

CAMELLIA-ROSEHILL PLACE STRATEGY

IMPLEMENTATION REPORT - SUSTAINABILITY

PREPARED BY KINESIS FOR NSW DEPARTMENT OF PLANNING & ENVIRONMENT

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The results presented in this report are modelled estimates using mathematical calculations. The data, information and scenarios presented in this report have not been separately confirmed or verified. Accordingly, the results should be considered to be preliminary in nature and subject to such confirmation and verification.

Energy, water and greenhouse consumption estimates are based on local climate and utility data available to the consultant at the time of the report. These consumption demands are, where necessary, quantified in terms of primary energy and water consumptions using manufacturer's data and scientific principles.

Generic precinct-level cost estimates provided in this report are indicative only based on Kinesis's project experience and available data from published economic assessments. These have not been informed by specific building design or construction plans and should not be used for design and construct cost estimates.

The Kinesis software tool and results generated by it are not intended to be used as the sole or primary basis for making investment or financial decisions (including carbon credit trading decisions). Accordingly, the results set out in this report should not be relied on as the sole or primary source of information applicable to such decisions.

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EXECUTIVE SUMMARY

Camellia presents a unique opportunity to be delivered as a low carbon, high performance precinct in Parramatta. This report provides a pathway for delivery of this precinct in line with the sustainability aspirations defined in the Camellia Rosehill Place Strategy Vision Statement and in accordance with Planning Priority C19 in the GSC's [Central City District Plan](#).

The 4 key outcomes that will be delivered from actioning this sustainability strategy will have significant benefits for the local community at Camellia-Rosehill. Additionally, the precinct will be positioned as a benchmark in sustainability, providing broader resilience, economic and social benefits to the wider Parramatta LGA, GOPP region and Greater Sydney. These benefits include the precinct's contribution to the broader region's emissions reductions, greening, resilience to drought and heat, and improved mobility and accessibility.

These 4 key sustainability outcomes for the precinct are:

1. **Net Zero Emissions**
2. **Precinct Recycled Water to support a cool green precinct**
3. **Zero Waste Precinct**
4. **Parking and Mobility**

This report provides direction on how these outcomes can be achieved under the preferred planning scenario incorporating sustainability, resilience and circular economy principles.

The detailed strategies and interventions modelled in this reported were developed from broader regional and state level policy programs including:

- **Net Zero Emissions:** [NSW State Net Zero Plan](#), [NSW Electricity Strategy](#) and [Parramatta Council Sustainability Strategy](#)
- **Precinct Recycled Water & Greening:** [Premiers Priority for Greener Public Spaces](#) and [NSW Government Architects Draft Greener Places Guidelines](#).
- **Zero Waste:** The NSW Environmental Protection Agency (EPA) 20 year waste strategy, the [Cleaning up our Act](#) issues paper and the [City of Parramatta Waste and Resource Recovery Strategy](#)
- **Parking and mobility to reduce car dependency:** [NSW Future Transport 2056](#), [Parramatta Bike Plan](#), [Parramatta Ways Walking Strategy](#), [Parramatta Light Rail](#)

Importantly, this report and analysis builds on and incorporates previous work done by Kinesis for DPE and the City of Parramatta on the Camellia Town Centre.

The combination of policy, governance and infrastructure strategies considered in the modelling include:

- High Performance Buildings including BASIX and NABERS targets
- EV ready developments
- Significant precinct scale renewables and grid storage
- Connection to the proposed Sydney Water recycled water scheme coupled with increases in tree canopy and greening
- Parramatta Light Rail
- Precinct parking including transitional decoupled parking unbundled from the sale of apartments.
- Opportunities for car share
- Modular food and organics waste processing systems
- EarthPower Organics Waste processing facility

The resource consumption, associated emissions, waste and sewer vary under the final master plan.

Together, the combination of strategies can deliver the following outcomes. Kinesis recommends these as the target performance indicators from the precinct.

- Net Zero Emissions
- 43% reduction in peak electricity demand
- Zero Sewer Exports
- 100% of non-potable water demand serviced using recycled water
- 36% of total water demand serviced using recycled water
- Canopy Cover and greening targets as recommended in the Landscape Implementation Report
- Extensive greening including green walls on north and west facades of buildings
- Maximum parking rates aligned with Parramatta CBD Planning Proposal parking rate
- Camellia's residents car use is 47% lower than the Greater Sydney average
- Camellia's residents car use is 40% lower than the Parramatta LGA average
- 100% diversion of organics waste from landfill

Broader Benefits for the Project, Parramatta LGA and Greater Sydney

The combination of these strategies provides broader outcomes and benefits to the project, Parramatta LGA and to Greater Sydney and its residents, including:

- Establishing a new low carbon and low water use benchmark for new precinct development.
- Increasing housing affordability through lower parking rates and lower costs of energy and water.
- Reducing construction costs associated with excavation and construction of underground parking.
- Improving traffic flow at key intersections in and around the Camellia town centre.
- Increasing the opportunity for private investment in car share and mobility.
- Enabling and making use of an existing precinct scale recycled water system.
- Demonstrating how local infrastructure can deliver a truly Zero Emissions Precinct, through local renewable energy, building efficiency and waste infrastructure.



INTRODUCTION

PROJECT DESCRIPTION

New South Wales Department of Planning & Environment (DPE), in collaboration with City of Parramatta Council (Council), industry, the community and State agencies, is leading the development of the Camellia-Rosehill Place Strategy and Master Plan for the Camellia–Rosehill Precinct (the Precinct). The Precinct is defined by Parramatta River to the north, Duck River to the east, the M4 Motorway to the south and James Ruse Drive to the west, all of which form physical boundaries to the Precinct.

The Camellia Rosehill Precinct (the Precinct) is presently dominated by industrial activity, with large amounts of land also allocated to Rosehill Gardens Racecourse and stabling yards for Parramatta Light Rail and Sydney Metro. Its industrial legacy means that soils are heavily contaminated across most of the precinct.

Located in the geographic heart of Sydney, the precinct has an important strategic role in the Greater Parramatta and Olympic Peninsula (GPOP). Previous investigations have identified that the area should be retained for urban service land with a town centre, but that the costs of infrastructure and remediation should be carefully considered when making future land use decisions.

The Place Strategy and Master Plan prepared for the whole Precinct draws on the substantial body of previous investigations, including ongoing collaboration with industry, the community and state agencies.

The overarching objective of the Place Strategy is to provide an integrated 20-year vision, which recognises the strategic attributes of the Precinct, guides future land use and infrastructure investment decisions and which can be delivered with the support of State and local agencies.

DPE has engaged Kinesis to deliver a Sustainability Strategy, including net zero and circular economy concepts as part of Package A – Integrated Master Plan. As part of the scope, Kinesis has developed a sustainability strategy aligned to NSW Government and City of Parramatta policies on net zero emissions and circular economy.

CAMELLIA- ROSEHILL PRECINCT

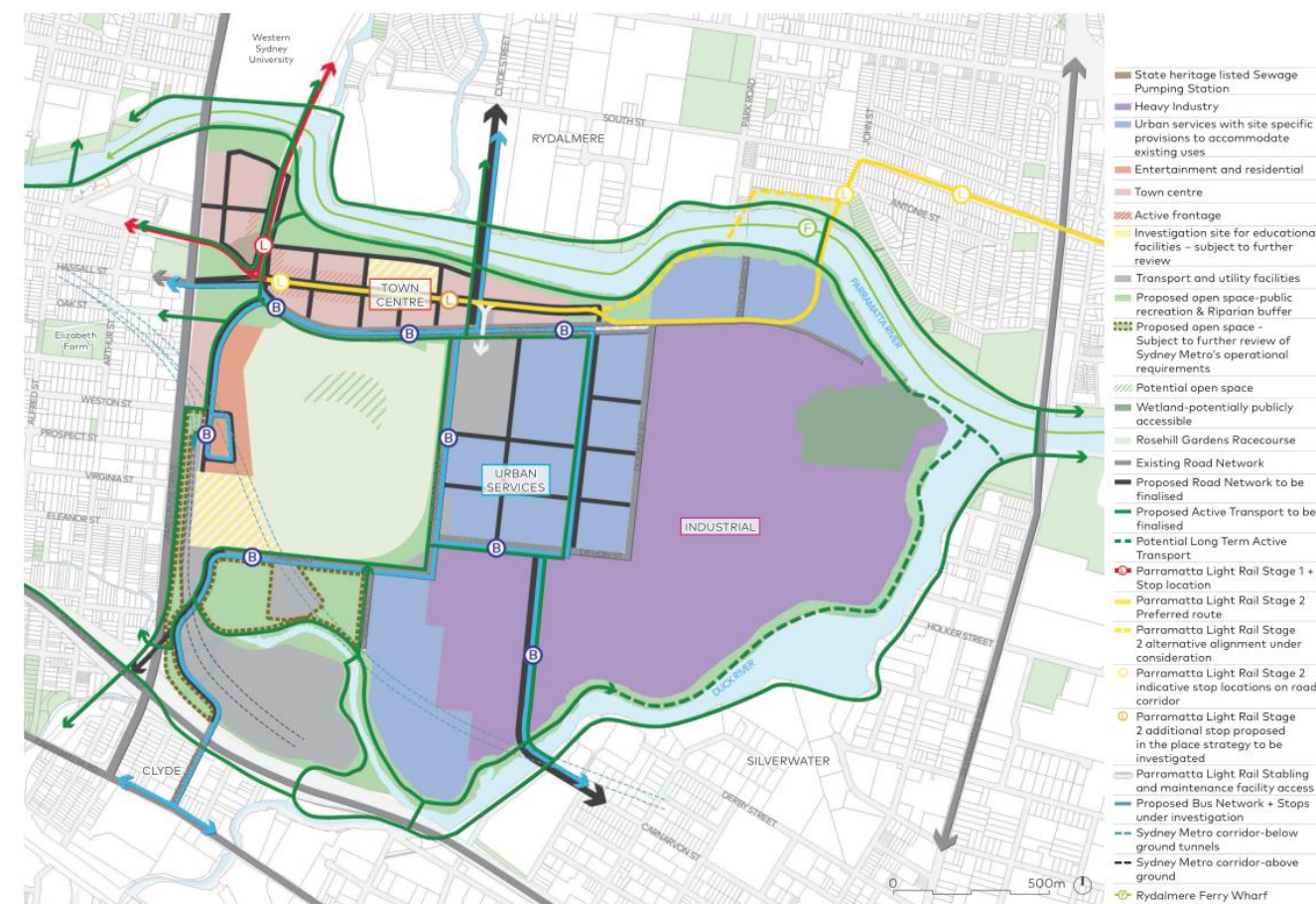


Figure 1: Camellia - Rosehill precinct boundary



PROJECT BACKGROUND

The Camellia Rosehill Precinct (~321ha) plays a strategic role in the Greater Parramatta and the Olympic Peninsula (GPOP). Camellia was identified by the NSW Government as a priority growth area in 2014, resulting in precinct wide Land Use and Infrastructure Strategy in 2015 and subsequently development of a Town Centre Master Plan in 2018. Work on the Town Centre was paused pending outcomes of Greater Sydney's 2019 Draft Place-based Infrastructure Compact (PIC) Pilot which aimed to ensure infrastructure delivery was matched with growth across the 26 precincts in the GPOP corridor. The PIC recommended that Camellia be retained for urban service and industrial land, however, should the Government seek to progress a town centre (in the form of the 2018 plan or a modified form), before any rezoning a number of issues had to be resolved. It was determined that a coordinated and strategic approach was required, and a place strategy be prepared for the whole Precinct, drawing on previous work and including ongoing collaboration with industry, the community and state agencies.

The Department of Planning & Environment (DPE) has engaged a range of technical services to determine opportunities and challenges at the site. These technical studies have informed the development of the place strategy and master Plan for the precinct. This Sustainability Implementation Report has been prepared as a part of the Sustainability, Net Zero and Circular Economy component of the Integrated Master Plan package.

An Enquiry by Design (EbD) process was undertaken to inform the preparation of the Place Strategy. The EbD was an interactive process which explored a number of master plan options for Camellia-Rosehill which could deliver the vision for the precinct, and resulted in a draft master plan which was the subject of public consultation as part of the Camellia-Rosehill Directions Paper. The draft master plan was further refined following exhibition of the Directions Paper and consideration of the submission received. The draft place strategy was publicly exhibited on 17 December 2021 until 4 March 2022. The draft master plan was further refined following exhibition of the draft place strategy and consideration of the submissions received. Refer to the Department of Planning and Environment's finalisation report for further information.

CAMELLIA – ROSEHILL VISION

Camellia-Rosehill has an important strategic role as an industry and employment hub within the Greater Parramatta and Olympic Peninsula (GPOP) Economic Corridor. By 2041, the precinct will be enhanced with service and circular economy industries and new recreational and entertainment facilities, all enabled by better transport access via light rail, active transport and road connections.

A well-designed town centre next to the light rail stop will be the focus of community activity.

A new urban services precinct and retention of heavy industrial land will ensure Camellia-Rosehill fulfills its potential to be an employment powerhouse.

New homes and jobs will be close to public transport supported by new quality public spaces including public open spaces, public facilities high quality street infrastructure, and walking and cycling paths.

Key environmental features such as Parramatta River, Duck River and their wetlands will be protected and enhanced. Camellia's rich heritage will be preserved, celebrated and promoted.

Country and culture will be valued and respected with the renewal guided by Aboriginal people.

The precinct will be net zero ready and set a new standard for environmental sustainability with embedded renewable energy networks, integrated remediation and water management strategies, and circular economy industries.

Recycled water will be connected to all residences, businesses and public spaces and will support the integrated network of green infrastructure.

Camellia will be a showcase of recovery and restoration – a place of economic prosperity but also a place where people love to live, work and enjoy.

FUTURE VISION FOR CAMELLIA - ROSEHILL



Figure 2: Future vision for Camellia - Rosehill



CAMELLIA-ROSEHILL MASTER PLAN

The master plan is shown in Figure 3 and forms the basis of the Place Strategy.

Key features of the master plan include:

- Provision for approximately 10,000 dwellings within a Town Centre serviced by light rail
- Provision for approximately 15,400 jobs
- A new primary school and primary and secondary high school
- District open space facilities
- Introduction of a new entertainment precinct and an urban services area
- Initiatives to Care for Country and continued protection of heritage listed sites
- Retention of the existing state heritage sewerage pumping station (SPS) 067 within the town centre
- Measures to mitigate land use conflicts and risks including buffers and setbacks from existing fuel pipelines and between the existing sewerage pumping station and future surrounding residential uses
- Access to the Parramatta River, Duck River and Duck Creek foreshores and potentially the wetland
- New transport infrastructure including a local road network, potential bus services, additional connections into and out of the precinct, and opportunities to integrate Parramatta Light Rail Stage 2
- An extensive active transport network
- A comprehensive remediation strategy
- A sustainability strategy and integrated water cycle management strategy.

