss of canopy since 2011. There is currently about 15% tree canopy cover remaining, but it is spread disproportionality across the Council area. Council's Street Tree Planning Policy is helping to address this decline in canopy cover and Council are currently undertaking an Urban Forestry Plan.

## Other

### **Indicator: Integration and intelligent control**

Intelligent control systems are limited to the control of single purpose water assets such as water supply and sewerage managed by Water Corporation. 40% of Council's irrigation systems use soil moisture probes linked to central control management system with full automation to trigger irrigation systems to come on in the future.

### 3.2 City State Benchmarking

Figure 2 summarises the city state benchmarking results for the Cockburn City Council (Council) area. Percentage attainment for each city state ranged from 100% as a Supply City and Sewered City down to 16% as a Water Sensitive City. This section summarises the key elements that contribute to the overall percentage attainment of each city state.

#### 100% attainment of Water Supply City and Sewered city

The municipality rated 100 % as a Water Supply City and 100 % as a Sewered City. The entire community has equitable access to safe and secure drinking water. Similarly, everyone has access to safe and reliable sanitation. The Council area is connected to the centralised sewerage network owned and operated by Water Corporation. The Wastewater Treatment Plant treats water to 'developed world standards' prior to release to an ocean outfall.

#### 100% attainment of Drained City

The municipality rated 100% as a Drained City. Council currently mitigates for all flood events and has conducted flood modelling to inform high-tide plus storm event mitigation responses. Older areas with higher levels of flood risk have been identified and changes to stormwater management is taking place to ensure appropriate drainage measures are implemented.

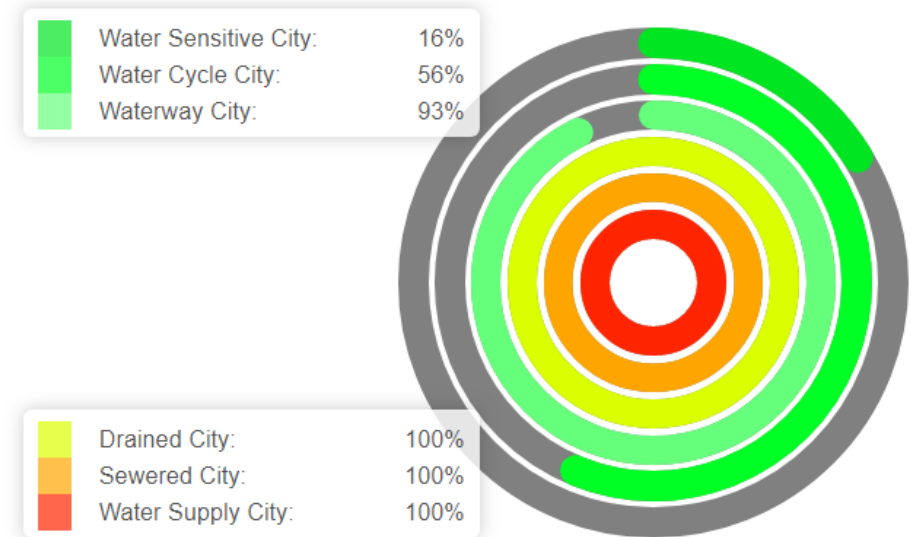


Figure 2. Benchmarking results for City of Cockburn

#### 93% attainment of Waterway City

The municipality rated 93% as a Waterway City. The Council area is characterised by numerous water features including a chain of wetlands and lakes such as Bibra Lake and Manning Park, as well as the coastline along Coogee Beach. People feel connected to these areas and they are popular to explore. The water quality in the lakes is monitored and is improving through the use of nutrient stripping basins.

Council should continue to preserve and enhance natural habitats through a range of strategic plans, schemes and grants. Examples include the Bush Forever Conservation Program and the Landowner Biodiversity Conservations Grant. Habitats are at risk of declining over time with development but opportunities to retain and improve over time also exist if carefully planned for.

Council has developed strong water governance through its engineering and environment teams. Council skills and knowledge in water management continues to strengthen with water related projects incorporated into district plans and local planning policies for WSUD.

A commitment to water conservation and efficiency through a water audit program allowed Council to achieve Waterwise Council status in 2013. This included the development of the Kwinana Water Recycling Plant (KWRP) in 2004 and geo-thermal heating for the aquatic centre 'Cockburn ARC' in 2017. Groundwater management actions in the area are improving with the implementation of a 10-year plan to address and safe guard the use of groundwater resources such as the Jandakot Mound aquifer. Some groundwater replenishment is also occurring.

### **56% attainment of Water Cycle City**

The municipality rated 56% as a Water Cycle City. Council has been implementing several initiatives to bring water to the front of mind for the municipality. Within city planning and design, Council has implemented control measures for the protection of water resources in receiving environments (LPP 5.3) and incorporated

water into district and local water management strategies, such as the Treeby District Structure Plan.

Cross-sector institutional arrangements and processes have also led to positive outcomes for water supply policy, surface water quality, and coastal protection (e.g. Cockburn Sound Coastal Alliance) with the DWER, CSIRO and several neighboring councils.

Opportunities for water-related businesses are being created through an ongoing push for water efficiency technologies through free home eco-audits for residents and sustainable projects grants for small businesses and schools.

Council also continues to enhance and connect its green-blue assets to create opportunities for community education and recreation. This has been achieved with numerous strategic documents in active transportation networks, public open space, street verge improvements, and urban heat island mitigation initiatives. Notable enhancements are now being seen across the northern section of the city. Educational opportunities are provided via the Cockburn Wetlands Education Centre with several supporting environmental festivals and school programs.

### **16% attainment of Water Sensitive City**

The municipality rated 16% as a Water Sensitive City. This is largely associated with the region's diversification in self-sufficient, fit-for-purpose water supplies and investments in resilient infrastructure. The Council area receives its drinking water supply through the Perth Integrated Water Supply Scheme (IWSS) by the Water Corporation. Water is affordable and hardship arrangements exist from the Western Australian Council of Social Services and Water Corporation.

## 4. Council's Twelve Point Plan

A twelve-point action plan has been developed for the City of Cockburn (Council) and their stakeholders. Actions listed do not reflect the priority of the actions to be undertaken. Actions are mutually reinforcing and provide an overarching framework to guide initiatives across Council to progress closer towards the aspirations of a Water Sensitive City.

### **Action 1: Join the Water Sensitive Cities transitions network**

Join the Water Sensitive Cities transition network in Perth, comprised of participants across industry who have had key roles in the development of the Vision of Perth and the Water Sensitive Cities Index. Participation with this group will enable Council to connect to other industry leaders and coordinate actions across organisations such as Department of Water, Water Corporation, and other councils to move towards a Water Sensitive City.

### **Action 2: Establish interdisciplinary project delivery teams**

Establish an interdisciplinary Integrated Water Management (IWM) team within Council. The purpose of the team is to undertake interdisciplinary project scoping and delivery to broaden knowledge sharing and skills and deliver holistic, water sensitive outcomes.

