

INNER WEST

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Eastern Channel Subcatchment Management Plan



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Front cover image:
Kendrick Park

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Eastern Channel Subcatchment 2070 Community Vision

We are defined by our place, the land of the Gadigal and Wangal peoples.

We acknowledge and respect our diverse cultures, heritage and history.

In 2070, our subcatchment is a tranquil, green urban utopia. Healthy mature trees thrive and the streets have lush verges. Native wildlife including birds and bats come from the river and have places to stop along the way. We embrace self-sustaining living.

The Cooks River and its catchment has been rewilded, and we swim in the river with the sounds of birds, insects and the fish jumping. Rain gardens are in every street, and floods are reduced by swamps, billabongs and water tanks. Strong regulation and planning policies protect native wild spaces.

Our community is socially inclusive and people gather in multipurpose places to sit, share and play. We connect with each other and our natural surroundings in the subcatchment, embracing opportunities to learn from nature. We plan together, respecting our diverse backgrounds and cultures.

All houses harvest rainwater, have green roofs and walls and use solar energy. Backyards have native grasses, frog ponds, bee hives, and compost bins. Food is grown and shared in community gardens. We can go out for a walk, picking plums and bush tucker as we go along.

We cycle down Unwins Bridge Road that's now an avenue of trees. Transport systems are efficient, shared, public and non-polluting. We are able to shop locally.

Figure 1: Eastern Channel Subcatchment Community Vision

1 Introduction

Inner West Council has a program of subcatchment planning to improve ecological sustainability in the Inner West. Council uses a collaborative approach for this planning, inviting participation from everyone who lives, works, and owns or manages land in each subcatchment. This means that the subcatchment management plan and the actions to improve ecosystems and liveability in the area are tailored to suit the local people and place.

The collaborative process to create the Eastern Channel Subcatchment Management Plan involved stakeholders at each stage of planning and decision making, including creating the vision and goals, and identifying actions, shown below in Figure 2. Information about the local context was collated to create subcatchment social and physical profiles and these were presented in the *Planning the Eastern Channel Subcatchment* information booklet.

The Eastern Channel Subcatchment Management Plan provides a plan for green infrastructure and ecological sustainability actions for the next ten years. Actions are for Council and key stakeholders.

What is Green Infrastructure and Water Sensitive Urban Design?

Green infrastructure is the natural and engineered infrastructure that results in the provision of ecosystem services, e.g. trees, parks, wetlands, saltmarsh, roof gardens, habitat; or ecosystem service functions e.g. stormwater harvesting.

Water Sensitive Urban Design (WSUD) is the sustainable management of water in urban areas. It looks at the urban water cycle as a whole and is incorporated into green infrastructure to: minimise potable water use; minimise stormwater runoff; clean and filter stormwater; and reduce impervious surfaces.

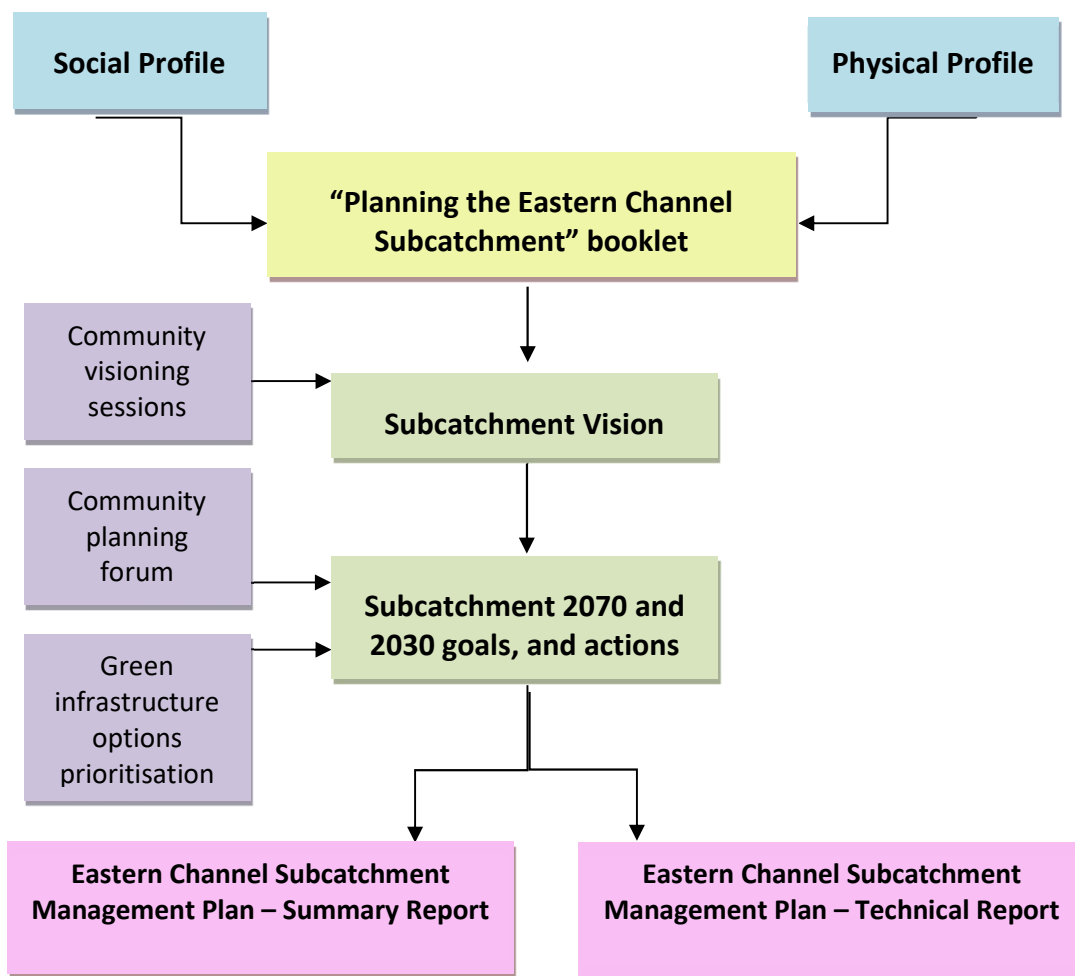


Figure 2: Inner West Council’s Subcatchment Planning process

2 Eastern Channel (Tempe) Subcatchment Overview

The Eastern Channel (Tempe) Subcatchment, referred to throughout this plan as EC Subcatchment, is located in the southern part of the Inner West local government area (LGA). The EC Subcatchment has a total area of 52 hectares (ha) and covers most of the suburb of Tempe, shown in Figure 3. It is bounded by Samuel Street to the north, the Princes Highway to the east, the Cooks River to the south, and the Eastern Channel and Eastern Suburbs and Illawarra rail line to the west. The Sydney International Airport is south-east of the Subcatchment.