MASTER PLAN - CAMELLIA - ROSEHILL

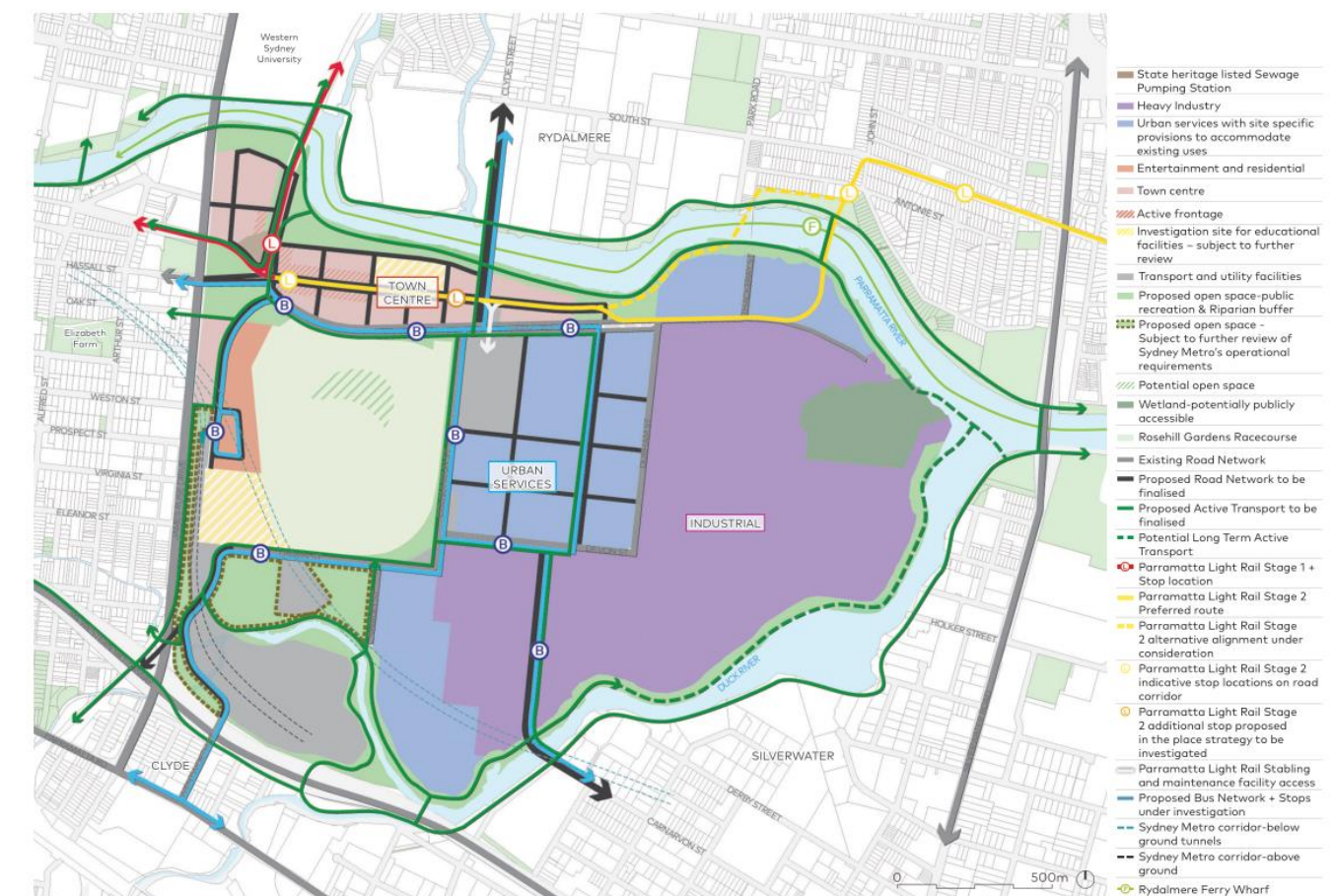


Figure 3: Master plan - Camellia - Rosehill



LEADERSHIP IN SUSTAINABILITY

Globally, exemplar developments and precincts have made claims and commitments to delivering “environmental best practice” and “net positive” or “carbon neutral” outcomes. Few projects, however, understand the implications of these commitments or identify the technologies and mechanisms to achieve these outcomes.

At the same time, there is a shift towards a more efficient and sustainable way to deliver infrastructure to precincts and cities. The emergence of new technologies and new business models for utility infrastructure provision can provide a solution to achieve a meaningful impact.

Camellia presents a unique opportunity to lead best practice sustainability, due to:

- The scale of the project provides a catalyst for establishing a new benchmark for sustainable residential development
- The existing, adjacent recycled water infrastructure provides an opportunity to deliver a low water use precinct with cooling benefits
- The development of the Parramatta light rail through the Camellia provides an opportunity to deliver a new community that is decoupled from car dependence
- The adjacent large roof areas of existing and new light industrial and business roof space provides an opportunity to power the town centre with renewable energy
- The EarthPower Organics Waste processing facility provides an opportunity for a circular economy approach to realising a zero-waste precinct.

To leverage these opportunities and create an authentic solution for Camellia that truly delivers on its guiding principle to demonstrate leadership in sustainability, Kinesis has identified five key opportunities:

1. High Performance and Future Proofed Buildings
2. Precinct Recycled Water
3. Cool Green Camellia
4. Zero Waste Precinct
5. Parking and Mobility.

The outcomes delivered at Camellia will have broader benefits across the Parramatta LGA

- The sustainability strategies for Camellia align with the principles and interventions outlined in the [Parramatta Council Sustainability Strategy](#)
- The Camellia precinct sets a benchmark for sustainable development and expectations for all new development in Parramatta
- A circular economy approach can be adopted for resource use and recovery across the LGA. Specifically, precinct scale renewable energy and recycled water can increase energy and water resilience. Organics waste recovery and processing can relieve the pressure on Council’s waste services.

Targeting Net Zero Emissions by 2040 (earlier than state target of 2050)

The NSW State has a target to achieve net zero emissions by 2050. As a new and well designed precinct, Camellia can target net zero emissions by 2040. This will require the precinct to be net zero ready by 2035. That is, developments in the precinct should have sufficient infrastructure and space allocation to enable the shift away from fossil fuel energy by 2035. Specifically, measures should be taken from the get go to enable building and transport electrification.

- All buildings should be delivered as all-electric buildings with no gas.
- All buildings should be delivered with EV ready infrastructure to facilitate the uptake of low emissions electric vehicles in the precinct.

Note on embodied emissions

The emissions boundary considered in the scope of this study has not included whole of life embodied emissions. Assessing whole of life emissions is important and we are well positioned to help with this. Separate to this study, we are working with teams within DPE to explore incorporating embodied emissions in new building standards. A focused study can be conducted to adapt these findings for Camellia. It will include the following:

- Explore the scope of relevant embodied emissions for the Camellia precinct
- Project the embodied emissions if current construction settings and market activity was adopted for Camellia
- Identify strategies that consider a varying mix of building materials and construction activity to mitigate these emissions
- Develop implementation pathways that fit within DPE’s planning mechanisms to enable net zero embodied emissions.



OPPORTUNITIES DISCUSSION

HIGHER PERFORMANCE BUILDINGS

There is a trend towards higher building performance across Parramatta, reflecting the building industry's capacity to deliver more efficient buildings. This trend is attributed to both the increasing efficiency and lower costs of market available technologies (such as lighting and solar PV).

This is evidenced by Department of Planning BASIX data which highlights the outcomes of new developments. Since the introduction of BASIX, Greater Sydney has seen increasing trends in over-compliance, particularly in BASIX Energy outcomes, i.e. new developments are achieving higher BASIX targets (Figure 4). It should be noted that Parramatta's new apartments are not exceeding BASIX compliance requirements as much as average new apartments across Greater Sydney. These charts highlight that current BASIX targets do not reflect what is possible in sustainability in new apartments and in particular, we need to raise BASIX targets for apartments in Parramatta.

This is further supported by trends in energy consumption across the Metropolitan region. Between 2012 and 2019, per person greenhouse gas emissions from building energy consumption have dropped by 33%, meaning that the average home across Sydney performs equivalent to approximately BASIX Energy 25 (source: Kinesis analysis of Ausgrid and Endeavour Energy datasets, 2016). In other words, a new high rise apartment block that is built to its BASIX Energy target of 25, performs on par with the average existing housing stock or the current BASIX targets are outdated.

Given these recent trends, Kinesis explored a suite of strategies that could be implemented to ensure new residential development at Camellia delivers best practice outcomes. Through these strategies, it is expected that new residential development at Camellia can deliver higher BASIX targets including:

- **BASIX Energy 40** (15 points over the current BASIX requirements of 25 for high rise apartments)
- **BASIX Water 65** (over 50% increase in the current BASIX requirements of 40)

This performance outcome assumes:

- Average 6-star NatHERS across all dwellings
- LED lighting, lighting motion sensors and CO sensors for parking areas
- Significant on-site renewables or access to local offsite renewables
- Water and energy efficient dishwashers
- Connection to recycled water (see *Precinct Recycled Water* section of this report)
- A maximum parking rate that responds to future mobility patterns and transport infrastructure

BASIX ENERGY OVER COMPLIANCE SCORES APARTMENTS

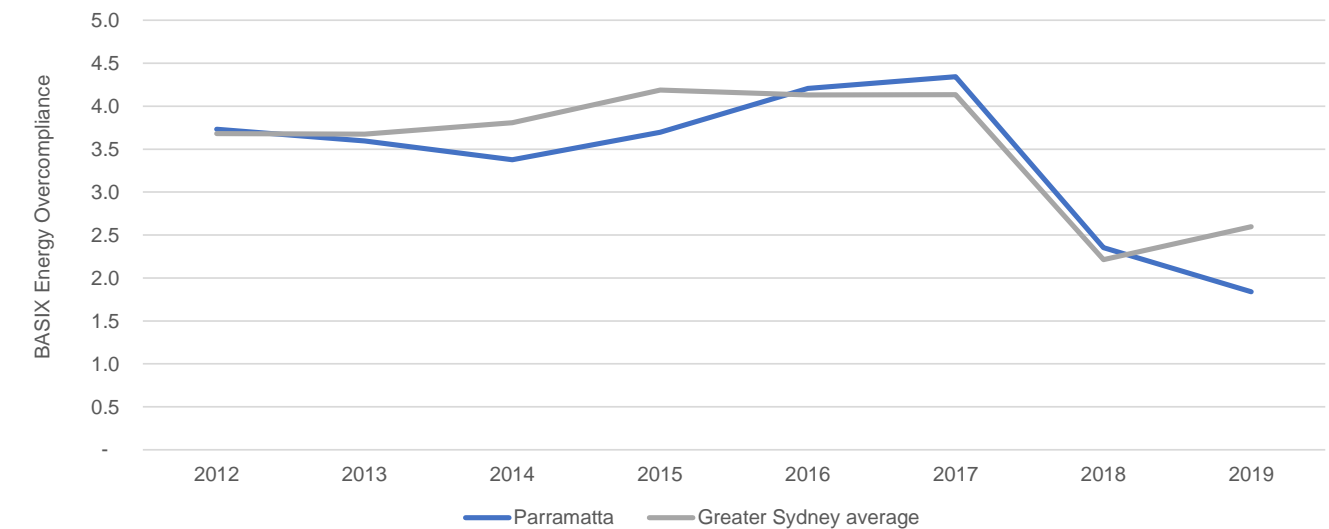


Figure 4: Annual Average Points above BASIX Energy compliance for all new apartments - Parramatta vs Greater Sydney average (Source: [NSW DPE BASIX datasets](#))

BASIX WATER OVER COMPLIANCE FOR APARTMENTS

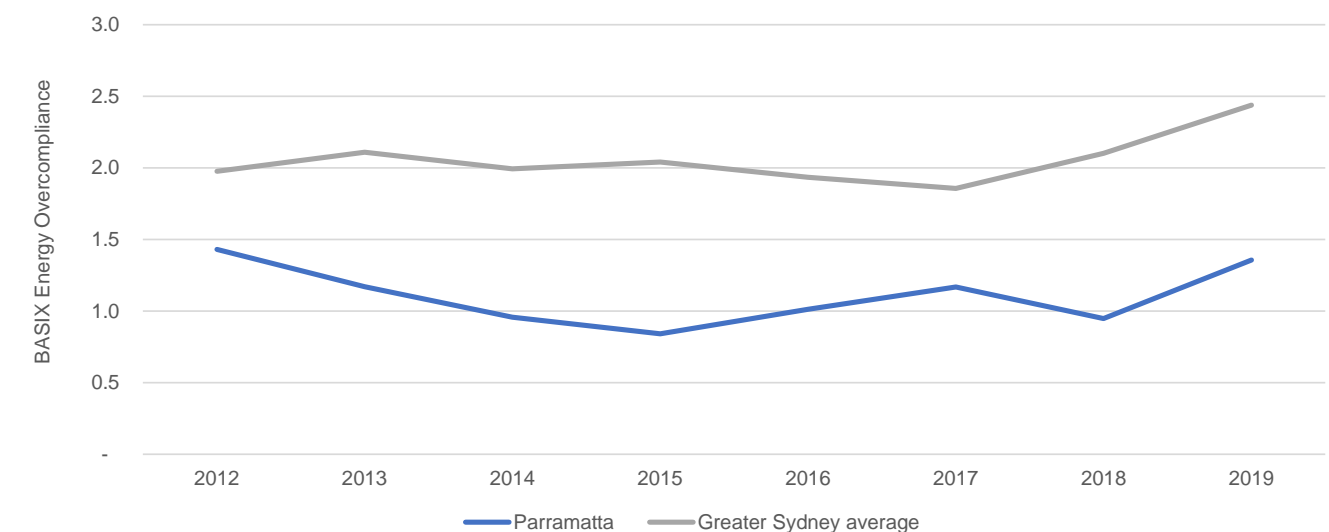


Figure 5: Annual Average Points above BASIX Water compliance for all new apartments - Parramatta vs Greater Sydney average (Source: [NSW DPE BASIX datasets](#))



Non-Residential

Current requirements for new non-residential buildings are established by the National Construction Code (Section J Energy Efficiency). It is expected that Camellia will include a variety of non-residential building types, including commercial, retail, general business and light industrial.

