



Parramatta Ways Walking Strategy

Implementing Sydney's Green Grid

The City of Parramatta is a proud signatory of the Walk 21 International Charter for Walking





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Parramatta Ways

An Interconnected Network of Great Streets and Open Space



Parramatta Ways is a plan to improve walkability across Parramatta. Walkability is a measure of how pleasant and attractive an area is to walk. Internationally, it is recognised as one of the key aspects that make a city liveable.

Parramatta has many great destinations such as parks, natural bushland and heritage sites that provide good reasons to walk. To make our city more walkable we need to better connect people to these places and support walking in their everyday journeys.

At the core of this strategy is our street network, the local corridors and footpaths that provide access to shops, schools, open space, transport options and community facilities. Some of the key destinations are also the urban creek and open space trails that form green corridors across Parramatta. Together these streetscapes and green corridors provide an opportunity to create an extensive network, tying together the places people live and work with great places to visit.

As a result this strategy is not just about transport but also a plan for increasing urban greening, recreation and local centre amenity. It is about continuing to improve the quality of our streetscapes, open space and river corridors to make our city more attractive for walking.

To realise Parramatta Ways we will bring together the existing programs of work and teams across Council that are already delivering outcomes such as Transport, Streetscapes, Urban Greening, Recreation, Environment, Place Making, City Activation, Water Sensitive Urban Design, Heritage and Urban Heat Island effect mitigation.



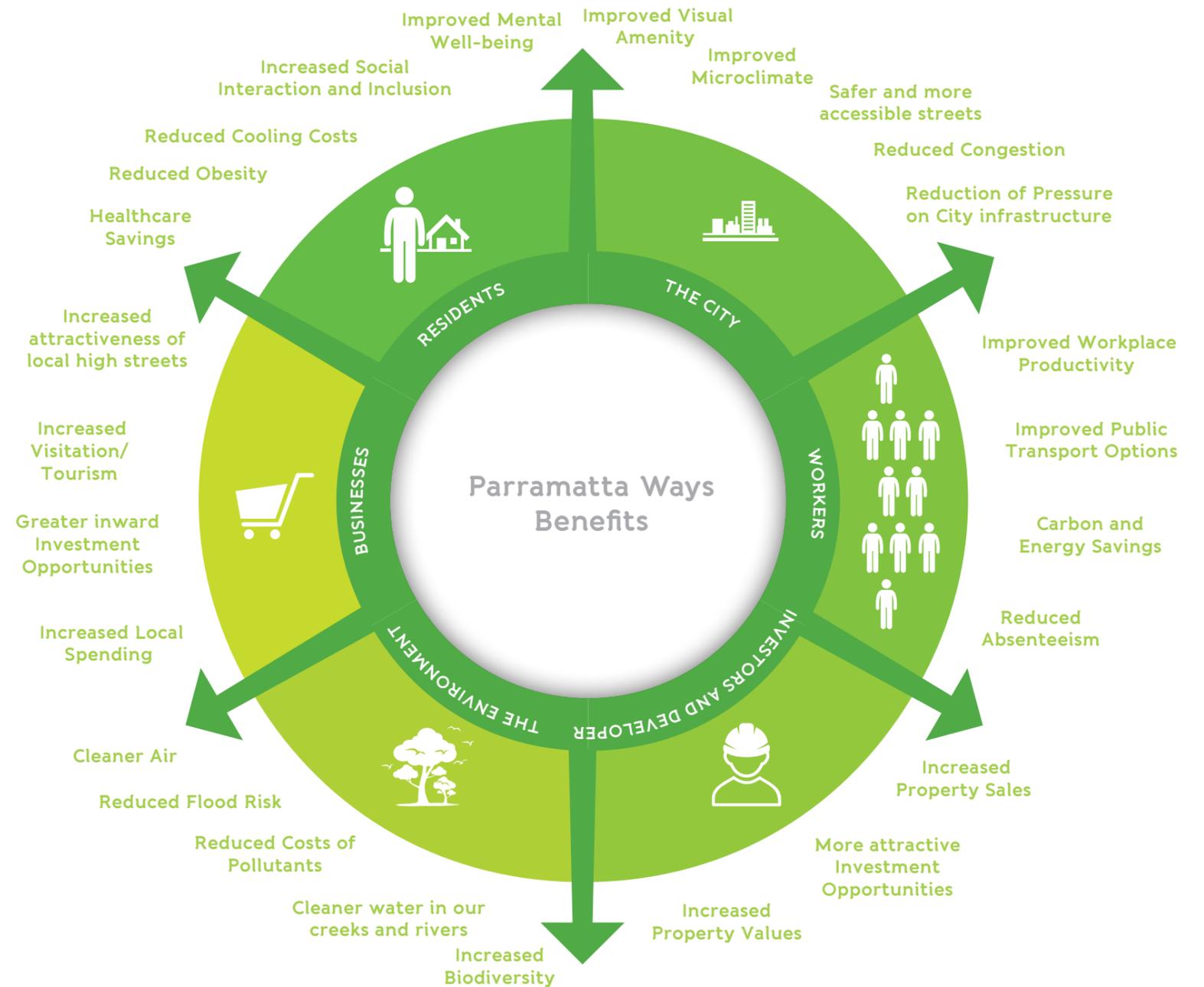
Through program alignment we aim to increase in number the delivery of these projects and their capacity to achieve multiple benefits. A clear long-term vision will allow Parramatta Ways to be built over time through a multi-stage implementation strategy.

Parramatta is facing significant growth and infrastructure investment. Parramatta Ways aims to assist in successfully integrating new development patterns, densities and facilities with existing communities and valued local destinations. Balanced growth provides the opportunity to establish a future pattern of development where access and liveability are not only managed but also enhanced.

This strategy is an important part of making Parramatta Australia's next great city. As Parramatta takes its place as a global city at the centre of Sydney, it will help ensure we meet the expectations of both our current and future residents.



Benefits of Parramatta Ways



Expanding our Liveable Network

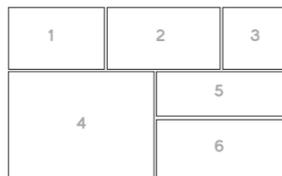
Building on Great Places and Recreation Opportunities



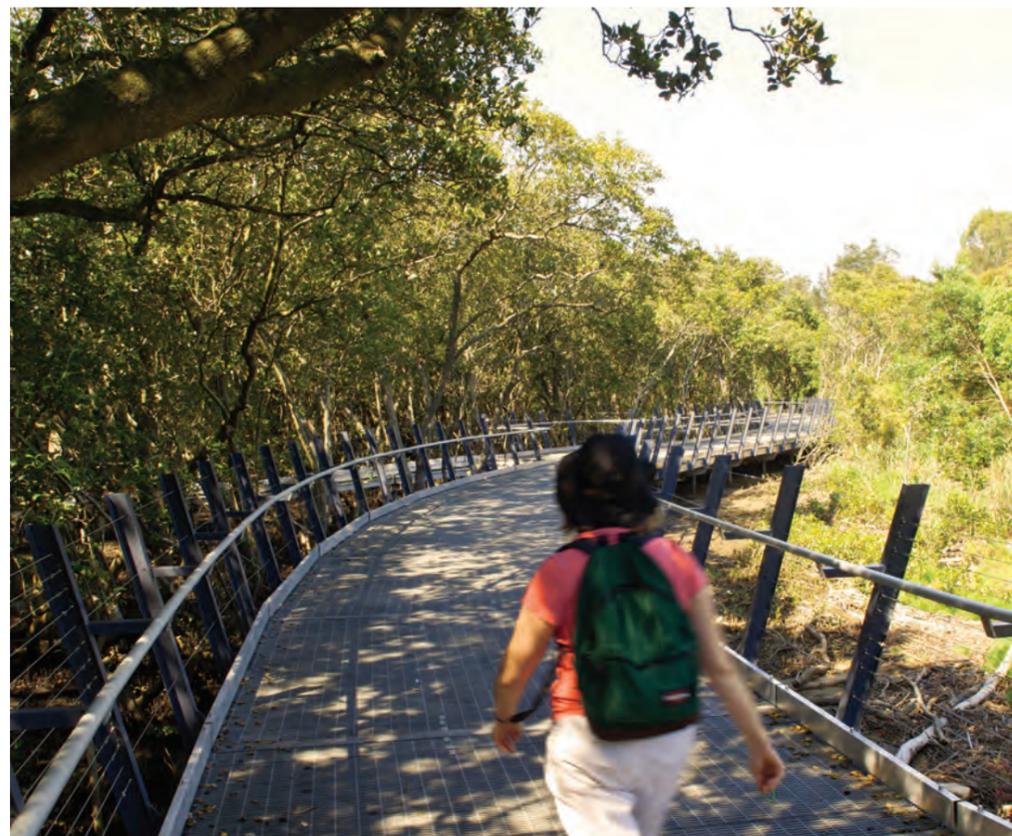
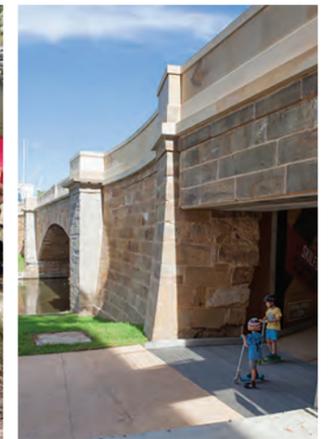
The City of Parramatta has numerous examples of high quality open space and active transport projects either already delivered or underway. Examples such as the Parramatta Valley Cycleway, Baludarri Wetlands boardwalk and the re-opening of Lake Parramatta for swimming have all been embraced by the community. These are some of the important projects that help make our city liveable. Parramatta Ways aims to build on this success, increasing access through and to these places.

We want to create a safe and attractive walking network, accessible to everyone. A network that provides a great variety of local walking opportunities and supports our community and the environment. It will help reveal some of our existing cultural assets, reinforcing a distinct and local character. It will increase our city's environmental resilience through increased canopy cover and green infrastructure. It will also become part of the greater transportation network, making it attractive for people to walk more and drive less.

Parramatta Ways aims to bring more life to our streets, creating a green, active and walkable city. As part of our vision we have outlined a series of project objectives and targets. These will be used over the longer term to measure our success.



1. Centenary Square - Parramatta CBD
2. Lake Parramatta
3. Lennox Bridge portal
4. Parramatta Valley Way - Ermington
5. Baludarri Wetlands
6. Riverside Park - Newington



Project Objectives

Aspirations for Parramatta Ways

Targets

1
Identify and complete priority missing pedestrian network connections

2
Increase recreational walking participation

3
Increase walk to school rates

4
Increase walk to work/public transport trips

5
Increase foot traffic to local centres

6
Increase tree canopy cover along network

7
Increase perceptions of safety associated with walking

8
Ensure all residents live within 5min walk of the Parramatta Ways network

The City of Parramatta is preparing a delivery framework which will include a data collection and monitoring framework for determining measurable indicators linked with our targets. Refer Appendix A



Create a Walkable City

Connect Parramatta by making walking safe, comfortable and attractive for all users across the LGA



Reveal Parramatta

Establish Parramatta as a key regional destination by revealing its iconic, everyday and hidden attractions



Improve the Environment

Improve the environmental performance of streets and walkways through significant tree planting and enhanced green corridor connections



Build on Local Identity

Provide walks with a distinctive identity related to local heritage and the specific qualities of place



Support Healthy Lifestyles

Create an environment that encourages active living and improves well-being



Engage the Community

Enable opportunities for increased community engagement and participation

Community Expectations

Community Consultation and Survey Feedback



Parramatta Ways is a project that is closely aligned with the needs and expectations of our community. This alignment can be most clearly seen in recent work undertaken on defining the future vision of Parramatta. As part of this process extensive consultation (over 9000 people) was undertaken to define a shared vision and priorities for the City.

Through this process participants provided some strong feedback on both how they feel about Parramatta and what they would like to see in future. Through the variety of responses there were some clear trends in the topics and themes.

Critically, it is interesting to note the alignment of some of the top priorities:

- Managing Growth
- Improving Transport
- Promoting Green Spaces and the Environment

Our residents have a strong sense of local identity and pride in their communities. The future growth is seen as an important aspect of stronger Parramatta however our residents want to see the infrastructure that supports this growth delivered alongside development. The community also want to ensure that existing green and open space is protected.



Top strategic priorities - A Shared Vision for Parramatta

Parramatta Ways is a plan to deliver both integrated transport and new open space opportunities. It is a local, community oriented project that aims to put more life on our streets and assist in delivering the infrastructure that supports future growth.

Other consultation has also been undertaken that demonstrates the community's desire for Parramatta Ways outcomes. In a 2016 community survey on Environmental Attitudes and Behaviours the people of Parramatta indicated that walking and cycling routes were the number one topic that they were most interested in learning about.

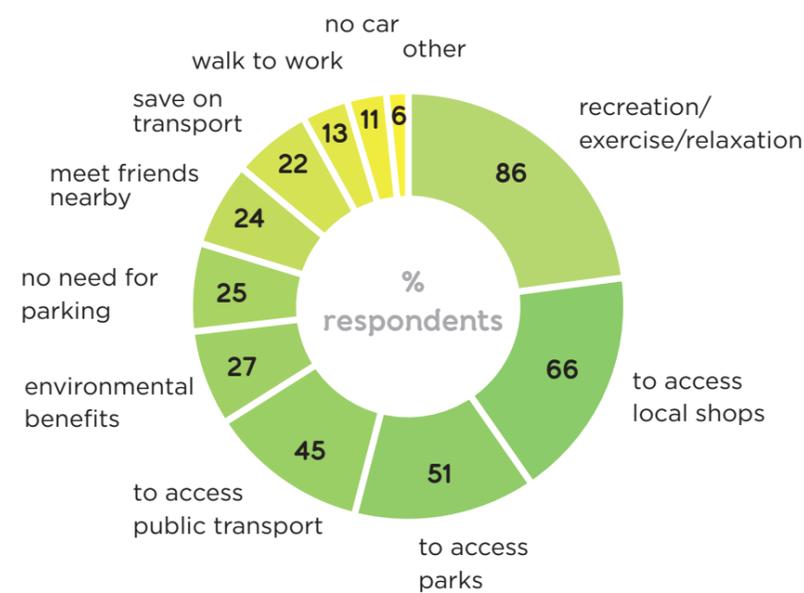
In addition, members of Our City Your Say panel were surveyed in December 2015 regarding their walking habits, motivations, reasons for avoidance, and the types of facilities and assets that the community expects. When asked, respondents indicated the factors that would improve walkability are firstly better quality footpaths and crossings (26%), followed by trees to provide shading (17%).

Initial surveys have provided important information on what the community would like to see in their local area. Ongoing community engagement will be critical to the success of Parramatta Ways. A more extensive consultation and engagement process will be undertaken through implementation phases to ensure Parramatta Ways meets the needs of individual communities.

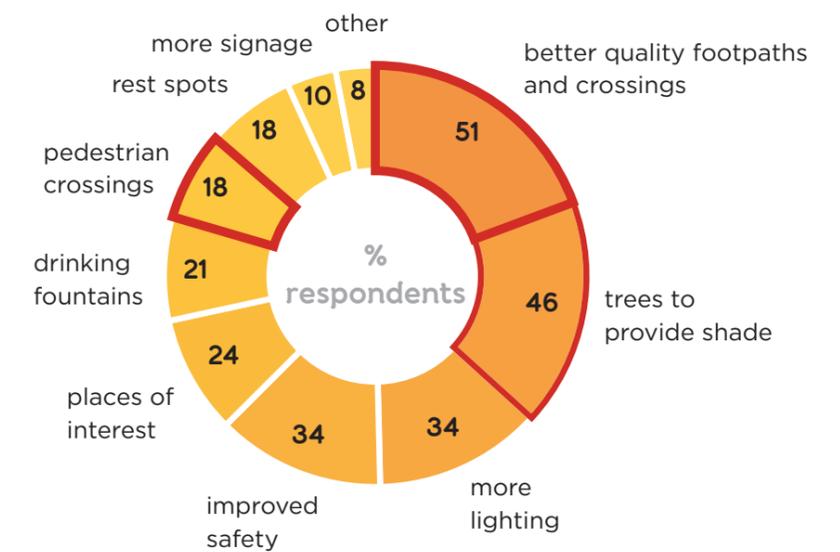


Selected Community Voice Panel Results

Q3: Why do you walk?



Q7: What are the factors that would improve walkability in your area?



Note
Respondants could select more than one option during survey.

The Importance of Parramatta

The Drivers for creating a Green, Active and Walkable city

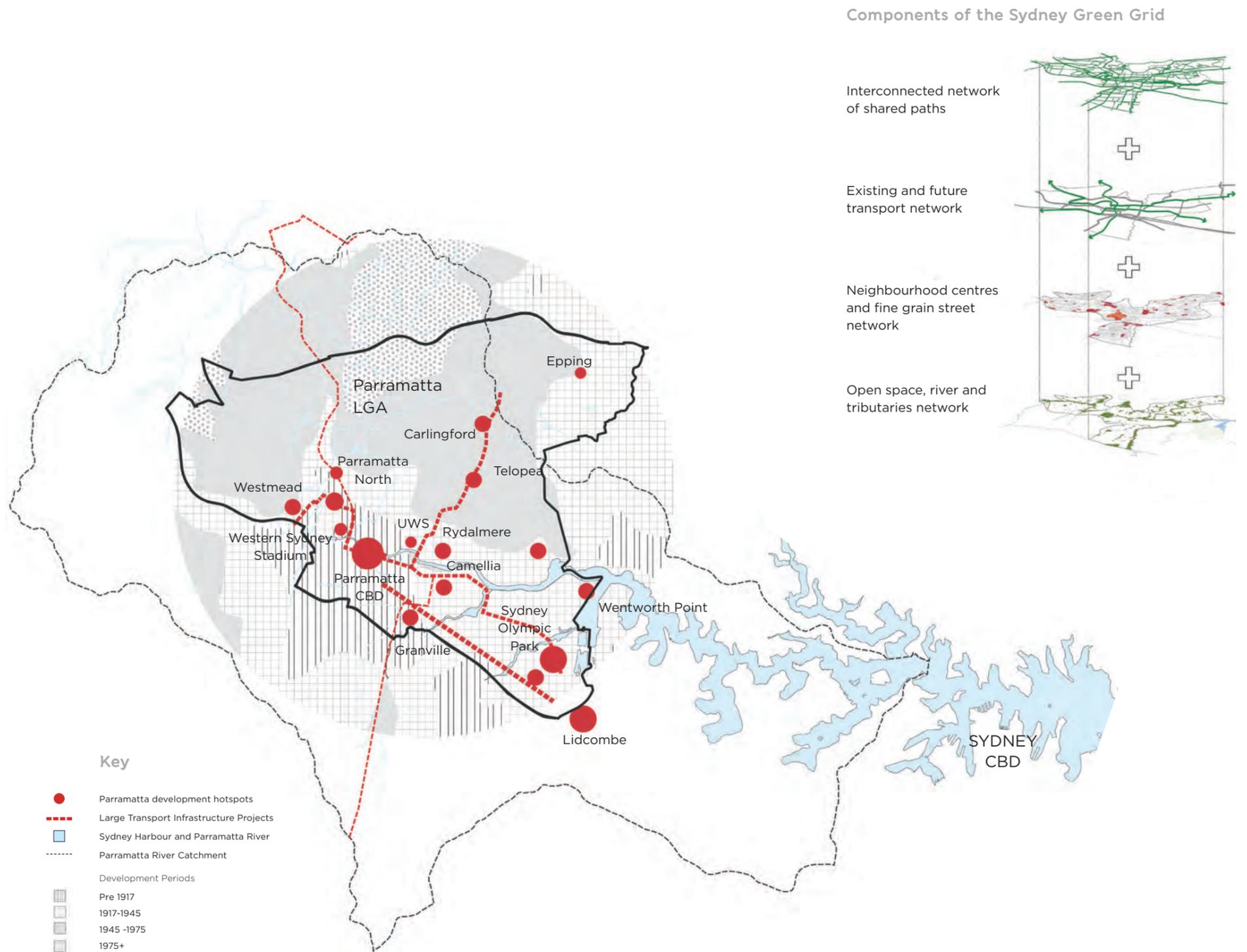


Sydney's metropolitan strategy, A Plan for Growing Sydney, anticipates Parramatta to be the fastest growing centre outside of Sydney CBD over the next twenty years. This growth reflects Parramatta's value both geographically and economically for Sydney. Importantly development and growth need to be supported with the infrastructure that creates liveable communities.

In Parramatta, historical patterns of development have made walkability a challenge. This challenge results in broader economic, environmental, health and transport implications. Fundamentally, many of these development patterns restrict walkability and the associated benefits. As Parramatta faces future growth there is both an opportunity and a demand to create a green, active and walkable city.

A Plan for Growing Sydney aims to deliver the Sydney Green Grid, a network of interlinked, high quality, green spaces that connect with town centres, public transport networks, the harbour, rivers and major employment and residential areas. Parramatta Ways is a local initiative that will deliver Sydney's Green Grid for the City of Parramatta.

The Green Grid represents a shift in urban planning towards creating active and more walkable cities. This move reflects an increased understanding of the relationship between health, liveability and urban development patterns.



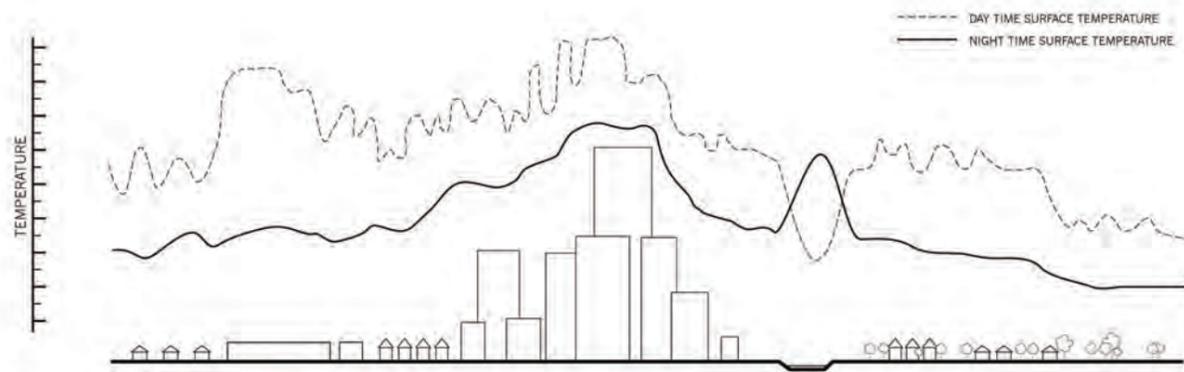


Diagram illustrating the impacts of urban heat island (UHI) effects day vs night

Liveability

A more walkable environment with increased access to high quality open space attracts greater investment² and supports business³.

As Parramatta's population grows, the demand for quality open space will increase to meet the needs of the community. Increasing density and a trend towards more apartment living increases pressure on existing public open spaces, particularly as private open space is reduced. As a result both access⁴ to and the quality of Council's open space will play a critical role.