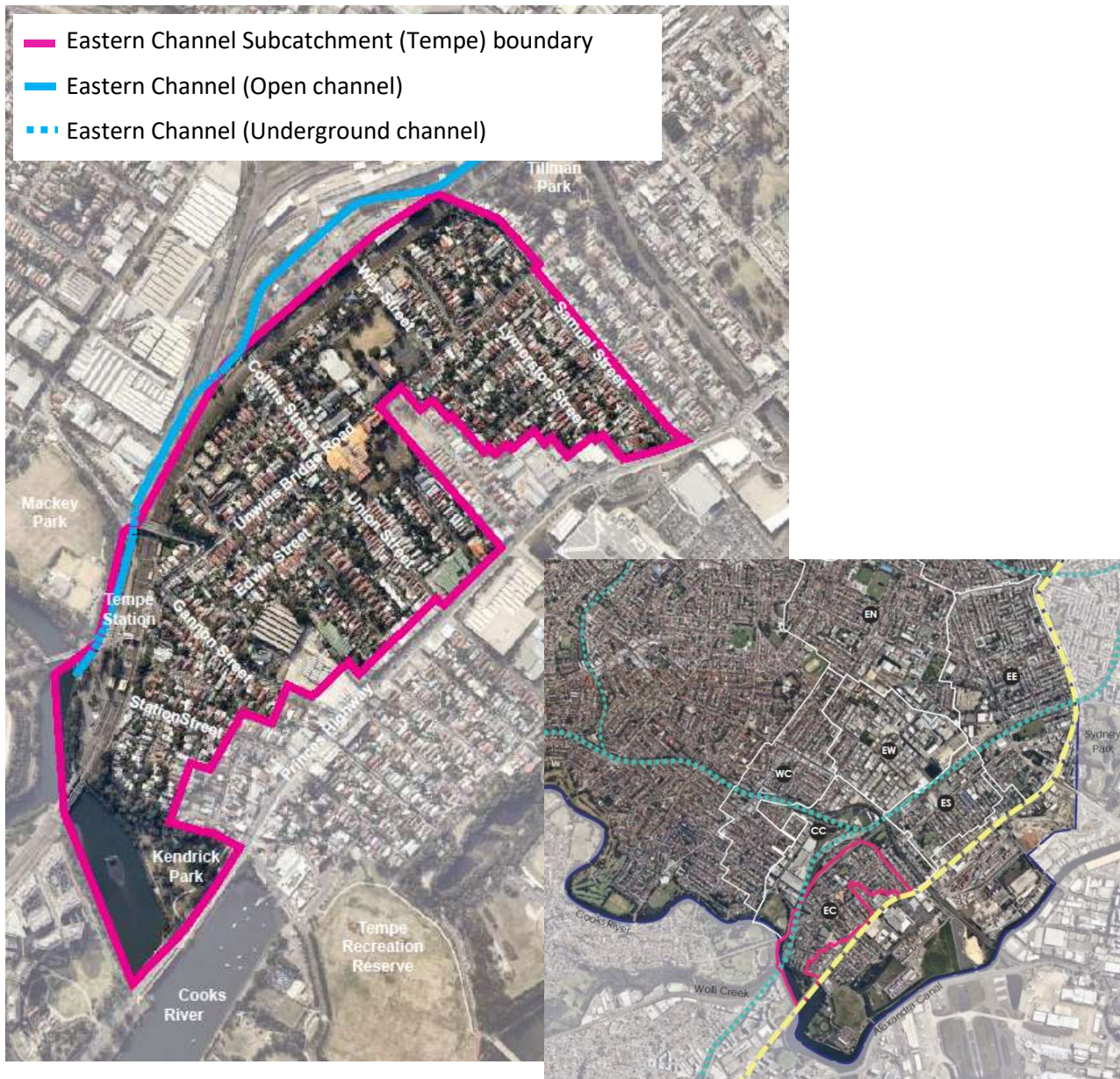


Figure 3: Eastern Channel Subcatchment (Tempe) and Eastern Channel alignment

The EC Subcatchment is part of the 345ha Marrickville Valley subcatchment. It is within the regional Cooks River Catchment which drains an area of 590ha to the Cooks River.

Eastern Channel Subcatchment Fast Facts

- 52 hectares
- Population – 2,720 (ABS 2016)
- 978 Residential dwellings
- Landuse is mostly residential
- Some commercial properties along the Princes Highway
- Two schools (Tempe Public School and Tempe High School)
- Major transport infrastructure - bus depot, train line, Tempe train station and Princes Highway
- Kendrick Park on Cooks River
- Two small local parks - Toyer Street Reserve and Green Street Playground



3 Place-based Planning in Eastern Channel Subcatchment

A collaborative planning approach, as outlined in Figure 2, was used to create this plan. It provides an opportunity for the community, Council and other stakeholders to work together and participate in identifying problems and solutions for their neighbourhood. Subcatchment stakeholders are involved at each stage of planning and decision making including creating the vision, establishing goals and identifying on-ground actions. Stakeholders included:

- Local residents
- Tempe Public School and Tempe High School staff, parents and students
- Betty Spears Child Care Centre staff, parents and children
- Council staff
- River Canoe Club
- Cooks River Alliance (catchment group)
- Sydney Water
- Transport for NSW (Roads and Maritime Services and Sydney Trains)

Major land managers and decision makers were invited to be part of the planning and to explore possibilities for on-ground works and capacity building initiatives. The combination of local knowledge on environmental issues with participant aspirations helped Council develop a better understanding of the solutions that will be most appropriate for the community, environment and economy of the subcatchment.

3.1 Subcatchment Profiling

The *Planning the Eastern Channel Subcatchment* information booklet (Inner West Council, 2019) was produced to better understand the local context. This booklet presents social and physical profiles of the subcatchment, including history, community make up, land use, urban water cycle, urban forest, biodiversity and flooding.

This information booklet was an important tool and it was provided to all stakeholders who took part in the planning process. It created a common understanding of the local context and helped all stakeholders make informed decisions.

3.2 Creating the Vision

All residents and local schools in the EC Subcatchment were invited to visioning sessions during March, April and May 2019. The EC Subcatchment 2070 Vision, shown in Figure 1, is derived from the ideas developed by 68 participants at seven visioning sessions. Representing community desires, it is the reference point for planning the EC Subcatchment.



Figure 4: Developing a subcatchment vision

3.3 Community Planning Forum

The community vision was the basis of the planning forum held over two nights in May 2019, the forum involved local residents, Council staff, Cooks River Alliance, River Canoe Club, Roads and Maritime Services, Sydney Trains, Office of Environment and Heritage, and Sydney Water. On the first night, 23 participants developed long-term goals and possible actions to work towards the 2070 vision. On the second night, 21 participants developed the short-term 2030 goals and possible actions that covered the themes water and catchments, biodiversity, sustainable living and community connections. These are outlined in the Eastern Channel Subcatchment Goals and Action Plan.



Figure 5: Community Planning Forum

3.4 Refinement and Prioritisation of Actions

Following the vision sessions and planning forum, a group of local residents formed a working group and met in September 2019 to refine the actions and review on-ground works options. Actions relevant to Council were further investigated and prioritised by staff from across Council taking a multi-disciplinary approach.

On-ground green infrastructure works related to the actions are shown in italics in Table 1. More details of these actions and how they will be implemented are provided in Section 6 - Green Infrastructure Options.

4 Eastern Channel Subcatchment Goals and Action Plan

The goals and actions developed through the community planning forum and a technical study are provided below. The Eastern Channel Subcatchment Action Plan, as outlined in Table 1, details how Council and other stakeholders will work to achieve the short term 2030 Goals.

The Action Plan is a working document that will be reviewed by Council at least twice over the ten year period to 2030.