To cover the variety of non-residential building types and embed high performance outcomes, the following requirements are recommended:

- **Commercial buildings >10,000 m² GFA:**
 - NABERS Energy 5.5-star (whole building)
 - NABERS Water 4-star (whole building)
 - NABERS Water 5-star where recycled water is available (whole building)
- **Shopping Centres:**
 - NABERS Energy 5-star (base building)
 - NABERS Water 4-star (base building)
 - NABERS Water 5-star where recycled water is available (base building)
- **Other non-residential buildings and floor space:**
 - High efficiency, LED lighting
 - Motion and daylight sensors in common areas
 - High efficiency HVAC systems (minimum COP 5 or greater)
 - 5-star WELS rated tapware in kitchen and bathroom tap fittings
 - 4-star WELS rated toilets or waterless urinals (where urinals are installed)
 - 3+-star WELS rated showerheads (4.5 - 6 L min) where showerheads are installed

- **Renewable Energy**

Solar PV should be installed on all roof space with an average of 6 hours a day sun producing capability. As the type, scale and demand of non-residential buildings will vary significantly, the amount of solar PV installed should be determined on a building by building basis.

Future Proofing Buildings

In addition to building performance requirements, the project should consider encouraging other future proofing strategies that respond to emerging technologies and address existing and future challenges:

EV Charging Bays

Where commercial and residential parking is provided it is considered prudent to provide the infrastructure or the capacity for EV Charging Points, including appropriate charging outlets in each parking space. Preliminary costings for EV infrastructure have been developed by Flux Consultants. It can be up to \$500,000 for an apartment building with 200 car spaces.

The benefits of electric vehicles are substantial both in terms of carbon reductions (shifting from petrol consumption to electricity consumption) and household cost savings. A resident in Camellia that switches to an EV, is expected to save approximately \$1,200 per year in fuel costs.

Transport and parking strategies are discussed further in *Parking and Mobility*.

Battery Storage Ready

With the cost of batteries expected to decrease rapidly it is considered desirable to build the future capacity so the Camellia precinct can have a dispersed capability of battery capacity to manage energy demands, solar PV generation and significantly reduce peak electricity demands and growing infrastructure requirements. This would be assisted by the following:

- Each apartment being allocated a virtual 5-10 KWh battery capacity.
- The building infrastructure to provide sufficient plant room space and electrical services connectivity (e.g. wiring loops to meters and switchboards) so batteries can easily be retrofitted into buildings at a later date.

The role of batteries at Camellia is discussed further in the *Net Zero Emissions* section.

PRECINCT RECYCLED WATER –

Recycled water is currently available in the area through the Rosehill Recycled Water Scheme, operated by Aquanet (see Figure 6). The Rosehill scheme is supported by Sydney Water (under a 20 year contract with 15 years yet to run) and has facilities in Rosehill (Durham St) with the potential to supply recycled water to Wentworth Point, Rhodes, Camellia, Parramatta and Westmead.

Furthermore, Sydney Water is investigating the viability of providing recycled water service for non-drinking uses, including greening and cooling, to the Greater Parramatta and the Olympic Peninsula (GPOP) with a new resource recovery facility located within the Camellia-Rosehill precinct. Over time, the resource recovery facility could be upgraded to produce purified recycled water to supplement Greater Sydney's water supply. This is currently being considered as part of the Greater Sydney Water Strategy. It is envisaged that a 20-hectare site in suitably zoned land, such as the Camellia Industrial precinct, would be required to enable the potential resource recovery facility.

The high performance building targets outlined in the previous section provide a performance outcome to ensure new development contributes towards efficient resource consumption and a reduction in greenhouse gas emissions. From an energy perspective, the performance targets can be achieved at a building level, through building level implementation of better design and technologies. Achieving BASIX Water 65 and NABERS Water 5-star, however, will require buildings at Camellia to connect to a recycled water scheme.

This strategy would require connection by all buildings to recycled water for irrigation, toilet and laundry use, including dual reticulation throughout all buildings. Dual reticulation is estimated at approximately \$1,200 per apartment (or \$15 per m²), including piping and metering requirements.

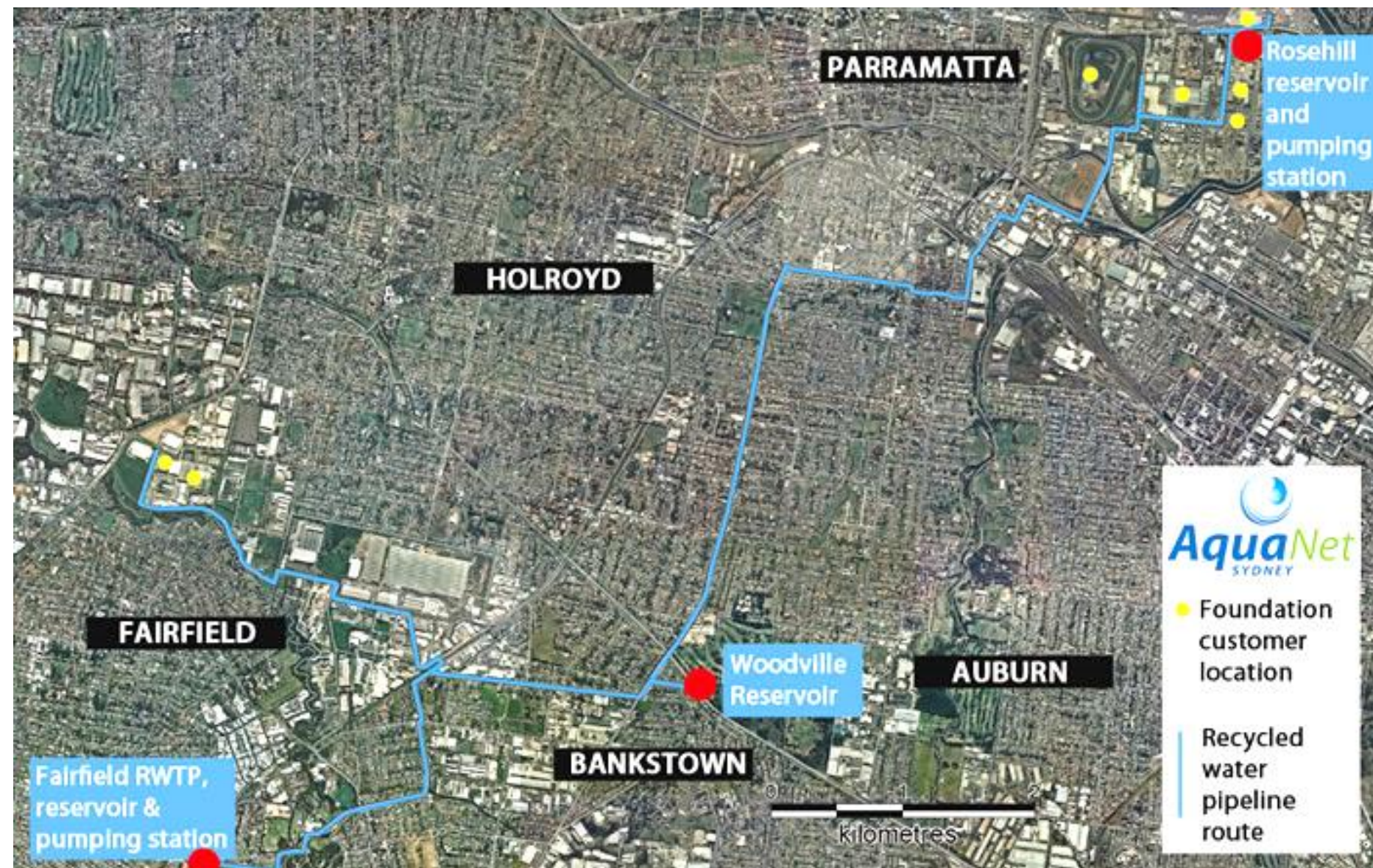


Figure 6: Map of Rosehill Recycled Water Scheme



COOL GREEN CAMELLIA

Without the cooling sea breeze off the coast, Parramatta's residents feel the full effect of these extreme summer temperatures and this gap is widening. Analysis of temperature records over the last 40 years shows that Parramatta has seen a rise in annual temperatures above that experienced in coastal parts of the city (Figure 7). The historical development of Camellia has left very little vegetation and produced a very low amenity environment. Without intervention, this would leave a hot and dusty environment for future residents with limited greenspace for recreation and leisure.

Major heat waves are Australia's deadliest natural hazards, causing more deaths since 1890 than bushfires, cyclones, earthquakes, floods and severe storms combined (Department of Infrastructure and Regional Development (2013) State of Australian Cities). People living in urban environments can be more susceptible than non-urban dwellers to the effects of heatwaves as a result of the urban heat island effect. The urban heat island effect is essentially the difference between the land surface temperature and the average air temperature. This is caused by the prevalence in cities of heat-absorbing materials such as dark coloured pavements and roofs, concrete, urban canyons trapping hot air, and a lack of shade and green space in dense urban environments.

Studies undertaken by the City of Parramatta highlight a strong correlation between surface types and land surface temperatures. Figure 8 shows an example in the Camellia precinct, highlighting the relationship between building, roof and road surfaces with temperature. When compared to an un-vegetated public domain, a green space and tree canopy can reduce land surface temperature by up to 15 degrees on a 35 degree day.

While aerial photos often demonstrate urban heat differential at roof height, the street level impact is the most critical for walkability and reducing pedestrian heat stress. To address this issue and ensure a resilient and cooler Camellia precinct, we will explore the delivery of adequate landscaping and vegetation at place. At a minimum, greening and cooling interventions that maximises drought resilient canopy cover on all pedestrian space (footpaths, trafficable pedestrian areas), green open space areas as well as other options including green walls and roofs can be explored. Additionally, the following can also be considered.

- Cool materials and building design, including heat-reflective materials and façade shading.
- Rooftop placement of HVAC heat rejection to allow for the removal of waste heat by the wind.
- Reduced reliance on cars for transport to reduce anthropogenic heat sources..
- Water sensitive urban design, irrigation and water features.

TRENDS IN HOT DAYS IN PARRAMATTA VS SYDNEY

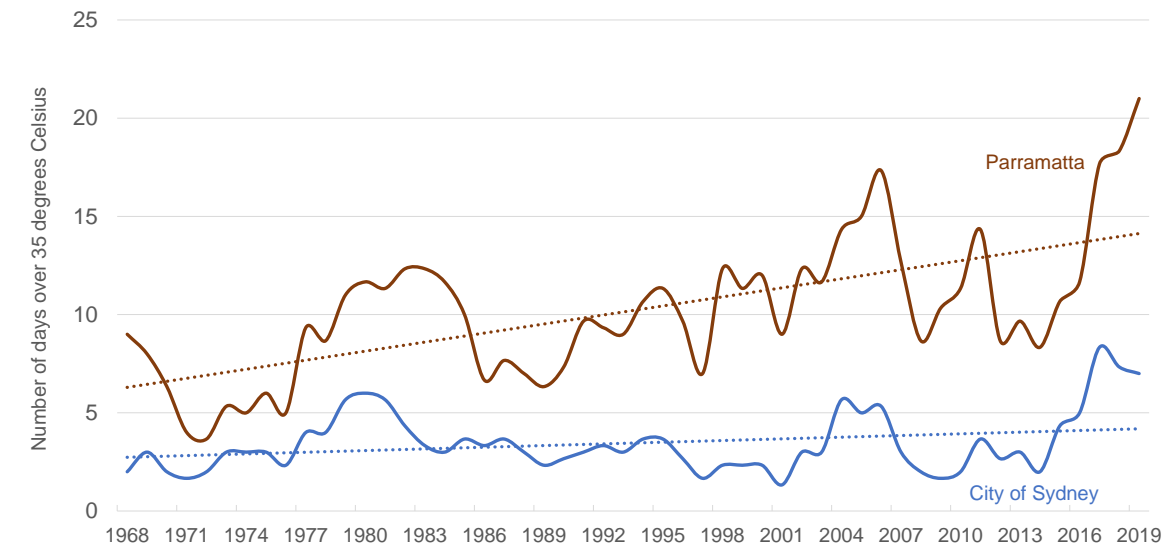


Figure 7: Trends in the number of days above 35 degrees, comparing coastal Sydney to Parramatta (Source: Bureau of Meteorology).

EXAMPLE CORRELATION BETWEEN SURFACES AND TEMPERATURE

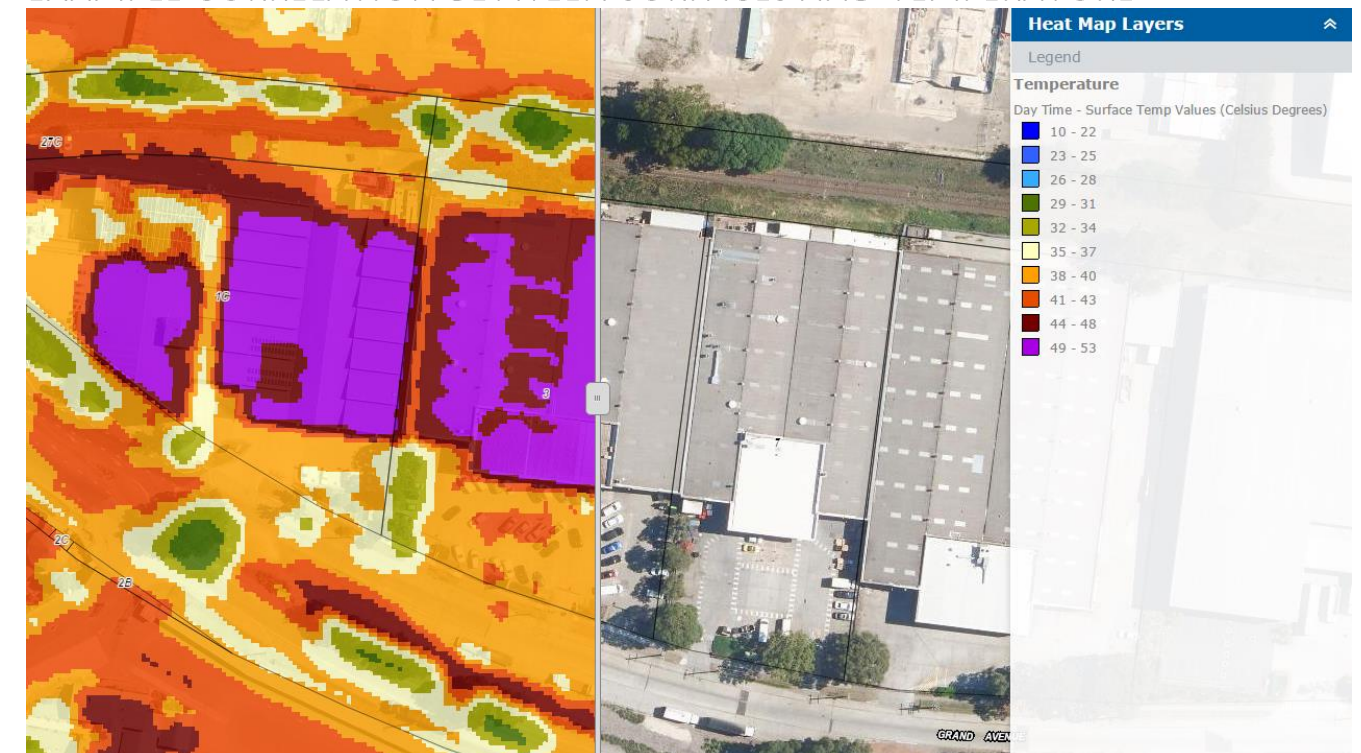


Figure 8: An example in the Camellia precinct highlighting the relationship between building, roof and road surfaces with temperature (Source: City of Parramatta Council, Interactive Heat Maps).