### **Action 3: Calculate the water and pollutant balance to identify opportunities and future risks**

Integrated Water Management requires sound knowledge of water sources and demands at the local scale, and the opportunities they present. A water and pollutant balance is a mass balance

accounting for water and pollutants entering, accumulating and exiting a system. The water balance includes potable mains water, alternative water supplies, wastewater, rainwater, stormwater, groundwater and evapotranspiration and infiltration. Collate and review relevant GIS and satellite data, including mapping of land use coverage, impervious fraction, drainage, supply and sewerage networks and groundwater across the municipality. Assess the beneficial impact of all existing WSUD assets. Use forecasts for population growth and changes in climate to assess future risks and opportunities for action.

### **Action 4: Showcase innovation in practice to mitigate the urban heat island effect**

The Council area has been identified as considerably vulnerable to heat stress (updated 2020 Vision report) and has been identified as a Council area for large greening opportunities. The Council area has 15% tree canopy and 26% total coverage of all vegetation. As the climate continues to become drier, the importance of canopy cover and “soil water banking” through the integration of engineered systems that mimic natural processes will become increasingly important. Passive and active irrigation with alternative water supplies will play a vital role in the establishment of greater canopy cover. Implement trials and demonstrations of ‘climate sensitive’ practices across streetscapes, commercial areas and the private realm of urban elements to function as part of the urban water system. As a minimum Council should support opportunities for more multifunctional green spaces in established areas that retain water in the landscape, such as along drainage corridors and the across the public realm.

### **Action 5: Funding maintenance of water related assets**

One of the biggest obstacles is resourcing maintenance of green blue assets by the Council. The incorporation of realistic maintenance costs into Council budgets will help ensure that these assets are adequately maintained and thereby help reduce the future risk and the financial burden associated with rectifying assets. Council should commence a life cycle costing data base to enable improved planning for maintenance of wetlands, lakes and other WSUD assets and to assist Council to better forecast budgets for the management into the future.

### **Action 6: Increase permeability**

There is a lack of policy to drive healthy and biodiverse habitats across Council areas in the private realm, especially for sub-divisions where increases in hard surfaces are occurring through urban consolidation and land use changes. This reduces catchment permeability and reduces groundwater recharge, as well as contributing to further loss of flora and fauna. There are several policy examples across Australia that have private permeability targets and tree plantings that Council should consider the merit of introducing.

### **Action 7: Increase utilisation of recycled water**

Currently 80% - 90% of irrigation water comes from bores. Council should commence a trial using 'fit-for-purpose' recycled water from the Woodman Point Wastewater Treatment Plant (WWTP) to irrigate priority parks, sporting grounds, and green spaces. This will

provide a climate resilient water source for irrigation, a reduction in groundwater use, and a reduction in treated discharges to the Cockburn Sound. The Cockburn Sound is important ecological area which has experienced a decline in health (die back of sea grass) in the northern section. This section is within the Council area and includes the location of the Woodman Point treated water discharge point. McGillivray Sporting Complex is the first large scale green space irrigation scheme in the Perth metropolitan area to use recycled water from the Subiaco WWTP. This provides a good case study for the City of Cockburn. This action will aid the Water Corporation's commitment to recycle 30% of managed wastewater by 2030.

### **Action 8: Greater protection and management of groundwater resources**

Over 50% of water supply is self-supply via domestic bores, which are largely unregulated. Private groundwater bores can also have low integrity and a high failure rate. With a drying climate and growing water demand, this has resulted in groundwater levels declining in the area with falling wetland water levels across the Swan Coastal Plain. Greater regulation of domestic bores will help Council protect and sustainably manage this common resource for future generations.

### **Action 9: Quantify water related benefits and costs**

Project selection should be based on the best-value-for-money options. This requires a project's broader economic, social and environmental benefits and future mitigated costs to be monetised in the evaluation. A multiple-criteria decision-making model should



be used by Council to assist in the selection of project. Efforts should be made to monetise broader water related benefits and costs.

### **Action 10: Bring the community along on the water sensitive journey**

Undertake a water literacy initiative in collaboration with Water Corporation and other councils to improve community understanding of the urban water cycle and the benefits of green-blue assets. This initiative should seek to create a shared understanding of the necessary changes in practices required to transition towards a water sensitive future beyond water efficiency to see the full enjoyment of the benefits of being a Water Sensitive City.

Recent research by the CRC for Water Sensitive Cities suggests that the first step is for industry to educate and familiarise community members with water-related terminology<sup>2</sup>. An education toolkit could:

- Describe the vision and aspirations of a Water Sensitive City using language that will not be lost on the wider community.
- Explicitly link Water Sensitive City outcomes to broader community aspirations for greener urban landscape and improved liveability.
- Outline inter-disciplinary planning and co-design processes, involving the community.

- Clarify where and how community can make choices and contribute to solutions.
- Inform the community about the basic requirements for installation and maintenance of assets that could be located on their properties.

### **Action 11: Co-design process for flagship water sensitive projects**

Council have the foundations and platforms to engage with the community but approaches do not provide citizens with a sense of power to influence. Co-design involves a shift in the focus of responsibility and control so that community become active partners in designing and shaping of water sensitive projects, rather than being passive recipients of pre-determined public realm designs. There are a number of potential projects in the public realm that Council are seeking to commence in the coming years. Council should identify one project to develop and trial a co-design process which could be used as a template for collaborating with citizens in the future.

### **Action 12: Tackle GHG emissions in the water sector**

There is a lack of policy and investment to drive delivery of multi-functional design outcomes to reduce energy consumption (or generate alternative energy supplies). There are a few examples of these technologies being trialled which are important to innovate practice, as well as provide an opportunity for education and knowledge sharing. There are excellent demonstration projects across Australia showcasing innovate waste to energy technologies

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<sup>2</sup> Fielding, K., Dean, A., Newton, F. (2016). Community understanding of water terminology. Melbourne, Australia: Cooperative Research Centre for Water Sensitive Cities.

to reduce the energy footprint of the water sector. Council has an important role to play to advocate for investment by Water Corporation and other stakeholders to demonstrate such initiatives locally in the Perth region.