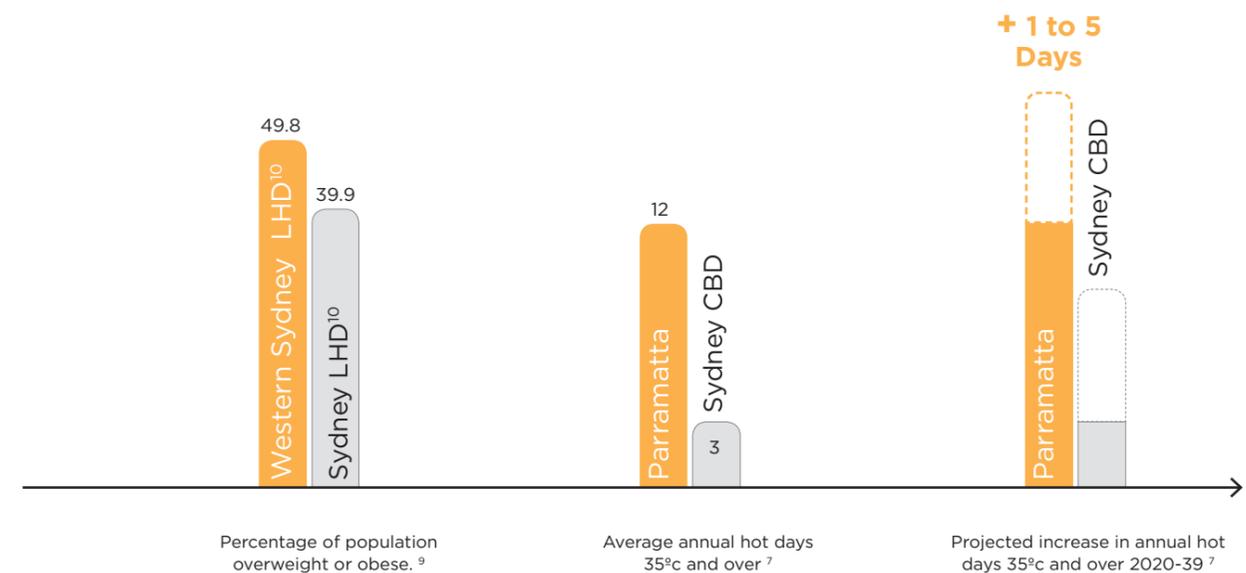
The more attractive, safe and comfortable connections we can provide to these places, the more desirable these communities will be to live in⁵.

Health

It is estimated that obesity costs Australia \$38 billion every year⁶. Western Sydney has the highest proportion of obesity in NSW.

Research shows that there is a strong correlation between community health and the design of the built environment¹. Car dominated development patterns in particular have been identified as particularly detrimental to population health.

Walkability and access to open space are key determinants of health and well-being in urban environments.



Transport

People are demanding walkable cities. In Sydney, 1 in 4 people between the age of 18 to 34 no longer have a licence or own a car. In fact trends suggest that peak car use is believed to have occurred back in 2001.

Change in car use is just one of the many trends surrounding the future of transport. Digital technology, new public transport opportunities such as light rail and increasing demand for cycling will impact how our cities function. The common element between many of these futures is the rising importance of walking. Walking is fundamental not just as a transport mode but as a method of integrating and supporting other transport options.

Environment

In Australia heat waves have resulted in more deaths than all other natural disasters combined⁷. In 2015 we saw global average temperatures reach 1 degree Celsius above pre-industrial levels. As this trend continues, the severity and prevalence of heat waves within NSW and Parramatta is expected to increase⁸.

The city's distance from the sea means that it does not benefit from the natural cooling effect of coastal sea breezes. Furthermore, Parramatta's extensive areas of hard urban surfaces, combined with its reduced tree canopy, absorb heat during the day and re-radiate it during the night, causing a phenomenon known as the urban heat island effect. Mortality rates during a heat wave increase exponentially with the maximum temperature, an effect that is exacerbated by the urban heat island effect. The design of our streets and street tree canopy will be critical to managing urban heat in the future.

1. Sallis, JF, Cerin E, Conway TL et al. Physical activity in relation to urban environments in 14 cities worldwide; a cross-sectional study, Lancet 2016; published online April 1. [http://dx.doi.org/10.1016/S0140-6736\(15\)01284-2](http://dx.doi.org/10.1016/S0140-6736(15)01284-2)
 2. Litman, T. Economic Value of Walkability, 2014
 3. Clifton, K. et al. for OTREC, Consumer Behaviour and Travel Mode Choices, 2012.
 4. NYC Department of Transportation, The Economic Benefits of Sustainable Streets, 2013.
 5. Cortright, J. for CEOs for Cities, Walking the Walk: How Walkability Raises Home Values, 2009.

6. Centre for Epidemiology and Evidence. HealthStats NSW. Sydney NSW Ministry of Health. Available at: www.healthstats.nsw.gov.au. Accessed Aug 2016
 7. Steffen, W. Hughes, L. Perkins, S. 2014, Heatwaves: Hotter longer more often, accessed online Sept 2016, <http://www.climatecouncil.org.au/uploads/9901f6614a2cac7b2b888f55b4dff9cc.pdf>
 8. Urban Heat Climate Change Impact Snapshot, Adapt NSW/OEH, 2015
 9. Social Health Atlas of Australia, PHIDU, accessed online Aug2016 <http://phidu.torrens.edu.au/social-health-atlases/data#social-health-atlases-of-australia-local-government-areas>
 10. LHD = Local Health District

The Parramatta Landscape

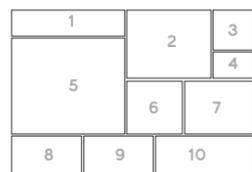
Revealing the Iconic, the Everyday and the Hidden



There are many layers to Parramatta. Some of them are well known, some of them under-appreciated and some of them just waiting to be uncovered. Parramatta Ways will build on the existing qualities and inherent value of Parramatta to develop a truly local project. Importantly as Parramatta faces future population growth, Parramatta Ways will help ensure that the community remains connected to Parramatta and the identity of place.

Parramatta's landscape has undergone significant change, particularly since the late 18th Century. However, as bushland has given way to farms, industry and suburbia, the legacy of the river and its supporting tributaries remain. Remnants of this legacy can be seen in the heritage, people, parks, reserves and many bushland corridors. It is this diversity of people and place that provide the foundation for a truly remarkable green grid strategy.

Parramatta sits at the confluence between freshwater creek systems and the saltwater of the harbour. This has naturally drawn many people and residents. The result is a landscape with a rich history marked by the many people who have made this area their home. It is a place of special significance for the first Australians and also later the British seeking to sustain



1. Parramatta Stadium
2. Rydalmere Cafe
3. Crest Cinema Granville
4. Chinese New Year celebrations
5. Old Government House
6. Parramatta Gaol
7. Old Duck River Bridge
8. Post-war housing
9. Erby Place
10. Lake Parramatta

the early colony on the fertile alluvial soils. Over time, many people have made Parramatta home, remaking and deepening local culture.

In the north of the LGA the landscape of Parramatta is characterised by a series of deeply incised river valleys carving their way through suburban development on top of the Hornsby Plateau. This is topography where the challenges of terrain have protected extensive lengths of unbroken green corridors. To the south of the LGA the shale hills of the Cumberland Plains have created a more languid series of streams which has resulted in many being channelised and surrounded by urban development. Both patterns provide unique opportunities for establishing an interconnected walking network. Topography will form the underlying structure of Parramatta's Green Grid, providing a pattern of use integrated with the natural terrain of the city.

It is this grid which will bring together the many local centres, large open spaces, creek and river corridors, bushland reserves, schools, bus routes, and railway stations across Parramatta. Parramatta's history and importance within the region has ensured that it is well endowed with a great variety of destinations and open space assets. Some of these are iconic and internationally recognised such as Parramatta Park, while other more local, everyday spaces such as Boronia Park at Epping, are given their value by the character of the local community which inhabits them.

There are however many more that remain hidden both to locals and visitors alike. Parramatta Ways provides the opportunity to reveal these elements, contributing to a deeper understanding of Parramatta as a place and shaping the future identity of our city.



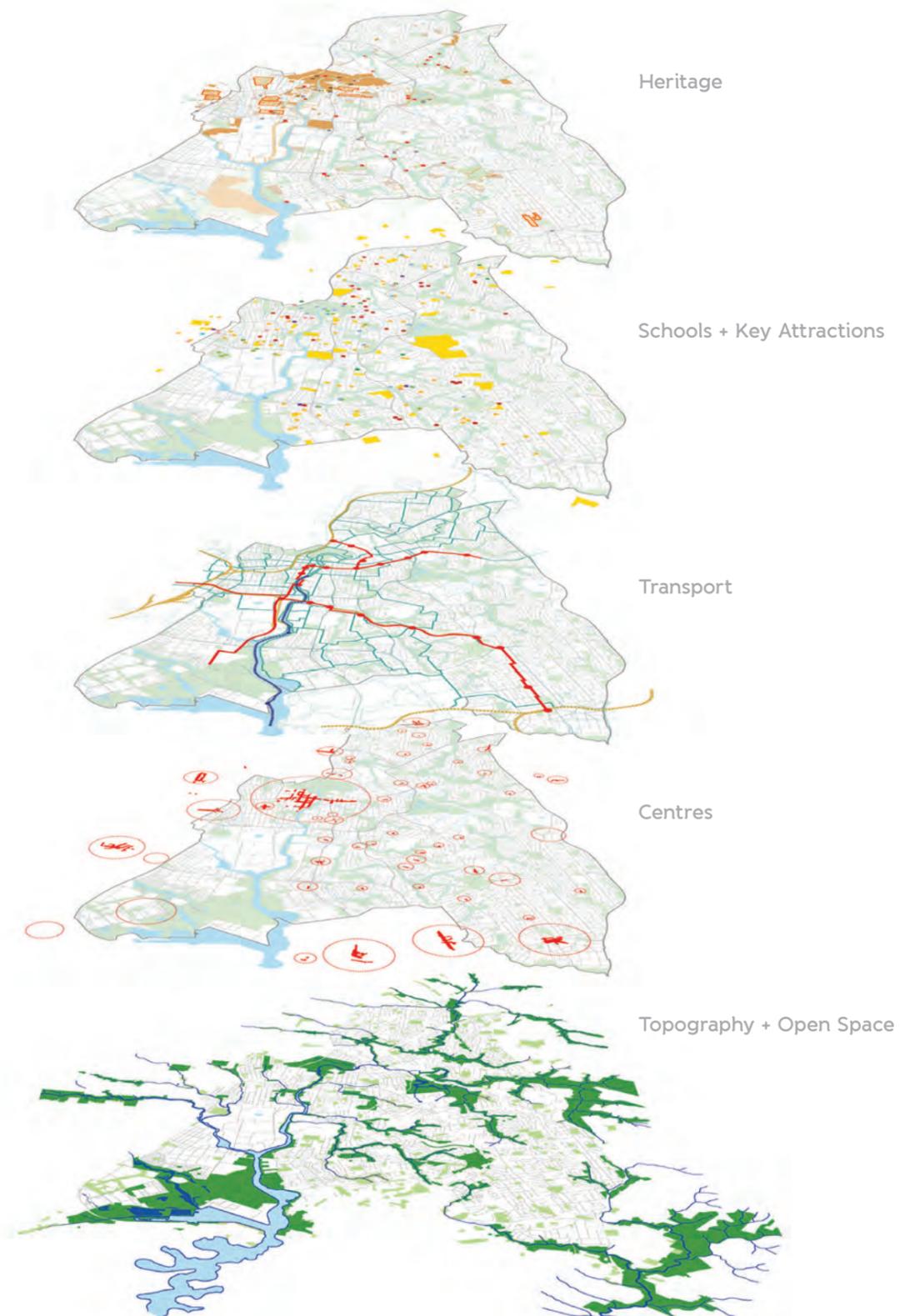
Streets

+



Open Space

Destinations and layers forming the basis for Parramatta Ways



Connecting People and Place

Creating Parramatta's Green Grid



Parramatta Ways aims to better connect communities with their local area. Part of this will be about improving our street network and green corridors to provide a better experience for people. These upgrades have been proposed along a network of routes linking walking trails, shops, schools, open space, transport options and community facilities. Initial route selection has been based on a series of strategies aimed at maximising the quality and number of these connections (outlined below).

The Parramatta Ways network also delivers and expands on the state government's plan for the Sydney Green Grid¹. The Sydney Green Grid provides a framework for increasing the amenity, use and accessibility of our open space. Parramatta Ways is directly aligned to the delivery of these objectives. The Sydney Green Grid identifies a number of priority links for the City of Parramatta. These routes follow many of Parramatta's regional green corridors and provide the chance to maximise the number of local

walking and open space access opportunities throughout the LGA.

Some of the District Plan priorities include: Parramatta River and Toongabbie Creek, Duck River and The Lane Cove River National Park. In addition to the priority corridors Parramatta also has many other important green corridor opportunities such as Subiaco Creek and The Ponds Walk, Vineyard Creek, Hunts Creek Walk, Darling Mills Creek, Northmead Gully, Haslams Creek, Powells Creek and Pendle Creek. These corridors offer valuable recreation opportunities and walking destinations that contribute to a distinct identity for Parramatta.

Alongside our green corridor opportunities there are also many transport, urban renewal and large infrastructure projects which will shape the future of our city. Projects such as Parramatta Light Rail and the Parramatta Road Urban Renewal corridor provide a catalyst for the development of high quality local walking

networks. In particular, infrastructure such as light rail can help shift car-dependency and provide more pedestrian focused, vibrant and lively streets. This will impact network priorities and create new connection opportunities.

Central to the overall network will be the quality of streets and the provision of a fine-grain walking network around our centres. The collections of shops, transport options and higher residential densities make these areas a priority for pedestrians and local residents. There are a great variety of centres with different settings across Parramatta, improving walkability will require individual solutions developed through consultation with local residents and businesses.

Parramatta Ways connects our local communities with some of our greatest assets. Through a focus on walkability, the network will improve the experience of Parramatta at the street level, creating a vibrant and active city.

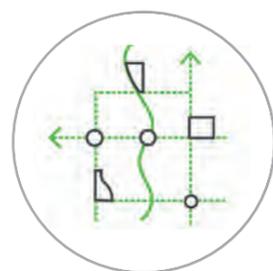


Artist Impression of Parramatta Ways Active Streetscape²

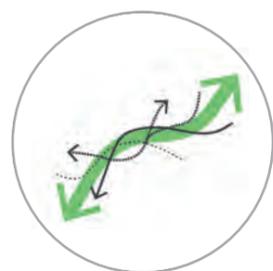
For further information on the variety of conditions considered in the network preparation please review the supporting analysis maps in Appendix A. For a route map with more detail on additional route opportunities refer to Appendix B. Routes illustrated are indicative and will be refined through both further consultation and project delivery.

1. Refer to the 2014 Plan for Growing Sydney and the 2016 Draft West Central District Plans
2. Conceptual image at Kleins and Balmoral Roads

Key Network Strategies



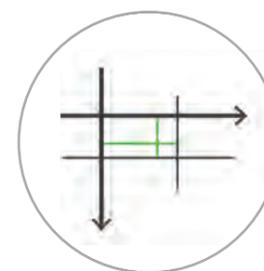
Stitch together key destinations into a connected walking network.



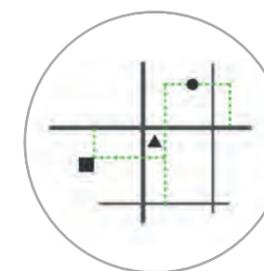
Utilise regional green corridors to maximise local walking and open space connection opportunities



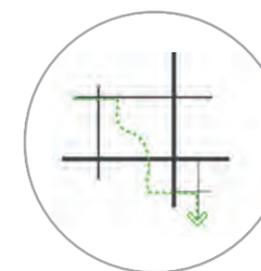
Build a series of identifiable loops that encourage recreational walking.



Create a finer network of pedestrian friendly streets across the LGA supporting the walking network.

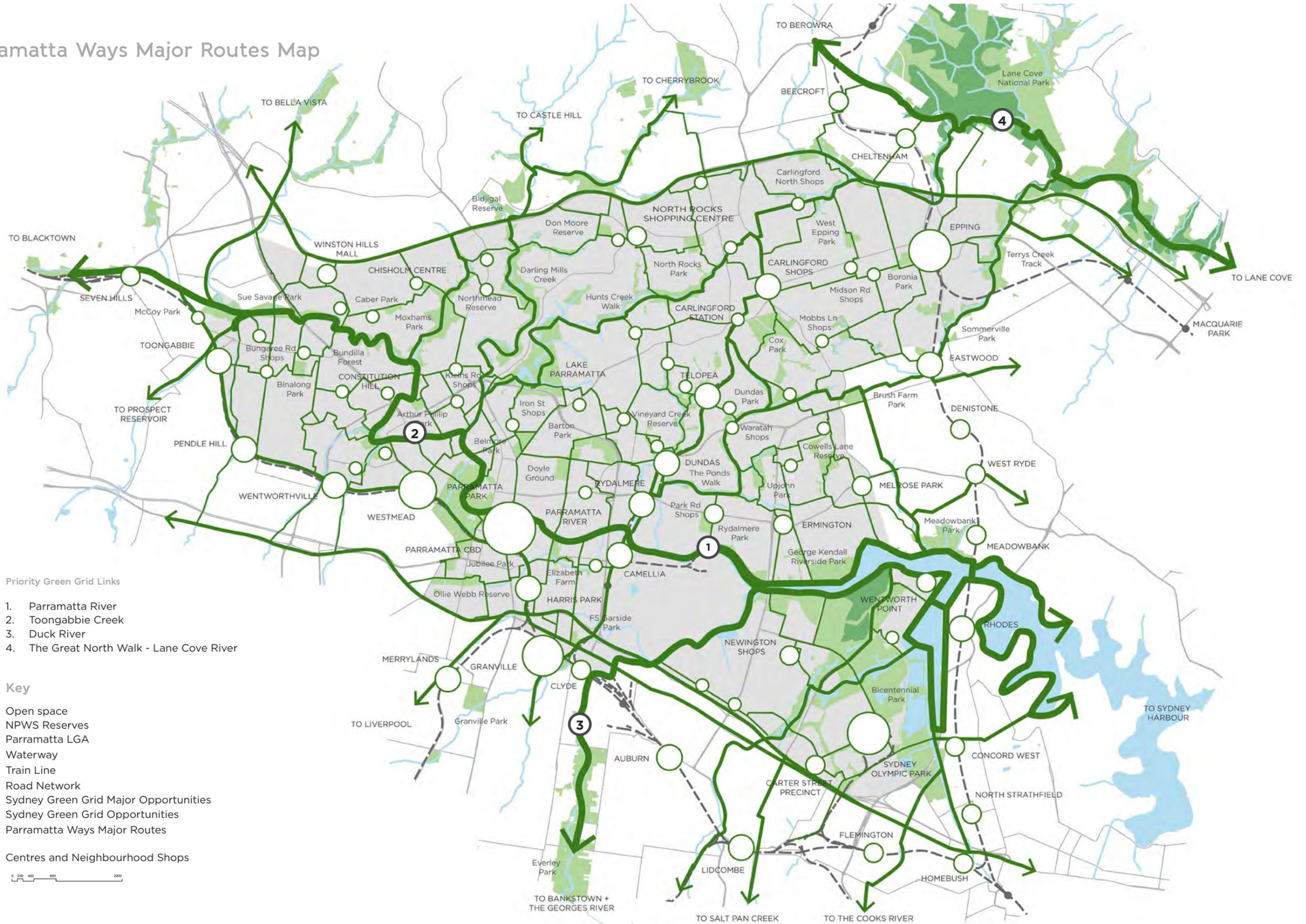


Maximise the number of community facility and destination connections.



Encourage local and serendipitous walking opportunities.

Parramatta Ways Major Routes Map



Priority Green Grid Links

1. Parramatta River
2. Toongabbie Creek
3. Duck River
4. The Great North Walk - Lane Cove River

Key

- Open space
- NPWS Reserves
- Parramatta LGA
- Waterway
- Train Line
- Road Network
- Sydney Green Grid Major Opportunities
- Sydney Green Grid Opportunities
- Parramatta Ways Major Routes
- Centres and Neighbourhood Shops



Creating Living Streets

Making our streets more walkable



To make walking attractive we need to create a network that is safe, comfortable and interesting. To achieve this, we need a collection of different strategies to target the many aspects of each of these criteria. This requires a multi-layered and co-ordinated approach to walking infrastructure delivery. Parramatta Ways is more than paths and signage. It is a strategy for putting people at the heart of our streets. This vision will help to establish the broader agenda for walking across the LGA, placing pedestrians at the top of the list when assessing street design.

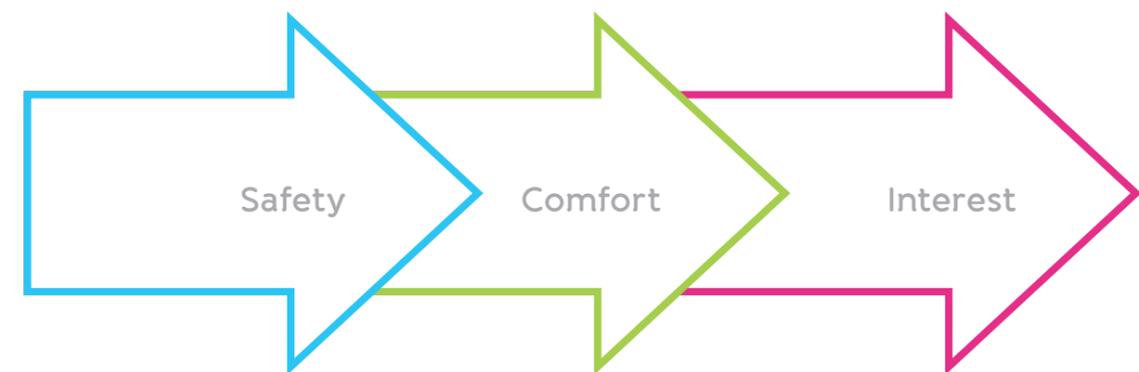
Perception of safety is a key determinant of use and will become pivotal to the success of Parramatta Ways. Community behaviour and expectations can be influenced through engagement programs, however to really support walking, we also need to demonstrate a commitment to making spaces safe and walkable through core infrastructure provision. Ultimately, our paths need to be safe enough to encourage a range of users such as people with prams and bags, the elderly, people with disabilities, commuters, families, women and children - people of all ages and abilities.

The infrastructure component with the greatest potential to support walking through comfort and amenity in Parramatta are street trees. Street trees, especially large street trees can transform the urban environment. In Parramatta where summer temperatures can soar, trees can cool footpaths and roads significantly, making walking on hot days not only possible but enjoyable. Street trees also slow traffic, provide a buffer between pedestrians and vehicles, transform street scale, purify and oxygenate the air, sequester carbon, help slow and filter stormwater, buffer winds and bring urban wildlife and the changing seasons into our lives.

Parramatta Ways aims to set a vision for cool, green and active streets as a starting point for pedestrian priority across the LGA. These streets will provide the basis on which the wider collection of things to see and do around Parramatta will be revealed and connected. Ultimately this will become the foundation for building a city where walkability is central to all planning and development.