Eastern Channel Subcatchment 2070 Goals:

- 50% of the EC Subcatchment is vegetated with trees and understorey.
- Native habitat corridors connect all lands across the subcatchment to the waterways and beyond.
- More than 50% of rainfall is kept 'in catchment' and does not directly flow to the river.
- All run off into the river is of a suitable quality for recreation and for healthy natural systems.
- We are all custodians looking after our environment, place and people.
- We all value knowledge and skills that are shared to sustain our community and resources.
- Our diverse and inclusive public and private places are available to grow and harvest food, play, learn and socialise.
- All properties in the Eastern Channel Subcatchment (Tempe) are ecologically sustainable, supporting the natural environment.
- We have a 10 min walkable neighbourhood with 75% of road reserve area as green space.

Table 1: Eastern Channel Subcatchment Action Plan

2030 Goals	Actions - Actions related to on-ground works in <i>italics</i>	Responsibility
<p>1. 20% of the EC Subcatchment has tree cover</p>	<p>1.1 <i>Identify opportunities for tree and understory planting in targeted streets for integration into the Street Tree Master Plan</i></p> <p>1.2 Ensure that the Street Tree Master Plan contributes to the 20% tree cover goal and references the Eastern Channel Subcatchment Management Plan</p>	<p>Council - UFE Team</p> <p>Council - UFE Team</p>
<p>2. Understorey vegetation has increased from 2019 levels</p>	<p>2.1 Promote the Sustainable Streets – street garden program to EC Subcatchment residents</p> <p>2.2 <i>Identify opportunities for understorey planting to be put into the streetscapes landscaping schedule</i></p>	<p>Council - UFE Team</p> <p>Council - UFE Team</p>
<p>3. Native vegetation density and diversity has increased from 2019 levels in all habitat corridors</p>	<p>3.1 Ensure strategies for biodiversity include increasing vegetation density and diversity to enhance habitat corridors in the EC Subcatchment</p> <p>3.2 Develop a backyard biodiversity education program and pilot implementation in the EC Subcatchment</p>	<p>Council - UFE Team</p> <p>Council - UFE Team</p>
<p>4. The number of private properties with native habitat has increased</p>	<p>4.1 Strengthen Council’s development controls to increase native habitat</p> <p>See Action 3.2</p>	<p>Council - UStr Team</p>

Eastern Channel Subcatchment Management Plan, May 2020

2030 Goals	Actions - Actions related to on-ground works in <i>italics</i>	Responsibility
<p>5. 40% of houses have rainwater tanks and/or infiltration systems (such as rain gardens or swales)</p>	<p>5.1 Promote the Rainwater Tank Incentive Scheme and the Urban Ecology Education Program to EC Subcatchment residents</p> <p>5.2 Strengthen Council's development controls to increase installation of rainwater tanks and infiltration systems</p>	<p>Council – UFE Team</p> <p>Council – UStr Team</p>
<p>6. 40% of streets have green infrastructure designed to treat and hold water in the landscape</p>	<p>6.1 <i>Identify opportunities for WSUD in targeted streets for integration into the Capital Works Program.</i></p> <p>6.2 <i>Collaborate with EC Subcatchment stakeholders to design and implement WSUD works on the land they own or manage.</i></p> <p>6.3 Explore opportunities to include WSUD in flood mitigation works recommended in the Marrickville Valley Floodplain Risk Management Study and Plan</p>	<p><i>Council – FRTS Team</i></p> <p><i>Council – UFE Team</i></p> <p>Council – FRTS Team, Council – UFE Team</p>
<p>7. Community facilities, including schools, parks, open space and public domain, showcase approaches to treat stormwater run-off to improve river health</p>	<p>7.1 WSUD and biodiversity are included in Tempe High School's and Tempe Primary School's sustainability strategies</p> <p>7.2 <i>Identify opportunities for WSUD in parks, open space and public domain for integration into the Capital Works Program.</i></p>	<p>Schools</p> <p><i>Council – UFE Team, Council – FRTS Team</i></p>
<p>8. Community emissions are on track to meet the 2036 goal of 75% less than in 2017</p>	<p>8.1 Work with State Government to increase BASIX targets for energy use</p>	<p>Council – US Team, Council – UStr Team</p>

Eastern Channel Subcatchment Management Plan, May 2020

2030 Goals	Actions - Actions related to on-ground works in <i>italics</i>	Responsibility
	<p>8.2 Facilitate renewable energy uptake, particularly the installation of solar panels</p> <p>8.3 Increase building environmental performance standards in Inner West Council planning controls. i.e. higher BASIX benchmarks and NABERs pre-commitments</p>	<p>Council – US Team</p> <p>Council – US Team, Council – UStr Team</p>
<p>9. The number of properties in EC Subcatchment that are ecologically sustainable has increased</p>	<p>9.1 Promote Council’s environmental education programs and workshops on ecologically sustainable living to EC Subcatchment residents and businesses</p> <p>9.2 Promote the sustainability component of Council’s DCP to encourage green infrastructure, such as green walls and roofs</p> <p>See Actions 5.1, 8.1, 8.2, 8.3</p>	<p>Council – UFE Team, Council – US Team</p> <p>Council – UFE Team</p>
<p>10. 20% of residents participate in Council programs for ecological sustainability</p>	<p>10.1 Promote relevant State and Commonwealth government programs through Council’s media</p> <p>See Actions 3.2, 5.1, 9.1</p>	<p>Council – UFE Team, Council – US Team</p>
<p>11. 30% of local streets have trees in parking lanes</p>	<p>11.1 <i>All Local Area Traffic Management devices, such as traffic calming features, are vegetated including trees where possible.</i></p> <p>See Action 1.1</p>	<p><i>Council – UFE Team, Council – FRTS Team</i></p>
<p>12. 50% of people of all ages are involved in caring for our</p>	<p>12.1 Promote volunteering opportunities to care for people and the environment in the EC Subcatchment.</p>	<p>Council – UFE Team, Council – CSC Team</p>

Eastern Channel Subcatchment Management Plan, May 2020

2030 Goals	Actions - Actions related to on-ground works in <i>italics</i>	Responsibility
environment, place and people.		
13. Collaborative planning and decision making for sustainability in the EC Subcatchment happens with the people and in the place.	13.1 <i>Council collaborates with EC Subcatchment stakeholders on designing and implementing multifunctional green infrastructure projects.</i> See Actions 1.1, 2.2, 6.1, 6.2, 7.2	Council, Subcatchment community
14. Schools and community facilities are designed as multi-use locations for sustainability hubs for learning.	14.1 Explore joint use of schools with the NSW Department of Education	Council – CSC Team
15. Food is grown in shared private and public spaces	15.1 Develop a community garden policy 15.2 Licence community gardens on Council land 15.3 Subcatchment residents and organisations, including schools, collaborate to safely produce food in the Eastern Channel Subcatchment	Council – US Team Subcatchment community Schools
16. The area of public and private space available for community is increasing	16.1 Map the social, cultural and recreational assets across the subcatchment 16.2 Create a social, cultural and recreational asset strategy for the Inner West that includes the EC Subcatchment	Council – CSC Team

Eastern Channel Subcatchment Management Plan, May 2020

2030 Goals	Actions - Actions related to on-ground works in <i>italics</i>	Responsibility
	See Action 14.1	

UFE Team – Urban Forest and Ecology Team

UStr Team – Urban Strategy Team

CSC Team – Community Services and Culture Team

US Team – Urban Sustainability Team

FRTS Team – Footpaths, Roads, Traffic and Stormwater Team

5 Green Infrastructure Options

Opportunities to improve the local environment and help meet the Subcatchment goals were investigated across the EC Subcatchment in both the public and private domain.