## Appendix 1 List of Workshop Participants

**Workshop Facilitators:** Lindsey Brown and Sara Lloyd

Council Participants			
Name	Unit within Council	Name	Unit within Council
Adam Harris	Parks & Environment Team	Celina da Costa	Statutory Planning
Anton Lees	Parks & Environment Team	Andrew Trosic	Strategic Planning
Christopher Beaton	Parks & Environment Team	Tiffany van der Linde	Strategic Planning
Correa Driscoll	Parks & Environment Team	Mayor - Logan K Howlett	Strategic Planning
Claire Dunn	Parks & Environment Team		
Julie Reidy	Parks & Environment Team		
Linda Metz	Parks & Environment Team		
Lou Vieira	Parks & Environment Team		
Matthew Kennewell	Parks & Environment Team		
Andy Jarman	Parks & Environment Team		
Sabina Rahman-Horstmann	Engineering Development		
Sabbir Hussain	Engineering Development		
Sharif Malik	Engineering Development		
Doug Vickery	Engineering Development		
Patricia Orr	Heath Services		
Glenn Pethick	Cockburn Arc		
Brett McEwin	Cockburn Arc		
Sarahjayne Whiteley	Cockburn Arc		
Alana Austen	Sustainability Committee		
Lynette Jakovcevic	Sustainability Committee		
Daniel Arndt	Sustainability Committee		
Stephen Cain	Sustainability Committee		
Lee Haining	Facilities Maintenance		

Industry Stakeholder Participants	
Name	Organisation
Felicity Bairstow	Cockburn Wetlands Education Centre
Denise Crosbie	Cockburn Wetlands Education Centre
Philip Jennings	Cockburn Wetlands Education Centre
Lauren Waite	Water Corp representatives (Local)
Jane Sturgess	Water Corp representatives (Local)
Adele Gismondi	Water Corp representatives (Local)
Anna Lichovidova	Water Corp representatives (Local)
Jason Mackay	Water Corp representatives (Local)
Amy Cowdell	Department of Water and Environmental Regulation
Melissa Bromly	Department of Water and Environmental Regulation
Alan Rajah	Shire of Serpentine Jarradale
Anita Marriott	City of Vincent
Victoria Weir	City of Nedlands
Rachel Williams	City of Canning
Sally Boer	E2Designlab
Shelley Shepherd	Urbaqua
Helen Brookes	Urbaqua
Melissa McGrath	JBA
Andrew Ogden	Western Irrigation

## Appendix 2 Summary of Ratings for Each Indicator

<b>1. Ensure good water sensitive governance</b>	<b>3.6</b> 
1.1. Knowledge, skills and organisational capacity	3.0
1.2. Water is key element in city planning and design	3.5
1.3. Cross-sector institutional arrangements and processes	3.5
1.4. Public engagement, participation and transparency	4.0
1.5. Leadership, long-term vision and commitment	4.5
1.6. Water resourcing and funding to deliver broad societal value	4.0
1.7. Equitable representation of perspectives	3.0
<b>2. Increase community capital</b>	<b>2.7</b> 
2.1. Water literacy	2.5
2.2. Connection with water	3.5
2.3. Shared ownership, management and responsibility of water assets	2.5
2.4. Community preparedness and response to extreme events	2.0
2.5. Indigenous involvement in water planning	3.0
<b>3. Achieve equity of essential services</b>	<b>4.4</b> 
3.1. Equitable access to safe and secure potable water supply	5.0
3.2. Equitable access to safe and reliable sanitation	4.0
3.3. Equitable access to flood protection	4.5
3.4. Equitable and affordable access to amenity values of water-related assets	4.0
<b>4. Improve productivity and resource efficiency</b>	<b>2.4</b> 
4.1. Benefits across other sectors because of water-related services	2.0
4.2. Low GHG emission in water sector	1.0
4.3. Low end-user potable water demand	3.0
4.4. Water-related economic and commercial opportunities	3.0
4.5. Maximised resource recovery	3.0
<b>5. Improve ecological health</b>	<b>3.4</b> 
5.1. Healthy and biodiverse habitat	3.0
5.2. Surface water quality and flows	3.5
5.3. Groundwater quality and replenishment	3.0
5.4. Protect existing areas of high ecological value	4.0
<b>6. Ensure quality urban space</b>	<b>2.5</b> 
6.1. Activating connected pleasant urban green and blue space	3.5
6.2. Urban elements functioning as part of the urban water system	2.0
6.3. Vegetation coverage	2.0
<b>7. Promote adaptive infrastructure</b>	<b>3.6</b> 
7.1. Diverse fit-for-purpose water supply system	4.0
7.2. Multi-functional water system infrastructure	3.0
7.3. Integration and intelligent control	2.5
7.4. Robust infrastructures	4.0
7.5. Infrastructure and ownership at multiple scales	4.0
7.6. Adequate maintenance	4.0



### Appendix 3 Workshop Notes for Each Indicator

Indicator	Rating 0 to 5	Confidence High/Med/Low	Evidence
<b>1. Ensure good water sensitive governance</b>			
1.1. Knowledge, skills and organisational capacity	3	High	<ul style="list-style-type: none"> <li>- We have the skills and the knowledge but actively choose not to embrace the water cycle. Don't have capacity (financially) to fully embrace it.</li> <li>- Water governance is still directed through engineering (ie. local water management strategies). Engineering had a workshop with everyone in the room and the knowledge was there but the risk with implementing the infrastructure was too high.</li> <li>- Environment management teams are providing input into the solutions. Council needs to be across all of these. Skill building still needs to be developed.</li> <li>- The level of knowledge is determined by the organisational structure or where you work. E.g. Rec facility workers have knowledge a large amount of policy around water and Water Corp policy/plan around this. Therefore, ARC may score higher than the rest of the city. If role doesn't require you to think about water, then you probably won't have a lot of knowledge.</li> <li>- Need to develop an interdisciplinary approach e.g City of Mandurah has this in place - would be good to chat with them.</li> <li>- Have a water efficiency action plan – water-wise councils team with representatives from different departments.</li> <li>- Having asset management teams involved right from the start allows them to embrace it.</li> <li>- Risk adverse as there is a price tag associated with it. Risk appetite and different financial model needs to be in place.</li> <li>- Workshops have shown the knowledge is there and there is a fundamental understanding of what needs to take place.</li> <li>- Local planning policies for WSUD are in place. Local planning policy 5.2. and 5.3.</li> <li>- DCU Developmental control unit.</li> <li>- There are examples of developers coming together to form cross disciplinary groups. Cockburn Coast and Shoreline projects. e.g. Engineers, landscape. holistic approach.</li> <li>- Evidence from the Calleya example.</li> <li>- Waste and environmental programs.</li> <li>- Environmental education i.e. Bibra Lake</li> <li>- Water is considered in district plans and local plans</li> <li>- Port Coogee non-potable water supply scheme</li> </ul>