Proposed Order of User Consideration in Street Design

- ↓
- Pedestrians
- Cyclists
- Public Transport Users
- Specialist Service Vehicles
- Other Motor Traffic



Existing Conditions



Belmore Street



Balmoral Street



Fleet Street



South Street



Bourke Street

Safety

- Prioritising pedestrians along network routes and at intersections
- Increasing street activity
- Providing multiple route options
- Promoting clear sight-lines
- Lighting provision
- Traffic management
- Equal access for all users

Comfort

- Shade and sunlight
- Footpath quality and verge widths
- Increase priority of pedestrians at crossings
- Promoting accessibility

Interest

- Great destinations, parks, playgrounds and centres
- Access to bushland and biodiversity
- Access to Parramatta River and local waterways
- Revealing local heritage



Existing Conditions

There are over
100km
of park and bushland
walking trails

83%
of streets already
have good quality
footpaths

There is
less than
26%
tree canopy cover
in Parramatta

Most routes have
**little to
no shade**
along streets



Before



After

Artist Impression of Parramatta Ways Conceptual Street Upgrade

Project Value

The Benefits of Investment

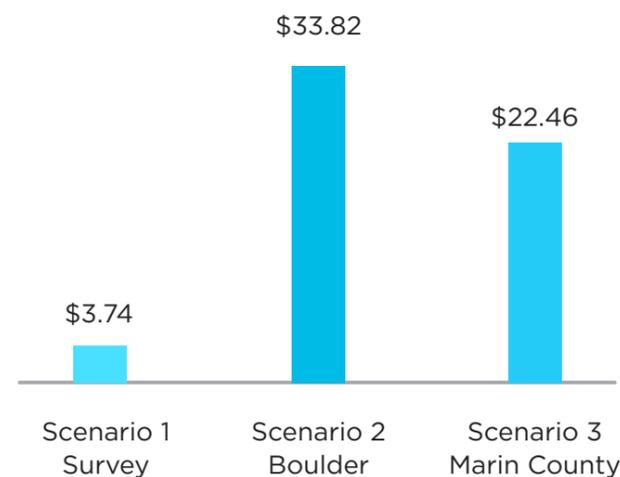


Parramatta Ways will assist in maximising the benefits of street infrastructure across Parramatta. In order to capture the value of some of the social, environmental and economic benefits of this, a return on investment study has been prepared by SGS economics. This study included both the anticipated capital costs and ongoing maintenance and renewal costs, over a 25 year delivery timeframe.

The report demonstrates that there is at least an expected return of \$3.74 for every dollar spent on Parramatta Ways. This figure is also demonstrated to increase dramatically depending on the levels of use associated with the network. Scenario 1 is based on an assumption of use using a local survey combined with national averages in active transport use. Scenarios 2 and 3 are US based on studies undertaken of uptake in use for city projects similar to Parramatta Ways.

The proportions of valued benefits can be seen heavily weighted towards the economic and health sectors. It is expected that a number of funding sources could provide the investment required to deliver the plan over time and capture these benefits, some of which include:

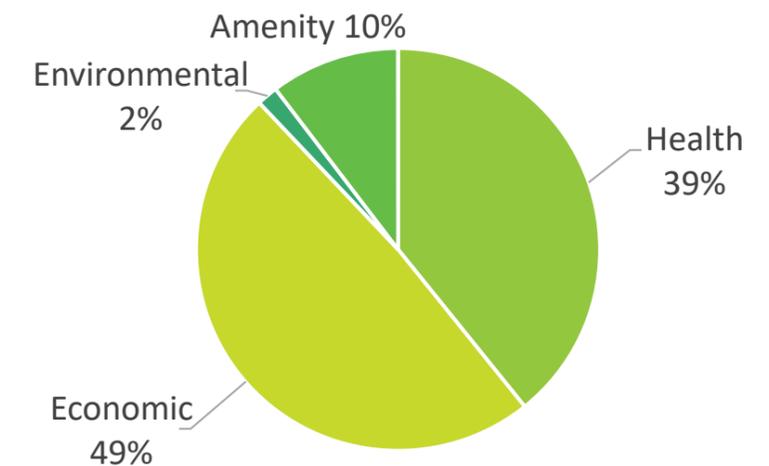
- S94A Developer Contributions
- Voluntary Planning Agreements
- Contributions towards community infrastructure (Phase 1 & Phase 2 value sharing)
- Federal and State Government assistance



Return on Investment Mode Share Scenarios from SGS Economics Report

“For every dollar spent benefits accruing to \$3.74 are returned to the society of the Parramatta local government area”

SGS Economics - Return on Investment of Parramatta Ways, Oct 2016



Benefits proportions to Scenario 1 from SGS Economics Report

Integrated Development

One of the other key benefits of Parramatta Ways is the opportunity for it to support planning across Parramatta. It is anticipated that the project will assist both internal and external stakeholders through the identification and prioritisation of important connections. Parramatta Ways will demonstrate the delivery of state government policy down to the local street level. It will also ensure that the benefits of new growth and density are shared by everyone.

Significant government and private investment is occurring in major precincts throughout Parramatta. Parramatta Ways will assist with ensuring that improved access is provided not just within these new precincts but also beyond, supporting wider urban integration and demonstrating the implementation of the Sydney Green Grid at the street level.

It is anticipated that many of these areas will contribute to the identification of new opportunities across the LGA with locally specific priorities supporting regional green grid opportunities.

Some key precincts include:

1. The Westmead health precinct
2. Parramatta North
3. Parramatta CBD
4. Parramatta Road Urban Transformation - Granville
5. Camellia
6. Telopea masterplan
7. Carlingford
8. Melrose Park
9. Wentworth Point
10. Carter Street and Sydney Olympic Park

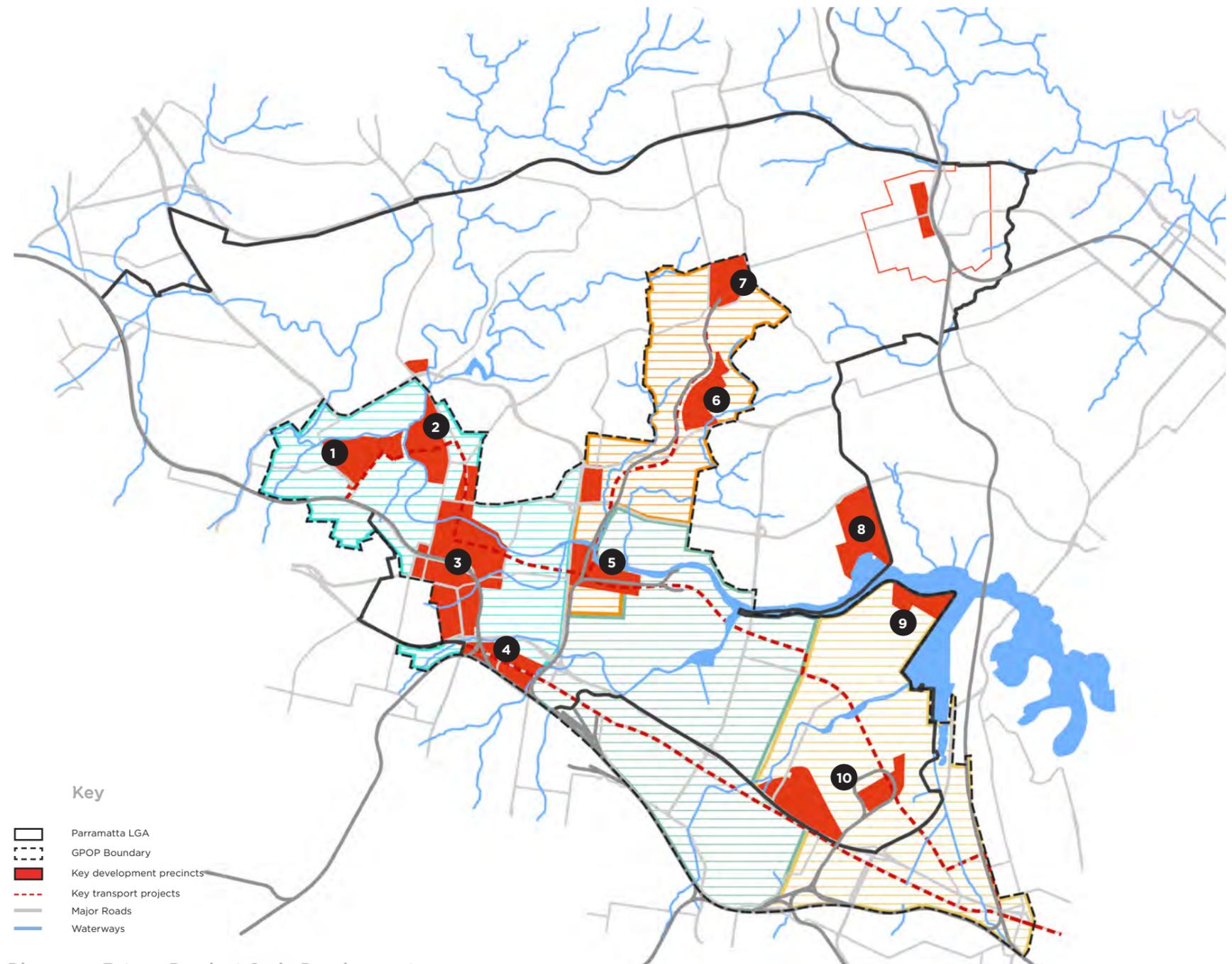


Diagram - Future Precinct Scale Development

Moving to Implementation

Establishing an approach for Project Delivery



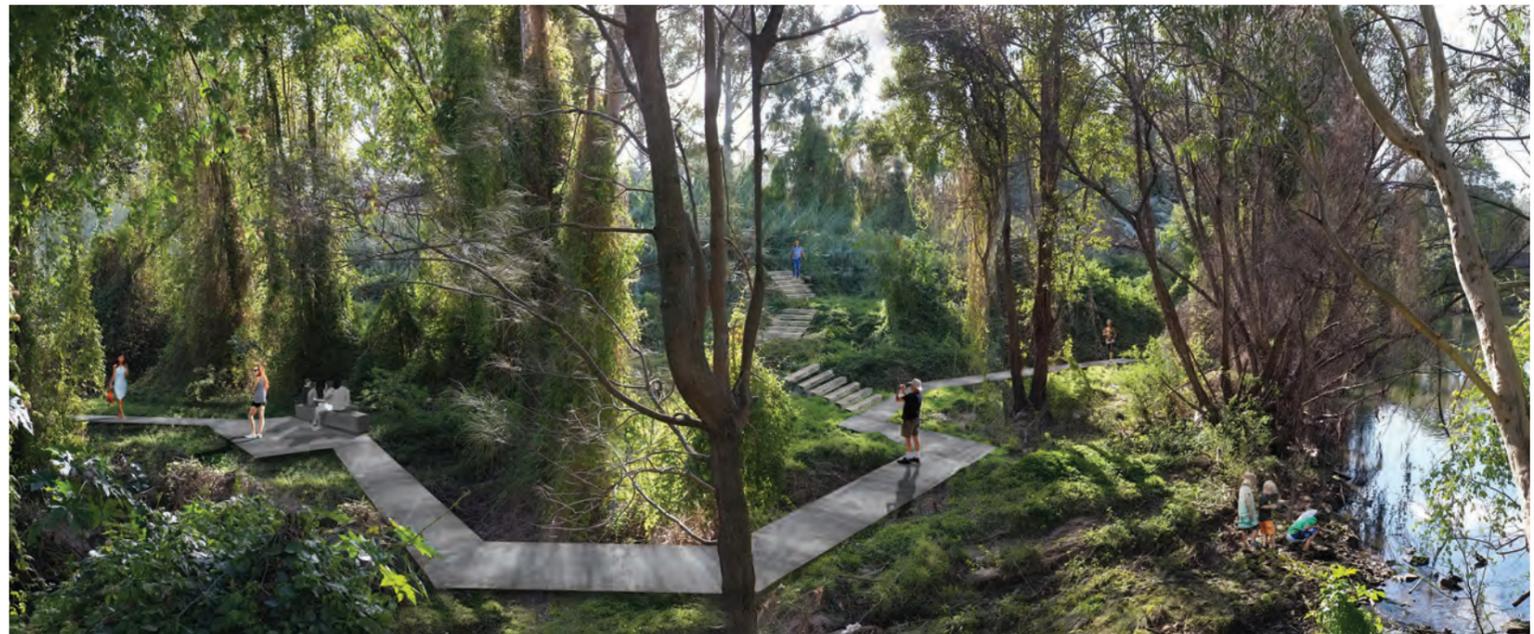
Parramatta Ways is centred on some of local government's core business, streetscapes and open space. To realise Parramatta Ways we will support existing programs and teams across Council that are already delivering outcomes in areas such as;

Transport, Streetscapes, Urban Greening, Recreation, Environment, Place Making, City Activation, Water Sensitive Urban Design, Heritage promotion and Urban Heat Island effect mitigation.

Council has already delivered a number of projects which successfully demonstrate the value in this co-ordinated approach. These examples were built over multiple-stages, in-line with a broader vision, allowing them to be linked to existing budgets and opportunities.

Examples include projects such as the Parramatta Valley Cycleway, where vision and big picture thinking led to a co-ordinated approach across government. The project has now provided public access to over 16.5km of the Parramatta River foreshore and has become incredibly popular with the community. The rate of use for the corridor has been increasing at some points up to 1000 extra people per month and forms the central spine to the Parramatta Ways network.

Council's 'neighbourhood centre program' also provides a great example where two (with two more in progress) 'connecting centres' projects have been completed. The 'connecting centres'



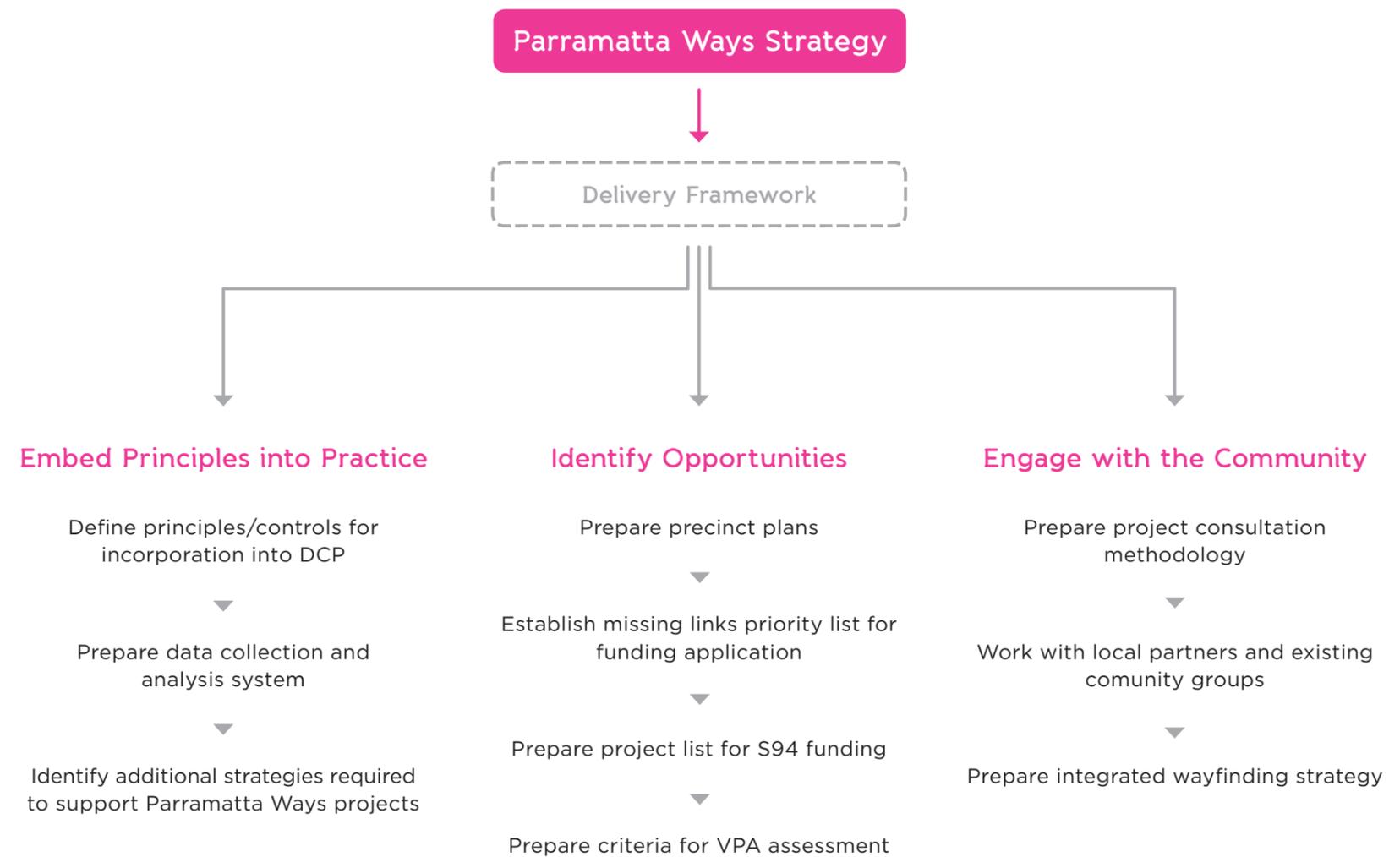
Artist impressions of potential future Parramatta Ways projects

projects were based upon some of the original research which 'Parramatta Ways' is based. They have included a combination of connectivity works between local centres and green spaces with aligned signage, kerb ramps, footpaths, seating, tree planting for shade and also necessary improvements to roadways to provide safe crossings. These projects occurred through consultation with local businesses, resident groups and charities. Initial consultation and findings have demonstrated the need for strong destinations to encourage mode shift and further destination attraction.

As part of the projects next steps the Parramatta Ways project team will draw from the experience associated with this work to assist in the preparation of a Delivery Framework. The primary objectives of the delivery framework are to:

- embed the principles of Parramatta Ways into Council practice
- identify Parramatta Ways project opportunities
- facilitate further community engagement

A shared vision and a co-ordinated approach is critical to ensuring we have the type of infrastructure that maximises the social and environmental benefits provided. Parramatta Ways demonstrates the City of Parramatta's commitment to providing the infrastructure that supports the health and well-being of our existing and future residents.



Appendices



- A** - Meeting Project Targets - Draft actions
- B** - Supporting Analysis Maps
- C** - Detailed Parramatta Ways Route Options
- D** - Return on Investment Study

A Meeting Project Targets - Draft Actions

The following tables demonstrate a draft basis for assessing delivery of the proposed targets and assessing project success over time. Critical to this process will be an initial task of establishing a robust monitoring and analysis system.

1 - Identify and complete priority missing pedestrian network connections

A Priority Area	Prepare detailed 'precinct' plan for selected priority area. Detailed plan to involve preparation of prioritised set of shovel ready projects for the precinct. Undertake detailed consultation at project implementation stages.
B Prepare Delivery Framework	Utilising priority area methodology to prepare detailed implementation and project priority plans for the whole LGA.
C Walkable Streets Manual	Prepare Walkable Streets Manual. Manual should review existing delivery/design practice and new opportunities that may not have been considered or may be restricted by current assessment methods.
D Pedestrian Infrastructure Audit	Prepare an audit of pedestrian infrastructure (issues + opportunities) for the Parramatta Ways network. Audit will include a prioritisation plan and costing for use by the PAMP program and traffic teams. Undertake review of key regional barriers and prepare detailed design of links to 'unlock' network potential.
E Co-ordinate access and links beyond Parramatta LGA boundaries	Work with adjoining councils + authorities to prepare joint funding applications and complete missing links across boundaries.

2 - Increase Recreational Walking Participation

A Wayfinding	Prepare graphic template + kit of parts for permanent and temporary wayfinding signage.
B Events and Communication	Support events and communication campaigns that promote walking.

3 - Increase walk to school rates

A Schools Consultation	Undertake consultation and develop partnerships with local schools. Review network and priorities based on detailed consultation.
-------------------------------	---

4 - Increase walk to work/ public transport rates

A Public Transport detailed Design Review	Review network and walking infrastructure upgrades in-line with existing and proposed public transport opportunities. Integrate walking assessment and analysis into all major project planning review and assessment.
B Bus Stop Improvement Program	Prepare a bus stop improvement plan based on an audit of existing assets - Associated with infrastructure audit.

5 - Increase foot traffic to local centres

A Centre Upgrades	Review 'connecting centres' program results and look for opportunities to expand on this work.
B Temporary Programs	Utilise pop-ups and temporary installations such as parklets to prepare temporary parking adaption strategy in local centres. Utilise temporary infrastructure to test project opportunities.

6 - Increase tree canopy cover along major routes

A Urban Greening Strategy	Support the development of urban greening strategy and integrate Parramatta Ways routes with the development of precinct plans.
B Street Tree Design Manual	Support the development of a street tree design manual that provides solutions for both CBD and suburban areas.
C Utilities Co-ordination	Work with State Government and local utilities to manage pruning practices, infrastructure and tree conflicts.

7 - Increase perceptions of both safety and quality associated with walking routes

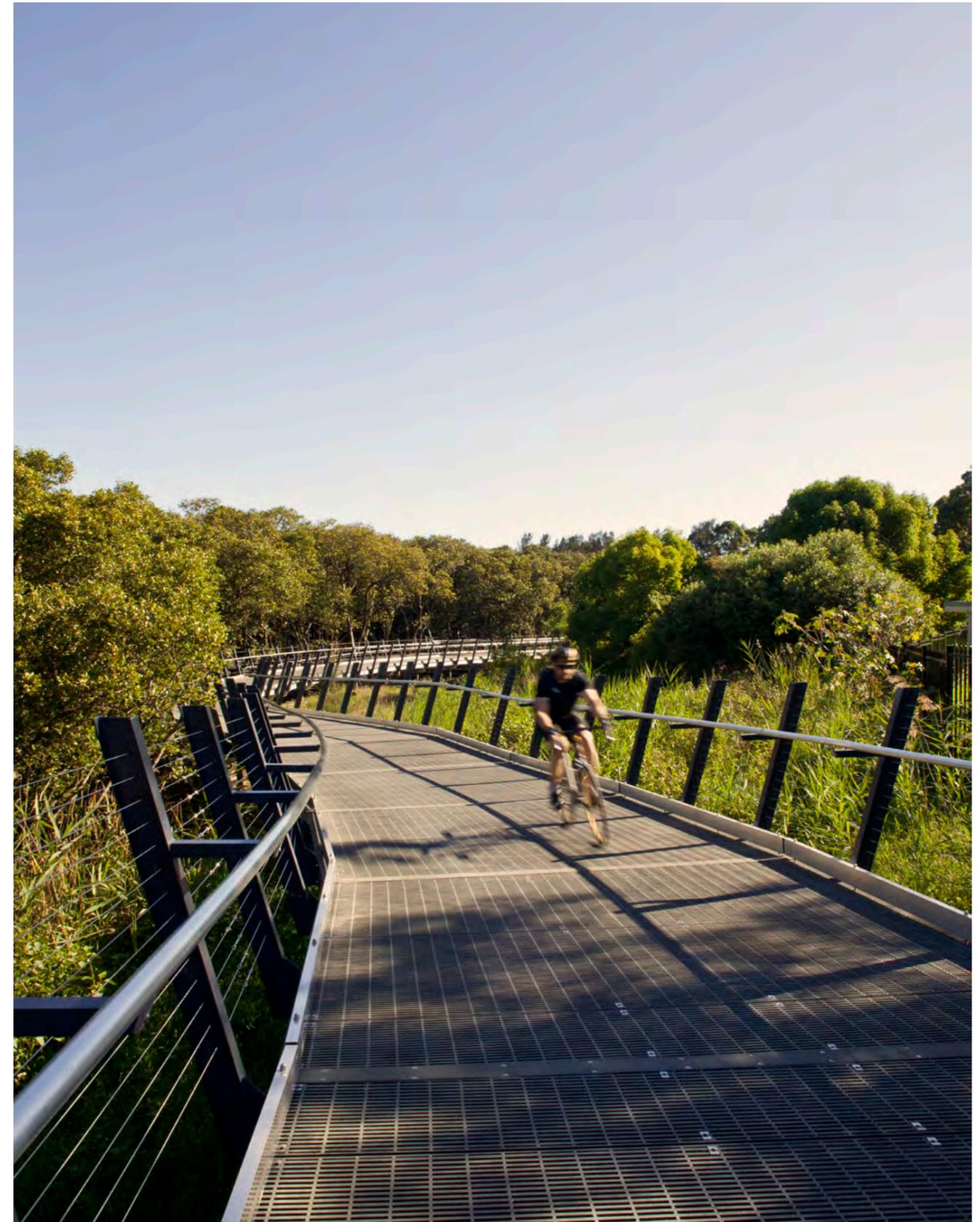
A Safe Design Integration	Maximise activity and passive surveillance through coordination with cycle program and open space management programs. Work with other design units to ensure that safe design opportunities are maximised for the network on an ongoing basis.
B Maintenance Program	Work with asset management groups to determine best practice outcomes and anticipated project costs.

