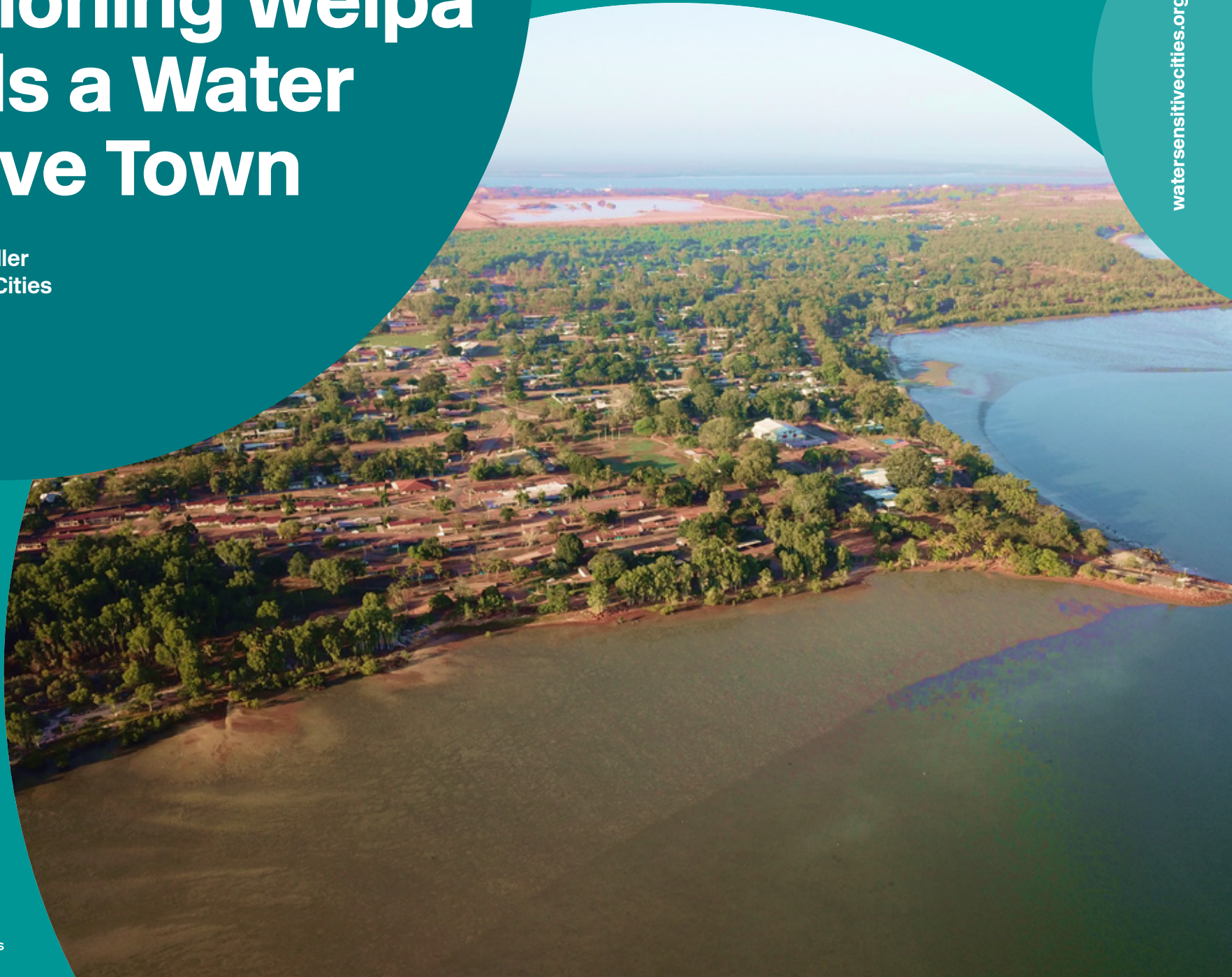


# Transitioning Weipa towards a Water Sensitive Town

Chris Tanner and Jurg Keller  
CRC for Water Sensitive Cities

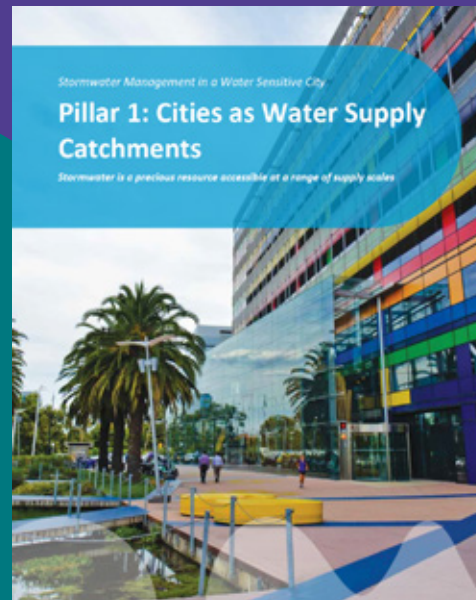
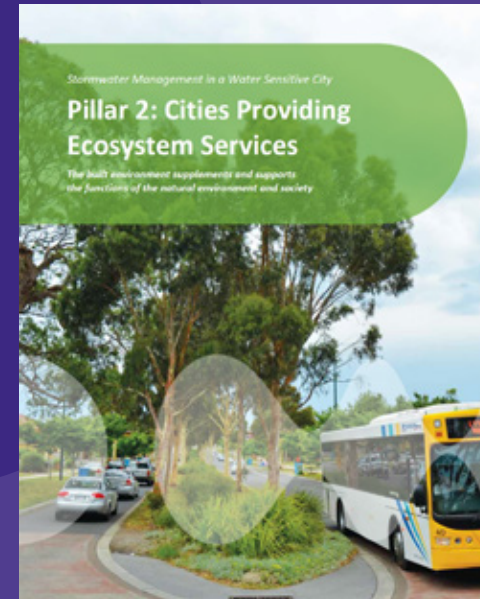
September 2018

[watersensitivecities.org.au](http://watersensitivecities.org.au)

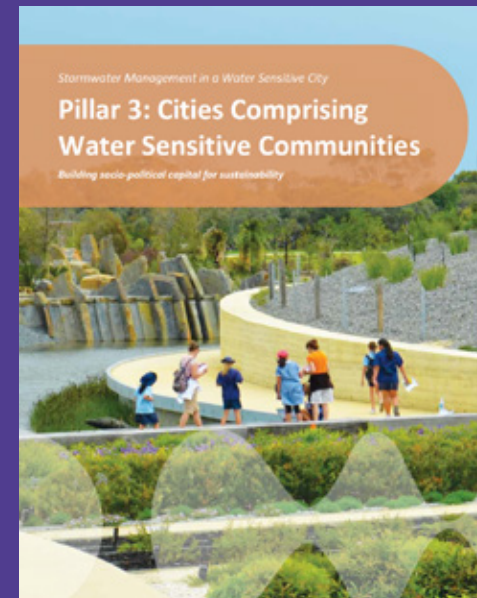


# What is a Water Sensitive City?

Provides a healthy natural environment, thereby offering a range of social, ecological and economic benefits



Serves as a potential water supply catchment, providing a range of different water sources at a range of different scales, and for a range of different uses



Consists of water sensitive communities where citizens are actively engaged in decision making, and demonstrate positive behaviours

# Context and motivation

- Improving liveability and sustainability
- Supporting a growing population
- Retaining people beyond their working life
- Attracting and retaining skilled workforce and their families
- Addressing community expectations
- Increasing economic opportunities, in particular tourism
- Supporting Weipa's transition towards a formal local council
- Helping to establish Weipa as the 'Capital of Cape York'