Indicator	Rating 0 to 5	Confidence High/Med/Low	Evidence
<b>1. Ensure good water sensitive governance</b>			
1.2. Water is key element in city planning and design	3.5	High	<ul style="list-style-type: none"> <li>- Lead agency is unspecified. Strategic Planning group in the City of Cockburn tend to be the lead as looking at changes in land use. Work closely with Dept of Water (now DWER),</li> <li>- Built form design is mostly engineering. Engineering team is where the decision lies. Authority here with engineering director.</li> <li>- Evidence: District and Local Water Management Strategies.</li> <li>- There is recognition that water planning is not just planning policy.</li> <li>- Cockburn coast alliance - dept of transport and defense working together. Modelling for the future. Several years and now at CSCA project plan (coastal example).</li> <li>- Water supply collaboration. DWER MAR policy, stormwater harvesting in collaboration with local government and regional water management strategies. Sub regional planning frameworks by DWER. These are all examples of scenario planning.</li> <li>- Planning stage decisions are often already made and zoned accordingly. Landowners want to benefit financially. Infill often done cheaply. Structure plan stage where density can be changed. State govt has and can override this. Not just lot size but built form that is put in place. Portion of site needs to be permeable and allow room for a tree.</li> <li>- Design WA hopefully will include this.</li> <li>- Finger often pointed at planners. Still too much emphasis on brick and tile houses in WA.</li> <li>- High level intent and outcomes don't match despite same legislative base.</li> <li>- WA houses are not designed for the land (unless in areas of topographical challenges e.g. Perth Hills).</li> <li>- Treeby District structure plan, local water management strategy</li> <li>- LPP 5.3 Control Measures for protecting water resources in receiving environments</li> </ul>
1.3. Cross-sector institutional arrangements and processes	3.5	High	<ul style="list-style-type: none"> <li>- Joint accountability as part of the Waterwise council program. Functional water savings team within City of Cockburn. Gold status across water cycle now.</li> <li>- Transparency processes. Difference between this and being understood. Highly technical knowledge highly accessible but not understood by the public.</li> <li>- Accessibility - change the language or target sectors to communicate what you are doing. Policy needs to be better understood by everyone.</li> <li>- City has recently overhauled website to be fully accessible by ESL and the culturally and linguistically diverse community.</li> <li>- We do have transparency but also might be about complacency. Community might not be interested. Council officers and public have different perceptions. Those inside the organisation feel it is more transparent. To those outside, not so transparent.</li> </ul>

Indicator	Rating 0 to 5	Confidence High/Med/Low	Evidence
<b>1. Ensure good water sensitive governance</b>			
			<ul style="list-style-type: none"> <li>- Being accessible and being transparent - there is a difference. If there was enough interest around a topic the City would act on it. If the community doesn't know what to ask for then it's hard to act on it. Need to act on where we get the most enquiries.</li> <li>- Waterwise aquatic facilities group. Tap In results now available.</li> <li>- There are a lot of working groups in the city.</li> <li>- As a resident it is not clear how the city is interacting with others on water.</li> <li>- Collaboration was not clear to an outsider.</li> </ul>
1.4. Public engagement, participation and transparency	4	High	<ul style="list-style-type: none"> <li>- Formal citizen engagement is often informal. Participating in water governance in some cases but not all. The formality in governance is a key area for improvement. Community drives a lot of the informal engagement processes, highly active. Protection of wetlands of interest, public seeks input on activities that relate to these especially. The City of Cockburn does genuinely empower groups to comment and engage, not shut down. Avenues for comment are provided.</li> <li>- "Comment on Cockburn" - a platform for issues and projects, etc. Email where you can click and comment.</li> <li>- Not sure how engaged volunteer organisations are at initial stages of projects. Not sure how much collaboration is going on.</li> <li>- Local planning strategy for water management - lists all the things the city is doing for community comment.</li> <li>- Letters to key community groups: Community Reference Group, Aboriginal reference group, youth advisory group, yangebup resident association, Beeliar progress association, Treeby resident group. Support that the city provides for these groups is sector leading. Cockburn community page - all groups are listed here.</li> <li>- Citizen, single person is transparent. Minister for volunteer and community services returned a letter to citizen, ""easier to communicate with minister than with council"". Citizen needs need to be met. People make their own solution as they feel abandoned.</li> <li>- Radio Fremantle as one avenue to communicate.</li> <li>- Formal Community Engagement Strategy, Communication Plan. Dedicated community engagement officer.</li> <li>- Many and varied activities at place.</li> <li>- Bibra Lake- Cockburn Wetland Education Centre. Emails and workshops for kids</li> <li>- Treeby District Plan, meeting with public/residential. Time to provide feedback and comments. Staff mentioned water and state govt policies, but got the feeling not informed about the reasons or purpose of some of the policies i.e. water protection area. Bush forever and water protection area largely preserved"</li> </ul>
1.5. Leadership, long-term vision and commitment	4.5	High	<ul style="list-style-type: none"> <li>- Different policies and strategies. Overarching Sustainability Strategy (incorporates water). Water efficiency action plan (endorsed by council). Water efficiency budget to deliver on items. Also to ensure all City departments are incorporated in Water Efficiency Action Plan.</li> <li>- Benchmarking endorsed by leaders.</li> </ul>



Indicator	Rating 0 to 5	Confidence High/Med/Low	Evidence
<b>1. Ensure good water sensitive governance</b>			
			<ul style="list-style-type: none"> <li>- Water Corp and DWER and minister all supportive.</li> <li>- Vision for Greater Perth WSC.</li> <li>- Missing formal policy aspects.</li> <li>- Part of ICELI project from the inception. First to uptake water sustainability issues. Embedded in the organisation for 8-10 years. Targets and goals set and changes.</li> <li>- Specific integrated WSC policy missing but integrated in everything.</li> <li>- Water wise council.</li> <li>- Licensing- meters and efficiency plan</li> <li>- Water saving measures- scheme use"</li> </ul>
1.6. Water resourcing and funding to deliver broad societal value	4	High	<ul style="list-style-type: none"> <li>- Budget focused where lowest cost options go ahead. Higher voted options may not deal with the budget.</li> <li>- Societal CBA - budget derived from societal impacts not lowest cost options. Could cut it by another 25/30%.</li> <li>- Go for the best bang for budget.</li> <li>- Not consistent. Compromise due to budget. Ad hoc.</li> <li>- WC customer research to look at water supply or demand and supply issue - what would be the community appetite for rainwater tanks (eg). WC has then suggested a price to implement this to incorporate into customer bill. Focus groups to determine willingness to pay.</li> <li>- Bigger projects always go out to tender with predetermined costs/budget. Submissions around this evaluation. Although it is not consistent. Examples: Free home water and energy audits (to a budget). Grants and subsidies. Support community groups.</li> <li>- City works closely with Water Corporation around water reduction. Recent programs around reduction of irrigation of POS. Recreational centre had to be a sustainable water user. Therefore question ad hoc as new projects all incorporate water sustainability.</li> <li>- Programs have been funded (10yrs ICELI).</li> <li>- Cockburn led the way with sustainability assessment and reporting. Monitoring for 10yrs. Water a part of this. Sustainability policy framework. Sustainability Strategy and State of Sustainability Report that comes out of this, key evidence. Waterwise council Annual Report. These reports are all available on the website.</li> <li>- Is it just happening at a project stage. At strategy level it is happening but not on ground. Council led activities/own and fund are doing well.</li> <li>- Policy consider liveability neighbours</li> </ul>
1.7. Equitable representation of perspectives	3	Med	<ul style="list-style-type: none"> <li>- Equity Policy - governance in charge of this.</li> <li>- City has many different policies to cover this. Equality in employment. Reference groups to ensure adequate engagement. Aboriginal liaison group. Disability. Youth. Not everyone is represented, but the City does its best.</li> </ul>