8 - Ensure all residents live within 5min walk of Parramatta Ways network

A Detailed Implementation Plan	Develop detailed 10 year program of work with priorities based on precinct plans.
---------------------------------------	---

Develop Smart City Walking, Monitoring and Analysis System for Target Assessment

A Walking Network Mapping	Prepare a detailed GIS 'walking route layer' for council-wide distribution and analysis. Utilising existing footpath GIS data create a single data set that can be used for detailed network analysis by all council departments.
B Monitoring Framework	Develop a walking data collection and audit system.
C Measure Targets	Using data collection framework to measure base-case conditions associated with all key targets.
D Consultation	Integrate community engagement and consultation into the data collection framework.



B Supporting Analysis Maps

Topography

Heritage

Destinations

Character Framework

High Density Residential

Transport

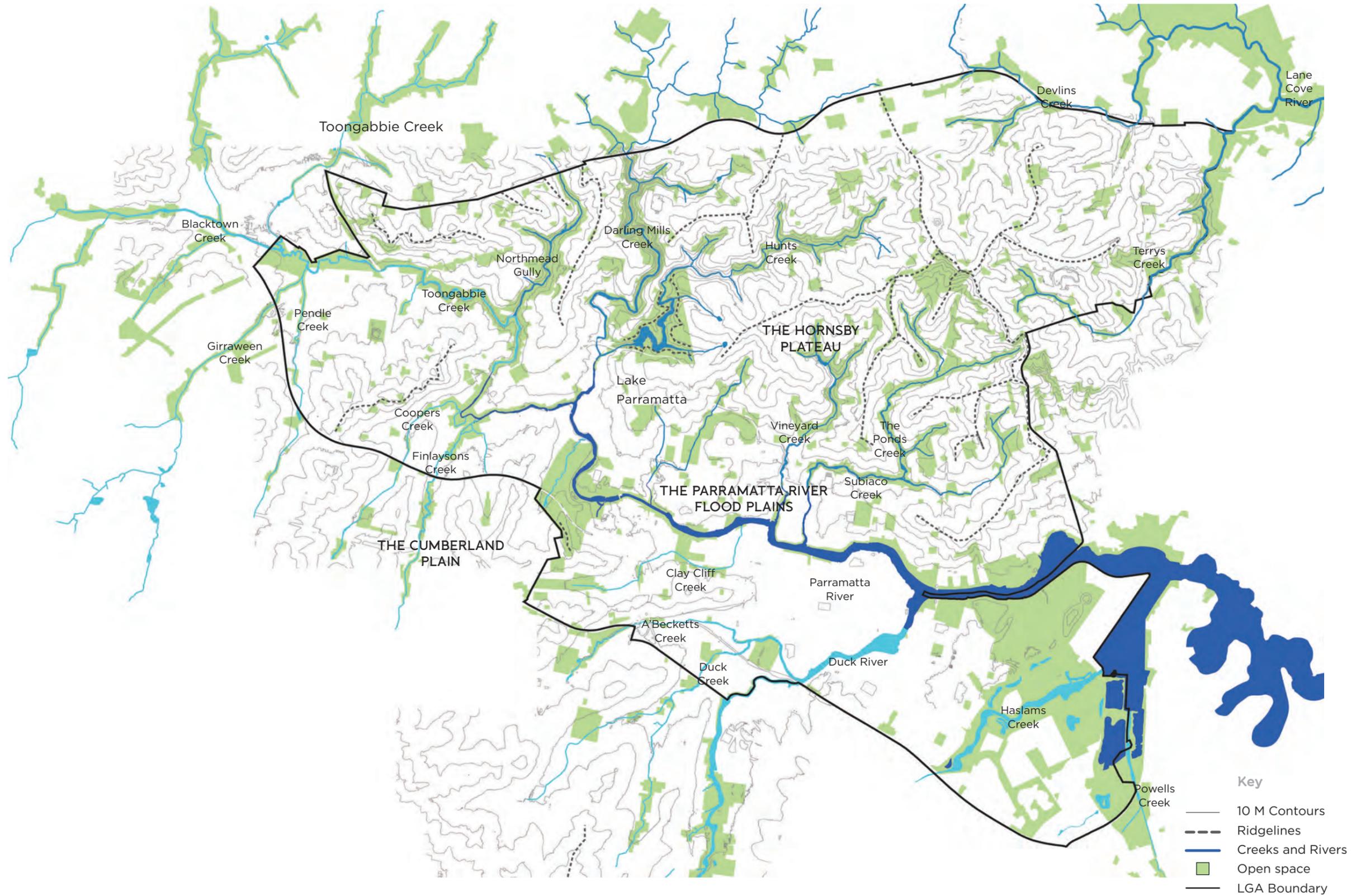
Barriers

State Managed Roads

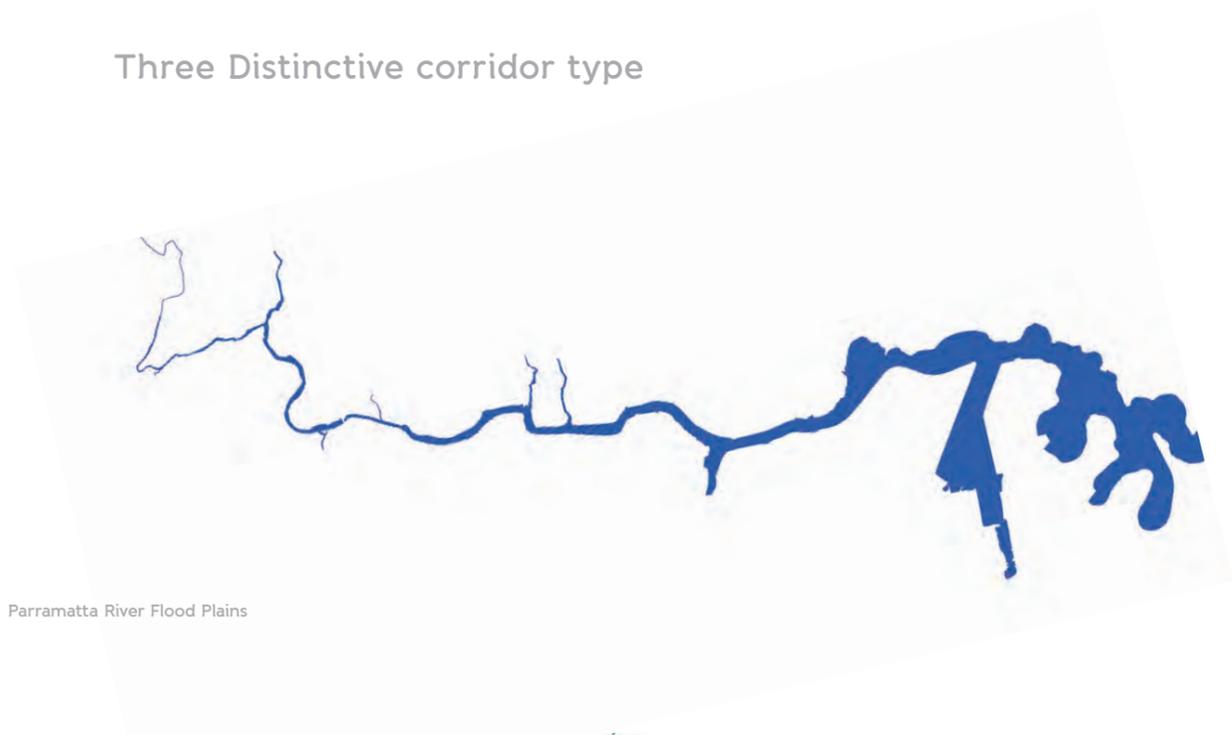
Note

Parramatta Ways analysis maps were originally prepared for the former Parramatta Council Local Government Area. Following council amalgamations May 2016 some datasets are not yet complete/available. Maps have been updated to reflect the new council boundaries where possible however there may still be some data gaps in new council areas.

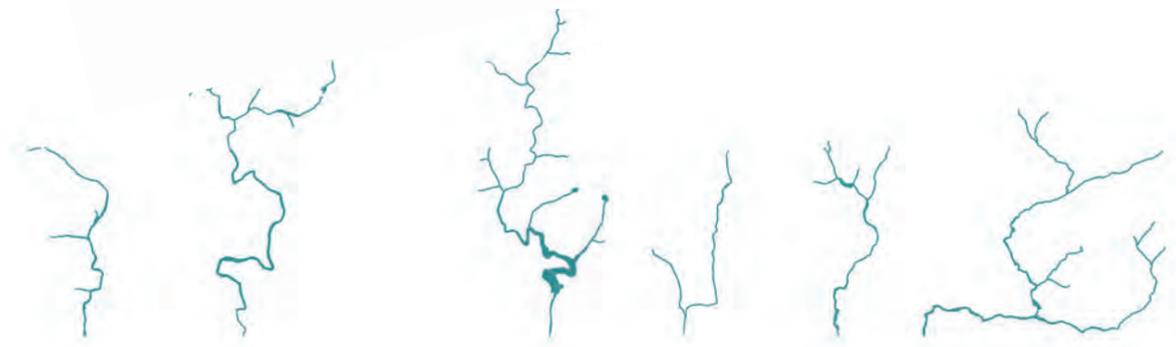
Topography



Three Distinctive corridor type



Parramatta River Flood Plains



The Hornsby Plateau



The Cumberland Plain



Silverwater Road



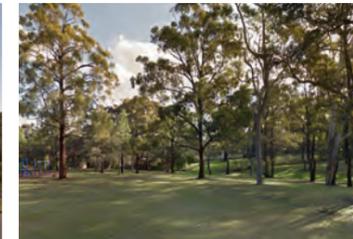
Rydalmere



Queens Park



Quarry Branch Creek



Upper Brickfield Creek



Bushland



Blacktown Creek

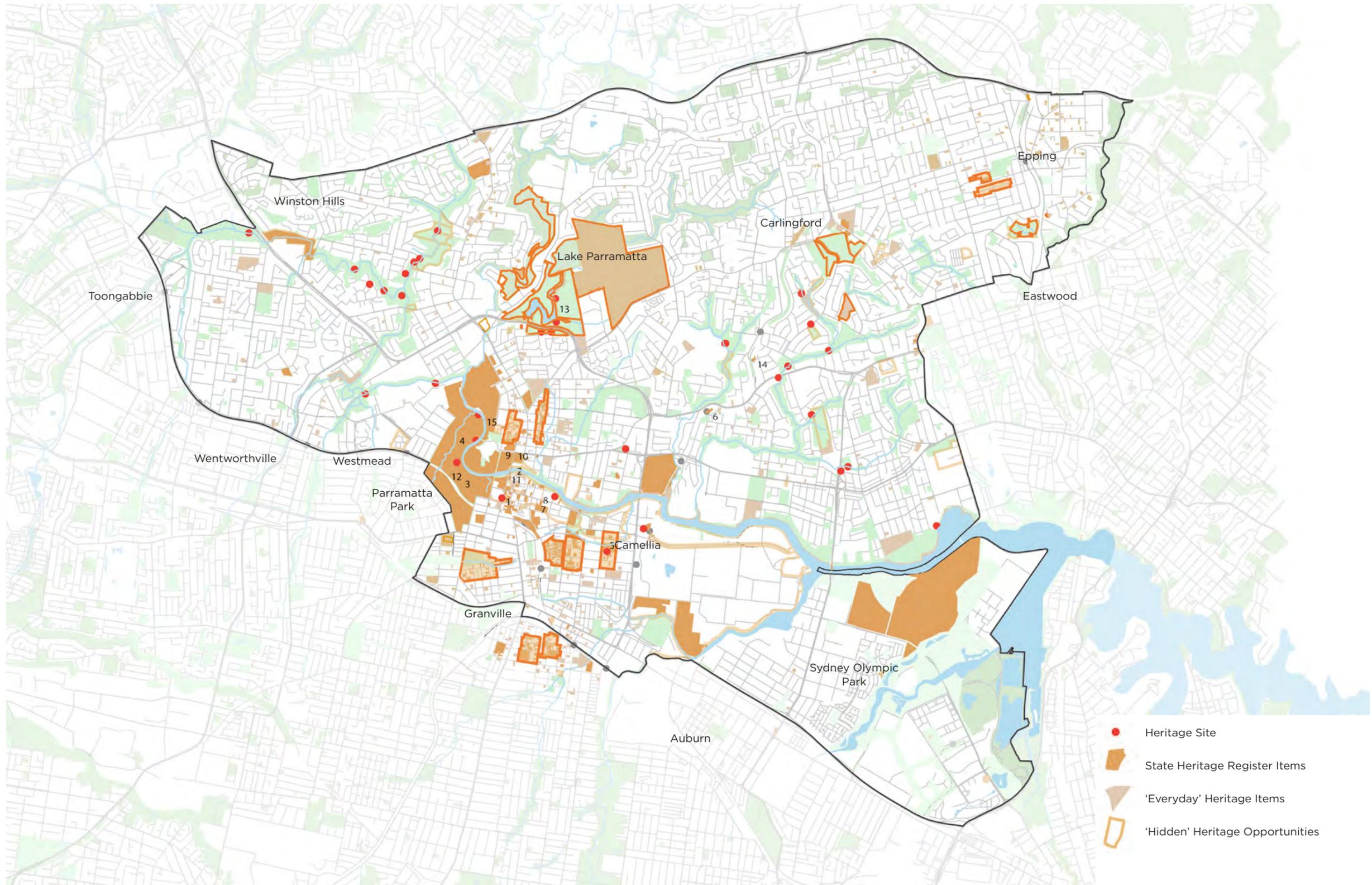


Greystanes Creek



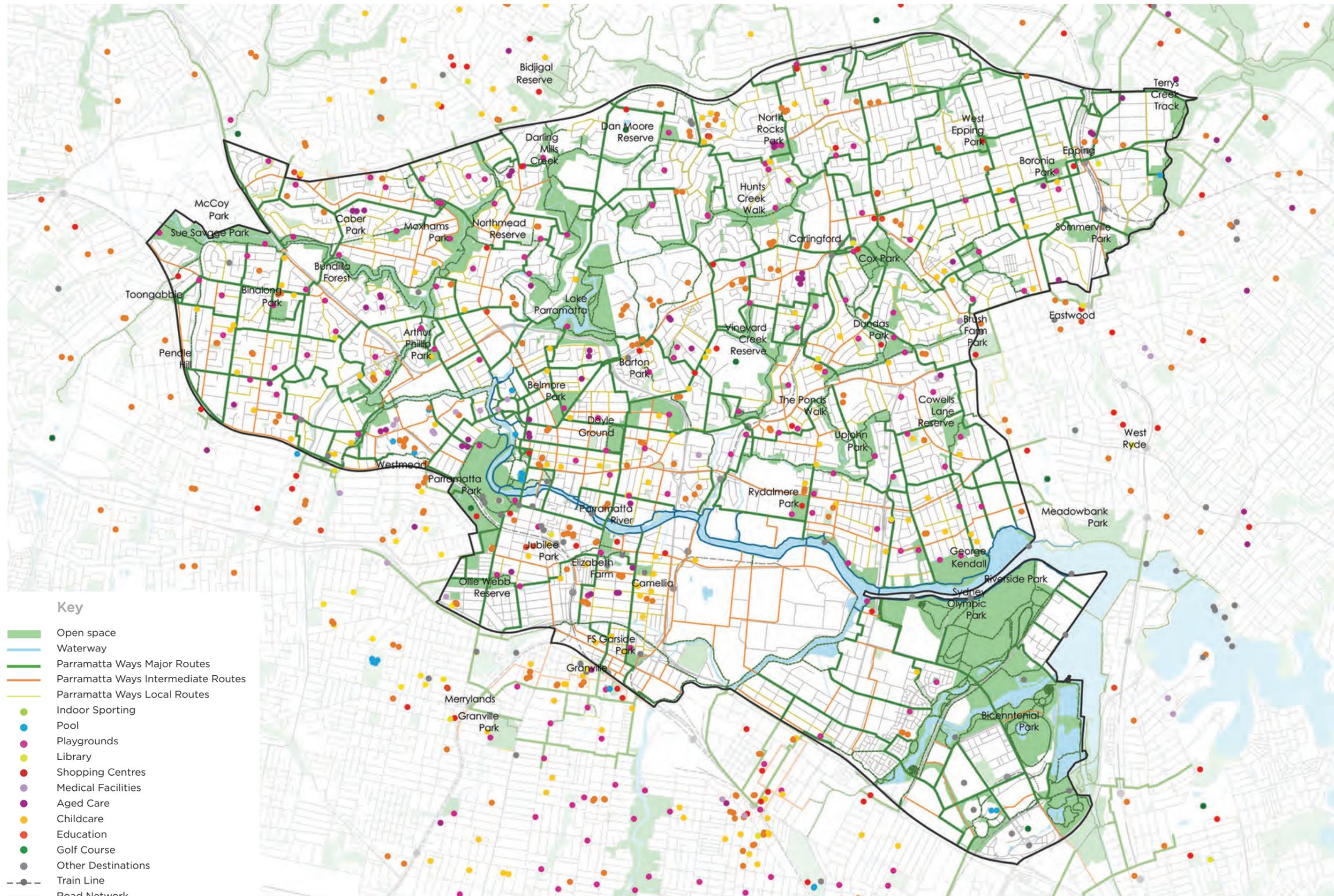
Finlayson Creek

Heritage



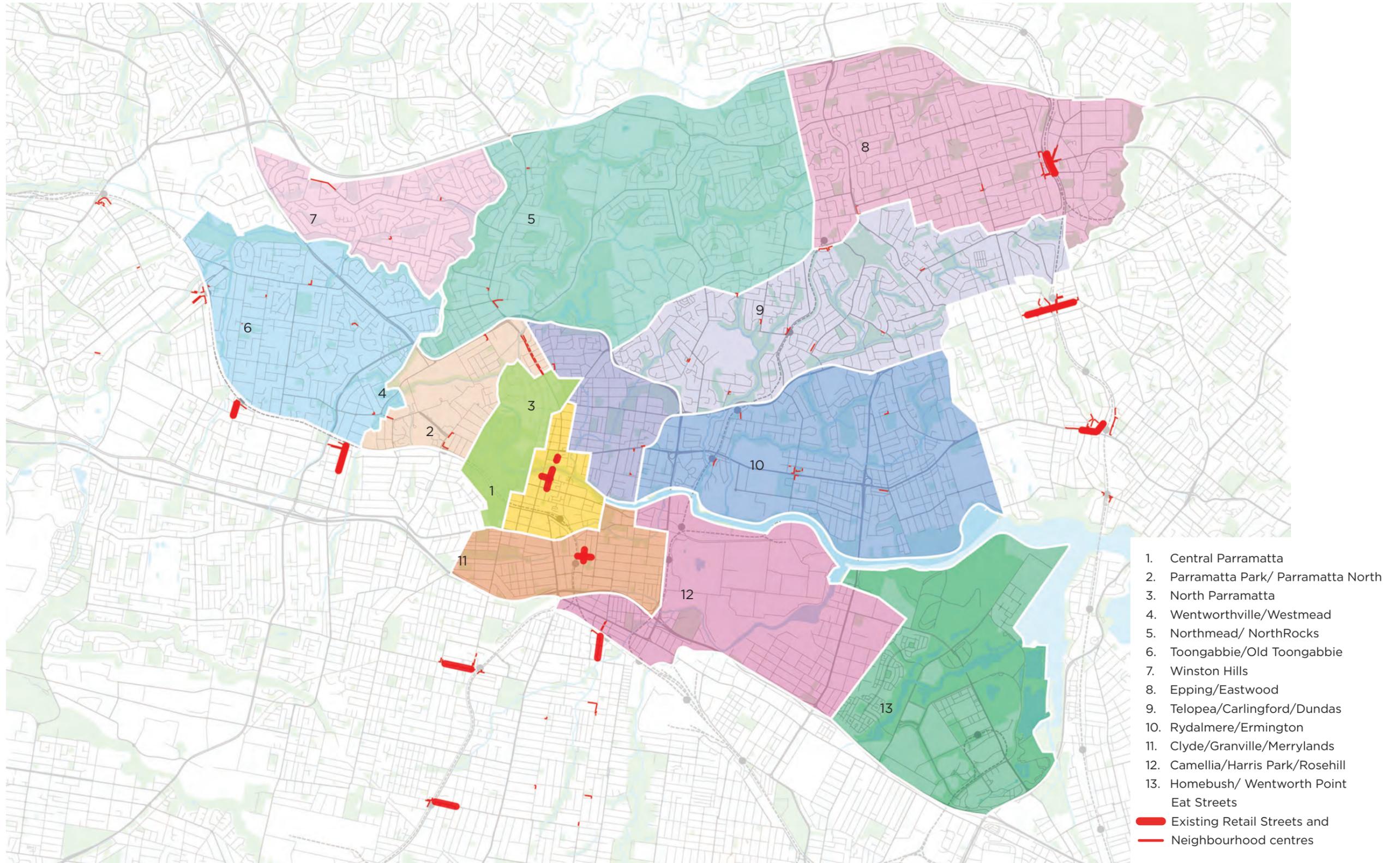
Destinations

Active Streets and Centres

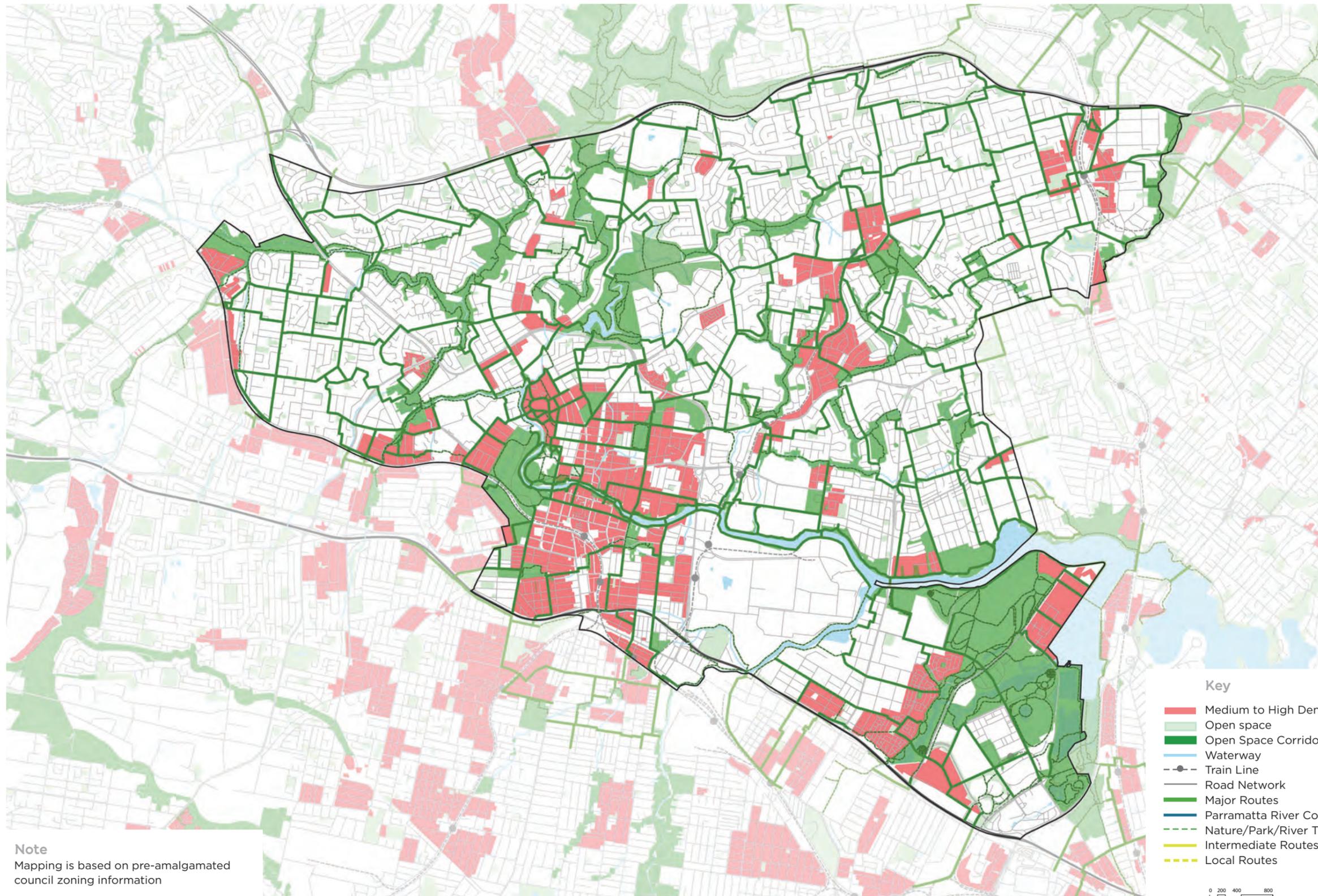


- Key**
- Open space
 - Waterway
 - Parramatta Ways Major Routes
 - Parramatta Ways Intermediate Routes
 - Parramatta Ways Local Routes
 - Indoor Sporting
 - Pool
 - Playgrounds
 - Library
 - Shopping Centres
 - Medical Facilities
 - Aged Care
 - Childcare
 - Education
 - Golf Course
 - Other Destinations
 - Train Line
 - Road Network