Options have been identified for green infrastructure in:

- Private domain
- Streetscapes and roads
- Parks and open space
- Other public land and buildings

The options developed have been informed by existing conditions, physical and financial factors, land ownership and land use zoning.

5.1 Land Use Zones

EC Subcatchment is predominantly residential. The largest land use zones are low-density residential (45.9%), road reserves (19.6%) and infrastructure (13.1%). Natural waterways (6.9%) and special activities (6.9%) make up the next-largest areas and together these five areas represent more than 95% of the subcatchment area.

The table below lists the land use zones in the Subcatchment according to the Marrickville LEP (2011).

Table 2: Land use breakdown in EC Subcatchment (Tempe)

Zone	Description	Area (ha)	Area (%)	Main land manager
R2	Low density residential	23.9	45.9%	Private landholders
B1	Neighbourhood centre	0.1	0.3%	Private landholder
B5	Business development	0.4	0.7%	Private landholders
B6	Enterprise corridor	0.7	1.3%	Private landholders
RE1	Public recreation	0.5	1.0%	Public - Council
RE2	Private recreation	0.2	0.4%	Private landholders
SP2	Infrastructure	6.8	13.1%	Public - State government

SPI	Special Activities	3.6	6.9%	Public –State government
IN2	Light industrial	2.0	3.9%	Private landholders
W1	Natural waterways	3.6	6.9%	Public –State government
	Road reserves	10.2	19.5%	Public - Council
	Total	52	100%	

5.2 Options for the private domain

As Table 2 shows, a large proportion of land in the EC Subcatchment is zoned for uses that are predominately managed by private landholders. Residential and business related land zones account for approximately 60% of the Subcatchment and the residential use areas alone make up 51% of all the impervious area in the Subcatchment. The options for the private domain which are detailed in the Action Plan are:

- Promoting Council’s Sustainable Streets program
- Developing a backyard biodiversity program (see Figure 6)
- Promoting Council’s Rainwater Tank Incentive Scheme (see Figure 6)
- Promoting Council’s environmental education programs
- Promoting volunteering opportunities to care for people and the environment in the EC Subcatchment
- Residents and organisations, including schools, collaborate to safely produce food in the EC Subcatchment



Figure 6: Green infrastructure options for residential areas

5.3 Options for publicly managed land

Land managed by Council and State Government agencies makes up approximately 30% of all land within the Subcatchment. Potential green infrastructure works for these

areas, shown in Figure 7, were developed to help meet the EC Subcatchment goals. Sites were selected by:

- Looking at opportunities and constraints on public land;
- Working out potential pollution and volume reductions in stormwater runoff going to the Cooks River;
- Identifying biodiversity corridors across the subcatchment; and
- Reviewing other plans and strategies such as the Marrickville Street Tree Masterplan, Biodiversity Strategy and Marrickville Valley Flood Management Plan.

Possible locations for green infrastructure works include Council's parks and streetscapes, Tempe Train Station Commuter Car Park, Tempe Public School, Tempe High School and Betty Spears Childcare Centre.

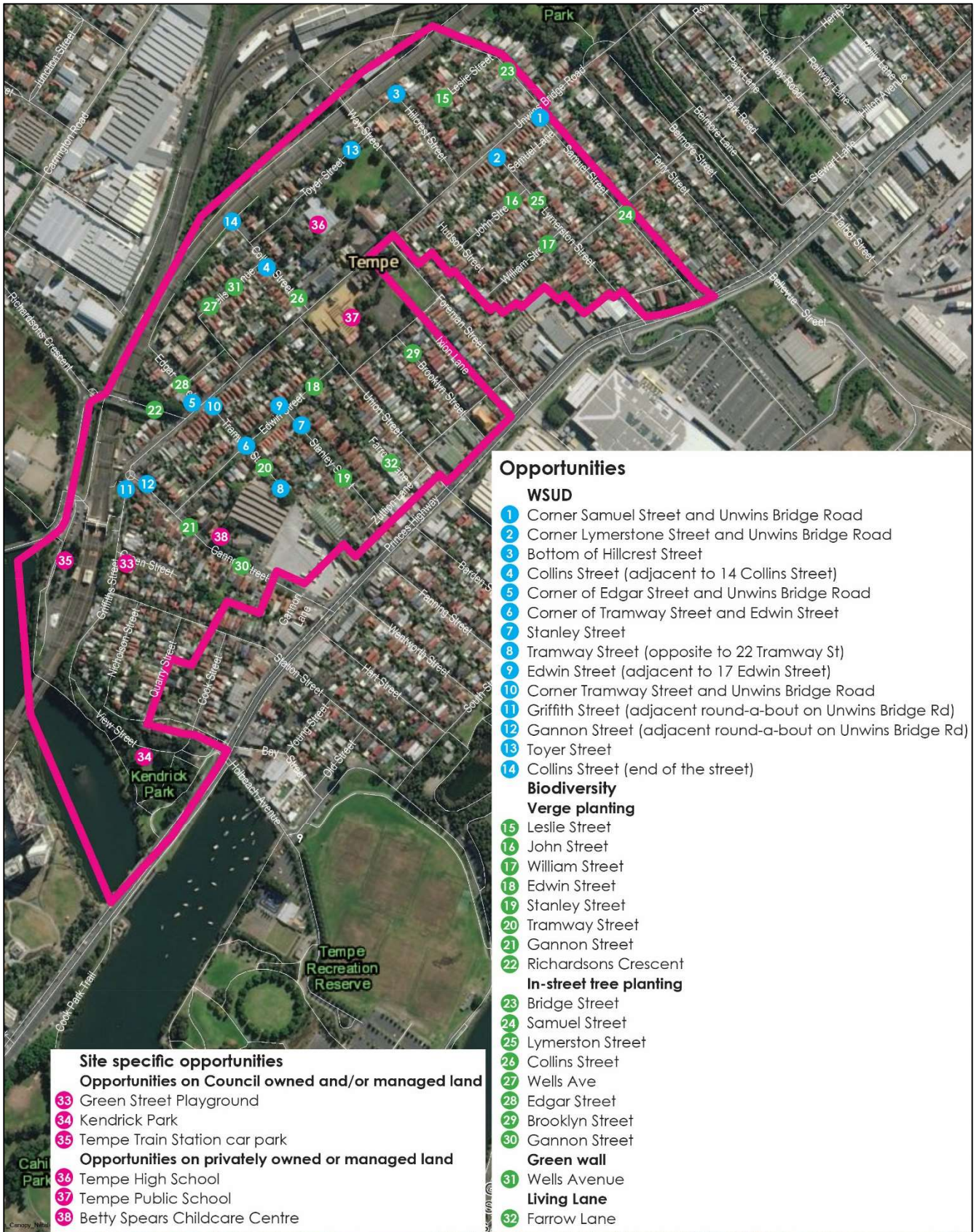


Figure 7: Eastern Channel Subcatchment Green Infrastructure Options

5.3.1 Funding Council Options

The identified works on Council owned land will be incorporated into Council's infrastructure works program for renewals and upgrades where possible. The proposed works will be scheduled based on Council's asset management plans and budgeted in Council's Long-Term Financial Plan.