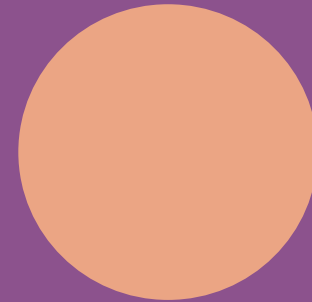
# Good examples



# Good examples — Parks and greens



# Key challenges



# Key opportunities



# Key opportunities





# More opportunities



# Key challenges and opportunities

## Wet-dry tropic climate means low or no rainfall for 6–8 months a year

- Lawns and other low vegetation die back if not watered – resulting in brown/dusty surfaces
- Plenty of infiltration occurs in the wet season – shallow aquifers and existing bores could make water available in dry season

## Wastewater treatment plant produces 1.3–1.5ML/day of good quality effluent

- Water could be used for irrigation – but may require disinfection
- Treatment plant is located some 4km out of town, so piping could be costly
- Using water and nutrients, plus composted biosolids and green waste from town, local produce could be grown in vicinity of treatment plant

## Urban/housing design could take better advantage of local conditions and potential values

- Many properties ‘closed in’ with colorbond fencing – blocking breezes and outlook
- Large area for public footpaths/verges/stormwater drains, but they are not well vegetated and have limited or no irrigation



# Key challenges and opportunities

## Water sensitive practice can increase health, liveability and productivity

- Green infrastructure (living streams, wetlands etc.) increases liveability and directly impacts house values
- Increased vegetation cover provides cooling benefits that have significant direct benefits for human health, active community and energy costs

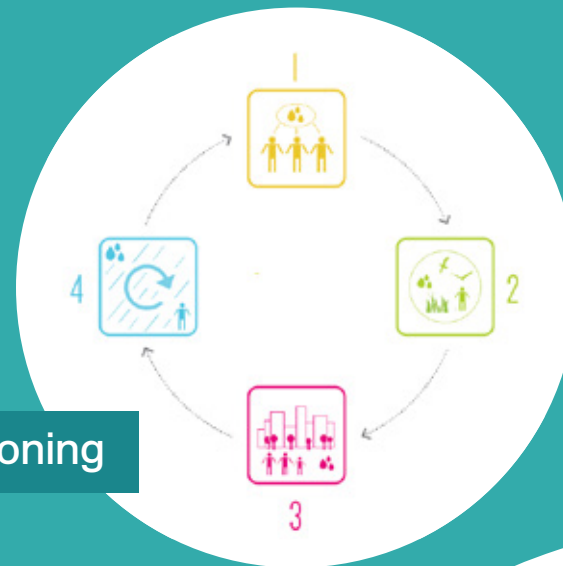
## Using solar energy for water heating provides major energy savings

- Across Australian cities, 87% of water system related energy consumption is for water heating at the household
- Weipa could achieve far greater energy savings through solar hot water systems than from all other town water supply and wastewater treatment uses

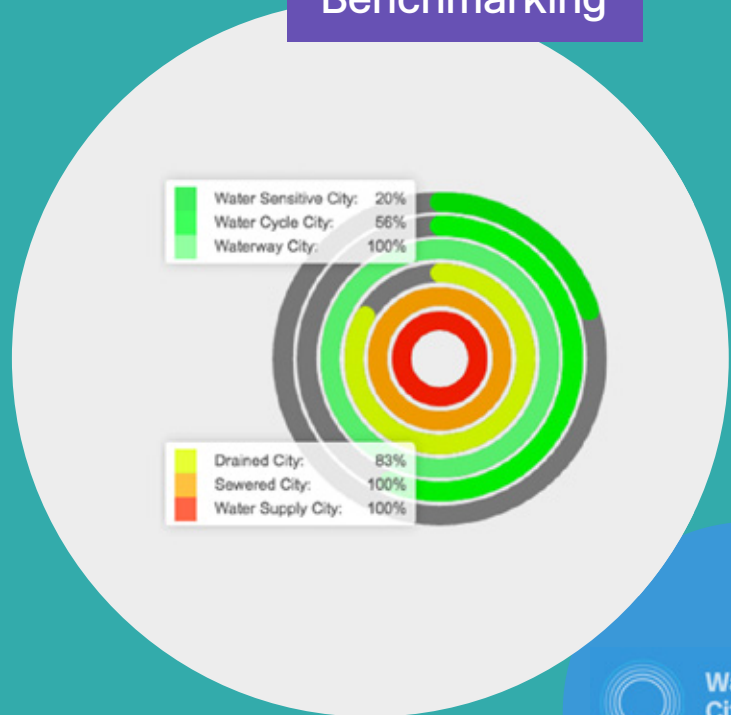
## Wet season water can be stored for dry season application

- Overall, Weipa receives a large excess of rain water relative to annual demand
- Existing/modified stormwater drain areas could support infiltration into shallow aquifers which can then be used during dry season

# Water Sensitive Cities transition process

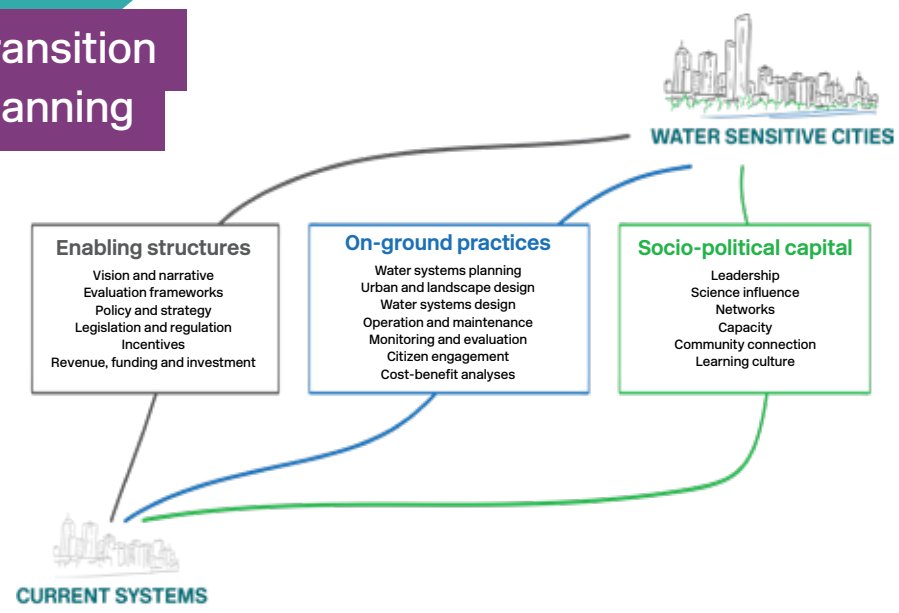


## Benchmarking



## Visioning

## Transition planning

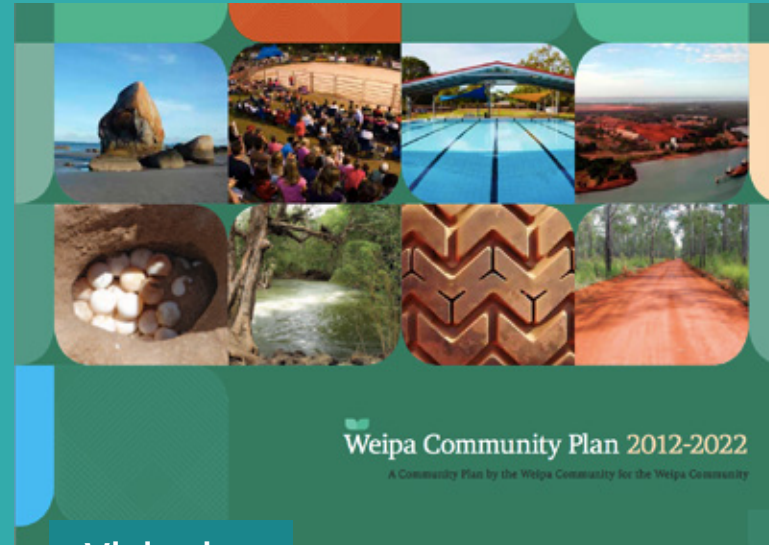


**Water Sensitive Cities Index**  
 Benchmarking cities against urban water indicators

# Weipa's transition process



Benchmarking



Visioning



Transition planning

**Weipa Town Authority  
Corporate Plan 2015 - 2020**  
2015 - 2020

July 2015

# Weipa's community views

## Views

- Optimism
- Community spirit
- Valuing our lifestyle
- Self-reliant
- Resilience

## Children's wishes

- Keeping the town *clean*
- Looking after the *environment*
- More *things for kids to do*
- Making sure the *town looks its best – clean and green*
- More shopping options
- A water park
- *Bikeways to link all parts of the town including parks*
- A better airport

We need better water pressure if the town is going to grow.