Character Framework



High Density Residential



Note
Mapping is based on pre-amalgamated council zoning information

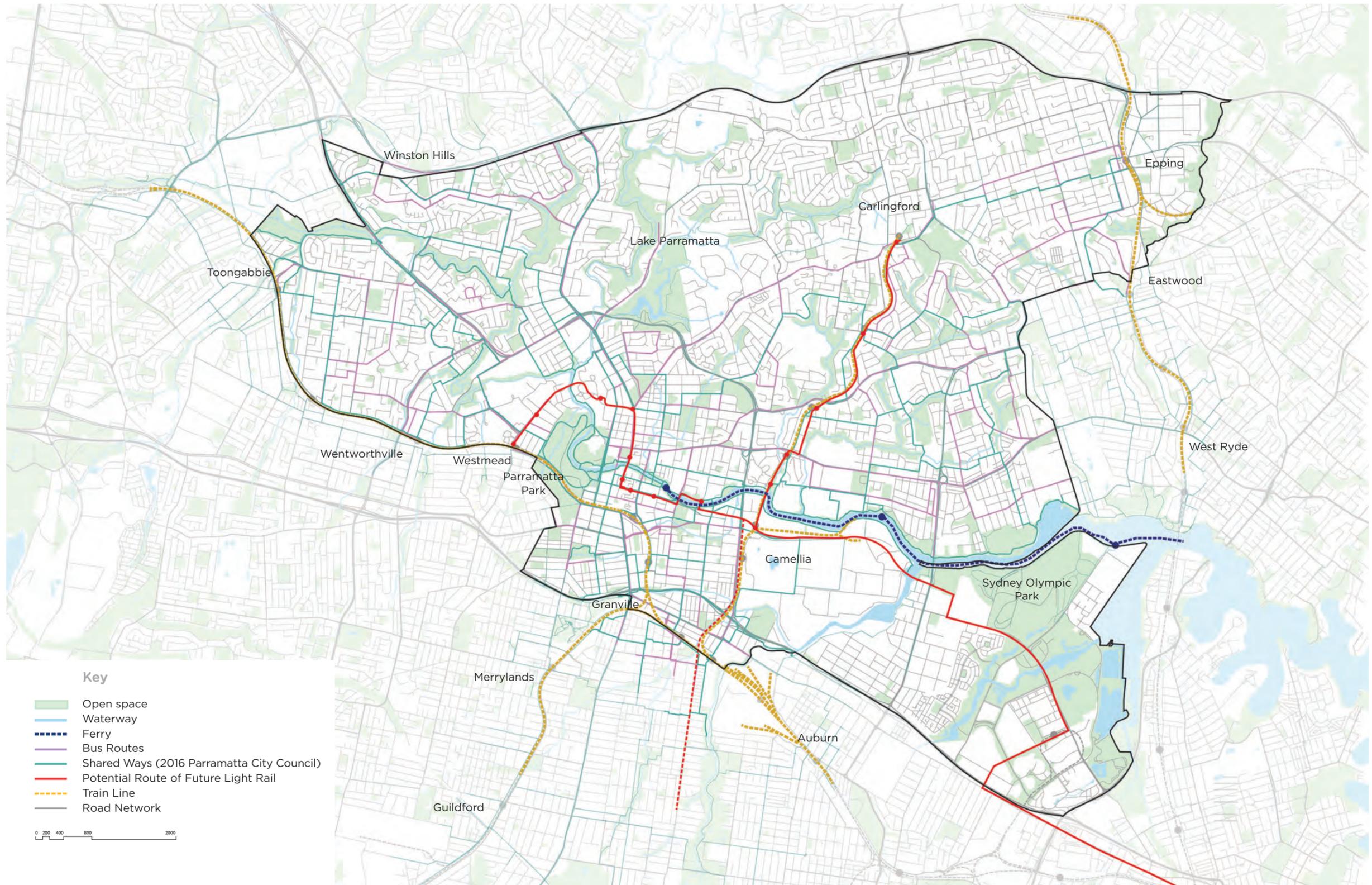
Key

- Medium to High Density Zonings
- Open space
- Open Space Corridors/Destinations
- Waterway
- Train Line
- Road Network
- Major Routes
- Parramatta River Corridor
- Nature/Park/River Trails
- Intermediate Routes
- Local Routes

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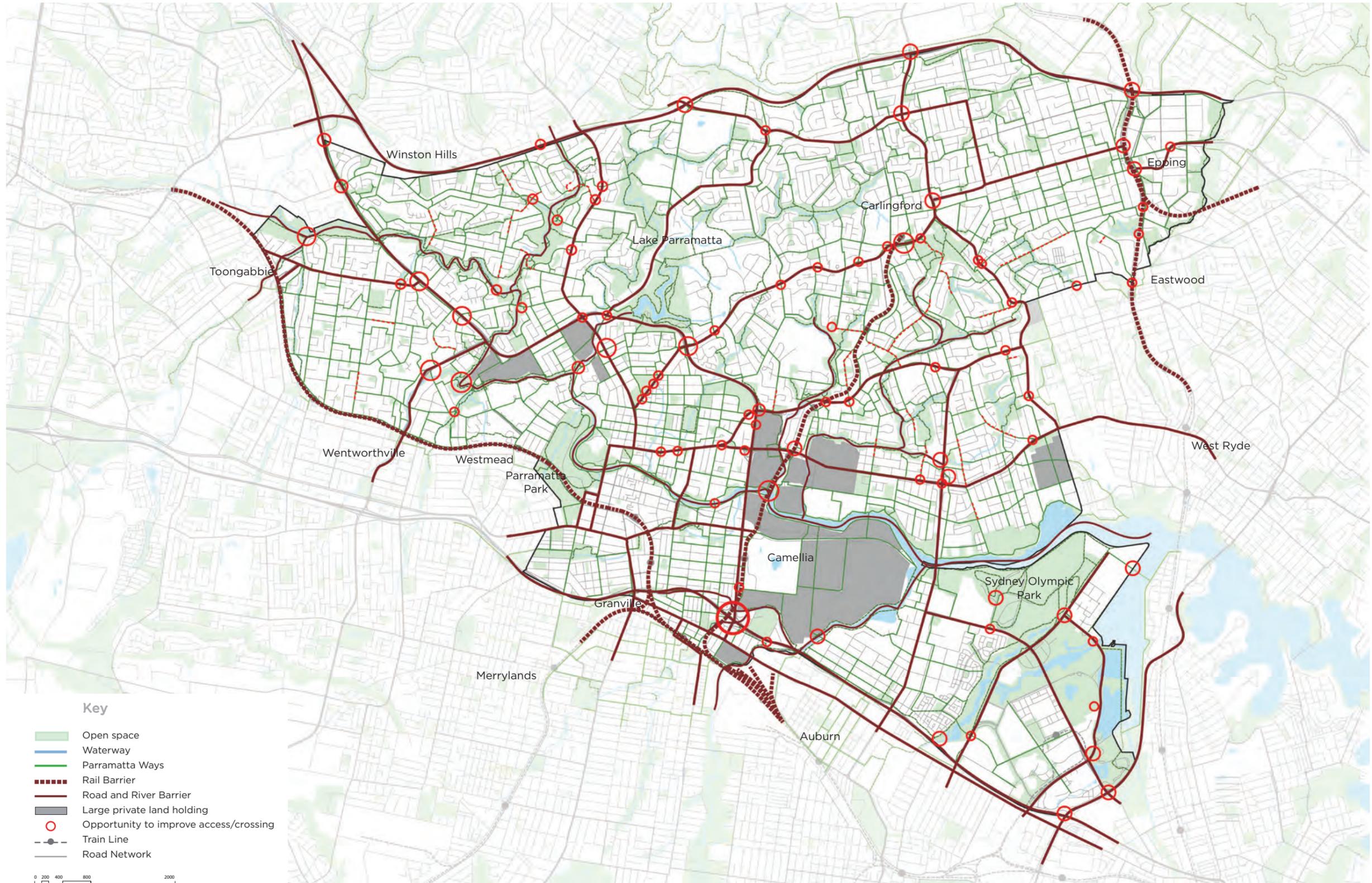
Transport

Key Transport Corridors

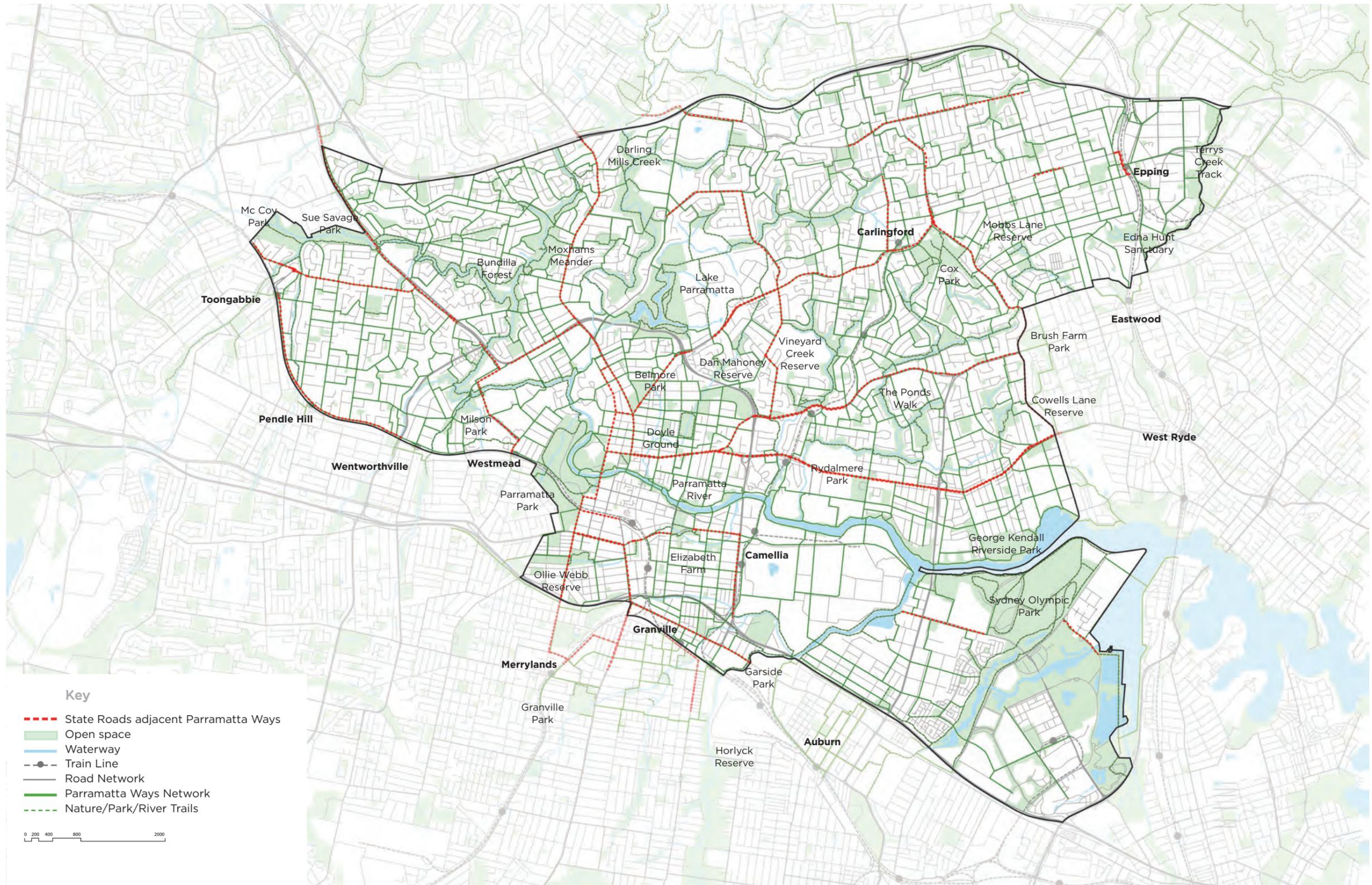


Pedestrian Barriers

Rail, Road and River



State Roads



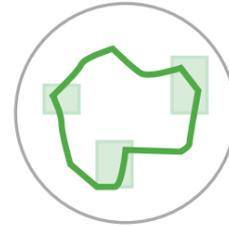
C

Detailed Route Options

The following map demonstrates a more detailed route network than the regional network shown in the body of the report. These additional routes provide a more comprehensive selection of opportunities for further investigation and review.

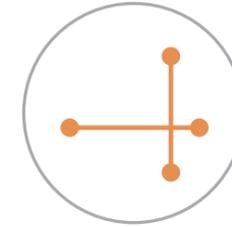
In order to differentiate the different qualities and roles for the routes within the network they have been divided into three route types. Major Routes, Intermediate Routes and Local Routes. These provide a range of route opportunities that demonstrate some of the different priorities for walkability across the LGA.

Route selection will be refined through both further consultation and project delivery.



Major Routes

These build on Parramatta's topography, open space network, centres and key destinations to provide the primary recreation framework for Parramatta Ways.



Intermediate Routes

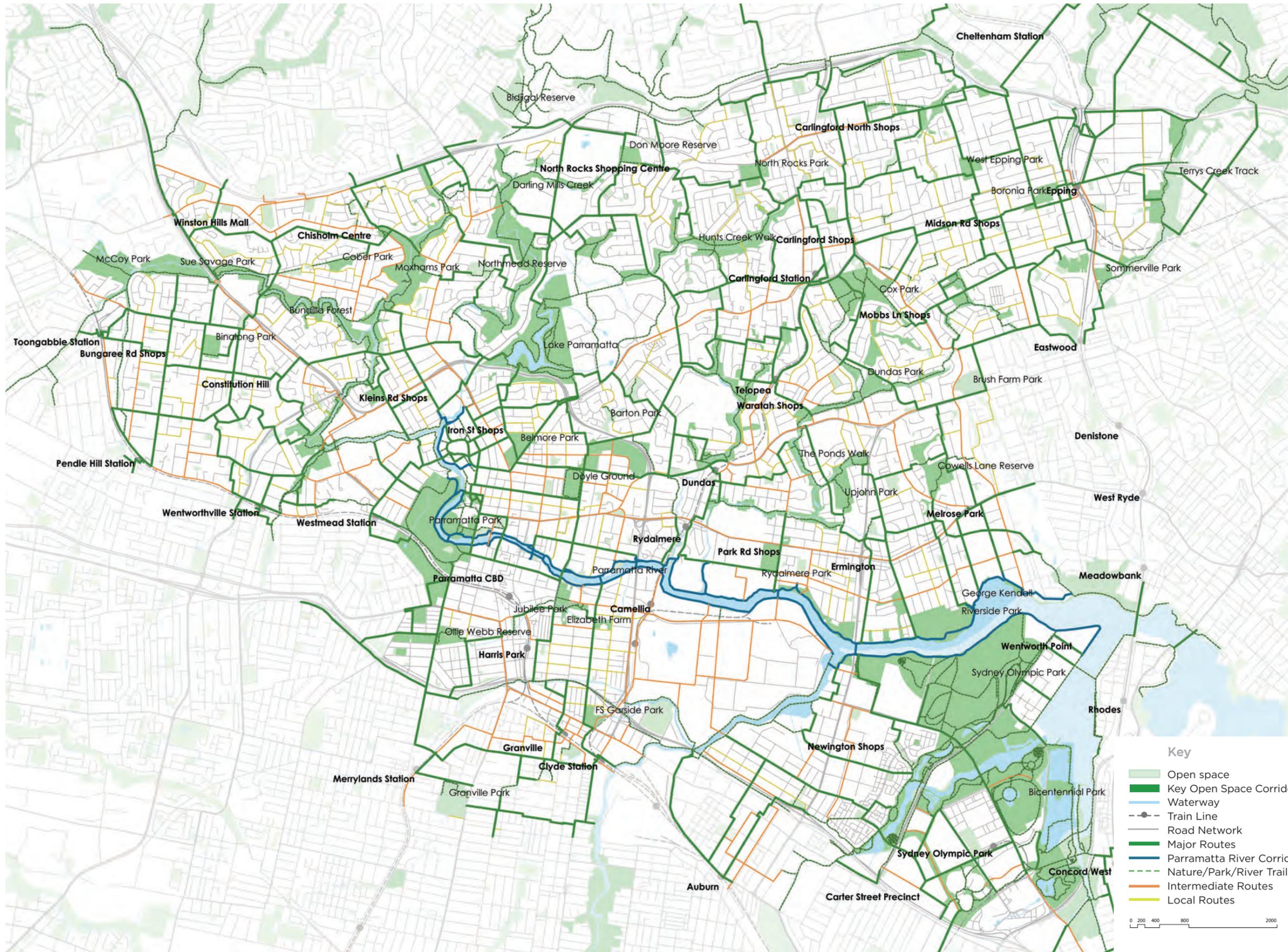
These provide increased connections in difficult but important transport corridors, such as distributor roads, rail corridors, bus routes and areas under future development.



Local Routes

These form companion routes to the larger grid network, adding diversity and flexibility to the many walks and experiences of Parramatta Ways.



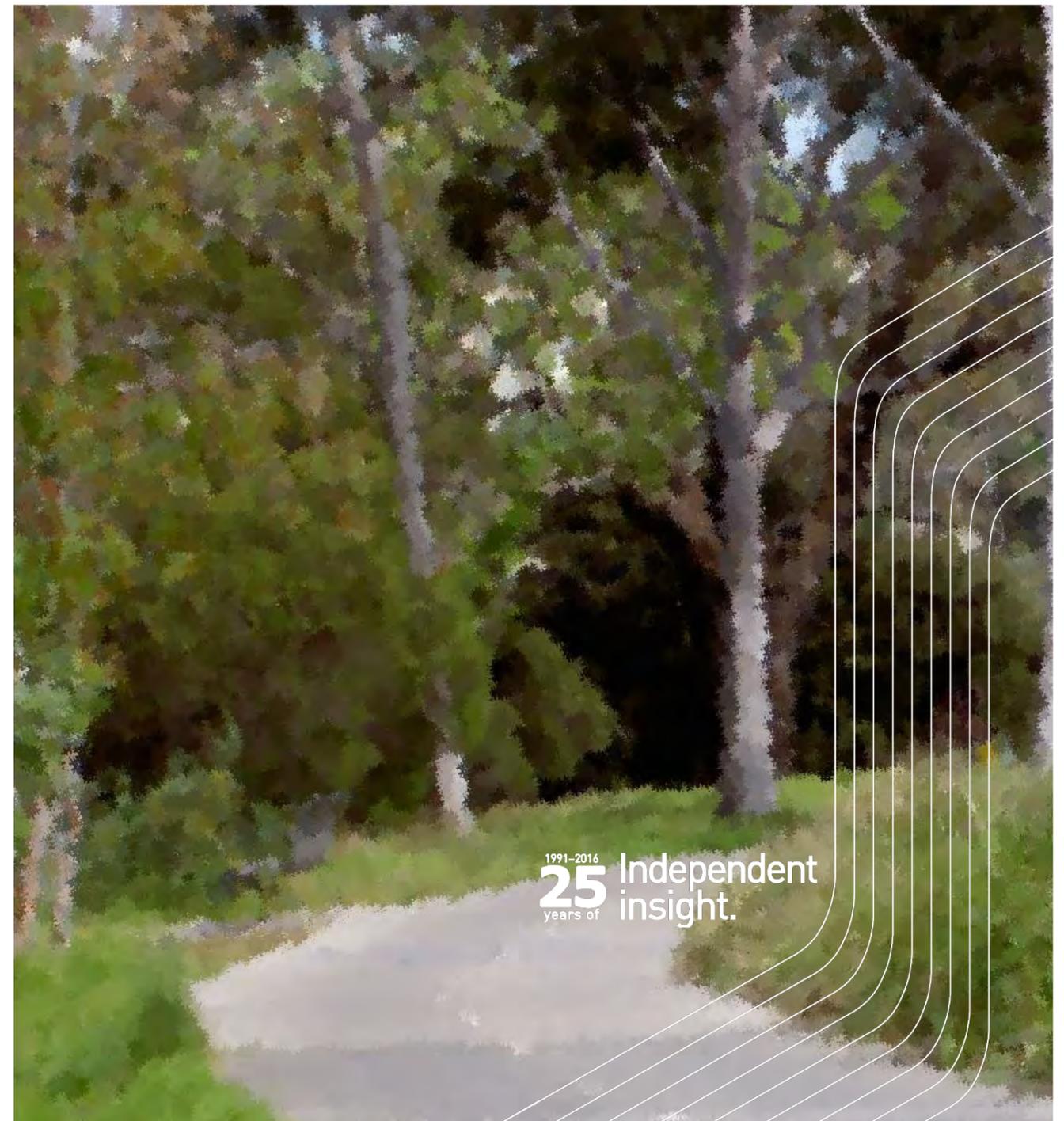


D Return on Investment

Return on Investment of Parramatta Ways

Final Report

City of Parramatta Council
October 2016





This report has been prepared for City of Parramatta Council. SGS Economics and Planning has taken all due care in the preparation of this report. However, SGS and its associated consultants are not liable to any person or entity for any damage or loss that has occurred, or may occur, in relation to that person or entity taking or not taking action in respect of any representation, statement, opinion or advice referred to herein.