Indicator	Rating 0 to 5	Confidence High/Med/Low	Evidence
<b>1. Ensure good water sensitive governance</b>			
			<ul style="list-style-type: none"> <li>- Messages that do go out are available to all groups. Communication team ensures that messages are available and are also proactive in making this available as a right.</li> <li>- Internally - ID as an issue in senior management. Working closely with senior management. Elected body 50/50. Female deputy.</li> <li>- City has social procurement policy in place. Disability access and inclusion and have taken on city contracts. Good examples of participation but not leadership.</li> <li>- An issue for the past 6 yrs. 2yrs ago an executive position was created that recognises females in the workplace.</li> <li>- Internally a multi-cultural workplace. Quite diverse but not in leadership. "</li> </ul>

Indicator	Rating 0 to 5	Confidence High/Med/Low	Evidence
<b>2. Increase community capital</b>			
2.1. Water literacy	2.5	High	<ul style="list-style-type: none"> <li>- Cockburn Wetlands Education Centre.</li> <li>- City of Cockburn- website and Facebook.</li> <li>- World Environment Day primary schools’ festival.</li> <li>- New developments i.e. Calleya you get water wise landscaping done with a rain sensor and a street tree. No groundwater bores are allowed.</li> <li>- Get Wild About Wetlands school holiday program.</li> <li>- No recognition of personal responsibility for water cycle.</li> <li>- People have an interest in water but may have little knowledge as information not regularly provided.</li> <li>- Depends on socio-economic areas and cultural differences. Engaged in some places and not in others. Broad spectrum.</li> <li>- Issue exists with landowners above Jandakot Mound. Naive to crisis as dialogue about mound not being important to our sensitive city future. People don’t appreciate the resource and a complete lack of understanding. Want it developed but don’t realise issues that come with this. Landowners putting pressure on City and a lot of ignorance around water balance. Undermine government as precedent already been set to develop. Poor communication on how precious it is.</li> <li>- Reference to Melbourne’s water restrictions. General community get messaging that there is no need to worry. Positive messaging and "she'll be right mate".</li> <li>- Waterwise schools program - this is done really well (Waterwise school program and fertilise wise).</li> <li>- Messaging gets lost into higher education. This is largely a state govt issue (e.g. school curriculum).</li> <li>- Main evidence is from the CRC water literacy study and school curriculum. WA low percentage of water literacy.</li> <li>- Might be a generational thing - younger households take on the message. Older household think as long as I pay the bill. Message may need to do a full generation before we see change.</li> <li>- Older generation may not know why they are water saving (Focus group data).</li> <li>- Also depends on demographic and geography. Eg Hills residents have a better understanding of water cycle/efficiency.</li> <li>- Messaging at wetlands centre - your personal water use influences the wetlands.</li> <li>- Those that are engaged continue to be engaged. Mostly anecdotal evidence.</li> <li>- Perth is a bit different to other cities in that groundwater is a very important source here, including City of Cockburn.</li> <li>- Some data and insights from garden bore phone survey - SA3 Cockburn.</li> </ul>

Indicator	Rating 0 to 5	Confidence High/Med/Low	Evidence
<b>2. Increase community capital</b>			
2.2. Connection with water	3.5	High	<ul style="list-style-type: none"> <li>- Reasoning is based on a generational factor. Younger know about water cycle. Older don't think about water much more other than it is good for the garden.</li> <li>- Younger here than state average. 36/37 average.</li> <li>- Hamilton Hill, Spearwood - older</li> <li>- Intergenerational differences in water values describes the discrepancy here. New estates i.e. Treeby have stormwater systems as a feature in parks.</li> <li>- Cockburn has many wetlands which are popular for people to explore i.e. Bibra Lake and Manning Park. The ocean is also popular i.e. Coogee Beach.</li> <li>- Festivals are held i.e. Australia Day at Coogee Beach, Froggy's Fun on the Green at Manning Park.</li> <li>- Street trees- City of Cockburn is planting and maintaining street trees</li> </ul>
2.3. Shared ownership, management and responsibility of water assets	2.5	Med	<ul style="list-style-type: none"> <li>- Wetlands are also water assets - here the city works closely with the community. Tree planting and ongoing co-operation between interested community groups and schools.</li> <li>- Formal consultative structures are in place. Maintenance examples, advisory committees around the management of wetlands. Small handful of examples and not the case with all water assets in the city. Broader management falls to the utility.</li> <li>- Wetland Education Centre is a community group funded by the council. Sponsorship and agreement that volunteers will manage.</li> <li>- Tree planting around the wetlands - linked to policy and strategy around active citizen programs.</li> <li>- Absence of water corporation guidelines to allow community ownership.</li> <li>- In WA, City of Cockburn the majority of assets are serviced and maintained by Water Corporation, DWER and local government.</li> </ul>
2.4. Community preparedness and response to extreme events	2	Med	<ul style="list-style-type: none"> <li>- ARC is an emergency response location and there is a response plan.</li> <li>- If there is a natural disaster (flood) then people come to ARC.</li> <li>- Detailed plan LEMAP (Local Emergency Management Action Plan) regularly test the emergency plans. Most staff not involved in this. Residents don't need to know all this but if an emergency happens then everything is in place. As a city all the plans and training are in place for first responders. Heatwave counts.</li> <li>- Common for people not to be prepared for water emergency response.</li> <li>- Droughts are our most common emergency. Public accepts drought water restrictions and plans have been in place for a long time. Drought is a prolonged event - can respond to it but may be different to "extreme event"</li> <li>- Informed but not prepared.</li> </ul>

Indicator	Rating 0 to 5	Confidence High/Med/Low	Evidence
<b>2. Increase community capital</b>			
2.5. Indigenous involvement in water planning	3	High	<ul style="list-style-type: none"> <li>- Interests and knowledge needs to be considered. Formal policy covers off on interest only at this stage.</li> <li>- Cockburn Aboriginal Reference Group. Need to assess how well this is integrated into every project? How well does the reference group relay the information to their families/community? Ref group self-appointed, EOI via known family groups.</li> <li>- No overarching policy.</li> <li>- Involvement through our allocation plans- environmental water requirements and licensing process. Allocation plans: Cockburn, Middle Canning surface water allocation plan, Jandakot SPP 2.3</li> <li>- There is legislation in place to protect cultural areas of significance, conservation wetlands and Bush Forever sites.</li> <li>- Not in infrastructure and planning space. Jandakot Mound Community Reference Group with no indigenous representation.</li> <li>- Plans get referred to Dept of Indigenous Affairs. Works within a conservation reserve go through a formal process. Well beyond informal.</li> <li>- SW Aboriginal Sea and Land Council - all applications referred here.</li> <li>- Formal policy frameworks and strategies in Planning. Section 18.</li> <li>- Indigenous Aboriginal Community Development Officer with the City.</li> </ul>