ZERO WASTE PRECINCT

A zero waste community aims to rethink waste as a resource.

Australia has one of the highest waste generation rates in the world. When benchmarked against other regions in the Organisation for Economic Co-operation and Development (OECD), Australians generate more waste than the average country in the OECD and significantly more than European and other Asia-Pacific countries (see Figure 9).

Every year, NSW households throw away more than 800,000 tonnes of edible food. This equates to \$10 billion – on average, \$3,800 per household, meaning a household wastes \$73 of food every week.

Based on waste audits in Greater Sydney, over 40% of the waste in the red bin, the bin destined for landfill waste, is composed of food and garden organics that can be composted and diverted from landfill. Organics waste disposed into landfill generates methane emissions which are 25-28 times more potent than Carbon Dioxide as a greenhouse gas. A further 20% of the waste in the red bin can be recycled.

The waste problem trickles down to Parramatta and Camellia under the final master plan:

- Significant number of dwellings and as such, residential waste is expected.
- Dark kitchens and other food service businesses require an innovative approach to tackle large amounts of food waste.
- We need to consider large amounts of organic waste from the correctional facility as well as the on-going problem of industrial waste.

An infrastructure led circular economy opportunity has been identified to:

1. Maximise the use of the existing Earthpower facility
2. Adopt a circular economy approach to rethink waste as a resource. The waste industry is undergoing significant innovation and we can pilot these innovative practices for Camellia. One example is the use of insects like maggots to transform food and organics waste to insect feed for livestock such as chickens, pigs and fish as well as soil fertilizer. These can be combined with the food and garden organics collection system to create commercial applications for the agribusiness sector in Western Sydney Figure 10.

2017 WASTE GENERATION – AUSTRALIA & OECD REGIONS

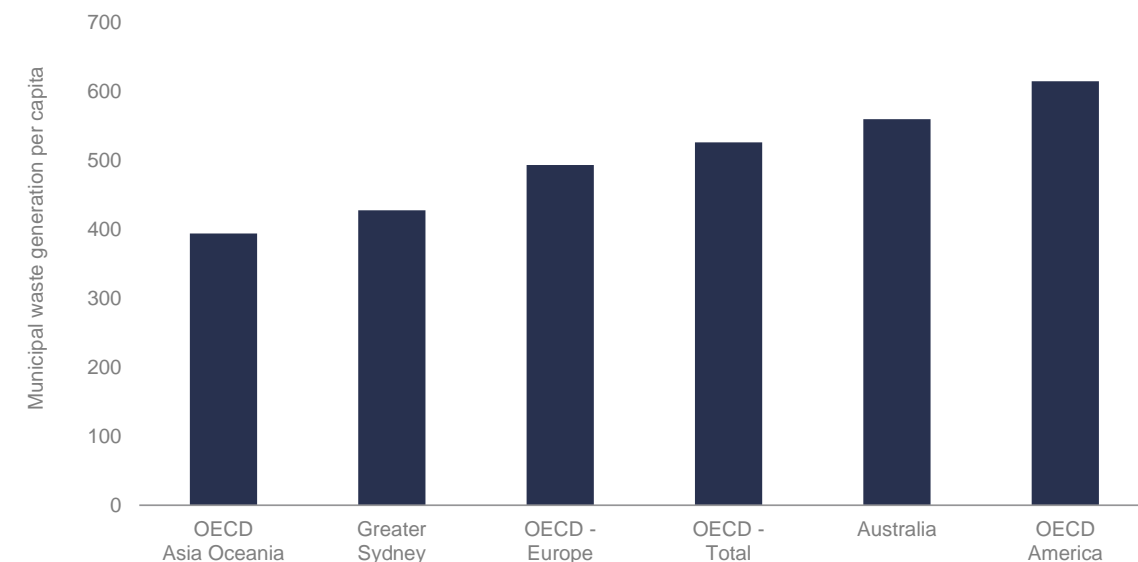


Figure 9: Waste generation per capita – Benchmarking Hawkesbury to Australia and OECD Regions

EXAMPLE WASTE INNOVATION – MODULAR ORGANICS WASTE MANAGEMENT USING INSECTS



Figure 10: Modular organics waste management system using insects. Source: Goterra



EVIDENCE BASED PARKING

Metropolitan trends in car ownership and the desire for more walkable environments lend themselves to a different approach to car ownership, parking and mobility strategies. This is already seen in adjacent Harris Park where average car ownership rates can be as low as 0.5 to 1 cars per household (see Figure 11).

Camellia is well connected to the Parramatta CBD and with the development of the Parramatta light rail through the site, car ownership rates could be expected to be as low as some of the more accessible areas around the Parramatta CBD. As such, planning should be made to ensure this access to public transport and access to employment is matched with lower parking rates for new dwellings.

The benefits of this strategy are significant and could facilitate:

- Lower construction costs associated with excavation and construction of underground parking.
- Lower housing costs - reducing parking by 1 space could equate to approximately \$60,000 to \$80,000 off the sales price of a new apartment.
- Less energy demands for parking lighting and ventilation equates to lower compliance costs with BASIX Energy Targets and lower energy costs for an apartment body corporate.
- Reduced pressure on the surrounding road network and less need for further road infrastructure upgrades
- Reduced challenges with managing flooding

The current parking rates for apartments in the Parramatta region are a minimum parking rate and do not respond to varying accessibility patterns observed across different parts of Parramatta:

3-bedroom	1.2 spaces per dwelling
2-bedroom	1.0 spaces per dwelling
1-bedroom	1.0 spaces per dwelling
Studio	0.6 spaces per dwelling

Based on 2016 ABS Census, current car ownership rates in Rosehill is about 1 - 1.2 cars per dwelling. This does not reflect expected improvements to active and public transport infrastructure in the future. This is highlighted in Figure 11, showing car ownership rates of 0.5 to 1 car per dwelling in high accessibility areas around adjacent Harris Park.

EXISTING CAR OWNERSHIP



Figure 11: Average car ownership rates (source: ABS Census 2016), showing 0.5 to 1 car per household in highly accessible areas around Harris Park.



This is supported by recent trends highlighting a shift towards low car ownership across Sydney. In 2009, the Bureau of Transport Statistics reported that 1 in 4 people aged 18 to 35 do not have a license or own a car. If you add to this the disruption posed by the emergence of the autonomous vehicle within the development timeframe of Camellia, it is clear that our parking rates need to respond.

To respond to these trends, we should explore the following opportunities:

1. Set parking rates as a maximum number of spaces permitted.
2. These maximum parking rates should reflect current and future car ownership rates and mobility trends. The Parramatta CBD Planning Proposal rates shown below reflect this:
 - Studio – 0.1 cars per dwelling
 - 1 bed – 0.3 cars per dwelling
 - 2 beds – 0.7 cars per dwelling
 - 3 or more beds – 1.0 cars per dwelling
 - Nil visitor
3. Parking should be provided as transitional structures that can be repurposed/ replaced as car ownership and mobility trends change (see Figure 12).

Delivering innovative precinct parking can have broader social, economic and environmental benefits outlined in Figure 13.

EXAMPLE - PRECINCT PARKING AS TRANSITIONARY, DECOUPLED PARKING



Figure 12: Transitional decoupled parking as an example

BROADER BENEFITS OF PRECINCT PARKING

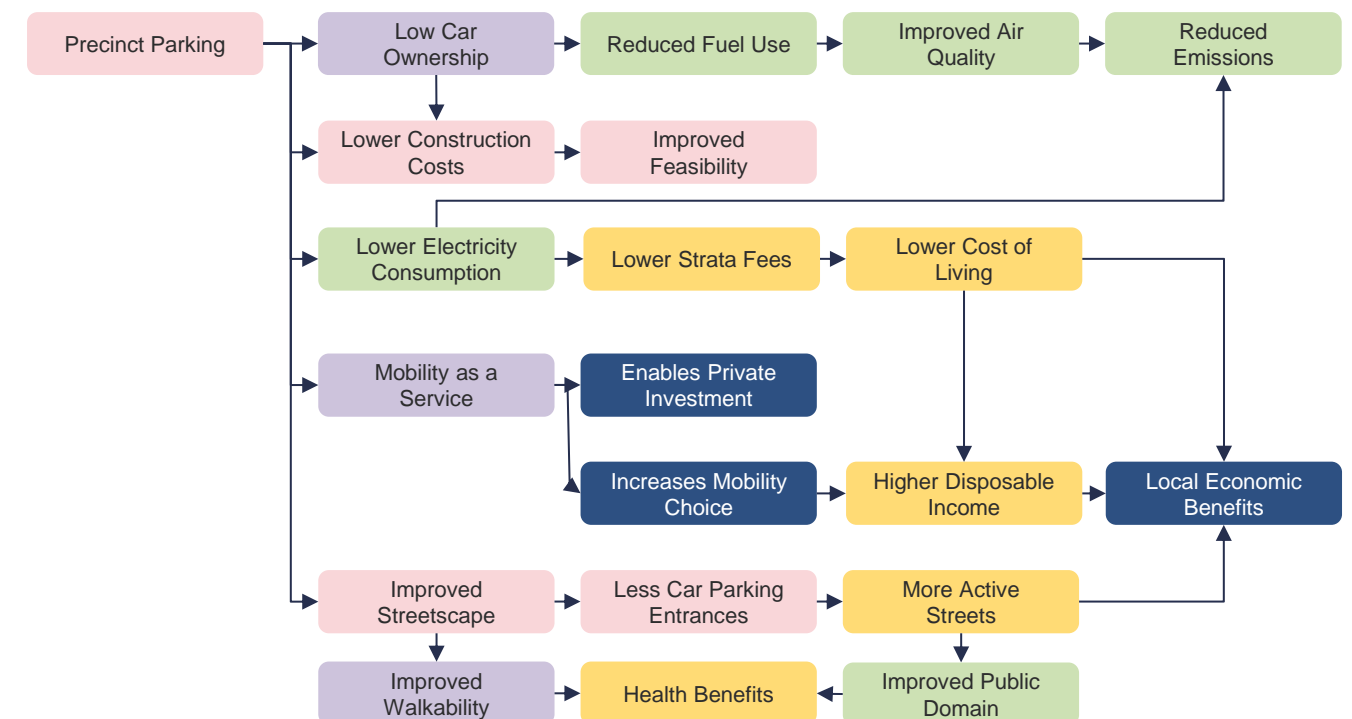


Figure 13: Broader benefits of innovative precinct parking

PRECINCT SCALE RENEWABLES FOR ZERO EMISSIONS

High rise residential development is typically limited in its ability to capture and use roof top solar PV. This is primarily driven by two reasons:

1. The roof space to electricity demand ratio is low, so while solar PV can be installed, it is generally only able to capture a small proportion of total building electricity demand
2. Electricity metering in apartment buildings means that solar PV is generally limited to deliver common area electricity demands, rather than individual apartment electricity needs.

Camellia, however, provide a unique opportunity to consider this on a local scale. Within the Camellia precinct there are large roof areas of existing and new light industrial and business roof space. Specifically, buildings within the government's influence are the Parramatta Light Rail Station and the Sydney Metro Stabling Yards. Technically, it is estimated that there would be adequate roof space in the adjacent area to house solar PV to power the entire town centre (see Figure 14), delivering a **net zero emissions precinct**.

This opportunity relies on encouraging a market response from existing industrial asset holders including Viva Energy and Boral to install rooftop solar PV. Along with the rooftop renewables on industrial sites, significant battery storage would also be required to manage the generation and use of solar PV across the precinct, delivered either at the building or network level. Behind the meter smart infrastructure need to be set up in these large solar PV assets to maximise the use of renewable energy within the precinct.

The delivery of this strategy will require a new approach to infrastructure delivery. Electricity generation from solar PV will be managed at the precinct level – solar PV generation on the adjacent industrial and business roof tops is distributed to the town centre via a private wire network.

Recently, a new model of infrastructure delivery has emerged. Private utilities are providing developments with decentralised energy and water solutions. While this is relatively mature in the delivery of precinct scale recycled water, the delivery of energy solutions is less mature.

A renewable energy powered Camellia could be coupled with more stringent energy strategies, including higher thermal performance of buildings, more efficient appliances and more efficient air conditioning systems. This would reduce the amount of renewable energy required to deliver a net zero emissions precinct.

Through significant local renewable energy, coupled with enhanced building efficiency, the precinct can achieve net zero emissions. This needs to be further analysed through precinct modelling.

EXAMPLE OF A PRECINCT SCALE RENEWABLE ENERGY STRATEGY



Figure 14: Powering the Camellia Town Centre with local, adjacent solar PV on large roof areas.



THE FINAL MASTER PLAN

This project team has explored the impact of applying the key strategic opportunities identified across the final master plan for the Camellia precinct.

The growth projections developed by Cox were used to understand the implications of growth and types of interventions required to deliver on the desired outcomes outlined by the project team as well as the key requirements of Parramatta Council's Sustainability Strategy.

They have been used to inform the local infrastructure, policy and governance requirements that must be put in place to respond to the trends and challenges outlined in the previous section of this report and ensure a sustainable response for any future urban form that Camellia can take.

Land use projections under the final master plan are documented in the final master plan document developed by Cox on behalf of DPE. These have been used for the sustainability modelling outlined in the following pages.