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GLOSSARY

BCR	Benefit Cost Ratio
BTS	NSW Bureau of Transport Statistics
IRR	Internal Rate of Return
JTW	Journey to work
LGA	Local government area
NPV	Net Present Value (expressed in \$AUD 2016)

SUMMARY REPORT

Parramatta Ways

The City of Parramatta Council has been working to develop the Parramatta Ways concept, a comprehensive program to improve the pedestrian environment across the City of Parramatta local government area. Parramatta Ways aims to create a walkable and liveable city through the delivery of a high quality walking network across the local government area. It aims to make streets desirable and sustainable places and connect people to community facilities, neighbourhood centres, transport nodes, parks and open spaces as well as Parramatta’s iconic destinations. The project aims to reveal the natural and cultural treasures of the urban landscape and link places where people live, work and visit.

The Parramatta Ways program sees the improvement of the pedestrian environment across the City of Parramatta local government area. Parramatta Ways includes the following elements:

- new and upgraded paths
- kerb extensions
- trees and understorey planting
- rain gardens and wetlands
- rest spot furniture
- interpretive elements including signs

These specific infrastructure investments are proposed to improve the quality of the walking network and connecting Parramatta’s destinations and, when combined, create a value beyond the individual elements. SGS Economics and Planning has been commissioned by City of Parramatta Council to prepare a Return on Investment study to determine the economic costs and benefits of the value created via delivery of the combined capital components.

Evaluation framework

A cost benefit analysis has been prepared to identify the economic costs and benefits of the Parramatta Ways project. The cost benefit analysis is largely consistent with NSW Treasury Guidelines, however the economic appraisal considered the likely costs and benefits to the society of the City of Parramatta local government area rather than the society of NSW.

Parramatta Ways is assessed against a base case, a ‘do nothing’ or ‘business and usual’ scenario. This base case is the most likely future outcome if Parramatta Ways does not occur.

To assess the economic costs and benefits of Parramatta Ways, a number of assumptions have been made:

- A discount rate of 7% has been applied to the discounted cash flow
- Timeframe for the proposal is 30 years
- Benefits accrue in proportion to the amount of Parramatta Ways completed

Parramatta is a city undergoing significant changes to its population, demographics, urban form, and increasing role as an employment centre. This change means that forecasting potential future walking and cycling patterns is difficult. In order to account for this change, a number of usage scenarios have been prepared using a survey of the City of Parramatta’s population and case studies of similar active

transport and recreation programs from the City of Boulder and Marin County in the USA. These scenarios have been employed to demonstrate the possible benefits of Parramatta Ways that can accrue as the population, employment opportunities, and urban form of Parramatta continues to grow and change.

Identifying the costs and benefits of Parramatta Ways

The costs of the Parramatta Ways project have been provided by Council and are summarised in the table below. Parramatta Ways has a total quantified cost of \$227,044,216 over the 30 year assessment period.

SUMMARY OF COSTS

	Costs	NPV (30 year period)
Construction Costs (Year 1 to Year 25)	\$208,235,000	\$201,423,575
Maintenance costs (proportion applied yearly)	\$2,054,692	\$25,620,641
Total	\$210,289,692	\$227,044,216

A number of benefits have been considered in association with Parramatta Ways. Where possible, these have been quantified after reviewing the relevant academic and economic literature. The benefits of Parramatta Ways vary depending on usage rates achieved. If walking and cycling activity in the City of Parramatta reach surveyed levels, the total of quantified benefit is \$541,281,373 over 30 years. Regarding the case studies, if mode share shifts similar to those observed in Boulder are achieved, quantified benefits could total almost \$4.9 billion over 30 years. If mode share shift of similar rates observed in Marin County are achieved, quantified benefits could total \$3.25 billion over 30 years.

SUMMARY OF BENEFITS

	Health	Environmental	Economic	Amenity	Total
Scenario 1 (Survey)	\$212,376,616	\$9,138,579	\$263,757,721	\$56,008,458	\$541,281,373
Scenario 2 (Boulder)	\$1,765,645,569	\$119,802,099	\$2,952,776,923	\$56,008,458	\$4,894,233,050
Scenario 3 (Marin County)	\$1,452,590,292	\$56,659,822	\$1,685,058,047	\$56,008,458	\$3,250,316,619

As with most economic appraisals, not all effects can be quantified. In this analysis, the unquantifiable effects include:

- Improved mental health benefits for City of Parramatta residents
- Increased trips on the Parramatta light rail
- Improved perception of safety and reduced crime rates
- Increased biodiversity
- Increased visitor spend in the City of Parramatta local government area
- Reputational benefits to the City of Parramatta Council

Findings

The findings of the cost benefit analysis are shown in the table below. Based on the survey rates of potential active transport and recreation, Parramatta Ways returns a net community benefit to the society of the Parramatta local government area, returning a Net Present Value of \$396.6 million and a Benefit Cost Ratio (BCR) of 3.74. The proposal has an Internal Rate of Return of 30%. These values increase substantially if usage rates witnessed in Boulder and Marin County are evident across the 30 year period.

SUMMARY OF FINDINGS

Scenario	Net Present Value	Benefit Cost Ratio	Internal Rate of Return
Scenario 1 (Survey)	\$396,556,075	3.74	30%
Scenario 2 (Boulder)	\$4,749,507,752	33.82	237%
Scenario 3 (Marin County)	\$3,105,591,321	22.46	154%

Sensitivity testing has been undertaken to test these findings. Variation in discount rates, lower population growth and lower usage have been tested. The findings of the sensitivity testing is shown below.

SENSITIVITY TESTING

Item	Net Present Value	Benefit Cost Ratio	Internal Rate of Return
Scenario 1 (Survey)			
Discount rate of 5%	\$577,664,494	4.49	30%
Discount rate of 7%	\$396,556,075	3.74	30%
Discount rate of 10%	\$231,434,711	2.90	30%
Scenario 2 (Boulder)			
Discount rate of 5%	\$6,580,791,556	40.81	237%
Discount rate of 7%	\$4,749,507,752	33.82	237%
Discount rate of 10%	\$3,048,703,850	25.97	237%
Scenario 3 (Marin County)			
Discount rate of 5%	\$4,319,651,324	27.13	154%
Discount rate of 7%	\$3,105,591,321	22.46	154%
Discount rate of 10%	\$1,979,751,656	17.22	154%

Conclusion

The proposal results in a BCR of 3.74, indicating that for every dollar spent on the proposal, benefits of \$3.74 are returned to the society of the Parramatta local government area. This represents an internal rate of return of 30%. This indicates that the Parramatta Ways program is likely to be justifiable on economic grounds. It provides a positive return on investment and could create a considerable net community benefit to the society of the Parramatta local government area.

In practice, the benefits of Parramatta Ways to society may be higher than this calculated value due to the unquantifiable effects associated with additional trees and physical activity enjoyed by residents of the Parramatta local government area.

The benefits to society associated with Parramatta Ways could be even more substantial if walking and cycling rates in the study area increase to reach the rates documented in the case study areas of Boulder and Marin County.

1 INTRODUCTION

1.1 Project overview

SGS Economics and Planning has been commissioned by City of Parramatta Council to prepare a Return on Investment study to inform the Parramatta Ways program. This report presents an economic evaluation of the project assessing the costs and benefits of the proposal.

1.2 Project context

The City of Parramatta Council has been working to develop the Parramatta Ways concept. Parramatta Ways aims to create a walkable and liveable city through the delivery of a high quality walking network across the local government area. It aims to make streets desirable and sustainable places and connect people to community facilities, neighbourhood centres, transport nodes, parks and open spaces as well as Parramatta’s iconic destinations. The project aims to reveal the natural and cultural treasures of the urban landscape and link places where people live, work and visit.

An artist impression of the Parramatta Ways program is shown in Figure 1.

FIGURE 1. ARTIST IMPRESSION OF PARRAMATTA WAYS



1.3 Report structure

This report is structured as follows:

Chapter 2: Options	Specifies the options under consideration for this report.
Chapter 3: Evaluation framework	Identifies the potential costs and benefits stemming from the Parramatta Ways, outlines the method of quantifying these costs and benefits, and presents the findings of the cost benefit analysis, including sensitivity testing.
Chapter 4: Conclusion	Summary of findings of the Return on Investment Study.
Appendix A: Survey methodology	Provides an explanation of how a resident survey has been used to quantify benefits of Parramatta Ways and presents the resident survey.
Appendix B: Quantified and unquantified benefits	Present the net present value of quantified benefits for each scenario and lists the unquantified benefits assessed.
Appendix C: Discounted cash flow	Presents the discounted cash flow prepared as for the cost benefit analysis.

2 OPTIONS

This chapter provides an overview of the options under consideration for this cost benefit analysis.

2.1 Base case

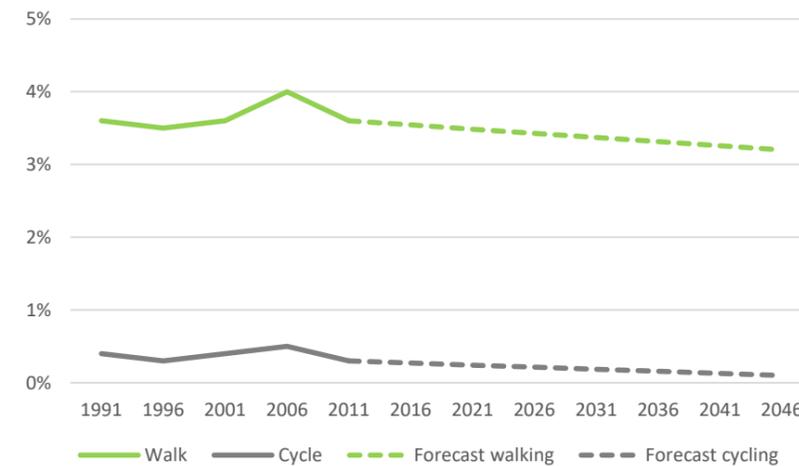
The base case for this evaluation is the most likely future scenario that would occur if the Parramatta Ways is not implemented (this is often referred to as a 'do nothing' or 'business as usual' scenario).

The base case for this analysis assumes the following:

- Continuation of Council's current procedures for the provision of footpaths, cycleways, tree plantings, and kerbing
- Levels of pedestrian and cycling activity follow historical trends, which have seen a slight decline in walking and cycling rates (see Figure 2). This is consistent with the case studies reviewed and applied to this study.

Current pedestrian and cycling activity levels have been ascertained through a survey of Parramatta residents. Further details of the survey are provided in Appendix A.

FIGURE 2. BASE CASE WALKING AND CYCLING MODE SHARES



2.2 Parramatta Ways scenarios

Summary of Parramatta Ways

The Parramatta Ways program sees the improvement of the pedestrian environment across the City of Parramatta local government area. Parramatta Ways includes the following elements:

- new and upgraded paths
- kerb extensions
- trees and understorey planting
- rain gardens and wetlands
- rest spot furniture
- interpretive elements including signs

The proposal involves three different tiers of streetscapes:

- Major routes - these build on Parramatta's topography, open space network and key destinations to provide the primary recreation framework for Parramatta Ways.
- Intermediate routes - these provide increased connections along difficult but important transport corridors, such as distributor roads, rail corridors, bus routes and areas under future development.
- Local routes - these form companion routes to the larger grid network, adding diversity and flexibility to the many walks and experiences of Parramatta Ways

These are specific infrastructure investments, combined these create a value beyond the individual elements. This report seeks to determine the economic costs and benefits of the value created via delivery of the combined capital components.

The proposal includes a substantial number of large tree species to be planted across the City of Parramatta local government area. Table 1 provides details of this for each of the routes.

TABLE 1. TREE PLANTING SCHEDULE

Category	100 L trees	200 L trees	Total number of trees
Major Routes	-	8,949	8,949
Intermediate Routes	11,113	-	11,113
Local Routes	8,064	-	8,064
Whole network	19,177	8,949	28,126

Source: Wilde and Wollard (2016)

3 EVALUATION FRAMEWORK

3.1 Economic costs and benefits

This section considers the likely costs and benefits associated with the Parramatta Ways project when assessed against the base case. The aim is to assess whether Parramatta Ways provides a positive pay off for society as a whole when viewed through the lens of cost benefit analysis. Limiting the scope of the appraisal to consider just the local area, rather than the state, is not in line with NSW Treasury guidelines, but is appropriate given the scope and scale of the proposals.

We have taken a balanced approach to identifying these effects, in line with guidelines for project assessment developed by NSW Treasury. Where possible, costs and benefits have been quantified and monetised and assessed through a cost benefit analysis

Description of a cost benefit analysis

The objective of cost benefit analysis (CBA) is to assist decision making that is consistent with 'efficiency' in the allocation of resources in areas where, for one reason or another, market forces do not guarantee an appropriate outcome. It considers the marginal costs and benefits when moving from the 'do nothing' or base case option to the project option.

The power of CBA as an analytical tool rests in two main features, namely that costs and benefits are:

- valued in terms of the claims they make on, and the gains they provide to, the triple bottom line as a whole (that is, including broader economic, social and environmental costs and benefits), so the perspective is a 'global' or society wide one rather than that of any particular individual, organisation or group.
- as far as possible, expressed in monetary terms and so are directly comparable with one another. Although we provide a framework identifying costs and benefits in this report, a full assessment would then proceed to quantify these.

SGS and others regularly apply cost benefit analysis to evaluate the economic merits of policy proposals, plans and projects. It explores whether a policy initiative or project will provide a net community benefit, taking into account that the resources deployed in implementing the initiative or project have alternative productive uses. When quantified, resource flows are expressed in real terms and social time preference is taken into account by discounting future costs and benefits to present day values.

Governments often require this technique in business case preparation, regulatory impact assessments and evaluation of strategic planning options. In NSW, applications for Treasury funding must provide a cost benefit analysis, which compares the net benefit to NSW society that would result from implementation of a particular project.

3.2 Estimating usage

Population

The benefits associated with the project are expected to flow to both Parramatta residents and visitors. However, our analysis will be conservative by focusing on the benefits flowing to Parramatta residents over the age of 15. The health and economic benefits of the usage from children below 15 is included by multiplying the benefits by 1.5. This takes into account the child as an additional user and the 'one-way' nature of school trips. The population of the Parramatta local government area in 2011 is shown in Table 2.

TABLE 2. POPULATION, 2016

City of Parramatta LGA	Number of persons
Population	236,272
Population (over 15)	195,196

Source: id., 2016

On 12 May 2016, the boundaries of the previous Parramatta City Council were changed to create the current City of Parramatta Council. Our analysis assumes an annual population growth rate of 2.6% in line with forecast prepared by id. for the new City of Parramatta local government area. The risk assessment in section 3.7 tests the sensitivity of the analysis to the forecast population growth.

Usage scenarios

Parramatta is a city undergoing significant changes to its population, demographics, urban form, and increasing role as an employment centre. This change means that forecasting potential future walking and cycling patterns difficult. In order to account for this change, a number of usage scenarios have been prepared from case studies of similar tree planting and active transport programs from around the world. These cities have employed a similar focus on improving the street environment to encourage active transport and recreation for residents, workers and visitors and have therefore been selected as appropriate case studies. These scenarios have been applied to demonstrate the possible benefits of Parramatta Ways that can accrue as the population, employment opportunities, and urban form of Parramatta continues to grow and change.

Data for the survey results includes active transport and recreation trips. Data for the case studies is largely collected and published for a shift in mode share i.e. walking or cycling replacing another mode of transport.

Scenario 1 - Survey results

A survey of City of Parramatta local government area residents was conducted to determine current and potential future active transport and recreation of existing residents. The survey instrument is shown in Appendix A and results were extrapolated to using the survey reweighting technique to match the City's demographic profile. The survey results for existing usage have informed active transport and recreation for the base case of this analysis. The potential future usage reported by existing City of Parramatta residents have been applied as a possible scenario of activity under Parramatta Ways. However, it is acknowledged that the City of Parramatta is undergoing significant change in population, demographics, and urban form and the survey results of existing residents may not represent the behaviours of future residents.

Scenario 2 - Boulder, Colorado

Boulder Colorado is a US city which made significant investments in pedestrian and cycling infrastructure between 1990 and 2009 and as a result experienced increases in non-automobile transport mode shares. The infrastructure investment included the completion of a footpath network throughout the city, the construction of a greenway network of separated bicycle and pedestrian paths and an increase

in high-frequency bus routes. Weekday and weekend trips were surveyed as well as purpose of trips (exercise, commuting, errands) and reported as a mode shift. Over the 20 year period, Boulder experienced a 2.2 percent increase in cycling as a mode share and no change in pedestrian mode share. However, it should be noted that pedestrian mode shares in the US declined by 1 percent over the same period.

Scenario 3 - Marin County, California

Marin County, California borders the City of San Francisco and forms part of the wider San Francisco bay Area. In recent years, Marin County has made a concerted effort to encourage and modes shift to walking and cycling across the County for recreation and for travel through WalkBikeMarin. The focus of WalkBikeMarin is linking gaps in existing transport infrastructure, primarily through the provision of direct shared paths, to create a holistic walking and cycling network linking key destinations across the County and connections to major transport hubs such as ferry terminals and the Golden Gate Bridge. WalkBikeMarin also included an extensive community outreach program. Weekday and weekend peak travel time activity has been recorded for the Marin County case study, however purpose of trip (e.g. journey to work, recreation, shopping etc.) has not. Weekend trips were assumed by WalkBikeMarin to be for recreation. Walking and cycling trips were reported as a mode share of all trips in Marin County.

WalkBikeMarin has been operating for a shorter period than the Boulder case study, starting with Federal funding in 2005. From 2007 to 2013 (the most recent data available), walking increased an estimated 20 percent and cycling increased an estimated 66 percent in Marin County (Volpe 2014). These increases equate to a 3.8 and 12 percent average annual growth rate for walking and cycling activity respectively (Volpe 2014). This equates to an increase in walking and cycling as a mode share of 4.1% and 1.08% over a 30 year period respectively.

Summary of scenarios

Table 3 provides a summary of the mode share shift over 30 years experienced under the base case and the three scenarios tested.

TABLE 3. MODE SHARE SCENARIOS (30 YEARS)

Scenario	Change in walking mode share	Change in cycling mode share
Current (Base case)	-0.4	-0.2
Scenario 1 (Survey)	0.51	0.21
Scenario 2 (Boulder)	0	3.3
Scenario 3 (Marin County)	4.10	1.08

Source: SGS Economics and Planning (2016)

Active transport and recreation

A key objective of the Parramatta Ways project is to increase active transport among residents for transport and recreation. The value of the proposal is largely dependent on the increase in walking and cycling trips in the City of Parramatta local government area directly attributable to the Parramatta Ways works. To estimate and quantify the potential increase in active transport, a survey of Parramatta residents has been conducted to determine current walking and cycling behaviours. The current level of usage was assumed to be representative of the journey-to-work (JTW) transport mode shares of the Parramatta local government area as per the 2011 Census in the absence of comprehensive data on recreational walking and cycling activity.

In the absence of comprehensive data detailing recreational walking and cycling activity across the local government area over time, using JTW mode share as a proxy is considered best way of quantify the recreation benefit as a separate effect. For the purpose of this economic appraisal in the absence of comprehensive recreational data, JTW mode shares are assumed to reflect recreation walking and cycling activity. This is considered to be a conservative approach as walking and cycling activity for recreation may exceed JTW trips.

The JTW data is used a comparison for the base case, with potential active transport and recreation trips included in the survey results under the project case. To address the uncertainty surrounding the impact of the Parramatta Ways project the analysis considered three case studies which demonstrated changes in the JTW transport mode shares. These case studies were then used as three scenarios representing the potential increase in usage arising from the project.

The current usage of the Parramatta area is shown in Table 4. This shows the potential additional usage for the population when fixed at 2016 levels – this is only for illustrative purposes, the cost-benefit analysis will account for population growth.

TABLE 4. CURRENT ACTIVE TRANSPORT AND RECREATION IN PARRAMATTA (KM PER WEEK)

Scenario	Walked (km/week)	Cycled (km/week)	Total (km/week)
Current (Base case)	1,015,560	449,400	1,464,960

Source: SGS Economics and Planning (2016)

TABLE 5. POTENTIAL ADDITIONAL ACTIVE TRANSPORT AND RECREATION ASSOCIATED WITH PARRAMATTA WAYS (KM PER WEEK)

Scenario	Walked (km/week)	Cycled (km/week)	Total (km/week)
Scenario 1 (Survey)	122,422	(20,412)	102,031
Scenario 2 (Boulder)	-	8,794,181	8,794,181
Scenario 3 (Marin County)	2,059,586	2,878,096	4,937,682

Source: SGS Economics and Planning (2016)

3.3 Assumptions

The following assumptions have been applied in this economic appraisal:

- The net benefit is calculated for the society of City of Parramatta local government area, rather than the society of NSW.
- The increases in active transport observed in case studies from similar projects around the world can be achieved through Parramatta Ways.
- A discount rate of 7% has been applied to the discounted cash flow.
- The timeframe for the proposal is 30 years.
- Active transport behaviours decline in line with historic trends under the base case.
- The 100L and 200L trees grow to a significant maturity in 12 and 10 years respectively.
- Active transport behaviours of people aged 0 to 15 years old have been included in this economic appraisal. The health and economic benefits of the usage from children below 15 is included by multiplying the benefits by 1.5. This takes into account the child as an additional user and the 'one-way' nature of school trips.
- There are five new wetlands proposed as part of the water sensitive urban design infrastructure

3.4 Costs

The costs of the project considered in this analysis are capital costs and maintenance costs. Capital and maintenance costs incurred under the base case are shown in Table 6 overleaf. The capital and maintenance costs of the Parramatta Ways program, including contingencies, is shown in Table 7. Construction costs are staged over a 25 year period in line with advice from City of Parramatta Council. Maintenance costs are staged over the 30 year appraisal period. The costs shown are in 2016 dollars and have not been discounted.

TABLE 6. BASE CASE COSTS (\$AUD 2016)

Type	Total estimated costs
Maintenance (total)	\$20,513,716
Operation (total)	\$18,726,108
Capital and renewal	\$10,059,652
Total	\$49,299,476

Source: City of Parramatta Council (2016)

TABLE 7. PROJECT CONSTRUCTION COSTS (\$AUD 2016)

Type	Total estimated construction costs	With contingencies (+15%)
Maintenance and operation (total)	\$34,066,793	\$34,066,793
Capital	\$197,908,810	\$223,723,003
Total	\$231,975,603	\$257,789,796

Source: City of Parramatta Council (2016)

3.5 Benefits

The benefits associated with the project are categorised into health, economic, environmental, and amenity benefits. A summary of all the quantified and unquantified benefits considered is included in Appendix B.

Health benefits

Health benefits associated with physical activity

Parramatta Ways aims to provide an appealing and amenable network for residents to exercise either by walking and running along the improved footpaths or cycling along the roads. The health benefits associated with exercise are well-known and include improved health of those exercising and reduced rates of morbidity and mortality.

A literature review has been conducted to determine the likely health benefits from increased physical activity and apply an appropriate value per kilometre travelled per person using the benefit transfer method. The health benefits to individuals (e.g. increased life span, increased quality of life) and avoided costs to government provided health services have been included. Health benefits stemming from increased tree coverage, such as reduced respiratory disease, have not been included as these benefits are included under improved air quality, which is detailed in the environmental benefits of Parramatta Ways.

In our analysis we use estimates of walking and cycling health benefits which have been quantified by the New Zealand Transport Authority (2010). The values calculated by the New Zealand Transport Authority are considered the most appropriate and relevant to the Parramatta Ways project of the economic literature reviewed. School trips have been scaled up by 1.5 to account for additional benefits flowing to the child and adult. The values of walking and cycling per kilometre per person has been inflated to \$AUD 2016 and are summarised in the table below.