Hopefully, that will improve soon.

I hope that one day, Weipa has less turnover of people so that sporting clubs like mine can retain members and volunteers for longer.

Wouldn't it be great if we could go to a local farmers' market and buy fresh food grown locally.

In the future, I hope that Weipa is a tourism destination in its own right, not a single track destination on the way to the Cape.

I hope that our town looks clean and green for visitors, with lots of native trees – a green oasis.

Wouldn't it be great if three generations chose Weipa as their choice for the best place to live.

Wouldn't it be great if one day, Weipa was known as the Capital of the Cape.

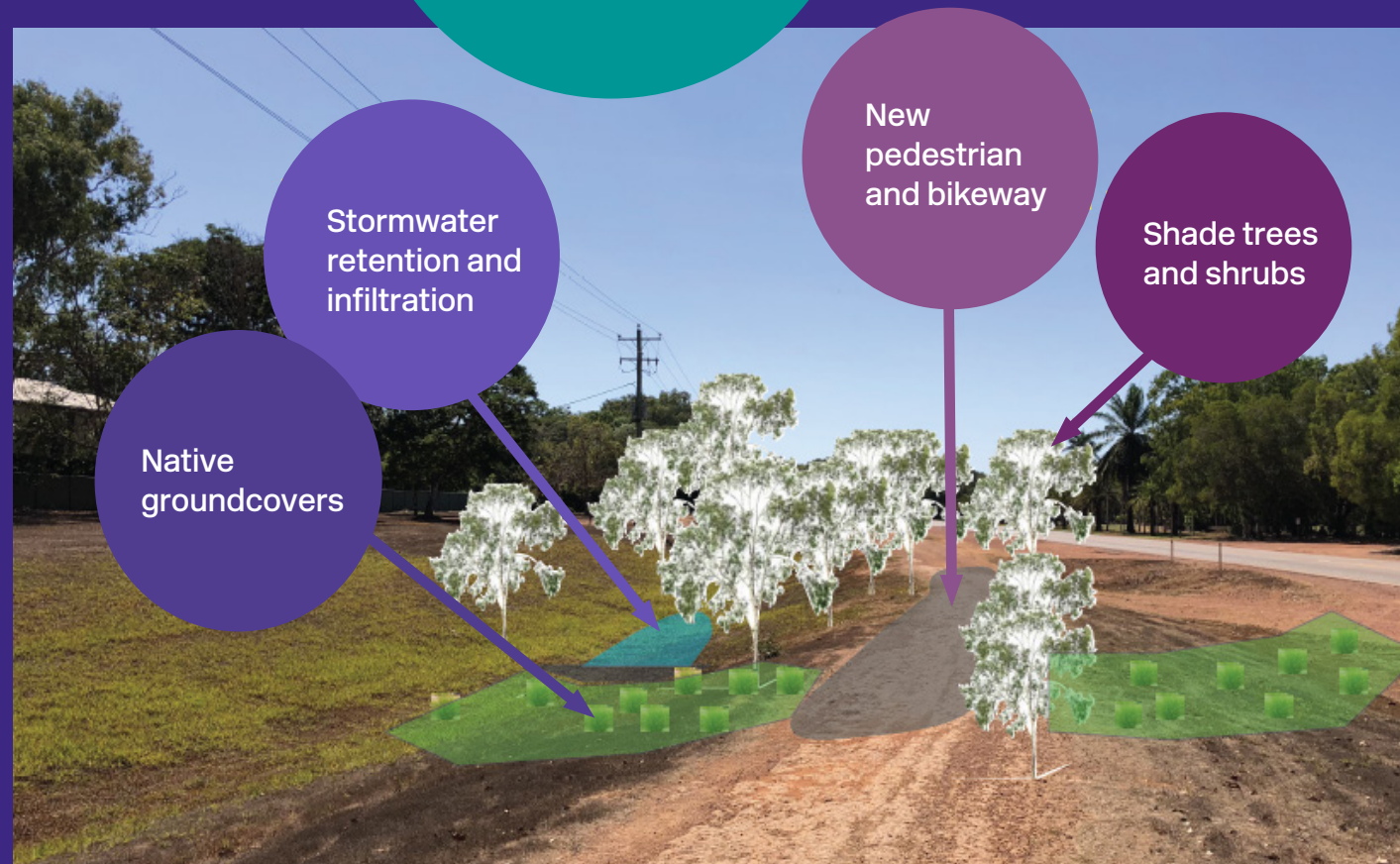
# Key ideas for a Water Wise Weipa

1. **Establish blue–green corridors** along major pathways/roads in town
2. **Enable underground wet-to-dry season water storage** using infiltration to local aquifers and recovery through existing bores
3. **Create living streams** in stormwater drains to improve infiltration during the wet and create green, cool environments in dry season
4. **Establish irrigation water network** along blue–green corridors to support **lush parks, safe sports grounds and attractive school areas**
5. **Produce fresh local fruits and vegies** using recycled water and compost from green waste and biosolids
6. **Offset power costs for irrigation network by encouraging solar hot water systems** installed across town, creating multiple savings
7. **Install low-pressure, pumped sewer systems** in new development areas to avoid/minimise fill requirements
8. **Establish a town-wide smart network** to monitor and control all water-related assets (and others) for maximal flexibility, efficiency and integration
9. **Encourage green landscapes, urban forests and water features** that further **increase the economic value** for property owners, businesses, tourism and the town overall
10. **Consider expanding caravan park into the ‘lakes district’** to create additional capacity, value and attraction for tourists

# 1. Establish blue-green corridors

What are they?

Green, shady active transport corridors and attractive waterways along road verges, existing pathways and drainage corridors



Native groundcovers

Stormwater retention and infiltration

New pedestrian and bikeway

Shade trees and shrubs



## Key ideas for a Water Wise Weipa

# 1. Establish blue-green corridors

### What benefits do they provide?

- **Shading** and **cooling** of walk/bikeways to encourage **active transport**
- **Attractive walking/running/cycling paths** for sport and recreation
- **Pleasant connections across the different town areas**
- **Dust** and **wind reduction**, plus **visual separation** from roads