Works will be funded by Council's Water Sensitive Urban Design projects budget and grants, such as the NSW Government 5 Million Trees Grant, as they become available.

5.4 Streetscapes and Roads

20% of the subcatchment is roads. They contribute to urban heat, local flooding and waterway pollution. Roads also contribute higher suspended solids and phosphorus loads than other surfaces. Therefore, streetscapes present an important opportunity to improve the local environment.

Streetscape green infrastructure options were divided into three categories:

- Footpaths and Verges
- Laneways
- Roads

They present opportunities to:

- Reduce impervious areas by replacing roads or footpaths with pervious materials or planted areas
- Increase greening, canopy cover and biodiversity by creating new garden beds
- Improve streetscape appearance and provide shaded, pleasant footpaths to encourage walkability

5.4.1 Footpaths and Verges

The area of footpaths in EC Subcatchment has been estimated as 3.1 ha, approximately 6% of the subcatchment area. In some streets there is potential for more substantial pervious areas to be created by planting in existing verges and footpaths.

Instead of discrete areas around trees, a continuous strip could be planted along the verge and include:

- Native plantings to improve habitat and support biodiversity
- Gravel, stepping stones, porous paving or other pervious surface covering where pedestrian access is required



Figure 8: Verge garden precedent images (Marrickville)

Opportunities for verge planting have been investigated along streets with wide footpaths which are currently paved or turfed. Five verge planting streets were identified by assessment using a multi-criteria framework, shown in Table 3.

Table 3: Identified streets for footpath greening

Priority	Street	Existing case		Potential future scenario with biodiversity plantings in verge	
		Existing footpath widths	Total footpath area (m ²)	Total footpath area (m ²) with 1.5m wide footpaths	Area (m ²) planted with local native species
1	William Street	3.5m	1000	420	580
2	Stanley Street	1.5m with a 4m turf verge	600	600	960
3	Edwin Street	1.5m with a 4.5m turf verge	820	820	2,700
4	Tramway Street	n/a	n/a	0	500
5	Gannon Street	2 - 4m	970	900	250
Total new area of biodiversity plantings in verge					4,990

As shown in Table 3, if the top 5 priority streets were modified to reduce the footpath width to 1.5m and incorporate continuous verge planting, an estimated 4,990 square metres of footpath or turf could be converted to biodiversity areas.

Completing the five verge garden and in-street planting projects will result in:

- Almost 5000m² of additional planted verge areas
- Increased habitat connectivity across the subcatchment
- Improved liveability and aesthetics

5.4.2 Laneways

The EC Subcatchment has 9 lanes with an estimated area of 0.5 ha. They cover 1% of the subcatchment. Laneways are typically 100% paved and most of this is a road surface.

Laneway projects present opportunities to:

- Reduce impervious areas by replacing roads with planted areas
- Treat runoff by slowing and capturing water for treatment before it reaches the stormwater system
- Increase biodiversity and habitat
- Create pleasant multi-functional spaces which can operate as public open space



Figure 9: Wilford Lane, Newtown (left) and Zuttion Lane (right) in the EC Subcatchment

Two lanes have been identified as high priority site for laneway projects, these are Farrow Lane and Zuttion Lane, shown in Table 4. Laneway upgrades here have great potential to improve liveability for the local residents.

Table 4: Priority lanes for greening

Priority	Lane	Size (m ²)	Notes
1	Zuttion Lane	790	<ul style="list-style-type: none"> • No exiting stormwater infrastructure • Green infrastructure elements could include green façade and permeable paving • Forms rear lane access to Tempe Hotel car park • Already scheduled for renewal in Council’s 4-year capital works program

Priority	Lane	Size (m ²)	Notes
2	Farrow Lane	400	<ul style="list-style-type: none"> Existing stormwater infrastructure Preliminary concept design completed and includes permeable paving, bioswale in centre of lane, planter boxes with climbers. Forms an access road for Farrow Lane residents

5.4.3 Roads

Roads cover 20% of the Subcatchment and cause significant stormwater pollution. They contribute almost 50% of the TSS and TP loads in the subcatchment. Green infrastructure options for roads include:

- In-street planting
- Streetscape rain gardens

These provide similar opportunities as verge and foopath options described previously. In addition:

- Rain gardens treat runoff by slowing and capturing water for treatment before it reaches the stormwater system
- In-road planting will increase canopy cover and provide shade
- Street tree pits designed with WSUD will also provide stormwater treatment benefits

In-street planting



Figure 10: In-street tree planting precedent image, Haberfield (left) and Tempe (right)

Tempe’s tree canopy cover is 10% at the most. Along with Sydenham and St Peters, it has the lowest canopy cover in the Inner West LGA. The subcatchment is affected by urban heat and also includes populations vulnerable to heat stress.

Opportunities for in-street tree planting have been analysed by reviewing existing street widths and identifying wide streets. Where preliminary analysis indicated that in-street

tree planting could be feasible, further analysis was done to investigate car parking, stormwater services and overhead power lines.

Five in-street planting streets were identified by assessment using a multi-criteria framework, shown in Table 5.

Table 5: Identified in-street planting sites and species

Number	Location	Approximate number of new trees	Suggested species (Marrickville Street Tree Masterplan, 2014)
1	Gannon Street	20	<i>Syzygium paniculatum</i> (opposite wires) <i>Acmena smithii</i> var. <i>minor</i> , <i>Tristaniopsis laurina</i> (under wires)
2	Brooklyn Street	18	<i>Melaleuca bracteata</i> (opposite wires) <i>Lagerstroemia indica</i> (under wires)
3	Collins Street	14	<i>Syzygium paniculatum</i> (opposite wires) <i>Tristaniopsis laurina</i> , <i>Acmena smithii</i> var. <i>minor</i> , <i>Angophora hispida</i> (under wires)
4	Samuel Street	28	<i>Lophostemon confertus</i> (both sides)
5	Edgar Street	10	<i>Eucalyptus haemastoma</i> , <i>Acacia binervia</i> , <i>Acmena smithii</i> (opposite wires) <i>Banksia serrata</i> , <i>Tristaniopsis laurina</i> (under wires)

Streetscape rain gardens

Opportunities for streetscape rain gardens have been investigated where streets have underground stormwater systems.

Where preliminary analysis indicated that rain gardens could be feasible, further analysis was done to check the rain garden area for potential connection with other infrastructure works.



Figure 11: Rain garden precedent images (Marrickville and Glebe)

The top five rain garden sites were identified by assessment of all rain garden projects using a multi-criteria framework, shown in Table 6.