TABLE 8. HEALTH BENEFITS ASSOCIATED WITH PHYSICAL ACTIVITY (\$AUD 2016)

Activity	Health benefits per km
Walking	\$2.28
Cycling	\$1.14

Source: New Zealand Transport Authority (2010)

Health benefits associated with an increase in tree cover

The mass planting of trees as part of Parramatta Ways also provided the potential for improved health, particularly for a reduction in respiratory diseases associated with air pollution (Donovan et al 2013, Riberio et al 2009, Pope et al 1991, Shanahan et al 2015). The health benefits associated with increased tree cover include both improved health for individuals and reduced costs associated with health care provision. In our analysis we apply estimates for health benefits associated with trees due to a reduction in air pollution as measured by Landry et al (2013). The value per tree per year has been inflated to \$AUD 2016 as summarised in the table below.

TABLE 9. HEALTH BENEFITS ASSOCIATED WITH ADDITIONAL TREE PLANTING, PER ANNUM (\$AUD 2016)

Benefit	Adopted value per tree
Improved health	\$0.66

Source: Landry et al (2013)

An increase in tree cover is also associated with a reduction in the urban heat island effect (Coutts et al 2007). Urban heat island refers to an increase in temperatures experienced in urban areas compared to surrounding areas. Urban heat islands form in cities due to a number of factors including limited vegetation and the prevalence of materials which absorb and radiate heat into the surrounding environment such as concrete and asphalt. An increase in temperatures associated with urban heat islands can see an increase in the number of heat-related illnesses requiring hospitalisation (Bassil et al 2010). Parramatta Ways has the potential to reduce the urban heat island effect and associated heat-related illnesses experienced across the Parramatta local government area.

In the absence of a reliable method for valuing this health benefit, a reduction in ambulance callouts for heat related illnesses has been used as a proxy to estimate the potential health benefits associated with a reduction in urban heat island. A potential reduction in average summer daytime temperature associated with an increase in tree cover calculated by Coutts et al (2007) for inner Melbourne has been applied. Using the calculation developed by Coutts et al (2007), a reduction in average summer daytime temperature of 0.56°C associated with urban heat island may be experienced due to the increase in tree cover under Parramatta Ways.

A review of academic, health and economic literature has found that ambulance call outs for heat related illnesses increase by 29% for every 1°C increase in summer temperatures (Bassil et al 2010). AECOM (2012) prepared a study of urban heat island impacts for the City of Melbourne. This study found the incidence rate of ambulance call outs in Melbourne of 0.09 per 100,000 people per day of heatwave events. This incidence rate has been applied as a 'base case', and a reduction in ambulance call outs has been applied using the analysis of Bassil et al (2010) for a potential 0.56°C decrease associated with Parramatta.

The avoided ambulance call outs per year associated with Parramatta Ways has been determined with consideration of the current base cost of an ambulance call out in NSW and number of days over 35°C experienced in Parramatta in 2015 (Bureau of Meteorology 2016). Consideration has also been made for a forecast increase in days above 35°C as reported by the Office of Environment and Heritage's *Metropolitan Sydney: Climate Change Snapshot* (2014). The value per annum for reduced ambulance callouts associated with a potential reduced in urban air temperature under Parramatta Ways prior to and after 2020 are shown in Table 10.

TABLE 10. AVOIDED COST OF AMBULANCE CALL OUTS FOR HEAT RELATED ILLNESSES, PER 100,000 PEOPLE (\$AUD 2016)

Year	Value per year
2017-2020	\$81.67
2021-2046	\$95.28

Source: Coutts et al (2007), Bassil et al (2010), AECOM (2012), Bureau of Meteorology (2016), NSW Office of Environment and Heritage (2014), NSW Health (2016).

Economic benefits

The economic benefits associated with the proposal arise from increased expenditure at local shops, reduced work absenteeism, and increased worker productivity.

The uplift in land values from projects such as Parramatta Ways has been reported by a number of studies reviewed as part of this study. An uplift in land values in itself does not represent a net benefit to society. An uplift in property values is a *transaction*, with the seller 'benefiting' and the purchaser paying a 'cost' in equal amounts. This form of transaction is a zero-sum benefit and therefore an uplift in land values has been omitted from this analysis. Where property value uplift is used as a measure of benefits in other studies this is usually as a proxy for the bundle of amenity affects associated with the proposal being assessed. In this study, these effects are assessed separately and are discussed below.

Estimating active persons

To quantify benefits such as increased spending and productivity due to active transport choices it is necessary to estimate the number of active persons in each scenario. For the base case the number of active persons in 2016 is estimated from the survey results and then grows at the population rate of 2.63% per annum. For the scenarios it is assumed that additional increase in kilometres of active transport is explained in equal portions by already-active residents increasing the distance which they travel and by new residents becoming active. The table below summarises the estimated total number of active walkers and cyclist in 2046 in each scenario using this method.

TABLE 11. ACTIVE PERSONS IN 2046

Scenario	Walk	Cycle
Base	283,761	64,676
Scenario 1 (Survey)	302,343	83,730
Scenario 2 (Boulder)	295,303	411,398
Scenario 3 (Marin County)	413,718	191,477

Source: SGS Economics and Planning (2016)

Increased spend within the City of Parramatta by residents

A number of studies have shown that people walking and cycling to the shops spend on average more than a person driving to the shops (Sælensminde 2004, Armet et al, 2014, BEST 2004, Transportation Alternatives 2012, Clean Air Partnership 2009, Clifton et al 2013, SQW 2007, San Francisco Metropolitan Transport Authority 2013). An 'amenity margin' has also been noted for retail businesses located on treed streets compared to shops without street trees (Wolf 2005, Burden 2006, Georgia Urban Forest Council 2005). There is therefore potential for Parramatta Ways to increase spending from City of Parramatta residents within the local government area, diverting spending that would otherwise occur outside of the local government area.

However, the additional economic benefit of shoppers walking to retailers *and* the presence of street trees in centres combined has not been quantified and valued. There is potential for significant overlap between these two factors as the economic literature has only considered these benefits separately. It is not possible for the additional spend associated with walking and trees to be neatly summed together without the potential for double counting. To be conservative and avoid double counting, only the additional spend associated with walking has been applied to this analysis, noting that additional

unquantified benefit may also be achieved from the planting of streets trees in the City of Parramatta's retail centres.

A wide range of additional spend associated with walking compared to driving to the shops has been reported in the economic literature reviewed, ranging from an additional \$8.23 to \$166.67 per week. In our analysis, we have assumed an additional spend of \$52.22 per week per person walking to the shops in line with the findings of the San Francisco Metropolitan Transport Authority's 2013 street survey.

As the case studies reviewed do not detail the increase in active transport trips to the shops, the proportion of active transport trips observed in the survey (6.6%) has been applied and remains constant for the 30 year assessment period. This is considered to be a conservative estimate, however this assumption provides the most reliable results for the usage scenarios.

TABLE 12. ADDITIONAL SPEND PER WEEK FROM WALKING/CYCLING TRIPS (\$AUD 2016)

Benefit	Adopted value
Additional spend	\$52.22

Source: San Francisco Metropolitan Transport Authority (2013)

Increased worker productivity and reduced worker absenteeism

Numerous studies have demonstrated that workers who commute via active transport have reduced sick days per annum (Litman 2016, Sælensminde 2004, SQW 2007, UK Department of Transport 2010, Parks and Steeleman 2008, Shalyer et al 1993). This reduction in worker absenteeism provides a benefit to businesses and has been used in the economic literature reviewed as a proxy for increased productivity of workers. The studies reviewed have found a reduction in absenteeism from 0.4 to 1 day per annum.

Many of the studies reviewed consider only the benefit to new trips taken by active transport to and from work. SQW (2007) calculates the benefit of active transport commutes for all workers, regardless of their mode of transport before the commencement of improvements to the walking and cycling network. As the case studies reviewed do not provide a proportion increase in active transport commutes for workers, the value of \$140.36 (\$AUD 2016) per worker per year calculated by SQW has been applied.

As the case studies reviewed do not detail the increase in active transport trips to work, the proportion of active transport trips for work of 9% has been applied from the 2014/15 Household Travel Survey (BTS 2016). This is considered to be a conservative estimate, however this assumption provides the most reliable results for the usage scenarios.

TABLE 13. IMPROVED WORKER PRODUCTIVITY, PER WORKER (\$AUD 2016)

Benefit	Adopted value
Reduced worker absenteeism	\$140.36

Source: SQW (2007)

Environmental and amenity benefits

Parramatta Ways will provide environmental benefits to the City of Parramatta local government area through the mode share shifts of residents, introduction of trees, and construction and operation of water sensitive urban design elements including rain gardens and wetlands.

Mode share shift

Mode share shifts refer to the residents who choose to walk or cycle instead of travel by a vehicle. This shift presents a number of environmental benefits such as reduced air pollution, greenhouse gas emissions, noise, and water pollution.

A number of studies and economic appraisals have been reviewed to determine the variety and extent of environmental benefits to be gained from active transport modes (Transport for NSW 2013, Department of Infrastructure and Transport 2013, Grabow et al 2012, Howard 2014, Litman 2016, Litman 2014, Litman 2010, New Zealand Transport Authority 2013, PricewaterhouseCoopers 2010, PriceWaterhouseCoopers 2009, Queensland Government 2007, Sælensminde 2004, SQW 2007). The environmental values per kilometre walked or cycled reported by Transport for NSW (2013) have been applied as the most appropriate and relevant values to the City of Parramatta local government area.

Table 14 overleaf contains the benefits from Transport for NSW (2013) applied to this analysis.

TABLE 14. ENVIRONMENTAL BENEFITS FROM MODE SHARE SHIFTS (\$AUD 2016)

Cost	Cycle 2016 AUD (per km)	Walk 2016 AUD (per km)
Congestion cost savings	\$0.33	\$0.33
Vehicle operating cost savings	\$0.30	\$0.34
Public transport fare cost savings	\$0.12	\$0.12
Tolling cost savings	\$0.38	\$0.38
Accident cost	\$0.28	\$0.13
Air pollution	\$0.03	\$0.03
Greenhouse Gas Emission	\$0.02	\$0.02
Noise	\$0.01	\$0.01
Water Pollution	\$0.00	\$0.00
Nature and Landscape	\$0.00	\$0.00
Urban Separation	\$0.01	\$0.01
Roadway provision cost savings	\$0.04	\$0.04
Parking cost saving	\$0.01	\$0.01
Travel time cost	\$0.00	\$0.00

Source: TfNSW (2013)

As the case studies reviewed do not detail the proportions of mode choices which are replacing car trips and/or school trips, the portion of active transport trips are categorised using the portions attained from the survey. The table below identifies the proportion of trips representing a mode shift and the value of these trips.

TABLE 15. PORTIONS OF ACTIVE TRANSPORT REPLACING CAR TRIPS

	Walk	Cycle
Replacing car	45%	50%
Not replacing car	53%	48%
School trip	2%	2%

Source: SGS Economics and Planning (2016)

TABLE 16. BENEFITS OF WALKING AND CYCLING DEPENDING ON MODE SHARE SHIFT (\$AUD 2016, PER KM)

Mode share shift	Cycled (per km)	Walked (per km)
Replacing car	\$2.67	\$3.71
Not replacing car	\$1.14	\$2.28
School trip	\$1.70	\$3.42

Source: SGS Economics and Planning (2016)

It is difficult to quantify the benefits for each additional light rail trip. However, in the cases where a light rail trip is replacing a private vehicle trip some benefits such as reduced congestion costs, vehicle operating costs, accident costs, roadway provision costs and parking costs are expected. Table 17 summarises the benefits. The case studies reviewed do not provide relevant details to quantify this

benefit. Instead the results from the survey which indicate the additional light rail trips due to the project have been applied to scenarios 1, 2 and 3.

TABLE 17. BENEFITS OF MODE SHIFT TO LIGHT RAIL (\$AUD 2016)

Mode shift	Benefit per km
Replacing car	\$0.92
Not replacing car	\$0.00
School trip	\$0.00

Source: TfNSW (2013)

Environmental benefits of trees

The proposed project has accounted for a substantial number of large tree species to be planted within the Parramatta LGA. The table below provides details of this for each of the routes.

TABLE 18. TREE PLANTING SCHEDULE

Route	100 L trees	200 L trees	Total number of trees
Major Routes	-	8,949	8,949
Intermediate Routes	11,113	-	11,113
Local Routes	8,064	-	8,064
Whole network	19,177	8,949	28,126

Source: Wilde and Wollard (2016)

The environmental benefits of trees are well documented and have been previously quantified (Enspec 2015, Burden 2006, DCA Economics 2007, Donovan and Butry 2010, Efec and CASCADE 2015, Killacot et al 2002, McPherson 2003, McPherson et al, 2001, McPherson and Rowntree 1993, Pandit et al 2013, Soares 2011, Victoria Institute of Strategic Economic Studies 2015). The i-TreeEco report prepared by Enspec (2015) provides values specific to the tree species proposed to be planted for reductions in air pollution, rainfall and stormwater interception, carbon storage, and carbon sequestration. Enspec (2015) is considered to most relevant and appropriate of the economic literature reviewed for the Parramatta Ways program.

The benefits in Table 19 are applied to trees in the City of Parramatta local government area. The 100L and 200L trees do not achieve the full benefit shown in Table 19 immediately, taking 12 and 10 years to reach a significant maturity respectively. We have assumed that a 100L and 200L tree provide 50% and 75% respectively of the average benefit that existing trees in the Parramatta local government area provide.

TABLE 19. ENVIRONMENTAL BENEFITS PER TREE (\$AUD 2016)

Benefit	Adopted value per tree
Carbon storage	\$0.36
Carbon sequestered	\$0.91
Pollution removal	\$0.12
Cooling benefits	\$3.88
Heating Benefits	\$0.71
Rainfall interception	\$0.90

Source: Enspec (2015)

Amenity benefits of trees

The additional amenity value of trees have been documented and monetised in the 2015 i-TreeEco report. The amenity benefit attributed in this report is \$178.50 per tree per year (\$AUD 2016) which is only applied to trees. Since the project involves planting 100L and 200L trees it was necessary to make

assumptions around discounting the amenity benefit. The tables below illustrates the assumptions. It was also assumed that a 200L tree would reach a significant maturity after 10 years and a 100L tree would reach a significant maturity after 12 years.

TABLE 20. DISCOUNTING AMENITY BENEFIT

Tree size	Discount/Scale factor
100 L	0.5
200 L	0.75

Source: SGS Economics and Planning (2016) in discussion with City of Parramatta Council

TABLE 21. AMENITY BENEFITS PER TREE PER YEAR (\$AUD 2016)

Benefit	Adopted value per tree
Amenity	\$178.50

Source: Enspec (2015)

Environmental benefits of water sensitive urban design

The environmental benefits of water sensitive urban design have been well documented (Coombes et al 2000, Coutts et al 2013, CSIRO 1999, DCA Economics 2007, Dunne et al 2015, Efec and CASCADE 2013, Lloyd et al 2002, MWH 2013, Water by Design 2010, Weber 2015) however there are few relevant examples quantifying and valuing these benefits. The value of water sensitive urban design in improving water quality and avoided rehabilitation and conversation work downstream have been valued by Water by Design (2010) for water sensitive urban design elements in South East Queensland. The Water by Design report (2010) reports the value of a reduction in total nitrogen loads as a proxy for the value of a reduction in water pollutants more generally.

These values are calculated per hectare of water sensitive urban design per year and are shown in Table 22 below. The water sensitive urban design elements proposed as part of Parramatta Ways are approximately 3.5 hectares.

TABLE 22. ENVIRONMENTAL BENEFITS OF WATER SENSITIVE URBAN DESIGN PER YEAR (\$AUD 2016)

Benefit	Value per hectare
Reduction in water pollution	\$4,737.57
Avoided downstream rehabilitation	\$36,095.73

Source: Water by Design (2010)

Amenity benefits of water sensitive urban design

The additional amenity value of the proposed water sensitive urban design has been valued for rain gardens and wetlands separately. The amenity value of rain gardens (Bowman et al 2012) and constructed wetlands (Bastien 2011) were determined through willingness to pay surveys of residents. The values calculated from these surveys have been applied to the rain gardens and wetlands proposed.

TABLE 23. AMENITY BENEFITS OF WATER SENSITIVE URBAN DESIGN PER HOUSEHOLD (\$AUD 2016)

Benefit	Value	Timeframe
Wetlands	\$222.84	Per year
Rain gardens	\$1,900.41	One off payment

Source: Water by Design (2010)

3.6 Unquantified costs and benefits

Amenity disruption during construction

The proposed works may impact on the amenity of the Parramatta local government area during construction. The proposal may also impact on active transport and recreation patterns across the local government area during construction.

Increase in light rail usage

Survey responses suggest that improvements to the roads and footpaths will increase residents' use of the light rail. In this sense there are synergistic benefits between the Parramatta Ways project and the Parramatta Light Rail. Expenditure on the Parramatta Ways project is likely to complement the planned expenditure on the light rail and 'unlock' additional benefits of the light rail that otherwise would not have occurred unless the projects are developed together.

The value of increased usage of the Parramatta Light Rail has not been quantified for this report as this value is likely a benefit transfer. Nonetheless, the survey responses provide some quantitative evidence of additional benefits accruing to the City of Parramatta's society.

Table 24 summarises our survey responses regarding increased light rail usage. An increase in light rail usage is anticipated with the implementation of Parramatta Ways.

TABLE 24. INCREASED LIGHT RAIL USAGE (TRIPS PER WEEK)

	Base case	Option 1	Difference
Expected light rail trips	349,269	372,463	23,194

Source: SGS Economics and Planning, 2016

Improved mental health outcomes

Positive associations between interaction with urban green spaces, including street trees, and improved mental health outcomes have been noted across academic literature (Grinde and Paul 2009, Townsend and Weerasuriya 2010, Sugiyama et al 2008, Abraham et al 2010, Beer et al 2003, Nielsen and Hansen 2007, van der Berg et al 2010, Aspinall et al 2014). Physical activity has also been found to have some associations with positive mental health and may play a role in managing mild to moderate mental health conditions (Roe and Aspinall 2001, Alexandratos et al 2012, Paluska and Schwenk 2000, Biddle and Asare 2012, Penedo and Dahn 2005, Ohta et al 2007, Stathopoulou et al 2006, Atkinson and Weigand 2008). Physical activity such as walking and cycling may act as a 'stress buffer', providing some protection from the harmful impacts of stress (Brown and Siegel 1988) and can facilitate social interactions, reducing feelings of social isolation (Lund 2002, Brown et al 2007, Richard et al 2009). However, the literature reviewed does not demonstrate a causal relationship nor provide a reliable mechanism to quantify and monetise potential mental health benefits directly associated with Parramatta Ways.

Potential increase in perception of safety and reduction in crime

More people walking and cycling has the potential to increase the 'eyes on the street' (Jacobs 1961), increasing casual surveillance of streets and public open spaces throughout the Parramatta local government area. This increase in casual surveillance and activity on Parramatta's streets and open spaces may reduce crime rates and improve residents' perceptions of crime and safety across the local government area.

A literature review has been conducted of examples in other cities of the relationship between tree cover, walkability, and crime and/or the perception of crime. In Rotterdam, improvements to the attractiveness of streets and pedestrian facilities has been found to be associated with a reduction in property crime and violent crime (Hoekman 2011). In the Baltimore metropolitan region, 10% increase in tree cover has been found to be associated with an 11.8% reduction in violent and property crime (Troy et al 2012). The provision of trees on public land was found to have a stronger association with a

reduction in crime than trees on private land (Troy et al 2012). Similar associations have been noted in Kitchener-Waterloo (Du and Law 2016), Portland (Donovan and Prestemon 2012), and inner city Chicago (Kuo and Sullivan, 2001), however the extent in crime reduction observed varies. A reduced perception of crime and improvements in perceived safety have also been associated with the visibility of vegetation higher than 2.5 metres (Li et al 2015).

It is important to note that the relationship between additional tree cover and reduction in crime/perception of crime has not been proven to be causal. Several other factors could be impacting on this relationship and/or some other third factor, such as household income, could be responsible for the reduction in crime/perception of crime. Furthermore, none of the literature reviewed provides a reliable method to value the reduction of crime and reduction in the perception of crime that may be attributable to trees.

Improvements to biodiversity

The planting of additional street trees and the provision of constructed wetlands has the potential to increase the biodiversity of the Parramatta local government area. This could involve attracting native species that previously had habitats in the City of Parramatta local government area but were driven out by human activity and/or increases in native flora and fauna species that are currently found in the local government area.

Associations between increased native street tree cover and positive ecological outcomes (e.g. high number of native species, use as habitats) has been noted internationally (Nowak and Dwyer 2007, Fernandez-Juricic 2000, Shackleton 2016, Tzilkowski 1986, Kubista 2015, Avila-Flores and Fenton 2005). However, a reliable method of valuing increases in biodiversity remains elusive. Furthermore, the potential increase in biodiversity associated with Parramatta Ways is unclear.

Increased visitor spend to the City of Parramatta local government area

The Parramatta Ways program may see additional visitors from outside of Parramatta local government area, leading to additional spending that otherwise would not have occurred without Parramatta Ways. The role of Parramatta Ways linking destinations within the local government area has the potential to drive visitation to the local government area and increased visitor spend.

Street trees and improved walkability have been associated with increased positive perceptions of places by visitors (Dokmeci et al 2007, Deng et al 2010, Deng et al 2012, Wolf, 2005b), which can be a significant factor in driving repeat visitation, and in the case of Dokmeci et al (2007), improvements to the pedestrian environment, including improved pedestrian infrastructure and street trees, can result in increased visitation.

The potential for increased tourism spend directly attributable to the trees (and not to any other initiative in the Parramatta LGA) cannot be reliably determined within the scope of this project. Furthermore, the literature reviewed does not provide an estimated increase in visitor spend associated with increase street trees and walkability.

Reputational benefits to the City of Parramatta

Parramatta is a city undergoing immense change. The proposal has the potential to generate reputational benefits to the City of Parramatta as a desirable location to live, work, and for recreation. Increased use of Parramatta's streets and improved amenity may strengthen the sense of neighbourhood and local identity for residents. Reputational benefits may also accrue to the City of Parramatta Council as a leader in environmental sustainability, urban design, planning for healthy built environments, and encourage active transport and recreation. This additional reputational benefit may attract future interest and investment in Parramatta and provide the potential for national and international recognition of the City of Parramatta Council as a centre of best practice planning.

3.7 Findings of cost benefit analysis

The cost benefit analysis incorporates benefits accruing to the community as a whole, including economic benefits that accrue to the wider community and health and environmental benefits. A summary of the costs associated with the Parramatta Ways scenarios is shown in Table 25. The value of health, economic, environmental, and amenity benefits for each of the scenarios is shown below in Table 26.

TABLE 25. SUMMARY OF COSTS

	Costs	NPV (30 year period)
Construction Costs (Year 1 to Year 25)	\$208,235,000	\$201,423,575
Maintenance costs (proportion applied yearly)	\$2,054,692	\$25,620,641
Total	\$210,289,692	\$227,044,216

Source: SGS Economics and Planning (2016)

TABLE 26. SUMMARY OF BENEFITS

	Health	Environmental	Economic	Amenity	Total
Scenario 1 (Survey)	\$212,376,616	\$9,138,579	\$263,757,721	\$56,008,458	\$541,281,373
Scenario 2 (Boulder)	\$1,765,645,569	\$119,802,099	\$2,952,776,923	\$56,008,458	\$4,894,233,050
Scenario 3 (Marin County)	\$1,452,590,292	\$56,659,822	\$1,685,058,047	\$56,008,458	\$3,250,316,619

Source: SGS Economics and Planning (2016)

The analysis has been completed with three possible discount rates – 5%, 7% and 10% and calculates the Net Present Value (NPV), Benefit-Cost Ratio (BCR) and Internal Rate of Return (IRR).