	Area (sqm)
Employment	2,010,564
Residential	901,266
Education	76,297
Open space-public recreation & Riparian buffer	453,154
Riparian buffer (viva energy)	61,241
Wetland-potentially publicly accessible	98,714
Potential Open Space	26,264
Roads	351,176

LAND USE MAP – FINAL MASTER PLAN

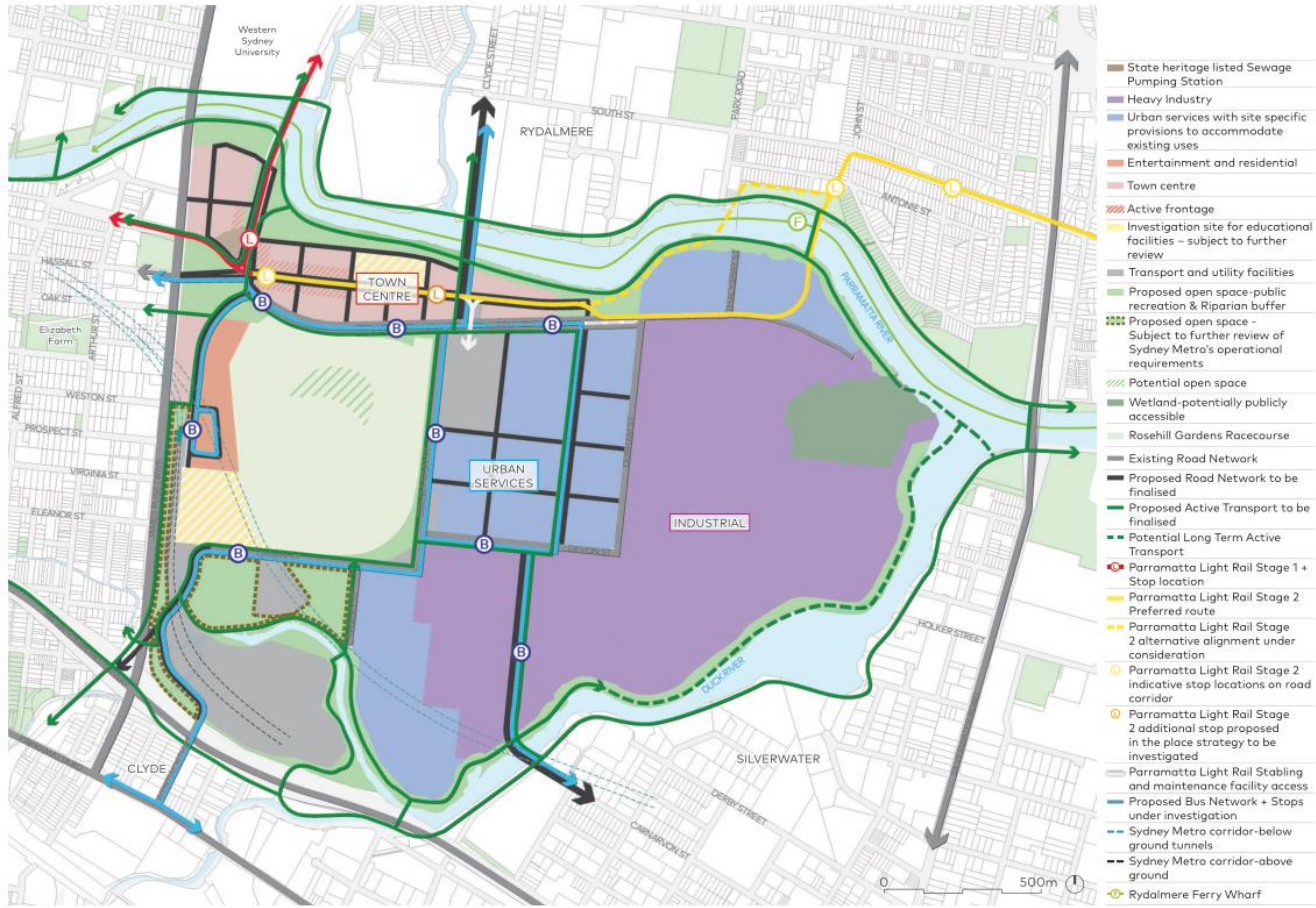


Figure 15: Land use map of final master plan



RESOURCE IMPLICATIONS OF GROWTH – BASELINE

To understand the magnitude of growth in resource demands and related infrastructure requirements, scenario analysis of the Camellia precinct was undertaken for the final master plan. In particular, growth in the energy demand, water demand and related infrastructure requirements were analysed.

First, Kinesis modelled a business-as-usual or baseline setting, which assumes that all new development under the final master plan achieves minimum building code compliance (with BASIX and Section J of the Building Code) and conforms with existing Parramatta Council parking controls.

Figure 16 and Figure 17 show the impact of growth on the resulting emissions and water consumption projections.

Analysis was undertaken using the Kinesis Platform - a strategic infrastructure and urban design tool, used in the analysis of key performance metrics of precincts, integrating land use and development inputs with demographic, utility, transport and affordability models.

The percentage growth in each planning scenario relative to the current resource demands are shown in Table 1.

KEY INDICATORS FOR THE FINAL MASTER PLAN

Metric	Current	Final master plan (Baseline)
Electricity consumption - TWh	35	236
Gas consumption - TJ	16	256
Peak electricity demand - MW	-	123
Stationary emissions - kilo tCO2-e	35	229
Transport emissions - kilo tCO2-e	4.2	10.1
Water use - ML	520	4,030
Sewer load - ML	-	2,911

Table 1: Modelled key performance indictors by scenario

BASELINE STATIONARY EMISSIONS

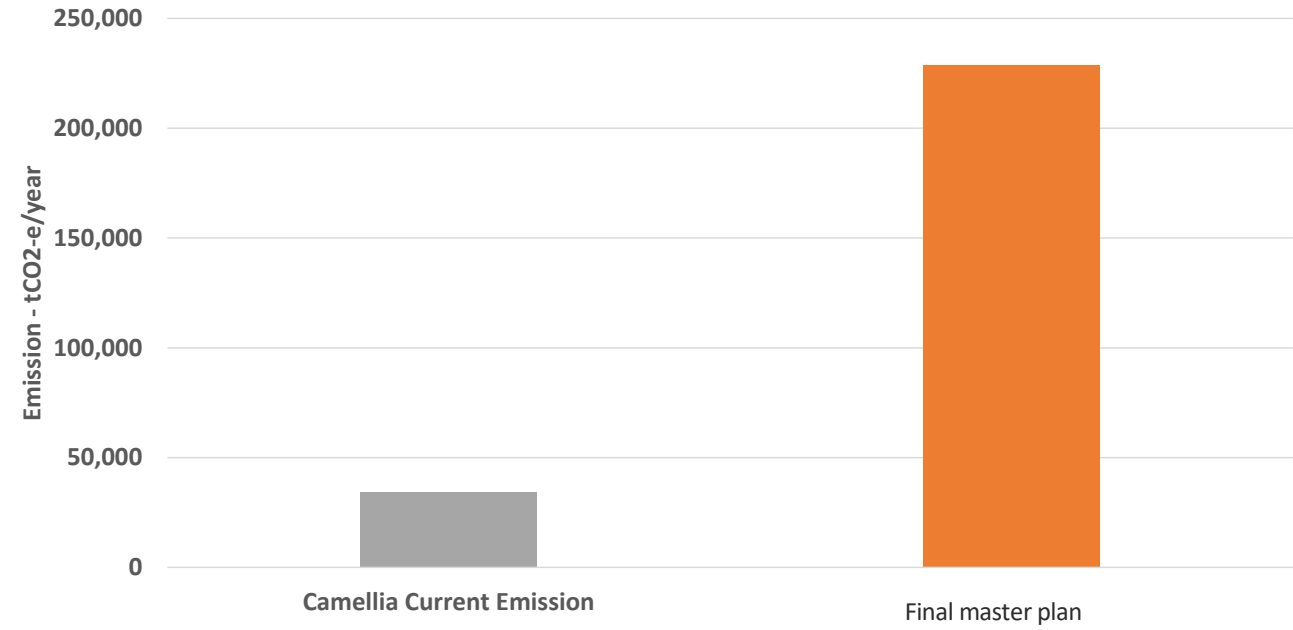


Figure 16: Total BAU stationary emissions

BASELINE WATER USE

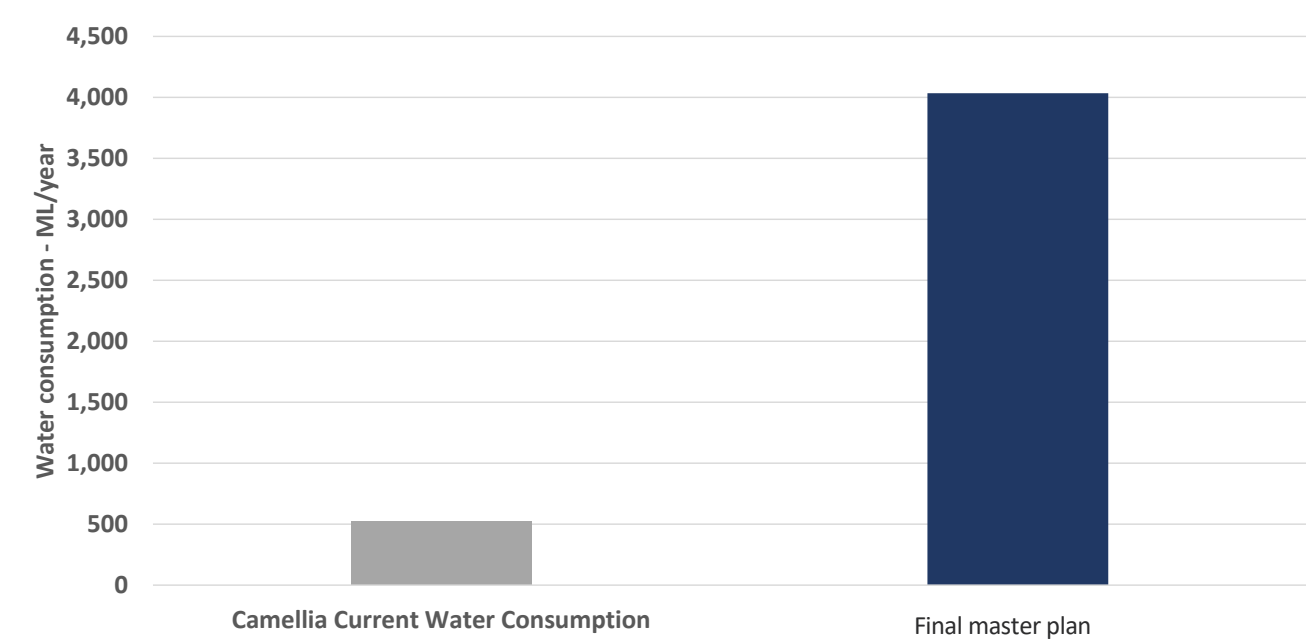


Figure 17: Total BAU water consumption



STRATEGIES FOR A SUSTAINABLE CAMELLIA

Kinesis has modelled a range of opportunities to guide the development of the Camellia to achieve high standards in sustainability under the final master plan.

These opportunities incorporate findings of the baseline analysis, the discussions from the two EbD workshops and the aspirations identified by stakeholders including DPE, Parramatta Council, TfNSW, EPA, etc.

They are packaged into 4 key strategies

1. Net Zero Emissions Precinct

Deliver a net zero emissions precinct through building efficiency and precinct scale renewables. The aim is to align with the NSW Net Zero Emissions Target as well as the City of Parramatta Sustainability Strategy.

2. Recycled water for a cool green precinct

Leverage the existing recycled water system create a cool green precinct. This strategy will effectively make Camellia a zero sewer export precinct, recycling all the sewer to service the irrigation requirements of the planned canopy and green cover. The integrated economic, social and resilience benefits of this strategy are significant.

3. Precinct parking for affordable housing

Precinct parking delivered as a transitional asset class that can be repurposed with changes in car ownership and mobility patterns. That is, provision of parking in temporary structures that is decoupled and unbundled from the sale of apartments. This not only future proofs the precinct but also supports lower remediation and construction costs, as such, increasing housing affordability.

4. Zero Waste precinct

Adopt a circular economy approach to rethink waste as a resource. This strategy will leverage the existing Earth Power facility and innovative on-site organic waste management techniques to transform waste to energy and feedstock for the Western Sydney agribusiness precinct.

The key impact of the interventions under the final master plan are summarised in this section. The recommendations are individually discussed in more detail after.



NET ZERO EMISSIONS PRECINCT

This strategy explores the delivery of a net zero emissions precinct through building efficiency and precinct scale renewables. This strategy has direct links to the City of Parramatta Sustainability Strategy, the NSW Net Zero Emissions Target and the non-negotiable outcomes identified in the two Enquiry by Design Workshops. The combination of high performance buildings, on-site renewables and the decarbonisation of the electricity grid can deliver Net Zero Emissions and energy resilience through peak demand reductions.

1. High performance building requirements

The City of Parramatta and DPE have already been exploring high performance building standards for Camellia.

An earlier study by Kinesis recommended the following high performance building targets for the Camellia town centre. These can be extended across the precinct. They include:

- BASIX Energy
 - Single dwellings - Energy 60
 - Apartment 1-3 storeys - Energy 55
 - Apartment 4-5 storeys - Energy 50
 - Apartment 6+ storeys - Energy 40
- BASIX Water 65 for all dwellings
- NABERS Energy – 5-star
- NABERS Water – 4-star (or 5-star where recycled water is available)

These building efficiency standards can mitigate the emissions growth and deliver more affordable and sustainable development outcomes.

Additionally, these high performance buildings must be future proofed to maintain their sustainability standards. Measures including installing electric vehicle charging points and installing the necessary infrastructure for battery storage would enable the buildings to be more energy resilient and ready for the expected uptake of electric vehicles.

2. Precinct scale renewables

Under the final master plan for the Camellia precinct, there is an opportunity to explore precinct scale renewables on specific land uses including - Innovation and industry areas, the stabling yards and the Urban Services areas. The estimated renewable capacity based on suitable roofspace is 125 MW.