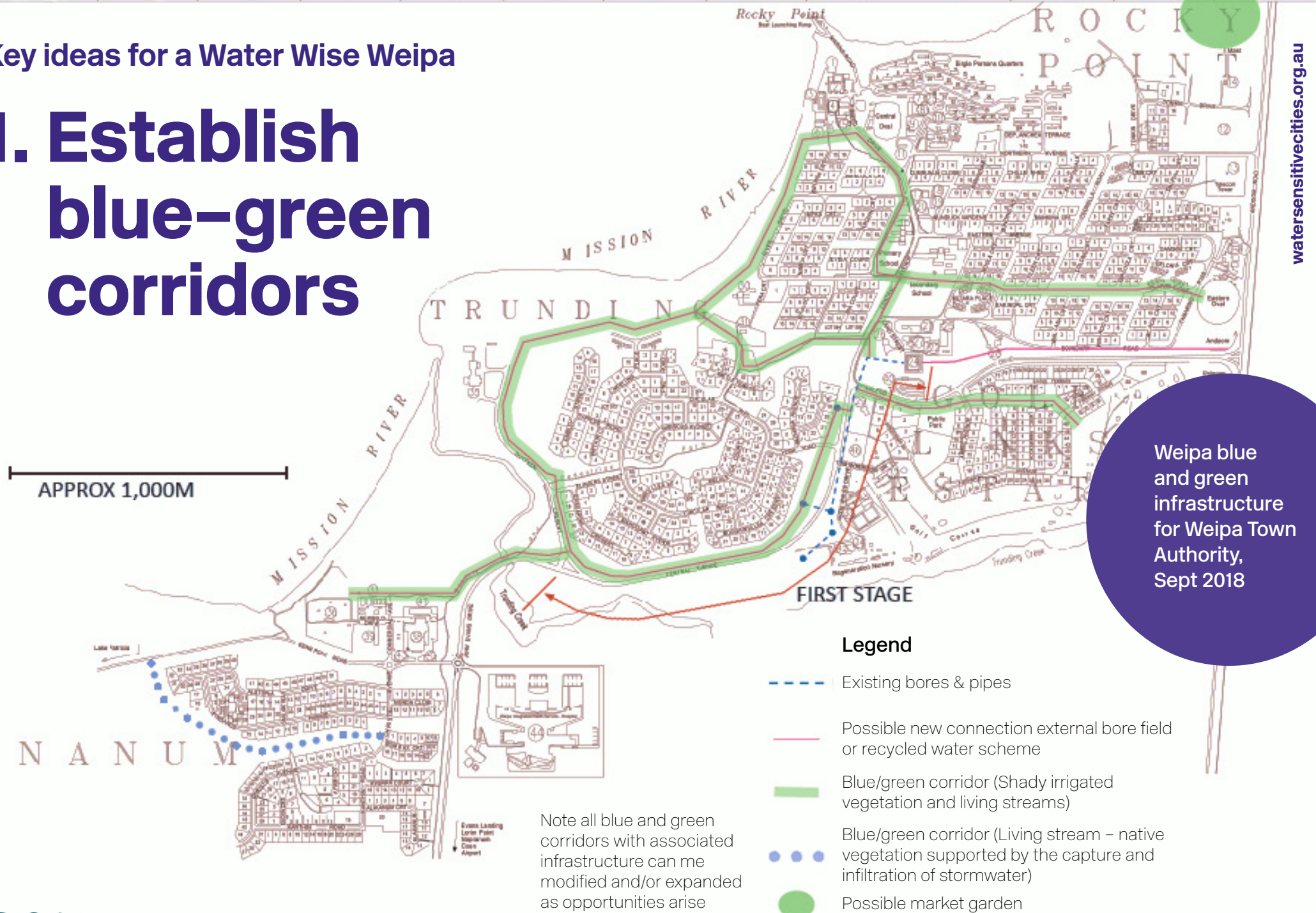
- **Natural ecosystems** for native plants and animal habitats
- Increased **amenity and liveability values** for local residents and tourists

In the future, I hope that Weipa is a tourism destination in its own right, not a side track destination on the way to the Cape.

I hope that our town looks clean and green for visitors, with lots of native trees – a green oasis.

## Key ideas for a Water Wise Weipa

# 1. Establish blue-green corridors

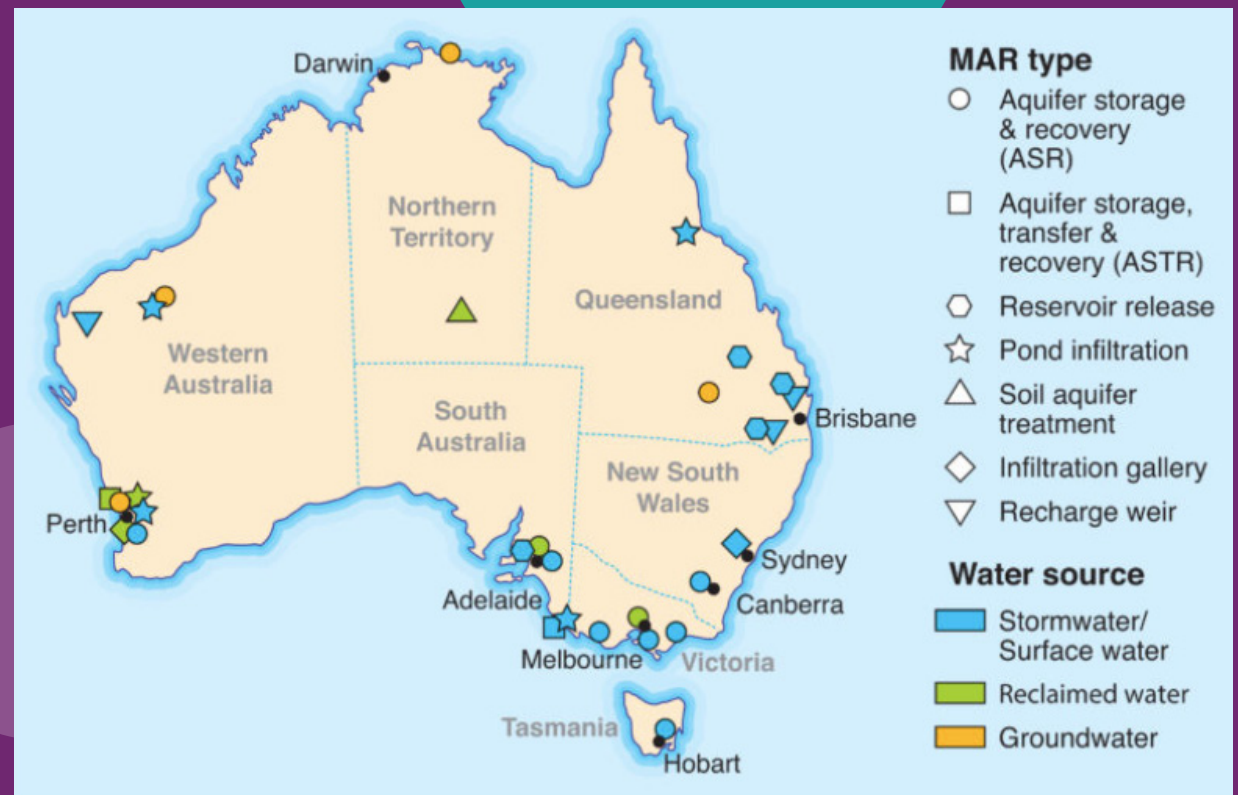


# 2. Enable wet-to-dry season water storage

## What is it?

- Existing shallow groundwater aquifers store excess rain/stormwater from the wet season, making water available for dry months

- This process is also known as managed aquifer recharge (MAR) and is practised quite widely across Australia (see below)



Snapshot of MAR in Australia in 2017. Image: CSIRO

## 2. Enable wet-to-dry season water storage

### What benefits do they provide?

- Total annual rainfall on Weipa town area is around 10,000ML/yr
- 5% of that rainfall actively infiltrated from stormwater drains (Idea 3) would support an additional groundwater recovery at a rate of 2.5ML/day (or 5 x swimming pool volume/day) during the dry season (200 days/yr)
- This storage equates to 20,000 rainwater tanks @ 25kL each, or equivalent to 1000 times volume of the swimming pool
- During dry season, the stored groundwater could be accessed through existing bores and fed into a (partially) new irrigation water network (see Idea 4) along the blue-green corridors
- Increasing infiltration and storage will move the groundwater recharge situation closer to 'pre-development' conditions, and support groundwater-based ecosystems such as Trunding Creek

Key ideas for a Water Wise Weipa

# 3. Create living streams



What are they and how do they work?