Table 6: Identified streetscape rain garden sites

Priority	Location	Approx. rain garden area (sqm)	Catchment area (ha)	TN removal (kg/year)
1	Toyer Street	515	0.385	1.68
2	Hillcrest Street	180	1.55	12.5
3	Stanley Street	65	0.45	4.14
4	Griffith Street	75	0.75	9.6
5	Corner of Tramway and Edwin Streets	105	0.47	2.2

If the top five projects are built, this will achieve:

- 30kg less Total Nitrogen entering the Cooks River per year
- 940 m² additional rain gardens and planted area
- Stormwater from 3.6ha of catchment area treated

5.5 Parks and public open space

Only 1.5% of the subcatchment area (1.2 ha) is zoned as open space. Due to the small area available, any public open space in the subcatchment must be designed as a multi-functional asset for community use. Options in parks and other public open space have to address a number of common issues such as stormwater related erosion, under and over utilisation of spaces and hot spots for litter. Opportunities for green infrastructure include:

- Biodiversity plantings and habitat enhancement

- Rain gardens and bioswales



Figure 12: Examples of open spaces in the Eastern Channel Subcatchment

Options for green infrastructure have been investigated, two potential projects were identified and concept designs were prepared for water sensitive nature play in Green Street playground and rain gardens and plantings in Kendrick Park. They are listed in Table 7 below.

Table 7: Green infrastructure options in public open spaces in the subcatchment

Park	Options	Approx. area (m ²)	Plant numbers	Approx. rain garden area (m ²)	Catchment area treated (m ²)	TN removal (kg/year)
Green Street Playground (276m ²)	• Rain garden and bioswale in park, incorporating nature play	20 (rain garden) + 16 (bioswale)	216	10	6,000	2.52
	• Biodiversity planting	85	540	n/a	n/a	n/a
Kendrick Park (16,703m ²)	• Foreshore revegetation	3 x 75m ²	1,350	n/a	n/a	n/a
	• Rain garden and bioswale (Nicholson Street)	40 (rain garden) + 20 (bioswale)	360	40	3,380	2.25
	• Rain garden and bioswale (Quarry Street)	30 (rain garden) + 20 (bioswale)	300	30	2,500	1.96
	• Rain garden and bioswale	85 (rain garden) +	660	60	4,200	5.72

	(corner Bay and View Street)	25 (bioswale)				
	• Rain garden (View Street)	80	480	60	1,630	1.44
	• Biodiversity planting	275	1,650	n/a	n/a	n/a
	• Biodiversity planting	960	5,760	n/a	n/a	n/a
	• Verge planting	450	2,700	n/a	n/a	n/a
	• Biodiversity planting	200	1,200	n/a	n/a	n/a

Completing the open spaces projects will result in:

- 11,510m² of catchment area treated (2.2% subcatchment)
- Additional 13,907m² of native understorey planting areas

5.6 Other public land and buildings

Other key green infrastructure opportunities on state owned public land in the subcatchment are in:

- Tempe Public School
- Tempe High School
- Betty Spears Childcare Centre
- Tempe Train Station and railway land (3.2% of subcatchment)



Figure 6: Tempe Public School (left) and Betty Spears Childcare Centre

The relevant key stakeholders for each site have been engaged through the subcatchment planning process. Further development of these options by land owners/managers would support the EC Subcatchment goals.

6 Recommendations

The subcatchment planning process used a collaborative approach to create a plan for green infrastructure and ecological sustainability actions for the next ten years. Guided by the goals and actions developed by the EC Subcatchment community and stakeholders a number of green infrastructure options have been investigated. Of these, a list of priority options and outcomes are summarised in Table 8.

The priority green infrastructure options will make a reasonable contribution to achieving the EC Subcatchment goals. However, the opportunities for Council to treat stormwater and improve biodiversity within public open space are limited. Therefore, actions by the community in the private domain and other stakeholders (such as schools) will be crucial to achieve the long term goals for EC Subcatchment.

Table 8: Priority green infrastructure options and outcomes for Eastern Channel Subcatchment

Location and recommended option	New trees	Potential shade provision (m ²)	Additional biodiversity planting (m ²)	Additional plants	Potential catchment area treated (ha)	TN removal (kg/year)
Green Street Playground rain garden, bio swale and biodiversity planting incorporating nature play	2	50	90 and 36 (rain gardens and bioswales)	756	0.6	2.08
Kendrick Park – 4 rain gardens, bioswales and biodiversity plantings	10	250	2,100 and 300 (rain gardens and bioswales)	14,400	1.17	11.37
Top five streetscape rain gardens	12	300	940	5,640	3.6	30
Top five in-street tree planting sites	90	2,250	540	3,240	-	-

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Location and recommended option	New trees	Potential shade provision (m ²)	Additional biodiversity planting (m ²)	Additional plants	Potential catchment area treated (ha)	TN removal (kg/year)
Top five verge planting streets	15	375	4,990	29,940	-	-
<i>Total new trees and plants</i>	129			53,976		
<i>Total additional shade (m²)</i>		3,225				
<i>Total additional catchment area planted (m²)</i>			8,996			
<i>Total catchment area potentially treated (ha)</i>					5.37	
<i>Total TN removal / year (kg)</i>						43.45
<i>Proportion of total catchment</i>			1.7%		10.3%	

7 Glossary

Biodiversity

Biodiversity is the variety of all living things, from the smallest microbe to the massive Blue Whale.

Climate change

Climate change refers to any change in climate over time, whether due to natural variability or as a result of human activity (NSW DPIE).

Ecology

Ecology is the scientific study of the processes influencing the distribution and abundance of organisms, the interactions among organisms, and the interactions between organisms and the transformation and flux of energy and matter (Cary Institute of Ecosystem Studies, 2018).

Ecosystem

An ecosystem is a dynamic community comprising populations of plants, animals, microorganisms and the non-living environment interacting together as a functional unit.

Ecosystem services

Ecosystem services are the benefits that plants, animals, water, soil, and air provide, e.g:

- trees acting as carbon sinks and providing oxygen and cooling;
- landscapes providing habitat, food, aesthetic, cultural and mental health benefits;
- fungi and insects supporting the food chain, soil formation and breaking down waste;
- bees, bats and birds pollinating plants

Green infrastructure

Green infrastructure is the natural and engineered infrastructure that results in the provision of ecosystem services, e.g. trees, parks, wetlands, saltmarsh, roof gardens, habitat; or ecosystem service functions e.g. stormwater harvesting.

Habitat

Habitat is the natural home or environment of an animal, plant, or other organism.

Impervious area

Impervious areas are covered by material that significantly reduces and prevents natural infiltration of water into the soil.

Potable water

Drinking quality water. In Sydney, Sydney Water pipes in the water from the catchment area to the west of Sydney. Sydney Water's operating license comes under strict guidelines and reporting requirements to make sure the quality is always safe for human consumption.

Stormwater

Stormwater is rain that drains into the stormwater system as 'runoff' from roofs, roads, footpaths and other surfaces. It usually flows untreated directly into local waterways. The water carries pollutants such as rubbish, animal droppings, engine oil, petrol, tyre rubber, soil, pesticides, asbestos and debris. Stormwater from public and private properties is increasingly being used to irrigate local sports fields and parks and provide water for wetlands.

Subcatchment

A subcatchment is a smaller catchment (or area) within a bigger catchment - the area of land which feeds water to the river. All the water enters the receiving waterway at the same point (in this case via the Eastern Channel next to the train line).

Urban ecology

Urban ecology is the interrelationship of all living things with people and the physical built environment including towns and cities.

Urban forest

An urban forest is the totality of trees and shrubs on all public and private land in and around urban areas (including bushland, parkland, gardens and street trees) and is measured as a canopy cover percentage of the total area and is recognised as a primary component of the urban ecosystem.