Indicator	Rating 0 to 5	Confidence High/Med/Low	Evidence
<b>3. Achieve equity of essential services</b>			
3.1. Equitable access to safe and secure water supply	5	High	<ul style="list-style-type: none"> <li>- No non-reticulated areas.</li> <li>- Water Corporation needs to abide by the National drinking water guidelines, ERA and DWER licenses. Legislation, Acts, policies and guidelines are in place.</li> <li>- 2016 water, sewerage and irrigation performance report</li> </ul>
3.2. Equitable access to safe and reliable sanitation	4	High	<ul style="list-style-type: none"> <li>- Some areas don't have reticulated sewer.</li> <li>- Industrial and commercial are a focus as non-biodegradable products are mostly put in the system here.</li> </ul>
3.3. Equitable access to flood protection	4.5	High	<ul style="list-style-type: none"> <li>- We don't experience flooding very often.</li> <li>- One issue is storm events and coastal inundation. High tide plus storm event - mitigation responses need to be arranged. Modelling all in place for responses.</li> <li>- Currently mitigating for all flood events. Older areas have been identified in our strategy and changes to stormwater management is taking place to ensure appropriate mitigation.</li> <li>- Co-ordinated response is in place.</li> <li>- Think about the design criteria - places are designed to flood (e.g. 1:100-year event) which might provide difficulties for people to get through roads etc.</li> <li>- Insurance companies still identify flood risk.</li> </ul>
3.4. Equitable and affordable access to amenity values of water-related assets	4	High	<ul style="list-style-type: none"> <li>- Drainage for liveability.</li> <li>- City does it well. A lot of effort into making assets accessible to all. Water assets - Bibra Lake, Coastal Trail - people come here as a destination for water assets. 95% is publicly accessible.</li> <li>- Bike path, walking paths/trails around wetlands and along the coast.</li> <li>- Zones where we know people/visitation will increase are given more attention - eg ARC facility.</li> <li>- Port Coogee canal lots (small percentage), although POS nearby that is useable for all.</li> <li>- Free parking at beach.</li> <li>- Thompsons Lake is accessible - an under utilised resource.</li> <li>- Cockburn central - utilise public transport to get to ARC and surrounds.</li> </ul>

Indicator	Rating 0 to 5	Confidence High/Med/Low	Evidence
<b>4. Improve productivity and resource efficiency</b>			
4.1. Maximised resource recovery	3	Med	<ul style="list-style-type: none"> <li>- Water Corporation Perth (BOM NWP part B 2015-16) 100% of biosolids reused</li> <li>- Water recycling scheme from Woodland point goes to Kwinana water recycling point for reuse. Biogas facility. Biosolids across the metro area is recycled majority goes to farmland for agricultural soils, 10% to composting. Council greenwaste facility - mulching</li> <li>- Metronet- whole of Govt</li> <li>- Water Corp- plans to offset energy use</li> <li>- Perth Peel @ 3.5 M, Perth Peel water @ 3.5M</li> <li>- Stormwater is starting to be captured locally.</li> <li>- Treated wastewater is discharged into the ocean via Woodman Point or other WWTP. Some of this water is recycled i.e. Kwinana water recycling plant</li> </ul>
4.2. Low GHG emission in water sector	1	High	<ul style="list-style-type: none"> <li>- Perth IWSS - desalination, groundwater, surface water and water replenishment, Water Corporation Perth (BOM NWP part B 2015-2016)               <ul style="list-style-type: none"> <li>o Tonnes CO2-equivalents per 1000 connected sewerage properties</li> <li>o Sewerage 160 tonnes</li> <li>o Water 587 tonnes</li> <li>o <b>Total net 738 tonnes</b></li> <li>o 75% of water use is residential</li> <li>o <a href="http://www.bom.gov.au/water/npr">www.bom.gov.au/water/npr</a></li> </ul> </li> <li>- Groundwater use- bores, some electricity required to turn pump on.</li> </ul>
4.3. Water-related business opportunities	3	Med	<ul style="list-style-type: none"> <li>- New market sectors in intelligent control systems, more water efficient irrigation systems, market gardens with improved systems (closed systems) moving away from sprinkler heads, few architects looking at more water efficient designs.</li> <li>- Wastewater technologies - subsoil irrigation, water treatment and disposal technologies.</li> <li>- Water wise garden design and incentives and grants - generate business opportunities for garden designers. Every house gets rain sensor connected to their garden - technology advancement and business.</li> <li>- Woodman Point - water recreational opportunities and businesses.</li> <li>- Notable business opportunities.</li> <li>- This area is getting larger because of groundwater resources becoming limiting i.e. Design &amp; Green Infrastructure and events are occurring to inform and educate architects and designers.</li> </ul>

<p>4.4. Low end-user potable water demand</p>	<p>3</p>	<p>High</p>	<ul style="list-style-type: none"> <li>- 109 kL per year per capita 298 L/person/day Check in Perth Water Action Plan</li> <li>- Water supply demand model and annual reports for water licensees. Again, Perth doesn't fit into this quite right due to us having lots of self-supply use. Water protection areas around drinking water production bores in Jandakot</li> <li>- Only looking at groundwater supplies- abstraction 2016 19% industry 47% of water abstracted was for the scheme</li> <li>- Non-potable scheme: Kwinana water recycling plant to the south taking treated wastewater from Woodman Point to industry 5GL. policies/guidelines             <ul style="list-style-type: none"> <li>- MAR policy</li> <li>- Guideline for the approval of non-drinking water systems in Western Australia</li> <li>- Western Trade Coast heavy industry local water supply strategy</li> <li>- DOH plan</li> </ul> </li> </ul>
<p>4.5. Benefits across other sectors because of water-related services</p>	<p>2</p>	<p>High</p>	<ul style="list-style-type: none"> <li>- Metro Net - transport network incorporating water efficiency</li> <li>- Perth-Peel Regional Water Plan 2010-2030 - alternative water supplies, some areas have done cost-benefit analysis</li> <li>- Kwinana- treated wastewater to enable growth of Industry</li> <li>- Geo-thermal heating for aquatic centre - cost-benefit stacked up</li> <li>- Water Corp drains - land utilised and designed for multiple benefits but benefits not monetised.</li> <li>- Pump station designs in new areas</li> <li>- Treatment plant designs</li> <li>- Drainage systems, harvesting lakes where benefits aren't monetised but value engineering and construction</li> <li>- CSIRO Report for Kwinana - looking at house prices and benefit to house prices</li> <li>- Typically, broader benefits not monetised but some examples mentioned above</li> <li>-</li> </ul>