- Living streams are re-creations of more natural **waterways** along urban drainage networks
- They slow down stormwater flows and retain some water to **reduce erosion, increase infiltration, support natural vegetation** and **treat stormwater to reduce pollution** at discharge



Key ideas for a Water Wise Weipa

# 3. Create living streams

Example of living stream in Darwin



# 3. Create living streams



## What benefits do they provide?

- They **drastically improve environmental outcomes** locally and in receiving waters
- **Shade and cooling** zones provide amenity and liveability benefits
- They directly **increase property values** for up to 200m either side of a (re-created) living stream

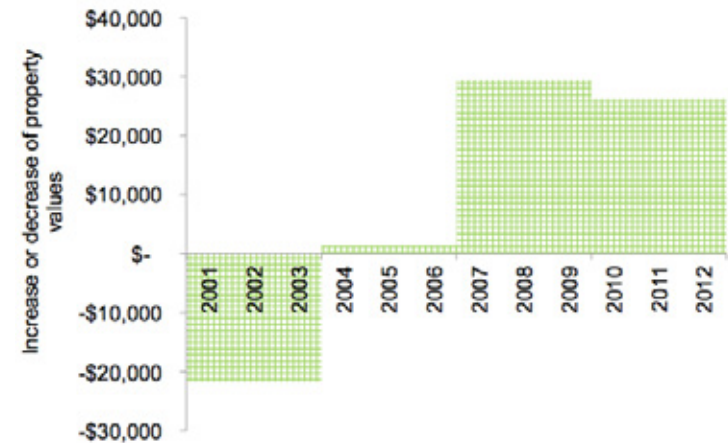


Figure 1. Impact of Bannister Creek living stream on the value of a median residential property within 200m of the project site.

# 4. Establish irrigation water network

## What is it?

- A **separate irrigation-only water network** could use the existing town-based bores (or alternatively recycled water from the wastewater treatment plant, see discussion below), as well as blue-green corridors **to deliver water to major parks, sports grounds, schools etc.**
- To **protect drinking water quality** and **minimise possible risks of contamination** from town-based bores, the drinking water could be supplied solely from the more protected bores along Andoom Road
- The irrigation water network will also **remove major peak flows from the town water supplies**, improving supply capacity and security for residential users, and resilience
- **Capacity of town water supply** from Andoom Road bores **must be assessed**, including expected reduction of water use for mining operations in coming years

We need better water pressure if the town is going to grow.

Hopefully, that will improve soon.



# 4. Establish irrigation water network

Should recycled effluent or town bores be used for irrigation?

## *Recycled treatment plant effluent:*

- ✓ Currently unused resource (but may have better use – see Idea 5)
- ✓ Contains nutrients that may be beneficial for lawns/parks
- ✗ Disposal to native vegetation problematic due to nutrients present
- ✗ Distance to town approx. 4km, plus crossing railway line/road
- ✗ Requires continuous chlorine supply, and regular flows
- ✗ O&M quite costly due to chlorine demand and cleaning
- ✗ OH&S/health regulation and licensing compliance very significant

## *Town bore supply:*

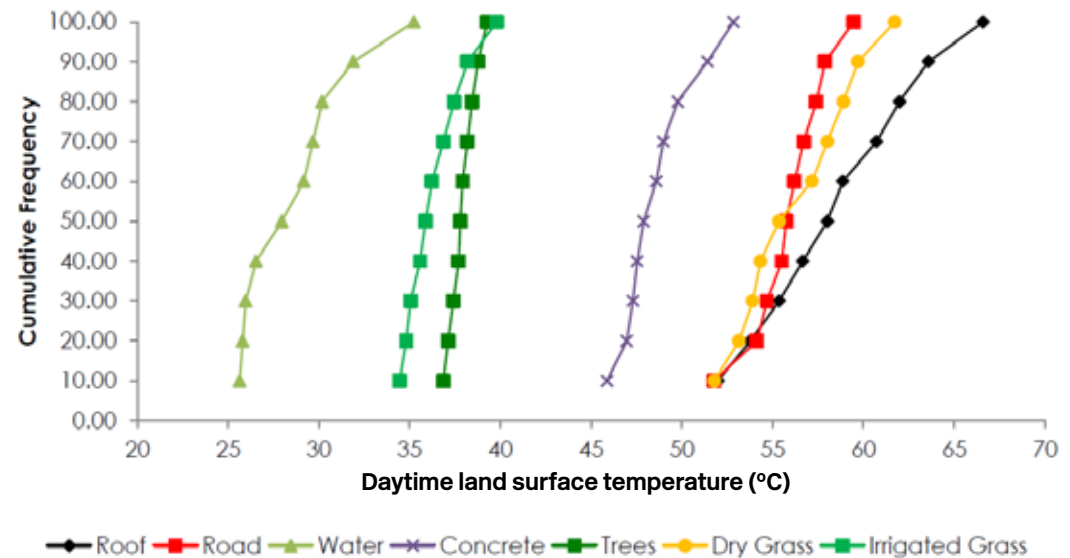
- ✓ Re-using existing facilities in town including pipe network
- ✓ Avoids possible contamination risk for drinking water supply
- ✓ O&M easy and cheap, mainly pumping costs, no disinfection
- ✓ Separate network reduces peak flows in drinking water supply
- ✓ OH&S/health regulation requirements are minimal
- ✗ Uses groundwater resource – need to ensure sustainable supply

# 4. Establish irrigation water network

Measured land surface data (12pm–2pm; 12am–2am) during an extreme heat event in City of Port Phillip, Melbourne (25 February 2012) (Prof Nigel Tapper, et al. CRCWSC)

## What benefits can it provide?

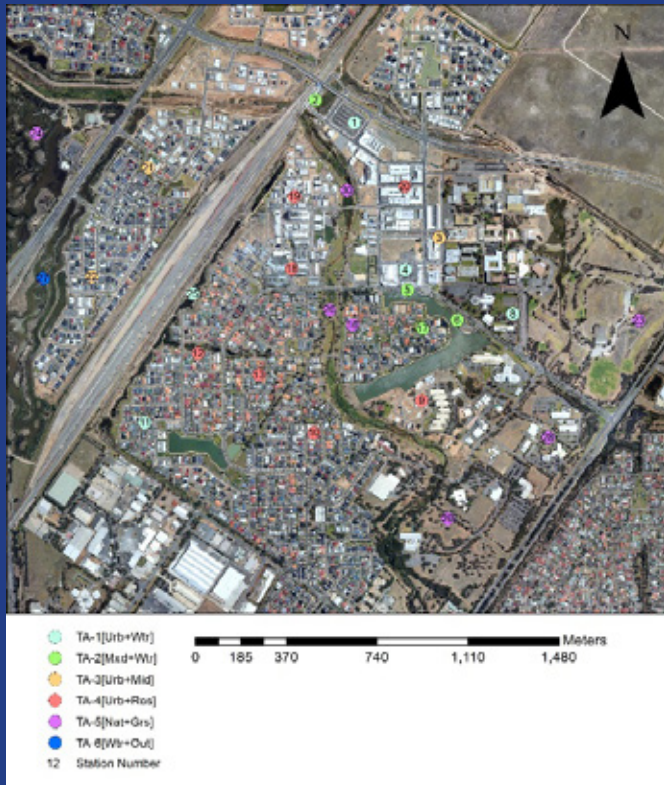
- Lush parks, safe sports grounds and attractive school areas
- **Cooling** effects of irrigated lawn/vegetation