The delivery of this scale of local renewable energy would require local electricity distribution management through the delivery of strategically located battery storage systems. These could be located centrally within the Innovation and Industry core, or throughout the precinct alongside substations as required

NET ZERO EMISSIONS

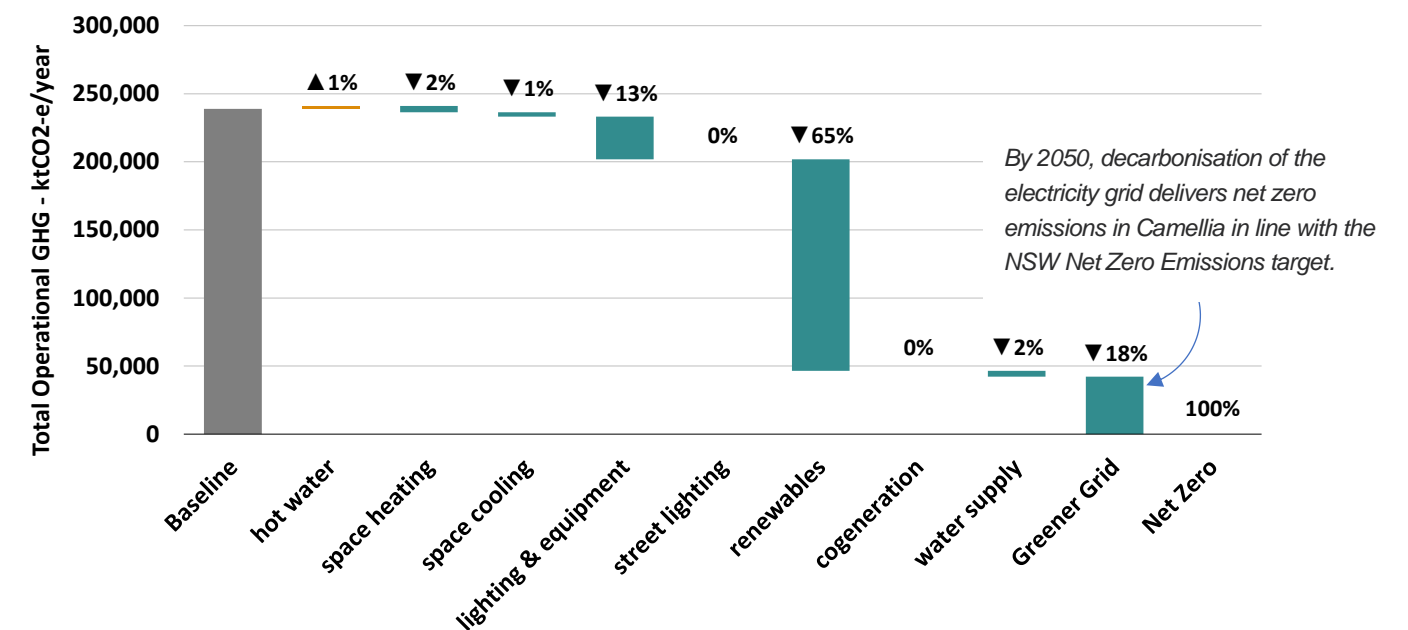


Figure 18: Stationary Emission reductions for the final master plan

PEAK DEMAND REDUCTION FOR THE FINAL MASTER PLAN

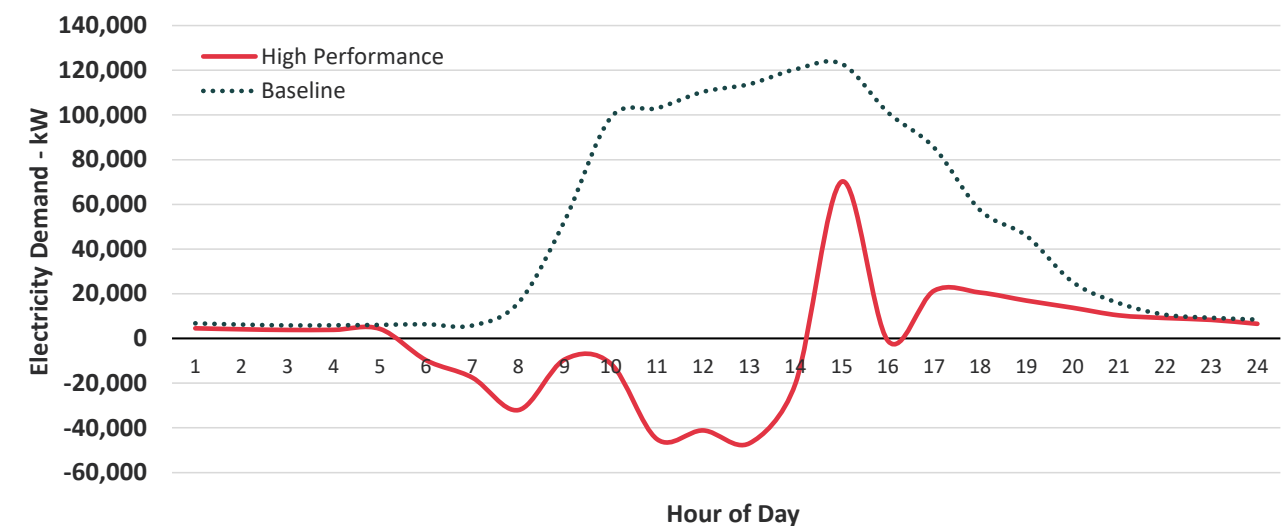


Figure 19: High performance peak demand reductions for the final master plan



3. Decarbonisation of the electricity grid

The electricity grid is undergoing a transition through the closure of coal fired power stations and their substitution with renewable energy. If the precinct was developed today, electricity use would be the largest source of emissions (approximately 70-80%). As such, the decarbonisation of the grid would have a significant impact on the projected emissions from the precinct. Kinesis has used projections developed by the Australian Energy Market Operator in its Integrated System Plan¹ to estimate the future electricity emissions from the precinct. The transition scenarios developed by the Australian Energy Market Operator (AEMO) in its Integrated System Plan are shown in Figure 20.

This expected transition of the electricity grid effectively provides flexibility on the level of renewables that needs to be delivered on-site in the precinct. While the goal should be to maximise renewables, stakeholders must consider economic feasibility and coordinate with the energy distributor to deliver an appropriate amount of on-site renewables.

NSW GRID EMISSION INTENSITY FORECAST

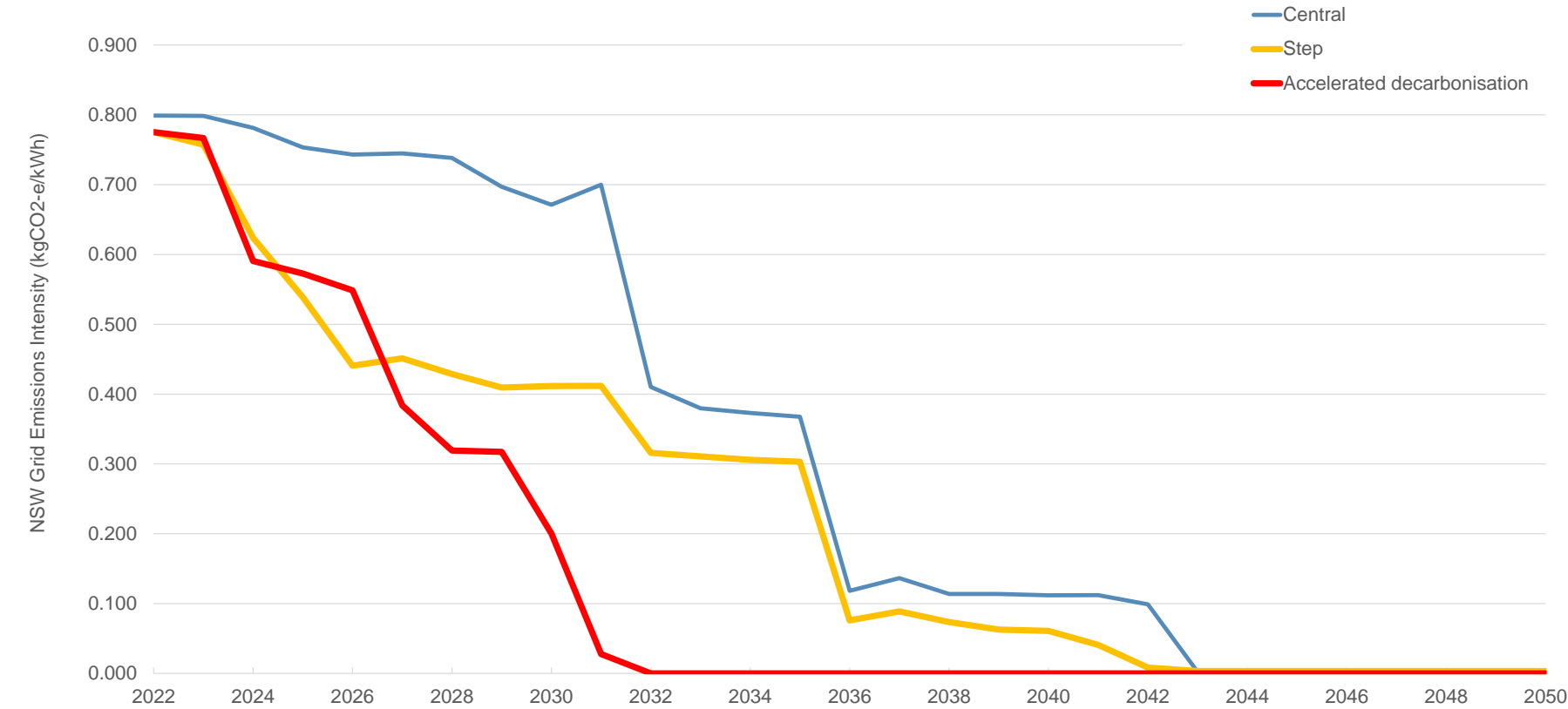


Figure 20: NSW future grid emission intensity forecast by AEMO

¹ AEMO, 2019, Draft 2020 Integrated System Plan



Example Clause for new building standards:

To increase BASIX targets through the BASIX SEPP and online tool, no change is required to Council's LEP or DCP. Although, identification of the BASIX targets in the DCP would be helpful for developers to understand what is required.

Should Council seek to include the higher BASIX targets coupled with incentives (floor space or height bonus, noting this is not recommended by Kinesis), the following is an example clause for inclusion in Council's LEP (source Parramatta CDB Draft LEP):

The part of any building that is a dwelling, including as a part of a residential flat building or mixed use development, complies with the following higher BASIX Energy and BASIX Water standards than the minimum standards as provided in State Environmental Planning Policy (Building Sustainability Index: BASIX) 2004:

*BASIX Energy 50 and BASIX Water 50 (<14 storeys)
BASIX Energy 40 and BASIX Water 50 (15 - 29 storeys)
BASIX Energy 35 and BASIX Water 50 (30 - 39 storeys)
BASIX Energy 30 and BASIX Water 50 (40+ storeys)*

A residential flat building or a mixed use development (that contains dwellings) which complies with this clause is eligible for an amount of additional residential floor space (above that already permitted elsewhere under this Plan) equivalent to that which exceeds the floor space ratio as shown on the Floor Space Ratio Map or Incentive Floor Ratio Map (as applicable to that development) by up to 5%, subject to the consent authority being satisfied that this additional residential floor space does not adversely impact on neighbouring and adjoining land in terms of visual bulk and overshadowing.

Example Clause for future proofing new buildings:

An example clause for provision of EV charging in new buildings is outlined below from the [Draft Telopea Precinct Development Control Plan](#).

All apartment residential car parking must:

- a) Provide an EV Ready Connection to at least one car parking space per dwelling.*
- b) Provide EV Distribution Board(s) of sufficient size to allow connection of all EV Ready Connections and Shared EV connections.*
- c) Locate EV Distribution board(s) so that no future EV Ready Connection will require a cable of more than 50 metres from the parking bay to connect.*
- d) Provide adequate space for the future installation (post construction) of compact meters in or adjacent to the EV Distribution Board, to enable the body corporate to measure individual EV usage in the future.*
- e) Identify on the plans the future installation location of the cable trays from the EV Distribution Board to the car spaces allocated to each dwelling that are provided a Future EV connection, and to make spatial allowance for it when designing in other services.*

C.2 All car share spaces and spaces allocated to visitors must have a Shared EV connection.

C.3 All commercial building car parking must provide 1 Shared EV connection for every 10 commercial car spaces distributed throughout the carpark to provide equitable access across floors and floor plates.

C4. The bicycle storage facility is to include 10A e-bike charging outlets to 10% of spaces with no space being more than 20 metres away from a charging outlet. Chargers are to be provided by the owner.

RECYCLED WATER FOR A COOL GREEN CAMELLIA

A key aspiration for the future of the Camellia precinct includes considerable urban greening. This includes maintaining and growing the precinct's green public domain, increasing canopy cover and having green facades on buildings. Kinesis has worked with other consultant teams to quantify the suitable level of greening in the precinct and the resulting irrigation demand.

The greening strategy is a mechanism to combat the ever-worsening heat wave conditions experienced by Parramatta's residents and workers. The irrigation water requirements from these green spaces will be quite high - as much as 185 ML per year. The increased water demand from this urban greening vision can be met using the Rosehill recycled water system.

The implementation and provision of green walls and facades, can deliver improved thermal performance of buildings over and above standard measures such as glazing, shading and façade design. While water reuse has traditionally been considered as a water conservation objective, recycled water provides the opportunity to flip this goal on its head and deliver resilient and cool building facades and adjacent public domain that results in improved building thermal design and an urban oasis that is cooler, more comfortable and more walkable on hot summer days.

Studies undertaken by the City of Parramatta highlight a strong correlation between surface types and land surface temperatures. When compared to an un-vegetated public domain, a green space and tree canopy can reduce land surface temperature by up to 15 degrees on a 35 degree day.

While aerial photos often demonstrate urban heat differential at roof height, the street level impact is the most critical for walkability and reducing pedestrian heat stress. To address this issue and ensure a resilient and cooler Camellia precinct, it is recommended that the strategy includes:

1. Maximise canopy cover and greening on all pedestrian space (footpaths, trafficable pedestrian areas). The canopy cover and greening targets recommended in the Landscape Implementation Report and based on evidence provided by NSW DPE have been modelled as part of this sustainability analysis and the associated water demands have been analysed.
2. Vegetation, green roofs, green walls and materials with a high solar reflectance away from the public domain are encouraged on at least 50% of the surfaces of all buildings, in particular western and northern building facades.

CASE STUDIES – RECYCLED WATER AND URBAN GREEN SPACE

Precinct scale recycled water systems are currently in operation in two locations across Sydney:

1. Central Park, currently supplying 1,400 customers with water for irrigation, toilet flushing and laundry use. A private water utility operates and maintains all water related infrastructure across the precinct. The recycled water system is housed in a Local Water Centre, built over four basement levels under the residential buildings. For more information see flowsystems.com.au/communities/central-park-water.
2. Shepherds Bay is a development at Meadowbank. The precinct scale recycled water system is designed to service the entire development comprising of 1,800 apartments, 2,450 sqm of childcare, community and retail space and 1.3 ha of landscaped area with recycled water. The system captures 100% of wastewater from the apartments and non-residential uses and services the irrigation, toilet flushing and laundry requirements of the development. For more information see <https://altogethergroup.com.au/about/communities/shepherds-bay/>





Recycled water is currently available in the area through the Rosehill Recycled Water Scheme, operated by Aquanet and is likely to be enhanced by the newly proposed Sydney Water plant (see Figure 8). The Rosehill scheme is supported by Sydney Water (under a 20 year contract with 15 years yet to run) and has facilities in Rosehill (Durham St) with the potential to supply recycled water to Sydney Olympic Park (SOPA), Wentworth Point, Rhodes, Camellia, Parramatta and Westmead.