Indicator	Rating 0 to 5	Confidence High/Med/Low	Evidence
<b>5. Improve ecological health</b>			
5.1. Healthy and biodiverse habitat	3	Med	<ul style="list-style-type: none"> <li>- Conservation Reserves that incorporate aquatic ecosystems.</li> <li>- Drainage corridors with some vegetation.</li> <li>- There are isolated pockets between wetlands, not well connected.</li> <li>- Biodiversity Schemes - to assist residential properties to plant native species.</li> <li>- At risk of declining over time with development but opportunities to retain and improve over time also.</li> <li>- Is there mapping of ecological corridors? Is there future planning to connect/retain connections between habitats? Are there ecosystem condition assessments undertaken? Yes - bush forever sites.</li> <li>- Quite a few of the wetlands to the West and central have corridors of native vegetation to join them together.</li> <li>- 2020 vision report- clearing is continuing. City of Cockburn reduced its canopy by 5% from 2011 to 2016</li> <li>- Nature reserves".</li> </ul>
5.2. Surface water quality and flows	3.5	High	<ul style="list-style-type: none"> <li>- Annual - Environmental management of groundwater of Jandakot mound including surface wetlands.</li> <li>- The southern western part of the coast is part of Cockburn Sound Groundwater recharge and reuse, stormwater retention in wetlands, first flush into nutrient stripping basins and larger flows replenish wetlands (wetlands are groundwater dependent systems, topped up with treated stormwater surface flows).</li> <li>- Water quality in lakes is monitored and is improving (incorporating nutrient stripping basins).</li> <li>- The southern western part of the coast is part of Cockburn Sound Wetlands- there has been a decline in water levels- this is a concern across the Swan Coastal Plain.</li> <li>- Environmental management of groundwater from the Jandakot Mound – triennial compliance report 2015.</li> </ul>
5.3. Groundwater quality and replenishment	3	High	<ul style="list-style-type: none"> <li>- Poor groundwater related to previous land uses e.g. market gardens.</li> <li>- Groundwater declining in volume (-3 gigalitres available for use = overallocated).</li> <li>- 10 Year Plan in place to address and safe guards in place.</li> <li>- Domestic bores are largely unregulated.</li> <li>- Groundwater plumes, some managed, some groundwater replenishment occurring.</li> <li>- Dept of Water reports to EPA on Ministerial sites and many don't meet requirements (but historical land uses come into play).</li> <li>- Environmental management of groundwater from the Jandakot Mound – triennial compliance report 2015 and Cockburn allocation plan and Western Trade Coast local water supply strategy.</li> <li>- A drying climate and increase in water demand has resulted in groundwater levels declining in the area. Allocation limits have been/are being reviewed to determine sustainable allocation limits to 2030. Balancing the system.</li> </ul>

Indicator	Rating 0 to 5	Confidence High/Med/Low	Evidence
<b>5. Improve ecological health</b>			
5.4. Protect existing areas of high ecological value	4	High	<ul style="list-style-type: none"> <li>- Legislation and policy in place.</li> <li>- Vegetation removal permits - no requirement for a clearing permit at sub-division stage, only applies to Federally listed/protected species.</li> <li>- Department of Planning bush forever guideline, City of Cockburn sustainability policy.</li> <li>- Mapping has occurred in the area. When developments occur specific assessment on flora and fauna are required.</li> <li>- Dept of Planning - Jandakot State Planning Policy 2.3.</li> <li>- Banksia Woodland threatened community - offset requirements if removing but this hasn't happened (new Federal listing and no clear offsets identified).</li> <li>- Fire Management Plan working against retainment of bushland.</li> <li>- Sustainability Strategy - but no powers to exclude development, Planning Commission determines development footprints.</li> <li>- Some decisions made 20 years ago and may not still apply or be such a great decision now.</li> <li>- Community recognition growing through education programs.</li> <li>- Biodiversity protection of banksia woodlands.</li> </ul>

Indicator	Rating 0 to 5	Confidence High/Med/Low	Evidence
<b>6. Ensure quality urban space</b>			
6.1. Activating connected pleasant urban green and blue space	3.5	High	<ul style="list-style-type: none"> <li>- Public Open Space Strategy, City Strategic Plan, Sustainability strategy.</li> <li>- Bike Network and Footpath Network Plan, Heat Mapping, Canopy Cover, (Stephan CEO CofC mentioned lots of strategic docs support this Indicator and most are publicly available).</li> <li>- Anecdotal comparative evidence of life in other cities, biophilia concept shallow, water may not be a positive experience in the urban landscape (mosquitos).</li> <li>- Some projects have retained vegetation with well utilised public open space (e.g. Treeby).</li> <li>- Data/liveability/walkability studies: City of Cockburn facebook page and fit bit data suggested that people like to exercise here. Fitbit results show that one of the wetlands is one of the highest visited locations (Bibra Lake?).</li> <li>- Disparity in the city. Northern part of the city the assets are well connected. Southern part there is an absence in connectivity. Bike path team absent today.</li> <li>- Could improve connectivity between lakes and wetlands (at the moment major roads and not linked to bike paths - Planning Dept).</li> <li>- Many of the wetlands have paths around them. You can run quite easily from east to west i.e. Beeliam Drive to Coogee.</li> <li>- Easy access around Manning Park, new stairs in. Bibra Lake very easy to run/ride/walk around with a great adventure playground.</li> <li>- Fast growing area. Urban planning changing and future plans are demonstrating a large improvement.</li> <li>- Removal of bushland to implement public open space for new development.</li> <li>- Staff here may not be aware of all the strategies and policies that influence this indicator.</li> <li>- Wetlands are a natural link but there are poor provision of roads and paths. Can enjoy these wetlands in your car. These elements should be the basis for planning.</li> <li>- Small public open space in many areas of the City and in new development areas (to meet planning and liveable neighborhood policy and stormwater infiltration) useability of these areas is reduced due to the stormwater capture and management.</li> <li>- Street verge improvement policy.</li> <li>- Set dog off-lead exercise areas, these were developed with consultation with public.</li> </ul>
6.2. Urban elements functioning to mitigate heat impacts	2	Med	<ul style="list-style-type: none"> <li>- New development with end of pipe solutions rather than integrated outcomes to maximise yield - not just developers maximising yield but also reflecting the environment they are operating in, scale of development and developer.</li> <li>- One of the biggest obstacles is resourcing maintenance by the City.</li> </ul>