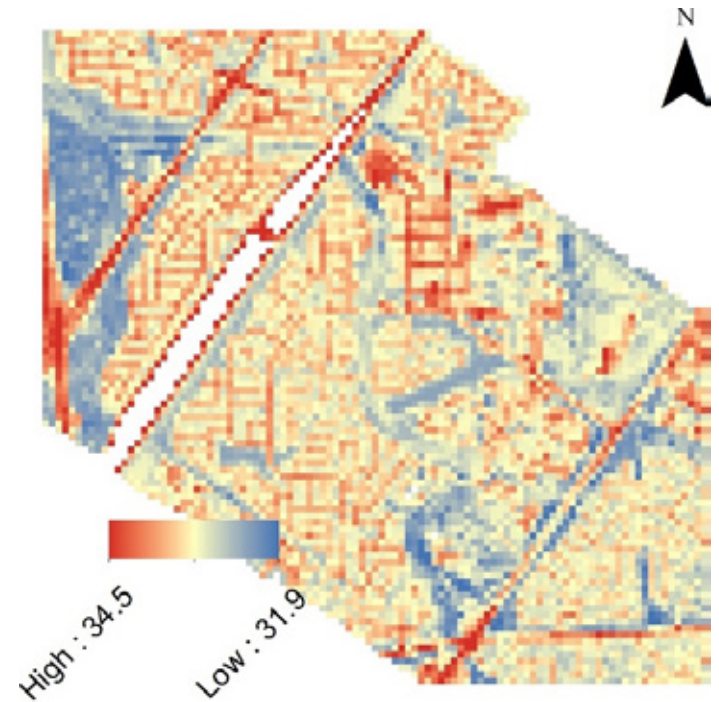
# 4. Establish irrigation water network

What benefits can it provide (cont'd)?

Air temperature cooling effects of water and green areas



Urban heat modelling analysis of Mawson Lakes (South Australia)



# 5. Produce fresh local fruit and vege

## Where and how could it be done?

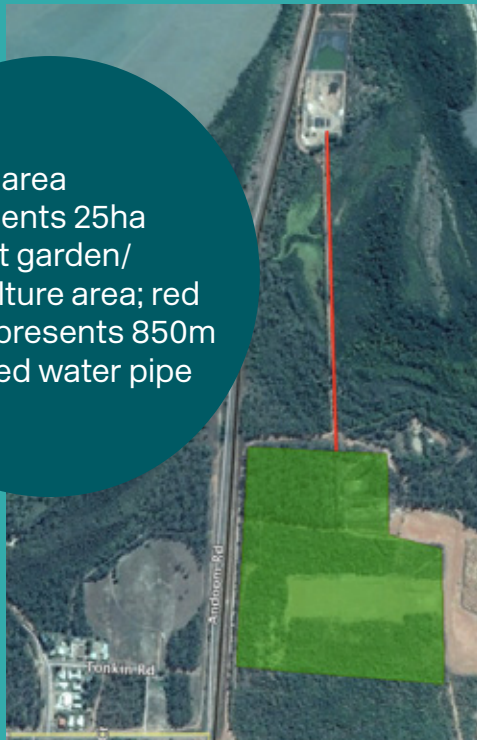
- **Beneficial reuse of treated effluent** from wastewater treatment plant could provide a sustainable water source **for local market garden and/or agriculture operations**
- **Current wastewater treatment plant** uses membrane bio-reactor technology and achieves **very good water quality with no solids and partial disinfection**; may be further enhanced by low-cost UV treatment to meet regulatory requirements for food production
- Additionally, **biosolids** from wastewater operation plus **green/garden waste** from Weipa township could be **composted to provide valuable organics and nutrients** to produce local fruit and vegetables
- To minimise transport and piping costs, and reduce potential groundwater contamination risks, the market garden/agriculture area should be **located close to the current wastewater treatment plant**
- During wet season, **infiltration of treated effluent could completely eliminate direct discharge to Mission River**

# 5. Produce fresh local fruit and vege

## What benefits can it provide?

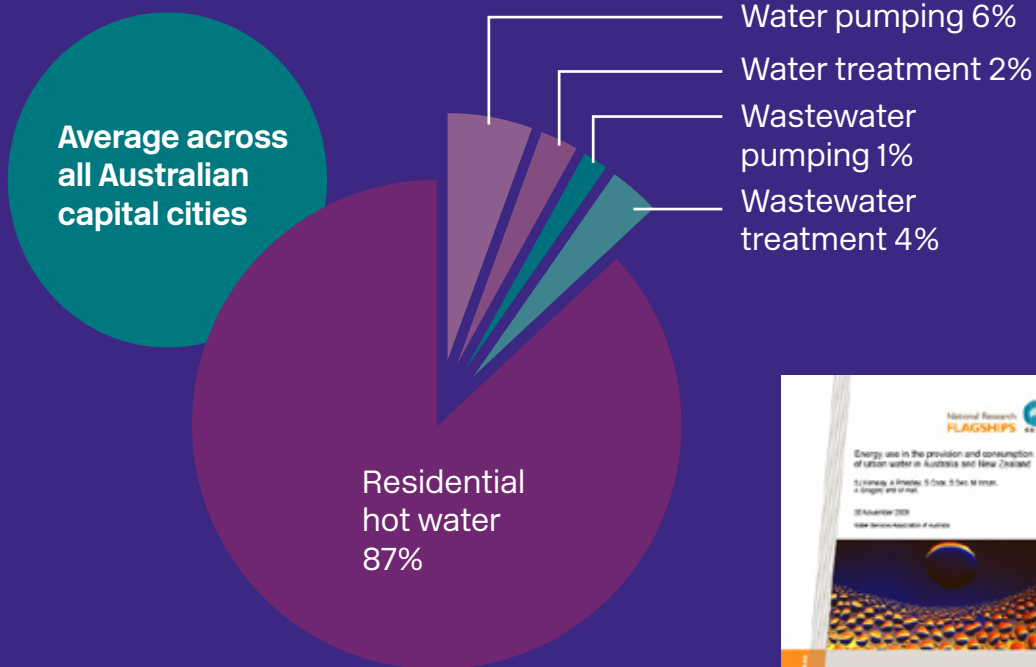
- Current wastewater flow of around 1.5ML/day could **support 15–30ha market garden/agriculture area**
- **New employment and commercial opportunities** would be created
- Beneficial reuse of water and biosolids will **reduce the pollution impact on natural environment** and **reduce landfill volume**
- Combined composting of green waste and biosolids will **create valuable resource also for parks/green corridors**
- If wet season flows could be infiltrated in same area or along the pipeline, **upgrade of effluent discharge facility may be avoided**

Green area represents 25ha market garden/ agriculture area; red line represents 850m recycled water pipe



Wouldn't it be great if we could go to a local farmers' market and buy fresh food grown locally.

# 6. Offset power costs for irrigation



## What is it and how could it work?

- Residential water heating is responsible for well over 80% of total power demand in urban water systems across Australia
- **Encouraging** (and potentially supporting) **solar hot water system installations** would very quickly offset any additional power use for irrigation network and could further reduce overall power demand
- Arranging a **bulk purchase and installation** in Weipa would likely deliver a **cost-effective solution** with potential payback within 3–5 years