The Rosehill plant has a capacity of 20 ML per day, is expandable to 25 ML per day, and currently operates at an output of about 6 ML per day. The recycled water is approved by IPART for use in boilers, cooling towers, industrial processes, wash down, toilet flushing and washing machines.

The high performance building targets outlined in the previous section provide a performance outcome to ensure new development contributes towards efficient resource consumption and a reduction in greenhouse gas emissions. From an energy perspective, the performance targets can be achieved at a building level, through building level implementation of better design and technologies. Achieving BASIX Water 65 and NABERS Water 5-star, however, will require buildings at Camellia to connect to a recycled water scheme.

Through connecting residential and non-residential buildings to recycled water, the system is expected to deliver the following range of outcomes depending on the planning scenario:

- **36% of total water demand** is delivered by recycled water,
- **54% reduction** in potable water consumption compared to the Base Case (Figure 21).
- **Zero** Sewer loads

This strategy would require connection by all buildings to recycled water for irrigation, toilet and laundry use, including dual reticulation throughout all buildings. Dual reticulation is estimated at approximately \$1,200 per apartment (or \$15 per m²), including piping and metering requirements.

Collaborate with Sydney Water to progress this strategy:

- Follow up with Sydney Water to finalise delivery plan for recycled water infrastructure at Camellia.
- The potential management and on-going maintenance of the precinct's public domain.
- Mandate dual plumbing in all new buildings to enable connection to a recycled water scheme.

MAINS WATER CONSUMPTION FOR THE FINAL MASTER PLAN

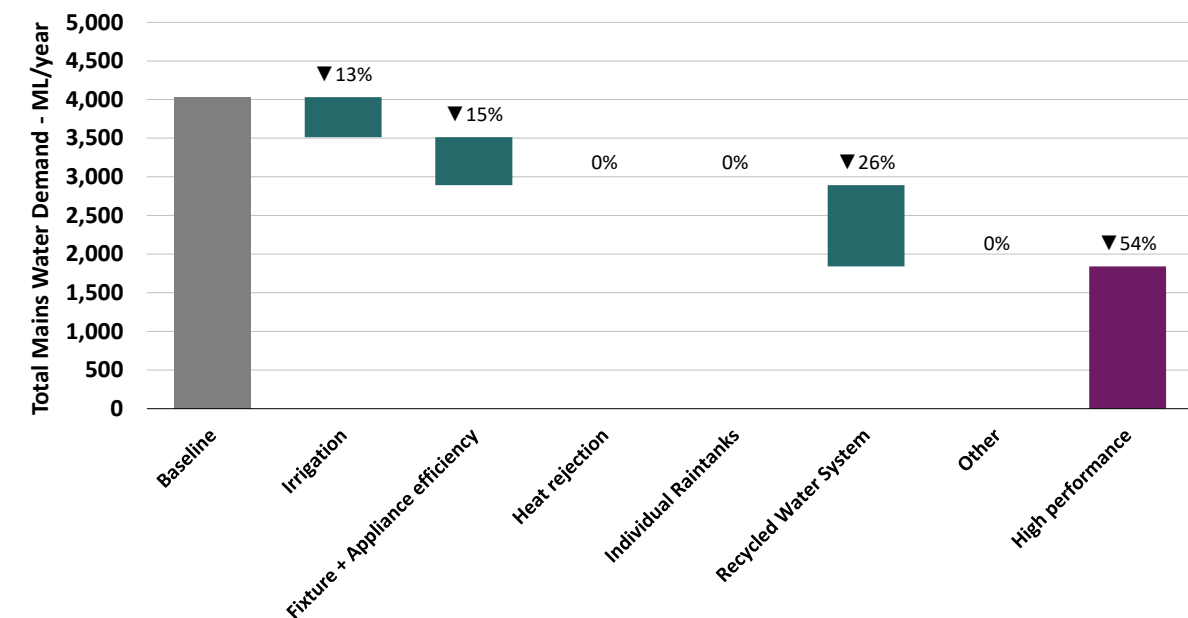


Figure 21: Mains water consumption reduction for the final master plan



Example Clause for Recycled Water delivery:

The inclusion of recycled water requires several levers as outlined above, including collaboration with Sydney Water, Aquanet and private water utilities to determine an appropriate recycled water provider for the precinct.

Development controls for this action include the provision for recycled water pipes within the new development. An example clause is outlined below:

- *The objective of this clause is to future proof the security of water supply*
- *The consent authority must not grant consent to development involving the construction of a new building or significant alterations to an existing building unless that building contains both potable water pipes and recycled water pipes for the purposes of all available internal and external water uses*

Source: Parramatta CBD Draft LEP Provisions

Example Clauses/ Mechanism for greening:

Public domain strategies relate specifically to increasing canopy cover and greening outcomes. It should be noted that this strategy and proposed clauses are not proposed to replace landscaping requirements but speak specifically to additional canopy cover inclusions.

The Draft Telopea Precinct Development Control Plan contains example clauses for greening and cooling that can be considered for the Camellia Precinct.

Canopy cover offsetting has not been included in the above clauses as further considerations by Council are required, including:

1. Under what conditions would Council consider offsetting
2. Where offsetting should be located
3. How is this managed and delivered by Council



ACCESSIBILITY BASED PRECINCT PARKING

This strategy aims to respond to the opportunities identified in the baseline report. Specifically, regarding accessibility based car ownership and transitional parking structures to improve development feasibility and deliver a more accessible and future proofed precinct. Kinesis has modelled:

1. Set parking rates as a maximum number of spaces permitted.
2. To reflect current and future car ownership rates and trends, the following maximum rates are proposed based on the Parramatta CBD Planning Proposal rates:
 - Studio – 0.1 cars per dwelling
 - 1 bed – 0.3 cars per dwelling
 - 2 beds – 0.7 cars per dwelling
 - 3 or more beds – 1.0 cars per dwelling
 - Nil visitor
3. For parking built above ground, floor to ceiling heights should be a minimum of 3.1m to be able to be converted to residential or retail uses in the future as car ownership and parking requirement reduce.

Additional considerations in the scenario modelling include:

Car Share

The reduction in parking rates provides a business case for private capital investment in the provision of car share. Car share provides an alternative to traditional car ownership, allowing residents or businesses to use a shared vehicle fleet. Car share relies on the restriction of parking and car ownership in areas of high public transport and mobility choice, and is considered an additional strategy that could be explained as a means of supporting the transition to low car use and car ownership rates. Car share should be provided at a rate of 1 space per 20 dwellings without parking and 1 space per 100 dwellings with parking. For building with car share, a parking rate reduction of parking spaces per 1 car share space is proposed.

Unbundled Parking

Unbundled parking is parking that is separated from the cost or rent of a dwelling or building. This is not only more equitable, but can also reduce the total amount of parking required for the building. For buildings with unbundled parking, a parking rate reduction of 20% is proposed.

Decoupled Parking

Decoupled parking could also be considered as a mechanism to reduce the need to build parking on-site and provide a more flexible built form for conversion to other uses in the future. Decoupled parking is

parking that is spatially separated from the building to which the parking services. It is also generally unbundled from the sale or rental of an apartment or building.

Council or privately owned and operated parking stations at the periphery of the Town Centre (as opposed to the centre) would address short term parking needs and reduce the potential requirement for individual developments to supply car parking on-site. This would also minimise the impact of traffic in Camellia and help support a gradual change in travel behaviour and patterns. This could be funded by a development fee in lieu of providing parking on-site, if considered appropriate.

Where appropriate, sites should be identified for spatially decoupled parking to reduce on-site parking and provide parking that can be transitioned to another use. For buildings with decoupled, unbundled parking, a parking rate reduction of 40% on maximum parking rates is proposed.

Parramatta Ways

Parramatta Ways is Australia's largest interconnected open space, bushland and urban walking network. The project will deliver the NSW Government's vision for the Sydney Green Grid, developing an interconnected pedestrian network to improve access, environmental resilience and community lifestyle opportunities. Parramatta Ways is a transport project focused on urban greening, recreation and local amenity.

Within Camellia, Parramatta Ways will connect new residents to the Parramatta River and other open spaces and form part of an integrated transport strategy for the precinct. It will create walkable streets which are linked to public transport nodes, providing an alternative mode of transport to the car.

Delivery of the Parramatta Ways project is essential to reducing car dependency and improving the liveability of Camellia. The City of Parramatta has prepared a Parramatta Ways Implementation Strategy to ensure successful delivery of the project.

Through lower and more strategic parking delivery, coupled with accessible transport and a more walkable community, the **modelled outcomes** are expected to deliver the following under the final master plan:

1. **29% reduction in car use** compared to the Base Case. Car use of a camellia resident would be 47% lower than Greater Sydney average and 40% lower than the Parramatta LGA average. (Figure 22)
2. Improved traffic flow at key intersections in the town centre.
3. **28% reduction in transport household costs** (compared to the Base Case), equivalent to approximately \$800 per year.
4. Lower construction costs associated with excavation and construction of underground parking.
5. Lower housing costs - reducing parking by 1 space could equate to approximately \$60,000 to \$80,000 off the sales price of a new apartment.
6. Less energy demands for parking lighting and ventilation equates to lower compliance costs with BASIX Energy Targets and lower energy costs for an apartment body corporate.



PER PERSON CAR USE REDUCTION FOR THE FINAL MASTER PLAN - TRADITIONAL MIXED USE PRECINCT

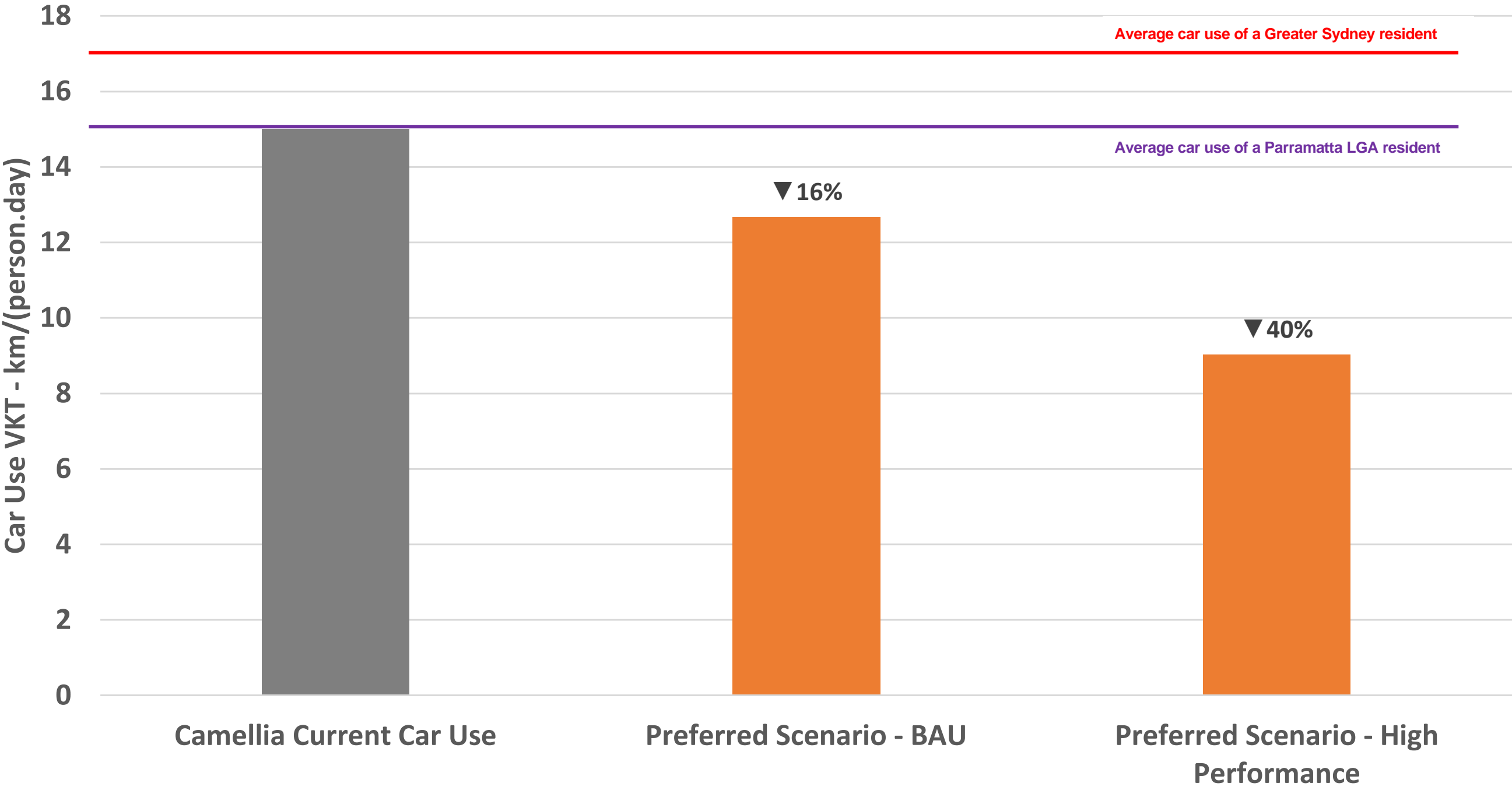


Figure 22: Estimated car use per person per day under the Base Case and High Performance Scenario

*Note: Percent reductions are shown as a reduction against the Base Case



Example Clauses:

Sustainable outcomes delivered through parking include reductions in energy use and greenhouse gas emissions, as well as increased housing choice and affordability. Inclusions for parking can be delivered through the LEP or DCP. Examples are provided below drawn from recently draft DCP provisions from various Councils (including the Rhodes East DCP):

- *All residential car parking is to be decoupled through separate titles to enable affordable housing and housing choice for residents.*
- *All residential car parking spaces must include EV ready infrastructure (see separate clause above)*
- *No minimum parking is specified.*
- *Underground parking should be minimised and any above ground parking must be sleeved with vegetation or active uses such as retail. To enable to the flexible conversion of parking to other uses over time, the minimum floor to ceiling height for any parking provided should be 3.6m.*

Maximum parking rates are recommended in line with the Epping Town Centre DCP for both residential and non-residential uses. Furthermore, it is proposed that car share is located in public areas (rather than within the building) to maximise the use of the car share vehicle as well as further enable zero parking developments across all precincts.