			<ul style="list-style-type: none"> <li>- Some parks irrigated with groundwater - cooling benefit but groundwater also supplies some drinking water demand. Lowering groundwater levels has impacts on groundwater dependent ecosystems.</li> <li>- Urban expectations make it difficult to achieve aspirations. It is not unachievable, just needs to happen in a different way.</li> <li>- Extremes - struggling with the position of the city as a whole. Planning attitudes are assisting in achieving great things.</li> <li>- Problems with developers incorporating WSUD. Disparities in the city due to this. Nationwide problem. Also, about the environment the developers are operating in within the City of Cockburn.</li> <li>- Affordability a key issue. Infill is predominately about affordability. Developers add in water sensitive attributes but that is at the expense of the buyer. Infill limited with existing infrastructure.</li> <li>- Small scale developer may not be able to achieve too much.</li> <li>- Workshop on biofiltration and one of the biggest obstacles is maintenance. Concern about uptake of new assets.</li> <li>- Not much reuse of stormwater harvesting occurs. However, drainage and basins are being used more and incorporated into public open space. In Aubin Grove not many street trees, canopy compared to Spearwood. City of Cockburn manages over 35,000 street trees (LPP 5.18).</li> </ul>
6.3. Vegetation coverage	2	High as data from CSIRO on tree cover.	<ul style="list-style-type: none"> <li>- 15% tree canopy (CSIRO data, 4th lowest in WA Vincent, Belmont and Fremantle lower).</li> <li>- Overall vegetation covers 26%.</li> <li>- Street Tree Planning Policy in place and Urban Forestry Plan in development.</li> <li>- Development may end up in reduction of tree canopy. 2011-2016 - has seen a decline in tree canopy cover.</li> <li>- 2020VISION- concerns with City of Cockburn 16.6% loss in shrubbery since 2011. A 5% loss of canopy. In urban WA average canopy cover is 19.95%, a reduction to 2011 levels. City of Cockburn has a rating of 1.5 out of 5, considered vulnerable and one of the worst LGA in Perth.</li> </ul>

Indicator	Rating 0 to 5	Confidence High/Med/Low	Evidence
<b>7. Promote adaptive infrastructure</b>			
7.1. Diversify self-sufficient fit-for-purpose water supply	4	High	<ul style="list-style-type: none"> <li>- Groundwater interception system (to protect marina) used for open space irrigation and garden irrigation - intercepts groundwater from market gardens.</li> <li>- Water Corp - Desalination plant, groundwater, dams - multiple sources that all contribute to centralised system.</li> <li>- South Jandakot drainage system and groundwater injection system.</li> <li>- Local privately-owned groundwater bores.</li> <li>- Industry - groundwater, Aquifer managed sources being investigated for fit for purpose.</li> <li>- 80% - 90% of irrigation water comes from bores (fit for purpose).</li> <li>- Dam water not factored into future planning because unreliable and also have desalination as the backup source.</li> <li>- Provides reasonable adaptability and flexibility.</li> <li>- Trials are in place to improve reuse of water for non-potable supplies.</li> <li>- Perth IWSS- diverse sources (ERA report).</li> </ul>
7.2. Multi-functional water infrastructure system	3	High	<ul style="list-style-type: none"> <li>- Drainage Management Strategy has looked at how assets can be multifunctional.</li> <li>- Some older drainage corridors and retarding basins have restricted access or fenced off.</li> <li>- There are lakes, wetlands, and corridors that are multifunctional.</li> <li>- Jandakot drainage system incorporates other elements.</li> <li>- Most parks act as detention zones/bubble up zones. Can have implications for functionality of the parks and location of parks (lowest areas of development sites).</li> <li>- Design guides available to make edges safe and to determine if fencing is required - Stormwater Management Manual.</li> <li>- Policy in place but legacy design issues/locations.</li> <li>- Some delivery and communication issues around usability of public open space (over winter) raised.</li> <li>- Established areas have low multifunctionality but new areas are being developed with catchments and basins servicing multiple uses. Example Treeby District Structure Plan, including water strategy</li> </ul>
7.3. Integration and intelligent control	2.5	High	<ul style="list-style-type: none"> <li>- Water Corporation led systems that are highly managed and automated (drinking water and wastewater) but City has little influence on.</li> <li>- Over 50% of water supply is self-supply. Difficult to get users to work together.</li> <li>- Larger scale injections schemes do help manage groundwater.</li> <li>- Irrigation control systems, soil moisture probes - manual management of irrigation.</li> <li>- Irrigation - 40% linked to central control management system with automation to come (planned).</li> </ul>

Indicator	Rating 0 to 5	Confidence High/Med/Low	Evidence
			<ul style="list-style-type: none"> <li>- Flood control systems integrated into lakes and parks (e.g. Lake system retention) - manual function not linked/automated.</li> <li>- No dynamic flood management system.</li> <li>- Automated monitoring but manualised response of irrigation systems.</li> <li>- Drainage system - auto monitored but manual discharges with cross organisational agreements. Cockburn Arts - example of highly monitored and controlled system.</li> <li>- For self-supply, unable to achieve this.</li> <li>- For scheme- yes monitoring in place.</li> </ul>
7.4. Robust infrastructures	4	High	<ul style="list-style-type: none"> <li>- Water Supply Treatment systems highly robust with fail safe systems built in.</li> <li>- Drainage Management Strategy in place.</li> <li>- Occasional pipe infrastructure failure (tree root ingress causing localised flooding).</li> <li>- Fairly robust - failures when heavy rainfall (above design capacity).</li> <li>- Failure of systems is very low.</li> <li>- Integrity is checked on an adhoc basis, general maintenance is programed.</li> <li>- Private groundwater bores can have low integrity and high failure rate.</li> <li>- Acid Management Strategy with 2-4 year checking program to add integrity back to management of systems.</li> <li>- Low failures, sometimes pipes will burst due to age.</li> </ul>
7.5. Infrastructure and ownership at multiple scales	4	High	<ul style="list-style-type: none"> <li>- Water Corp is a large company servicing water needs (potable) in City of Cockburn.</li> <li>- There is a lot of self-supply- groundwater use.</li> <li>- DWER have policies in place to encourage decentralised systems. It's still early days in this space i.e. Guideline for the approval of non-drinking water systems in Western Australia 2013.</li> <li>- Health Department restricts and discourages supplementary systems - Policy around alternative water sources are very restrictive.</li> <li>- Aquifer Recharge Policy.</li> <li>- National Guidelines on Recycling.</li> <li>- Supply issues, cost of grey water and rainwater systems more than bores.</li> <li>- Bores are actively discouraged, as there are limited areas where this is suitable - New Policy in progress to better manage groundwater resource.</li> <li>- Water wise behaviour and improved water literacy being encouraged.</li> <li>- Phone survey of 3000 people - do they have a bore, when and how do they use it.</li> <li>- 20% of people with block &lt;500m2 still have bores.</li> <li>- Opportunities are there but currently only one. Largest single operator is Cockburn Cement, carriage of shell sand (seawater), operate own private bores for industry processes (groundwater).</li> </ul>

Indicator	Rating 0 to 5	Confidence High/Med/Low	Evidence
			<ul style="list-style-type: none"> <li>- Jandakot Airport responsible for all disposal of its own stormwater and drainage.</li> </ul>
7.6. Adequate maintenance	4	High	<ul style="list-style-type: none"> <li>- Long term financial management plan to support it - asset management review strategy included in this.</li> <li>- Maintenance plans and guidelines available.</li> <li>- Biannual asset condition reports to guide investment, financial indicators that sit behind it.</li> <li>- GIS asset database, condition audits undertaken, budgets and desirable funding levels are set.</li> <li>- High level of maintenance on green infrastructure, wetlands and lakes are maintained, GPTs are cleaned out.</li> <li>- Uncertainties with future of assets due to climate change but currently levels of maintenance are adequate.</li> </ul>



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