Water sensitive cities

Water sensitive cities are places that:

- serve 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;
- provide ecosystem services and a healthy natural environment, thereby offering a range of social, ecological, and economic benefits; and
- consist of water sensitive communities where citizens have the knowledge and desire to make wise choices about water, are actively engaged in decision-making, and demonstrate positive behaviours such as conserving water at home. ([CRC for Water Sensitive Cities](#), 2018)

Water Sensitive Urban Design (WSUD)

WSUD is an urban planning, engineering and landscape design approach which integrates urban water cycle management (water supply, stormwater, groundwater, wastewater), with urban design to provide multiple benefits including improving environmental health and supplying ecosystem services.

8 References

ABS (Australian Bureau of Statistics), 2016 *Census Community Profiles*. Available: <http://www.censusdata.abs.gov.au/>.

Marrickville Council, 2011, *Biodiversity Strategy 2011-2021*

Marrickville Council, 2011, *Marrickville Local Environment Plan, 2011*

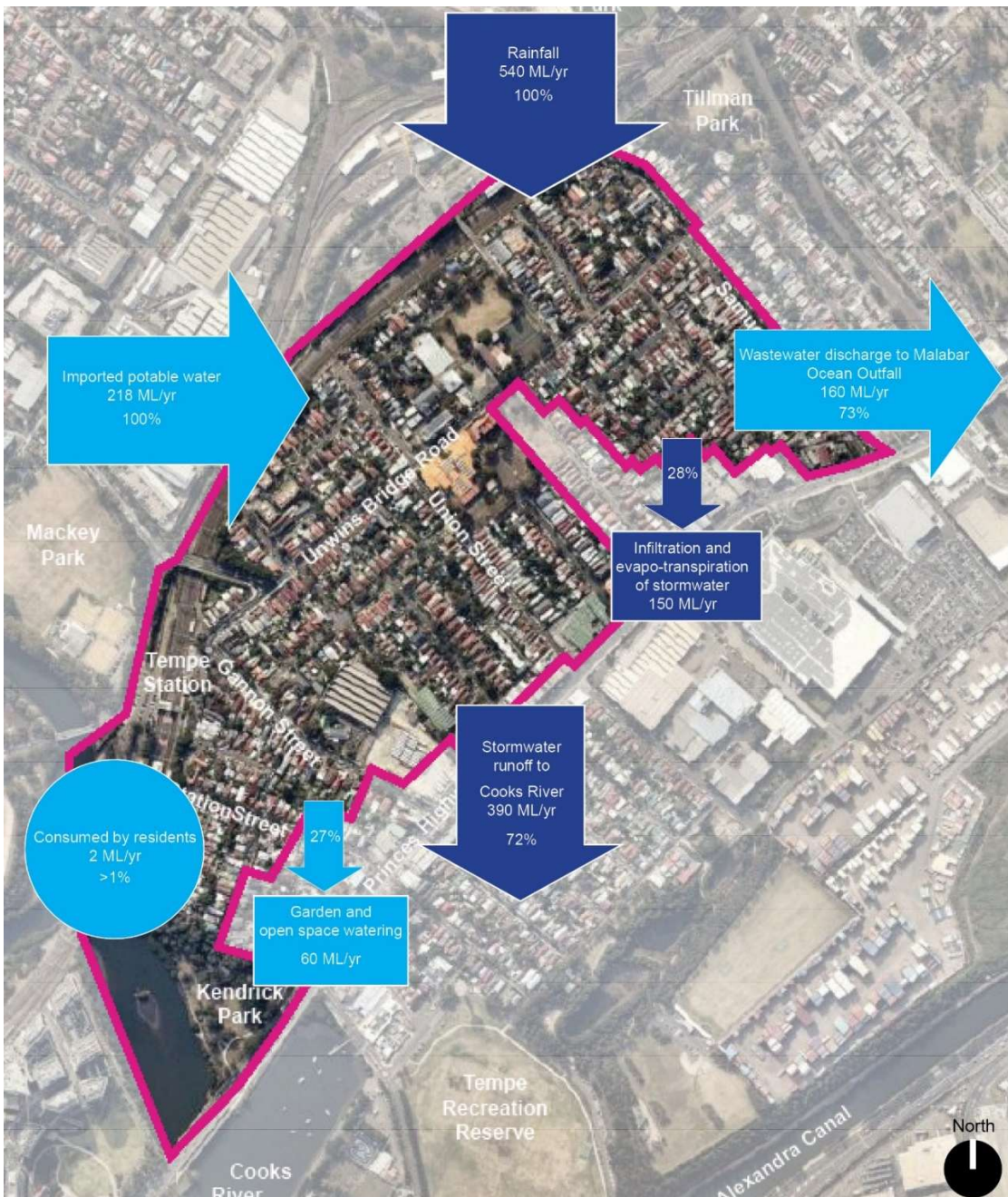
Inner West Council 2019a, *Planning the Eastern Channel Subcatchment (Tempe)*, information booklet.

Inner West Council 2019b, *Eastern Channel Subcatchment (Tempe) Physical Profile*, Technical Report.

9 Appendices

Appendix A: Eastern Channel Subcatchment Urban Water Cycle

The urban water cycle in the Eastern Channel Subcatchment is based on research and data from the Bureau of Meteorology, Sydney Water, and stormwater modelling. A study of the urban water balance highlights where potable (drinking quality) water savings can be made through harvesting rainwater and stormwater. Stormwater harvesting also provides an opportunity to treat stormwater and reduce the amount of pollution going into the Cooks River.



Eastern Channel Subcatchment (Tempe) urban water cycle

Appendix B: Water Efficiency

According to Sydney Water’s 2017–2018 data, Tempe houses and units/flats are already relatively water-efficient compared to Sydney-wide data. An average Tempe house uses 183 kL/year (see Table x). Many simple water efficiency measures (like installing more efficient fittings and appliances and planting more water-efficient gardens) may have already been undertaken however further reductions in water demand may come from behaviour change and substituting potable water with non-potable supplies such as rainwater tanks or recycled water.

2017–18 Sydney Water data for houses and units (annual water use in kL/year)