ZERO WASTE PRECINCT

Kinesis has built on Parramatta Council's Waste and Resource Recovery Strategy 2019–2023 (WARR) has key directions and priorities to:

- Avoid and reduce waste
- Improve reuse and recycling
- Manage problem waste better
- Reduce litter
- Reduce illegal dumping.

The WARR Strategy follows the principles of the waste hierarchy (see Figure 23) with the goal of firstly avoiding and reducing waste, whilst moving towards a more circular economy which values resources by keeping products and materials in use for as long as possible. Camellia can be zero waste precinct by adopting the waste hierarchy.

Based on current waste generation patterns in Parramatta, Kinesis has estimated the residential waste under the final master plan. This is shown in Figure 24. Under the final master plan, nearly 40-50% of the projected waste is expected to be composed of food waste. When sent to landfill, this food waste generates methane which has 25 times the global warming potential of carbon di oxide. Kinesis has identified two infrastructure strategies to manage the projected food waste:

1. Reuse and recycle waste using modular organics processing

Innovative modular organics managements systems use fly larvae to breakdown food waste to feedstock for agribusinesses². Approximately 25 modular waste processing units, each the size of a shipping container will be required to process the organics waste generated under the final master plan.

2. Recover energy – Consult with EarthPower facility to process waste

The EarthPower facility located at Camellia uses anaerobic digestion technology to convert solid and liquid food waste, into a combustible gas similar to natural gas. The food waste generated can be sent to the EarthPower facility to be processed into energy.

At this stage, the organics waste processing facilities can be set up within the existing industrial core.

² <https://www.afr.com/technology/maggot-waste-management-gets-tick-from-mike-cannon-brookes-tenacious-20200622-p554uu>

WASTE HIERARCHY

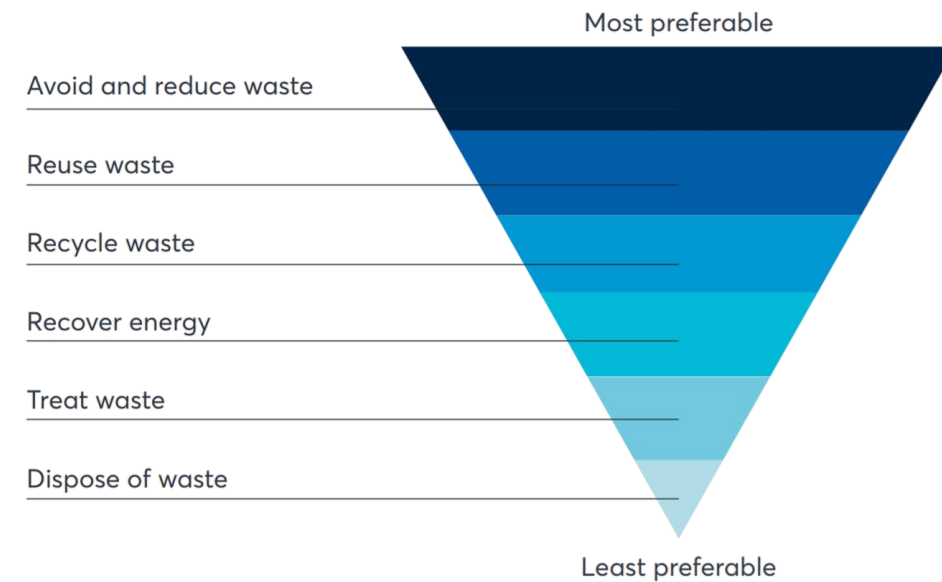


Figure 23: Waste hierarchy

RESIDENTIAL WASTE BREAKDOWN FOR THE FINAL MASTER PLAN

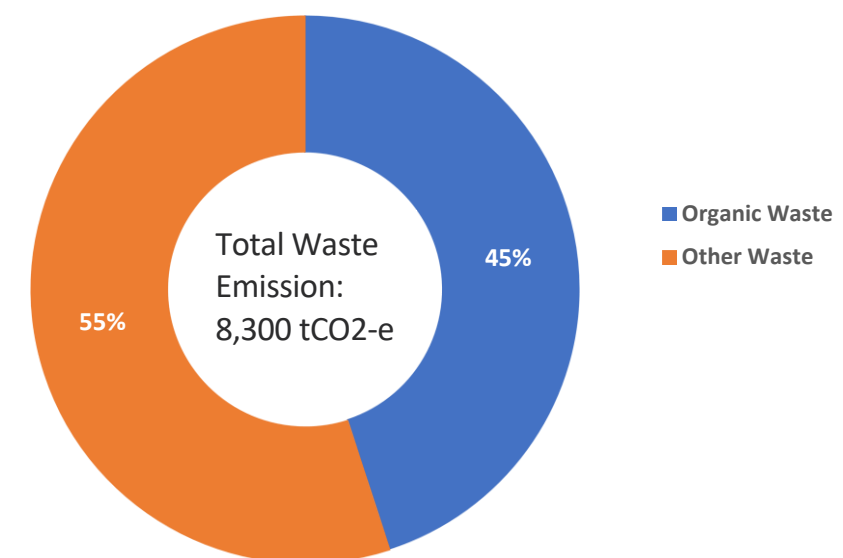


Figure 24: Residential waste breakdown for each development scenario



STRATEGY CONSIDERATIONS AND NEXT STEPS

Strategy	Strategy Details	Implementation Mechanism	Considerations	Next Steps
High Performance Buildings	<p>Residential:</p> <ul style="list-style-type: none">BASIX Energy 50 (+25) and BASIX Water 65 (+25) up to 15 storeysBASIX Energy 45 (+20) and BASIX Water 65 (+25) from 16 to 30 storeysBASIX Energy 35 (+10) and BASIX Water 65 (+25) from 31 to 40 storeysBASIX Energy 35 (+10) and BASIX Water 65 (+25) for 41+ storey developments <p>Commercial buildings</p> <ul style="list-style-type: none">Mandate NCC 2019 compliance through the NABERS Energy 5.5 star for Office pathway.NABERS Water 5-star (whole building). <p>Other non-residential buildings and floor space</p> <ul style="list-style-type: none">Mandate a minimum rating of 5 Star Green Star - Design & As Built or equivalent NABERS rating.5-star WELS rated tapware in kitchen and bathroom tap fittings.4-star WELS rated toilets or waterless urinals (where urinals are installed).4-star WELS rated showerheads (4.5 - 6 L/min) where showerheads are installed.Connection to recycled water for irrigation, toilet and cooling towers (where available).	<ul style="list-style-type: none">Determine project-based targets in BASIX.NABERS commitments and/or Green Star Design & As-Built for non-residential buildings	<ul style="list-style-type: none">BASIX Water target of 65 will require recycled water connection and reuse for irrigation, toilet and laundry. Precinct Solar PV is not included in BASIX Energy target outcomes (building level solar only is required)NABERS ratings are only available for large scale commercial buildings and shopping centres. Green Star Design & As Built could be investigated for other non-residential building types.	<ul style="list-style-type: none">DPE and Parramatta Council to update the BASIX SEPP or BASIX tool with Camellia specific BASIX targets Energy 45, Water 65. Noting that while shown to be technically possible these targets should be considered in the context of the variability of building typologies and design across the precinct. Further testing the BASIX tool should be undertaken to verify these targets in the context of specific building design.Prepare development controls which establish requirements for non-residential buildings through NCC pathwaysDevelop planning controls which mandate dual plumbing in all new buildings.
Precinct scale renewables and grid storage	<p>Options could include;</p> <ul style="list-style-type: none">Solar PV on innovation and industry, stabling yards, and the urban services buildings to power the Camellia Precinct.Precinct based System with strategic energy storage systems.Solar on new developments where feasible and does not have shading issues.	<ul style="list-style-type: none">Energy distributor to set up effective grid management within the precinct to ensure renewable energy is used within the precinct.Energy distributor to install adequate energy storage systems. These can be located centrally in the industry and innovation core or distributed at a substation level across the precinct.	<ul style="list-style-type: none">Building by building solar PV is limited by its ability to meet common area demands.The innovation and industry, stabling yards and urban services precincts could house solar PV to deliver the electricity demands of the Camellia Precinct. Alternative renewable energy sources may also be available for providers to deliver this electricity via a private wire network to the Precinct.This would require an alternative approach to infrastructure delivery.	<ul style="list-style-type: none">DPE and Parramatta Council to update BASIX SEPP or BASIX tool with Camellia specific BASIX targets Energy 100, Water 65Develop planning controls which mandate BASIX targets Energy 100, Water 65 for residential buildingsPrepare development controls which establish requirements for non-residential buildings, including performance targets equivalent to 5-star Energy and Water whole building NABERS ratings.Develop planning controls which mandate dual plumbing in all new buildings.



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				<ul style="list-style-type: none">• Prepare RFI for the provision of solar PV or other solutions to power the Precinct. Options should include; precinct based systems, off site PPA schemes by large industrial users or solar installation on new developments• This approach requires further investigation including governance, operation and local renewable energy sources and should be considered in a further study.
Precinct Recycled Water	<ul style="list-style-type: none">• Connection to precinct recycled water system for irrigation, toilet flushing and laundry for both residential and non-residential buildings.	<ul style="list-style-type: none">• Mandate dual plumbing in all new buildings to enable connection to a recycled water scheme.• Engage existing Recycled Water suppliers to investigate recycled water network in Camellia Precinct	<ul style="list-style-type: none">• Sydney Water is developing plans to deliver a recycled water system in Camellia. This requires further consultation to get a commitment and timeframe for delivery from Sydney Water.	<ul style="list-style-type: none">• Develop planning controls which mandate dual plumbing in all new buildings to enable connection to a recycled water scheme.• Collaborate with Sydney Water to develop plans for the delivery of recycled water to the precinct.
Cool Camellia	<ul style="list-style-type: none">• Cool materials and building design, including heat-reflective materials and façade shading.• Rooftop placement of HVAC heat rejection to allow for the removal of waste heat by the wind.• Reduced reliance on cars for transport to reduce anthropogenic heat sources.• Vegetation in the private and public domain to provide shade and cooling through evapotranspiration.• Water sensitive urban design, irrigation and water features	<ul style="list-style-type: none">• Planning requirements for access to public open space.• Public domain plan to accommodate canopy cover targets recommended in the Landscape Implementation Report that draws on analysis and evidence from DPE.• Development controls or incentives to encourage vegetation, green roofs, green walls and materials with a high solar reflectance away from public domain in particular on western and northern building facades.	<ul style="list-style-type: none">• Street level impact (building façade and public domain) is critical for walkability and reducing pedestrian heat stress.• Provision of urban greening needs to be supported by development controls, public domain plan and ongoing operational maintenance and costs.• Recycled water provides unlimited recycled water to maintain high water demand public domain areas. In addition, high water use public domain can improve the business model for recycled water, enabling more water to be used onsite. The provision of recycled water and the potential management of the precinct's public domain could be included as a specifications within the RFI for recycled water.	<ul style="list-style-type: none">• Public domain plan to accommodate minimum canopy cover target.• Include public domain improvements and management as part of recycled water RFI.• Include tree planting and Cool Camellia initiatives in Infrastructure Delivery Plan / s94 Plan.• Implement planning controls that require sufficient space for deep soil. See examples in Draft Telopea Precinct Development Control Plan
Parking and Transport	<ul style="list-style-type: none">• Parking rates for Camellia in line with the Parramatta CBD Planning proposal;<ul style="list-style-type: none">Studio – 0.1 cars per dwelling1 bed – 0.3 cars per dwelling2 beds – 0.7 cars per dwelling3 or more beds – 1.0 cars per dwellingNil visitor• Parking rates further reduced through inclusion of car share• Provision for unbundled and decoupled parking• EV charging outlets in all parking areas• Integrate existing City of Parramatta active transport strategies into the public domain (Parramatta Ways Walking Strategy and LGA Bike Plan)	<ul style="list-style-type: none">• Development controls for<ul style="list-style-type: none">– Parking rates– Car share provisions– Floor to ceiling height requirements for above ground parking– Provision and encouragement of unbundled and decoupled parking– Electric Vehicles• City of Parramatta active transport strategies – Parramatta Ways Walking Strategy and LGA Bike Plan to be integrated into public domain plan.	<ul style="list-style-type: none">• Recent trends in car ownership and the delivery of the Parramatta Light Rail requires Camellia to respond with a new approach to parking and mobility.• Decoupled parking or parking managed at a precinct scale would ensure the most efficient use of parking and future proof parking for other uses.• Increasing floor to ceiling heights of above ground parking would increase construction costs. However, this is expected to be offset by reduced parking and/or the ability to decoupled parking.• Council could also play a role in the ownership and delivery of decoupled parking to further improve the feasibility of development.	<ul style="list-style-type: none">• Prepare development controls which set revised parking rates for Camellia in line with the Parramatta CBD Planning proposal;<ul style="list-style-type: none">Studio – 0.1 cars per dwelling1 bed – 0.3 cars per dwelling2 beds – 0.7 cars per dwelling3 or more beds – 1.0 cars per dwellingNil visitor• Prepare development controls for car share as follows; 1 space per 20 dwellings without parking and 1 space per 100 dwellings with parking.• Prepare development controls which future proofing buildings including installation of electrical circuits, minimum charging points and signage for electric vehicles• Enable planning controls which allow for the provision of unbundled and decoupled parking solutions.



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				<ul style="list-style-type: none">City of Parramatta Walking and Cycling strategies (Parramatta Ways Walking Strategy and LGA Bike Plan) to be integrated into public domain plan.
Zero Waste Precinct	<ul style="list-style-type: none">Consult with Earth Power to process organics waste from the Camellia Precinct.Alternatively, install 25 organics waste processing units in the industrial core to manage organics waste onsite and produce agricultural feedstock,	<ul style="list-style-type: none">Develop an agreement with Earth Power to manage organics wasteDevelop an agreement with Goterra to process organics waste on-site using modular organics waste processing units.Parramatta Council to implement a food and garden organics collection service within the future precinct. A separate waste service to landfill, recycling, green waste, etc.	<ul style="list-style-type: none">Separate organics waste collection must be implemented and supply Earth Power facility.Alternatively, outsource fully integrated waste collection to processing service to Goterra or similar organisation.	<ul style="list-style-type: none">Council to trial food and garden organics collection service in similar sized precincts to assess risks and success. For example, rates of contamination in the food and garden organics waste must be assessed and mitigated. Learnings to be applied to Camellia Precinct.Prepare a Request for Information from Goterra and other related providers for the delivery of modular organics waste processing from the precinct

Table 2: Summary of strategies, implementation mechanisms, considerations and next steps for each strategy proposed for Camellia