# 7. Install pumped sewer systems

## How does it work and what benefits can it provide?

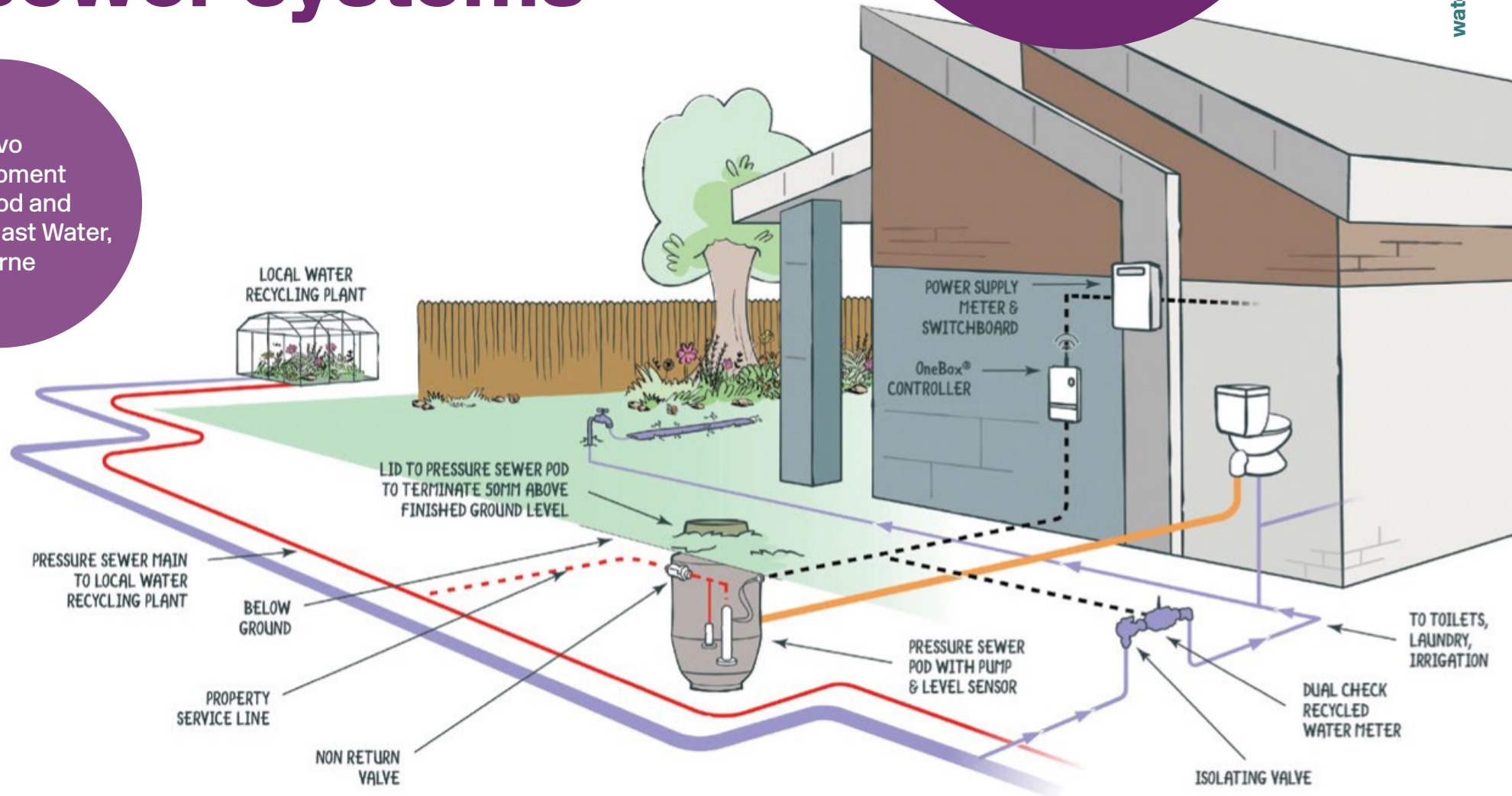
- Small submersible pumps and low pressure (poly-pipe) sewers can replace traditional gravity-based systems and larger pump stations
- **Reduced fill** required to create sufficient gradient in gravity sewers (and/or deeper pump station installation) **creates major savings in new developments**
- **Installation is relatively quick and easy** and can be driven under roads etc. through directional drilling
- Completely sealed sewer lines **reduce risk of leakage and potential infiltration** into groundwater
- Each pump sump can have sufficient storage to **delay pumping during peak flow times** in traditional sewers, thus also **increasing capacity of wastewater treatment plant**

Key ideas for a Water Wise Weipa

# 7. Install pumped sewer systems

Pressure sewer and recycled water household connection

Aquarevo Development  
Villawood and  
South East Water,  
Melbourne





# 8. Establish a town-wide smart network

## How does it work and what benefits can it provide?

- Most new water system equipment (meters, pumps, valves etc.) can be controlled/monitored remotely; a town-wide smart network could take full advantage of these developments
- It would allow optimal operation and flexibility for the irrigation network, but could also extend to the existing and new sewer and water supply network
- The smart network could also be extended to other aspects, particularly power supply or communications (e.g. widely accessible wifi to attract/support tourism, transitional workforce, local residents)
- This idea could set up Weipa for the rapidly expanding 'Internet of Things' progression

Wouldn't it be great if one day, Weipa was known as the capital of the Cape.

# 9. Encourage green landscapes

## How does it work and what benefits can it provide?

- **Green landscapes have many direct and indirect benefits** and should be encouraged; also at the individual property level
- Green landscapes could include **native and culturally valuable plants**, as well as **fruit trees** and **ornamentals**
- A **'free trees for your garden' initiative** could increase **community engagement** and may be supported by RTA rehabilitation program
- **Engaging schools and community groups in tree-planting initiatives** (e.g. along blue-green corridors) builds ownership and support from local residents, who also benefit directly

### Views

- Optimism
- Self-reliant
- Community spirit
- Resilience
- Valuing our lifestyle

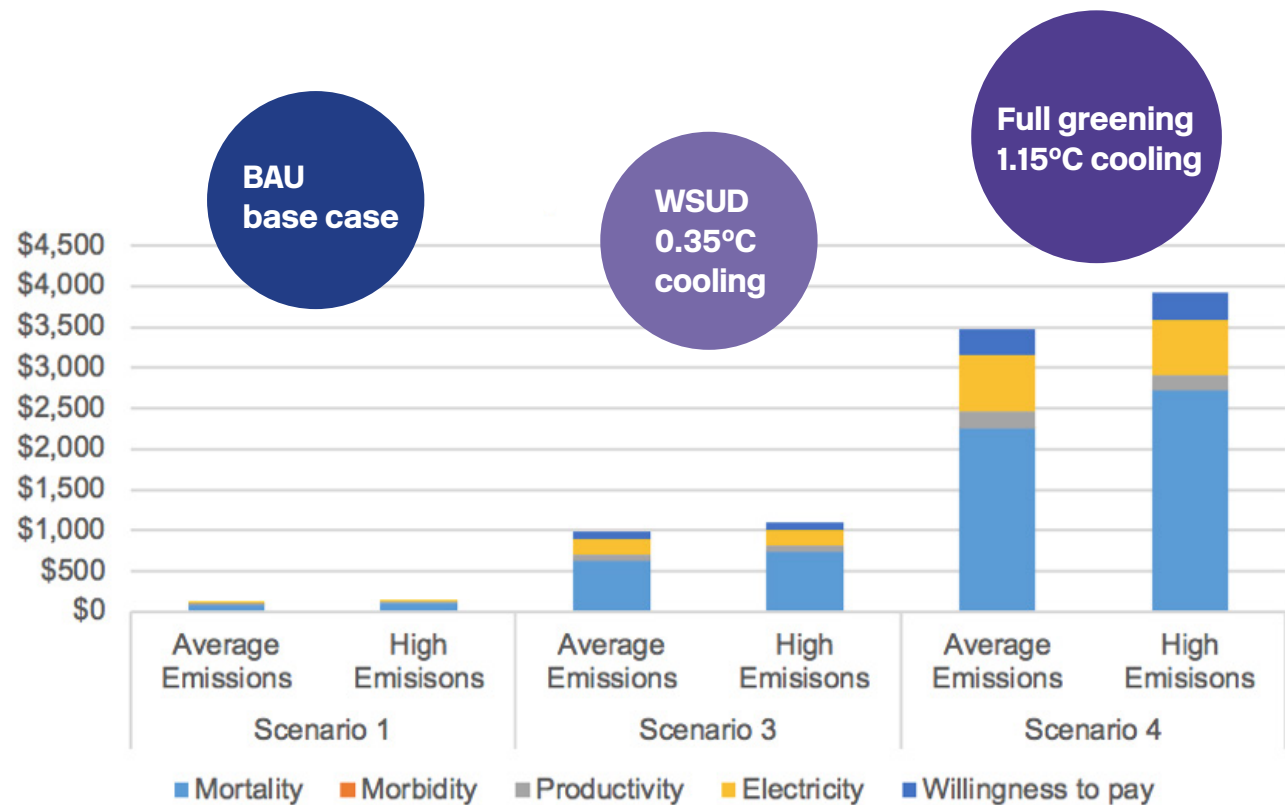
Wouldn't it be great if three generations chose Weipa as their choice for the best place to live.