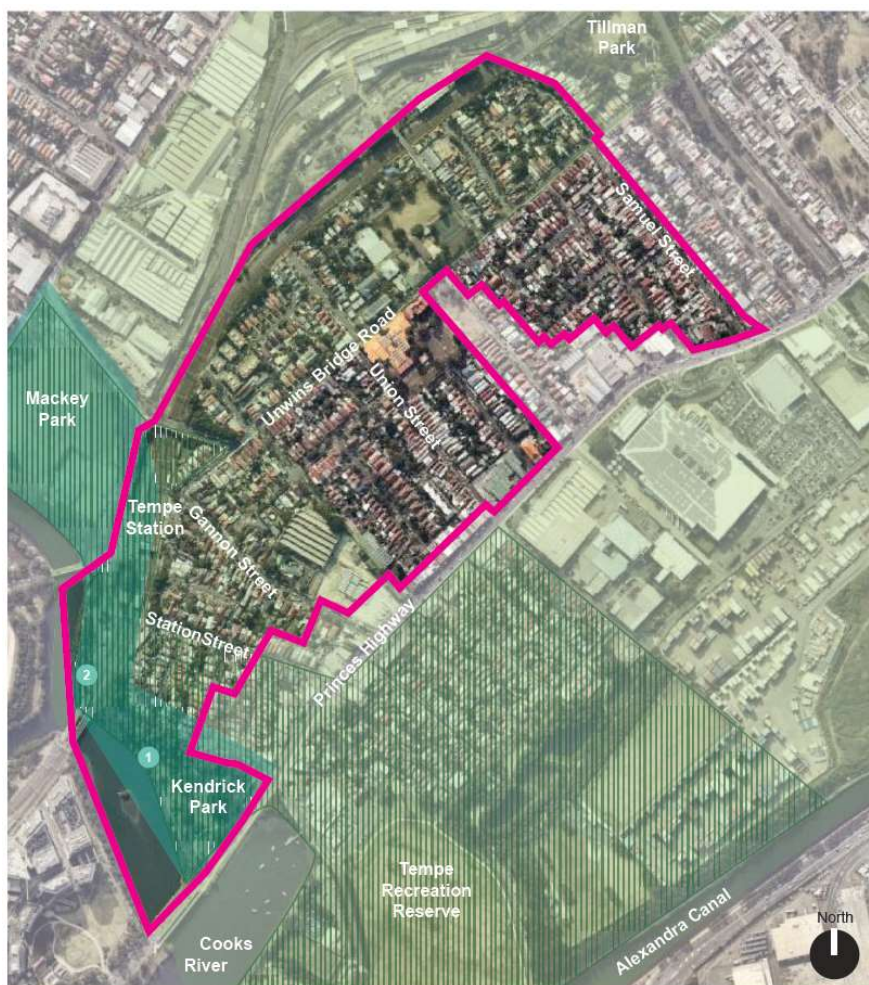
Property	Tempe	Inner West	Sydney
House	183.7	191	249
Unit/flat	132	135	159

Appendix C: Urban Ecology – Wildlife Corridor and Priority Biodiversity Area

The land along the Cooks River foreshore has been identified as an important wildlife corridor and part of the Cooks River Priority Biodiversity Area (Marrickville Local Environment Plan 2011). This wildlife corridor connects Marrickville Golf Course to Kendrick Park, the largest park in Eastern Channel Subcatchment (Tempe).

This area important because it:

- provides structural habitat through a mixture of native and exotic vegetation and food resources for a range of fauna, including frogs, rock/crevice dependent reptiles, moisture dependent reptiles, nocturnal birds, small grain-eating birds, small nectar-eating and insect-eating birds, microbats and mega bats; and
- provides local and regional connectivity. In particular, Kendrick Park and the Cooks River link Mackey Park and Tempe Reserve via the low-lying land and vegetation along the river corridor (Marrickville Biodiversity Strategy 2011-2021).



■ EC Subcatchment boundary ■ Biodiversity Priority Planting Areas (Marrickville Council)
 Wildlife Corridor (Marrickville LEP and DCP)
 Priority Biodiversity Area (Marrickville Council)

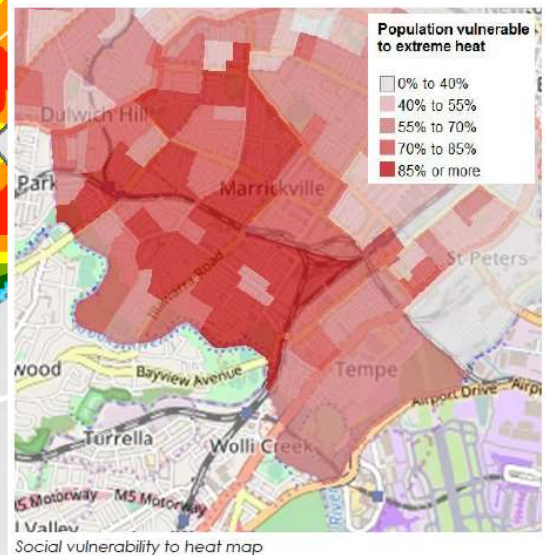
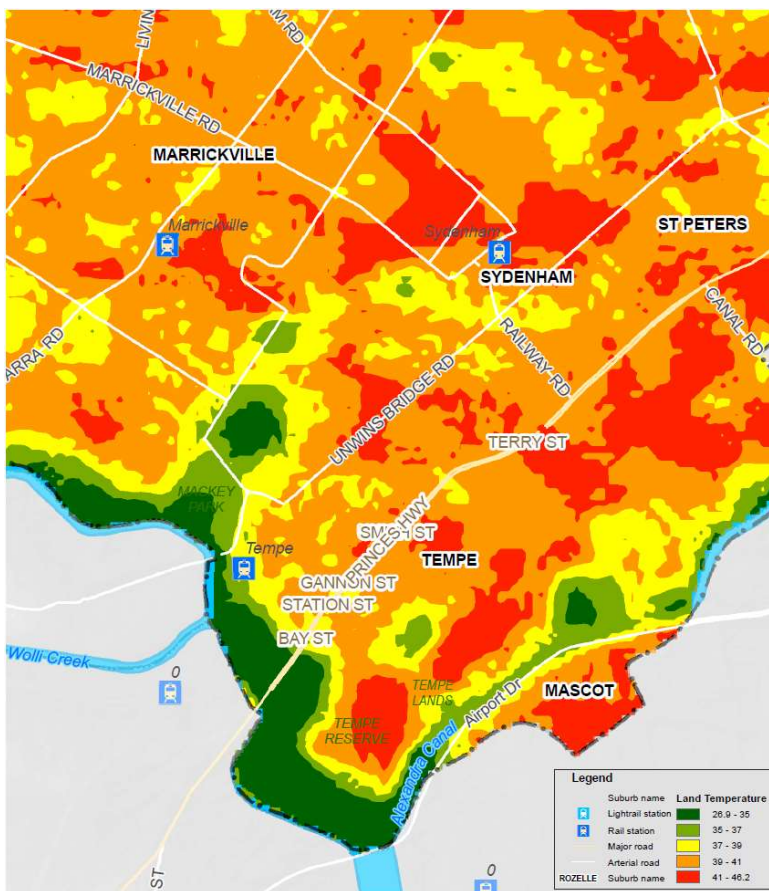
Eastern Channel Subcatchment (Tempe) biodiversity areas

Appendix D: Urban Ecology – Urban Heat and Climate Change

The Eastern Channel Subcatchment (Tempe) currently has a low canopy cover and its total area is made up of 70% hard surfaces. Urban areas with a high proportion of hard surfaces such as concrete and roads store and radiate heat, especially where there is little vegetation. This build-up of heat is known as the urban heat island (UHI) effect. The urban heat map below shows land surface temperatures on 2 February 2011, a heatwave day (data provided by CSIRO and Geosciences Australia).

Addressing the risk of heatwaves and the UHI effect is a high priority. Some people are more vulnerable to heat stress due to age, health or other factors. The social vulnerability to heat map shows areas where the community is more vulnerable to heat stress, and this can be used, in combination with the urban heat map, to help prioritise locations where more green cover is needed most.

Urban heat can be reduced by increasing green cover. Green infrastructure options have been identified and listed in this plan that will address urban heat and include increasing vegetation cover and keeping more water in the landscape through water sensitive urban design (WSUD) in new and existing areas.



Eastern Channel Subcatchment Heat and Population Vulnerability Maps