All three of the discount rate scenarios show positive NPVs and BCRs greater than one, as shown in Table 27 below. The discounted cash flow is shown in Appendix C.

TABLE 27. SUMMARY OF FINDINGS AND SENSITIVITY TESTING

Item	Net Present Value	Benefit Cost Ratio	Internal Rate of Return
Scenario 1 (Survey)			
Discount rate of 5%	\$577,664,494	4.49	30%
Discount rate of 7%	\$396,556,075	3.74	30%
Discount rate of 10%	\$231,434,711	2.90	30%
Scenario 2 (Boulder)			
Discount rate of 5%	\$6,580,791,556	40.81	237%
Discount rate of 7%	\$4,749,507,752	33.82	237%
Discount rate of 10%	\$3,048,703,850	25.97	237%
Scenario 3 (Marin County)			
Discount rate of 5%	\$4,319,651,324	27.13	154%
Discount rate of 7%	\$3,105,591,321	22.46	154%
Discount rate of 10%	\$1,979,751,656	17.22	154%

Source: SGS Economics and Planning (2016)

4 CONCLUSION

Parramatta Ways has a total cost of \$257.8 million over a 30 year period, accounting for construction and maintenance of the network across the local government area.

Under all scenarios tested, the costs of Parramatta Ways are outweighed by the quantified benefits to society. Based on surveyed responses from the existing Parramatta local government area population, the proposal returns a BCR of 3.74, indicating that for every dollar spent on the proposal, benefits accruing to \$3.74 are returned to the society of the Parramatta local government area. This represents an internal rate of return of 30%.

The rate of return could be substantial if walking and cycling uplifts similar to those witnessed in case studies for the USA. Internal rates of return 237% and 154% may be achieved if mode share shifts in line with those observed in Boulder and Marin County.

A number of benefits have not been quantified as part of this study. While these benefits are not included in the economic results, improvements to mental health, biodiversity, safety and the perception of crime, and the reputation of the City of Parramatta and to Council as an organisation may also occur under Parramatta Ways, providing an additional net benefit to the society of the Parramatta local government area.

This indicates that the Parramatta Ways program is likely to be economically justified, provide a positive return on investment, and could create a net community benefit to the society of the Parramatta local government area.

APPENDIX A – SURVEY METHOD

Survey overview

A survey of Parramatta local government area residents was conducted to determine current levels of active transport and recreation and the likely future active transport and recreation patterns. This survey was drafted by SGS and administered by the City of Parramatta Council.

A total of 538 survey responses were received from Parramatta local government area residents. Participants varied in age, location, and walking and cycling behaviours. Participants were asked about their current walking and cycling patterns, including how far they walk and cycle and the purpose of their trip. After providing an overview of the Parramatta Ways program, participants were then asked about their likely current and walking patterns, including how far residents would walk and cycle and the purpose of their trip. Participants were also asked about their anticipated use of the Parramatta light rail before and after the Parramatta Ways project is implemented.

The findings of the survey were then reweighted to apply to the population of the previous Parramatta local government area as reported at the 2011 Census.

Survey reweighting technique

Ideally, the sample of survey responses mirrors the population it came from. Unfortunately, this is usually not the case, due to non-responses from certain groups, self-selection, and survey method (e.g. online survey may preclude elderly population who do not regularly access the internet). This may cause some groups to be over- or under-represented in survey results.

A weighting adjustment is used to account for these issues. For this survey, responses have been reweighted considering the age and gender of respondents. Five year age groups from 15 to 84 and a group for respondents 85 years and over have been used to reweight survey responses to better reflect Parramatta's population.

Weightings have been applied to reflect the make-up of the Parramatta local government area's population by age and gender at the 2011 Census. It is noted that the boundaries of the Parramatta local government area have changed when the new City of Parramatta Council formed in May 2016.

Resident survey

The following pages present the survey which was distributed by the City of Parramatta Council for this study.

Introduction

Parramatta City Council is investigating how our residents and businesses use the existing walking and cycling networks now and into the future. We would like to ask you about how you use walking and cycling infrastructure (such as footpaths, cycleways and shared paths) across the Parramatta City Council area and how your walking and cycling habits might change if there were upgrades to our streets. Thank you for helping us with this survey.

Demographics

1. What is your gender?

- a) Male
- b) Female
- c) Other

2. What is your current age?

- a) Under 18 years old
- b) 18-24 years old
- c) 25-34 years old
- d) 34-39 years old
- e) 40-50 years old
- f) 50-59 years old
- g) 60 -69 years old
- h) 70+ years old

3. Which suburb do you live in?

- a) Carlingford
- b) Constitution Hill
- c) Dundas
- d) Dundas Valley
- e) Eastwood
- f) Epping
- g) Ermington – Melrose Park
- h) Granville – Clyde
- i) South Granville – Chester Hill
- j) Guildford
- k) Harris Park
- l) Merrylands
- m) Northmead
- n) Oatlands
- o) Old Toongabbie
- p) Parramatta
- q) North Parramatta
- r) Rydalmere
- s) Rosehill – Camellia
- t) Telopea
- u) Toongabbie
- v) Wentworthville – Pendle Hill
- w) Westmead
- x) Winston Hills
- y) Other, please specify: _____

Current walking and cycling habits

4. Do you currently walk or cycle along the footpaths or roads in the Parramatta Local Government Area?

- a) Yes
- b) No, why? _____

If you answered “Yes” to question 4:

5. Do you walk further than you cycle along the footpaths or roads in the Parramatta Local Government Area?

- a) Yes, I walk further than I cycle
- b) No, I cycle further than I walk
- c) Neither, I walk and cycle roughly the same distance

6. In an average week, how far do you currently walk and/or cycle in total along the footpaths or roads in the Parramatta Local Government Area?

- a) 1-3 km
- b) 4-6 km
- c) 7-10 km
- d) 11-15 km
- e) 16-20 km
- f) more than 20 km

7. What are the two main reasons for your walking and/or cycling trips in the Parramatta Local Government Area?

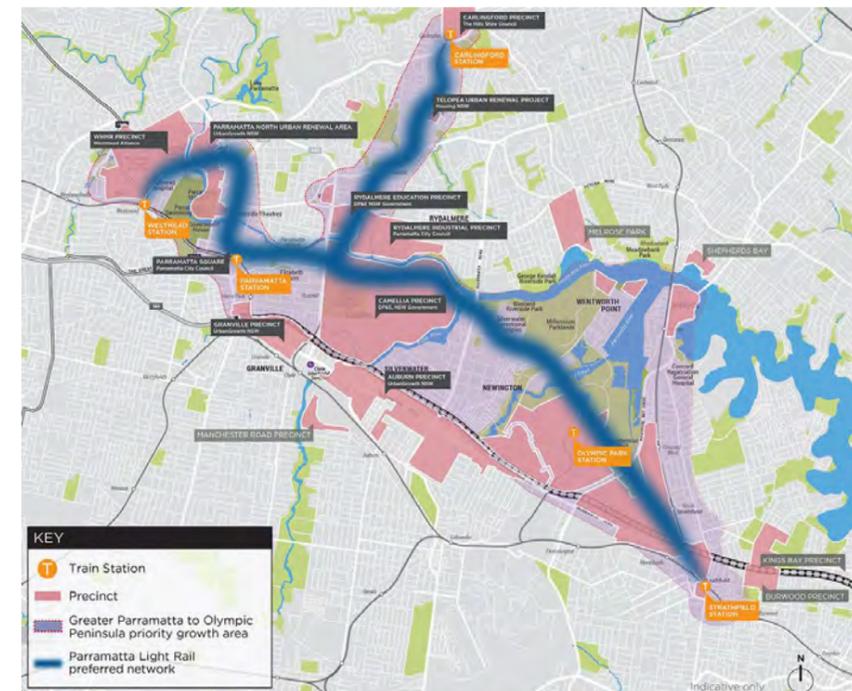
- a) Recreation/exercise
- b) Commuting to and from work
- c) Going to and from the shops
- d) Going to the doctor, library or other community services
- e) Taking children to school, childcare, or activities such as sports
- f) Other, please specify: _____

Light rail network

The NSW Government announced that construction of a light rail network (shown in the map below) will start in 2018. The light rail aims to support the creation of new communities and employment opportunities across the Greater Parramatta to Olympic Peninsula Priority Growth Area. The light rail network will include:

1. A core spine linking precincts within Greater Parramatta including Westmead health precinct, North Parramatta, and the Parramatta CBD.
2. The replacement of the existing heavy rail service between Clyde and Carlingford with a more frequent light rail service.
3. A light rail service through Camellia renewal area, Sydney Olympic Park also connecting to Strathfield.

LIGHT RAIL NETWORK



8. How often would you expect to use the light rail per week?

- a) Not at all
- b) 1-3 trips
- c) 4-6 trips
- d) 7-9 trips
- e) more than 10 trips

If you answered that you expect to use the light rail at least once per week (that is, you answered b), c), d), e) or f) to question 8):

9. What do you expect will be your main purpose of using the light rail?

- a) Recreation/exercise
- b) Commuting to and from work
- c) Going to and from the shops
- d) Going to the doctor, library or other community services
- e) Taking children to school, childcare, or activities such as sports
- f) Other, please specify: _____

Proposed upgrade

Parramatta City Council is considering plans to deliver a 380 km high quality walking network throughout the local government area. The aim is to make streets desirable and sustainable places which connect people to community facilities, bus stops, parks, and open spaces as well as Parramatta’s iconic destinations.

Figure 1 provides a ‘before and after’ illustration of the Council’s vision of the upgrade, which would significantly increase the number of trees across Parramatta (providing for more shade and creating a more pleasant environment) and improve pedestrian infrastructure by providing or upgrading footpaths and installing benches and drinking fountains.

COUNCIL'S VISION FOR THE UPGRADE



For the rest of the survey, the term ‘proposed street upgrades’ means street environments similar to the ‘after’ illustration above.

Upgrade scenario

10. Given the proposed street upgrades, do you expect that you will walk or cycle along the footpaths or roads in the Parramatta Local Government Area?

- a) Yes
- b) No, why? _____

If you answered “Yes” to question 10:

11. Given the proposed street upgrades, do you expect that you will walk further than you cycle along the upgraded footpaths or roads in the Parramatta Local Government Area?

- a) Yes, I expect that I will walk further than I cycle along the upgraded footpaths and roads
- b) No, I expect that I will cycle further than I walk along the upgraded footpaths and roads
- c) Neither, I expect that I will walk and cycle roughly the same distance along the upgraded footpaths and roads

12. Given the proposed street upgrades, in an average week how far do you expect you would walk and/or cycle along the footpaths or roads in the Parramatta Local Government Area?

- a) 1-3 km
- b) 4-6 km
- c) 7-10 km
- d) 11-15 km
- e) 16-20 km
- f) more than 20 km

13. Given the proposed street upgrades, what do you expect the two main reasons would be for your walking and/or cycling trips in the Parramatta Local Government Area?

- a) Recreation/exercise
- b) Commuting to and from work
- c) Going to and from the shops
- d) Going to the doctor, library or other community services
- e) Taking children to school, childcare, or activities such as sports
- f) Other, please specify: _____

14. Given the proposed street upgrades, how often do you expect you would use the light rail per week?

- a) Not at all
- b) 1-3 trips
- c) 4-6 trips
- d) 7-9 trips
- e) more than 10 trips

If you answered that you would expect to use the light rail at least once per week with the proposed street upgrades (that is, you answered b), c), d), e) or f) to question 14):

15. Given the proposed street upgrade, what do you expect will be your main purpose of using the light rail?

- a) Recreation/exercise
- b) Commuting to and from work
- c) Going to and from the shops
- d) Going to the doctor, library or other community services
- e) Taking children to school, childcare, or activities such as sports
- f) Other, please specify: _____

16. Given the proposed street upgrades, do you expect that you will use the bus more, less or about the same as you do now without the street upgrade?

- a) More
- b) Less
- c) About the same

APPENDIX B – QUANTIFIED AND UNQUANTIFIED BENEFITS

Quantified benefits

Benefit	Value	Application	Source
Health			
Physical activity	\$2.28 \$1.14	per km walked per km cycled	New Zealand Transport Agency (NZTA) 2010 Economic Manual.
Heat island – reduction ambulance call out for heat related illness	\$5.68	per day above 35C	Coutts et al (2007) Basill et al (2010) AECOM (2012) NSW Health (2016)
Respiratory health	\$0.66	per tree per year	City of Tampa
Economic			
Congestion	\$0.33 \$0.33	per km walked per km cycled	Transport for NSW (2013)
Vehicle operating cost savings	\$0.34 \$0.30	per km walked per km cycled	Transport for NSW (2013)
Public transport cost savings	\$0.12 \$0.12	per km walked per km cycled	Transport for NSW (2013)
Tolls	\$0.38 \$0.38	per km walked per km cycled	Transport for NSW (2013)
Accident savings	\$0.13 \$0.28	per km walked per km cycled	Transport for NSW (2013)
Roadway provisions	\$0.04 \$0.04	per km walked per km cycled	Transport for NSW (2013)
Parking cost savings	\$0.01 \$0.01	per km walked per km cycled	Transport for NSW (2013)
Mode share to light rail with walking/cycling replacing car	\$0.92	per km travelled	Transport for NSW (2013)
Productivity	\$140.36	per worker per year	SQW (2007)
Increased expenditure	\$52.55	per shopper walking/cycling per week	San Francisco Metropolitan Transportation Authority (2013)
Environmental			
Air pollution	\$0.03 \$0.03	per km walked per km cycled	Transport for NSW (2013)
Greenhouse gas	\$0.02 \$0.02	per km walked per km cycled	Transport for NSW (2013)
Noise	\$0.01 \$0.01	per km walked per km cycled	Transport for NSW (2013)
Water pollution	\$0.00 \$0.00	per km walked per km cycled	Transport for NSW (2013)
Nature and Landscape	\$0.00 \$0.00	per km walked per km cycled	Transport for NSW (2013)
Urban separation	\$0.01 \$0.01	per km walked per km cycled	Transport for NSW (2013)
Carbon storage	\$0.36	per tree per year	Enspec (2015)
Carbon sequestration	\$0.91	per tree per year	Enspec (2015)
Pollution removal	\$0.12	per tree per year	Enspec (2015)
Rainfall interception	\$0.90	per tree per year	Enspec (2015)
WSUD downstream maintenance savings	\$36,095.73	per ha per year	Water by Design (2010)
WSUD reduced total nitrogen	\$4,737.57	per ha per year	Water by Design (2010)
Amenity			
Trees	\$178.50	per tree per year	Enspec (2015)

Benefit	Value	Application	Source
Raingarden	\$1,900.41	one off payment per household	Bowman (2012)
Wetlands	\$222.84	per household per year	Bastien (2011)

Unquantified benefits

- Improved mental health benefits for City of Parramatta residents
- Increased trips on the Parramatta light rail
- Improved perception of safety and reduced crime rates
- Increased biodiversity
- Increased visitor spend in the City of Parramatta local government area
- Reputational benefits to the City of Parramatta Council

APPENDIX C - DISCOUNTED CASH FLOW

Scenario 1

Year	Costs	Benefits	Net benefit	Discounted cash flow
1	\$2,979,857	\$16,823,175	-\$13,843,318	-\$13,843,318
2	\$6,190,843	\$16,987,551	-\$10,796,708	-\$10,090,381
3	\$9,492,085	\$17,151,926	-\$7,659,841	-\$6,690,402
4	\$12,872,206	\$13,110,508	-\$238,301	-\$194,525
5	\$16,336,217	\$13,233,789	\$3,102,428	\$2,366,827
6	\$19,908,008	\$13,357,071	\$6,550,938	\$4,670,728
7	\$23,547,054	\$13,480,352	\$10,066,701	\$6,707,868
8	\$27,275,377	\$11,500,737	\$15,774,640	\$9,823,653
9	\$31,096,796	\$11,603,471	\$19,493,324	\$11,345,292
10	\$35,013,761	\$11,706,206	\$23,307,555	\$12,677,766
11	\$39,028,790	\$11,808,941	\$27,219,849	\$13,837,191
12	\$43,101,008	\$7,705,881	\$35,395,127	\$16,815,970
13	\$47,276,521	\$7,767,522	\$39,508,999	\$17,542,468
14	\$51,413,057	\$7,829,163	\$43,583,894	\$18,085,767
15	\$55,658,399	\$7,890,804	\$47,767,595	\$18,525,097
16	\$60,013,983	\$5,849,547	\$54,164,435	\$19,631,684
17	\$64,484,178	\$5,890,641	\$58,593,537	\$19,847,658
18	\$69,072,003	\$5,931,735	\$63,140,268	\$19,988,592
19	\$73,780,555	\$5,972,829	\$67,807,726	\$20,061,859
20	\$78,613,012	\$6,013,923	\$72,599,089	\$20,074,253
21	\$83,572,638	\$6,055,017	\$77,517,621	\$20,032,026
22	\$88,662,780	\$6,096,110	\$82,566,669	\$19,940,931
23	\$93,886,875	\$6,137,204	\$87,749,671	\$19,806,256
24	\$99,248,451	\$6,178,298	\$93,070,153	\$19,632,859
25	\$104,751,127	\$6,219,392	\$98,531,735	\$19,425,199
26	\$110,395,761	\$2,054,692	\$108,341,069	\$19,961,753
27	\$116,189,023	\$2,054,692	\$114,134,331	\$19,653,417
28	\$122,134,828	\$2,054,692	\$120,080,136	\$19,324,540
29	\$128,237,192	\$2,054,692	\$126,182,500	\$18,978,127
30	\$134,500,237	\$2,054,692	\$132,445,545	\$18,616,919

Benefits PV	Costs PV	NPV
\$ 541,281,373	\$ 144,725,298	\$ 396,556,075

Scenario 2

Year	Costs	Benefits	Net benefit	Discounted cash flow
1	\$2,979,857	\$16,823,175	-\$13,843,318	-\$13,843,318
2	\$35,365,173	\$16,987,551	\$18,377,622	\$17,175,348
3	\$68,608,934	\$17,151,926	\$51,457,008	\$44,944,544
4	\$102,719,991	\$13,110,508	\$89,609,483	\$73,148,031
5	\$137,724,114	\$13,233,789	\$124,490,324	\$94,973,072
6	\$173,666,500	\$13,357,071	\$160,309,429	\$114,298,407
7	\$210,528,490	\$13,480,352	\$197,048,137	\$131,301,494
8	\$248,354,551	\$11,500,737	\$236,853,814	\$147,500,652
9	\$287,171,535	\$11,603,471	\$275,568,064	\$160,383,122
10	\$327,005,535	\$11,706,206	\$315,299,329	\$171,501,944
11	\$366,537,106	\$11,808,941	\$354,728,165	\$180,325,812
12	\$402,304,152	\$7,705,881	\$394,598,270	\$187,470,796
13	\$439,009,049	\$7,767,522	\$431,241,527	\$191,476,395
14	\$476,531,500	\$7,829,163	\$468,702,337	\$194,494,807
15	\$515,041,842	\$7,890,804	\$507,151,038	\$196,681,916
16	\$554,564,657	\$5,849,547	\$548,715,110	\$198,879,607
17	\$595,128,073	\$5,890,641	\$589,237,432	\$199,595,104
18	\$636,759,488	\$5,931,735	\$630,827,753	\$199,703,911
19	\$679,487,025	\$5,972,829	\$673,514,197	\$199,268,548
20	\$723,339,546	\$6,013,923	\$717,325,623	\$198,346,512
21	\$768,346,672	\$6,055,017	\$762,291,656	\$196,990,649
22	\$814,538,806	\$6,096,110	\$808,442,695	\$195,249,491
23	\$861,947,149	\$6,137,204	\$855,809,945	\$193,167,571
24	\$910,603,726	\$6,178,298	\$904,425,428	\$190,785,725
25	\$960,541,404	\$6,219,392	\$954,322,012	\$188,141,359
26	\$1,011,791,058	\$2,054,692	\$1,009,736,366	\$186,043,095
27	\$1,064,390,166	\$2,054,692	\$1,062,335,474	\$182,929,381
28	\$1,118,374,261	\$2,054,692	\$1,116,319,569	\$179,649,718
29	\$1,173,779,812	\$2,054,692	\$1,171,725,120	\$176,230,050
30	\$1,230,644,246	\$2,054,692	\$1,228,589,554	\$172,694,007

Benefits PV	Costs PV	NPV
\$4,894,233,050	\$144,725,298	\$4,749,507,752

Scenario 3

Year	Costs	Benefits	Net benefit	Discounted cash flow
1	\$2,979,857	\$16,823,175	-\$13,843,318	-\$13,843,318
2	\$23,735,093	\$16,987,551	\$6,747,542	\$6,306,114
3	\$45,042,543	\$17,151,926	\$27,890,617	\$24,360,745
4	\$66,902,994	\$13,110,508	\$53,792,486	\$43,910,692
5	\$89,333,939	\$13,233,789	\$76,100,150	\$58,056,440
6	\$112,372,084	\$13,357,071	\$99,015,013	\$70,596,336
7	\$135,990,051	\$13,480,352	\$122,509,699	\$81,633,385
8	\$160,223,361	\$11,500,737	\$148,722,625	\$92,616,976
9	\$185,089,684	\$11,603,471	\$173,486,213	\$100,970,555
10	\$210,605,687	\$11,706,206	\$198,899,481	\$108,188,139
11	\$236,788,476	\$11,808,941	\$224,979,536	\$114,368,188
12	\$263,612,155	\$7,705,881	\$255,906,274	\$121,579,227
13	\$291,138,198	\$7,767,522	\$283,370,676	\$125,819,969
14	\$319,240,106	\$7,829,163	\$311,410,943	\$129,224,470
15	\$348,081,852	\$7,890,804	\$340,191,048	\$131,931,954
16	\$377,681,488	\$5,849,547	\$371,831,940	\$134,769,007
17	\$404,482,386	\$5,890,641	\$398,591,745	\$135,016,814
18	\$431,358,849	\$5,931,735	\$425,427,114	\$134,679,329
19	\$458,942,922	\$5,972,829	\$452,970,093	\$134,017,506
20	\$487,253,235	\$6,013,923	\$481,239,312	\$133,066,680
21	\$516,308,912	\$6,055,017	\$510,253,895	\$131,859,303
22	\$546,129,579	\$6,096,110	\$540,033,468	\$130,425,150
23	\$576,735,378	\$6,137,204	\$570,598,174	\$128,791,520
24	\$608,146,984	\$6,178,298	\$601,968,686	\$126,983,418
25	\$640,385,613	\$6,219,392	\$634,166,221	\$125,023,727
26	\$673,470,184	\$2,054,692	\$671,415,492	\$123,707,752
27	\$707,425,905	\$2,054,692	\$705,371,213	\$121,461,744
28	\$742,275,714	\$2,054,692	\$740,221,022	\$119,124,041
29	\$778,043,153	\$2,054,692	\$775,988,461	\$116,710,381
30	\$814,752,384	\$2,054,692	\$812,697,692	\$114,235,076

Benefits PV	Costs PV	NPV
\$3,250,316,619	\$144,725,298	\$3,105,591,321

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