# 9. Encourage green landscapes

Current CRCWSC work demonstrates direct economic benefits of cooling achieved through green landscapes, with the major factors being reduced mortality (particularly ageing population) and energy savings

**Example for Vic housing development**

Estimated savings per household (50yr, 5% discount rate)



# 9. Encourage green landscapes

## Possible native plants

These shrubs and trees are **all native to Weipa**, and are tried/tested garden plants in Amrun Village. Most of these species have **significant value as cultural resources for Traditional Owners and are good for wildlife**. Seeds for all of these species are collected annually by Traditional Owners from Napranum, Mapoon, Weipa and Aurukun.

### Shrubs:

- OLivistonia muelleri – cabbage palm
- Grevillea glauca – bushman's clothes peg
- Pandanus spiralis – pandanus palm
- Asteromyrtus symphocarpa (Melalaeuca symphocarpa)
- Leptospermum madidum – weeping ti-tree

### Small trees:

- Sterculia quadrifida – beer nut/peanut tree
- Erythrina verspetilio – bat-wing coral
- Syzigium suborbiculare – lady apple
- Brachychiton garrawayae – flame tree
- Barringtonia acutangula – mango-pine (not tried yet)

### Large trees:

- Parinari nonda – nonda plum
- Terminalia catappa – beach almond
- Erythrophleum chlorostachys – Cooktown ironwood
- Eucalyptus sp. (tetrodonta/alba/brassiana)
- Melaleuca leucadendra – paperbark

Hopefully we can green up the town a bit! Really the best way to improve the image of a lot of the public spaces.

I hope that our town looks clean and green for visitors, with lots of native trees – a green oasis.

# 10. Consider 'lakes district' caravan park

## How does it work and what benefits can it provide?

- Tourist and workers' accommodation in Weipa is currently very tight and additional options must be considered
- When Peninsula Development Road is fully sealed, Weipa is likely to be much more attractive for caravan-based tourists ('grey nomads')
- The 'lakes district' would be a nice and quiet area, and would be offered only to self-contained caravans (no showers or sewer connections required). Power supplies would be provided and the facility would be managed as an 'extension' of the existing caravan park
- Weipa could achieve broad economic benefits if tourists spend significant time here (weeks rather than a couple of days)
- Some community facilities (covered tables, BBQs, self-contained toilet) could be provided to improve value to local residents as well
- Could add value to future development area between Nanum and Lake Mccleod, with further facilities (sewers, water) provided then

# 10. Consider 'lakes district' caravan park

Green line represents potential caravan space (approx. 2.8km length of shoreline); red line shows distance from existing caravan park (approx. 1km)



In the future, I hope that Weipa is a tourism destination in its own right, not a side track destination on the way to the Cape.

# Preliminary budget costings

Preliminaries	\$ 900,000
Landscape works	\$ 8,054,400
Irrigation main works (supply from existing town bores)	\$ 1,447,050
New water main connection to Andoom Road (East Mine) bores	\$ 1,005,000
Market garden/agriculture area	\$ 1,660,000
Total (excl GST)	\$ 13,146,450
Survey, investigation, design	\$ 1,314,645
Contingency (25%)	\$ 3,286,613
<b>GRAND TOTAL (excl GST)</b>	<b>\$ 17,747,708</b>
<b>BUDGET (excl GST), say</b>	<b>\$ 17,800,000</b>

## Preliminary budget costs for Water Wise Weipa initiatives:

- Blue-green corridors infrastructure
- Irrigation supply from existing town water supply
- Town water supply from Andoom Road (East mine) bore field
- Recycled water used for supply to a market garden/agriculture area

## Notes:

1. Only for the use of Weipa Town Authority
2. Assume that landscape works occur to 75% of blue-green corridors and 50% of parklands
3. Assume that new irrigation system is supplied throughout, all on new 'smart' controllers etc.
4. Estimated total area of blue-green corridors for landscape and irrigation works per Concept Plan is 13.6ha
5. Estimated total area of parklands for landscape and irrigation works is 10ha
6. Reference the CRCWSC Concept Plan dated Sept 2018

# Summary of benefits of key ideas to WTA and RTA

Idea	Benefits to WTA	Benefits to RTA
<b>1. Blue-green corridors</b>	<ul style="list-style-type: none"> <li>Improves liveability and amenity</li> <li>Creates connectivity across town</li> <li>Encourages active transport</li> <li>Offers sport and recreation opportunities</li> <li>Supports sustainable community</li> <li>Improves community spirit and lifestyle</li> <li>Improves attractiveness for tourism</li> </ul>	<ul style="list-style-type: none"> <li>Attracts and retains workforce</li> <li>Improves corporate image and reputation</li> <li>Offers better safety and human health outcomes</li> <li>Reduces maintenance (mowing)</li> <li>Offers better OH&amp;S outcomes for O&amp;M staff</li> </ul>
<b>2. Wet-dry season storage</b>	<ul style="list-style-type: none"> <li>Increases water storage/supply locally</li> <li>Improves drinking water supply system</li> <li>Supports potential additional bores</li> <li>Improves 'feel' of town in dry season</li> </ul>	<ul style="list-style-type: none"> <li>Reduces health risks from town bores</li> <li>Creates additional supply for irrigation</li> <li>Moves hydrology closer to pre-mining time</li> </ul>
<b>3. Living streams</b>	<ul style="list-style-type: none"> <li>Improves liveability and amenity</li> <li>Improves property values</li> <li>Reduces power costs for air-con</li> <li>Offers cooling and improved property outlook</li> <li>Opens up private-public boundaries</li> </ul>	<ul style="list-style-type: none"> <li>Reduces pollution from stormwater</li> <li>Reduces mortality during hot periods</li> <li>Reduces energy production requirement</li> <li>Replenishes aquifers through infiltration</li> <li>Re-establishes native flora and fauna</li> </ul>
<b>4. Irrigation water network</b>	<ul style="list-style-type: none"> <li>Ensures dedicated supply for irrigation</li> <li>Improves quality of sports and recreation areas</li> <li>Supports blue-green corridors</li> <li>Establishes Weipa as 'green oasis'</li> <li>Creates further greening opportunities</li> </ul>	<ul style="list-style-type: none"> <li>Increases capacity, via second network</li> <li>Reduces peaks in drinking water network</li> <li>Provides new drinking water supply pipe from protected bores along Andoom Road</li> <li>Improves resilience with dual supply (e.g. for firefighting etc.)</li> </ul>
<b>5. Producing local food</b>	<ul style="list-style-type: none"> <li>Addresses key community need</li> <li>Improves self-reliance of town</li> <li>Creates diverse business initiatives</li> <li>Improves employment opportunities</li> <li>Improves community engagement</li> <li>Reduces cost of living</li> </ul>	<ul style="list-style-type: none"> <li>Reuses treatment effluent</li> <li>Reduces/avoids environmental discharge</li> <li>Reduces pollution (nutrients)</li> <li>Decreases landfill requirements</li> <li>Supports green-waste recycling/composting</li> <li>Creates valuable resource (compost)</li> </ul>



# Water Wise Weipa

—  
green, cool,  
sustainable

Just add  
water!