SUSTAINABLE PRECINCT STRATEGY

Homebush North, Burwood-Concord and Kings Bay Precincts

20 July 2020
Prepared by Kinesis for
Canada Bay Council

KINESIS

Contents.

Executive Summary.

Delivering Canada Bay's High Performance, Zero Carbon Precincts.

The Sustainable Precincts Strategy provides analysis, a suite of strategies and mechanisms to enable Canada Bay Council to deliver on its aspiration to achieve high environmental performance that moves the community towards zero emissions by 2050.

Homebush North, Burwood-Concord and Kings Bay precincts, initially identified through the Parramatta Road Corridor Urban Transformation Strategy provide a significant opportunity to deliver cost effective and high performance, zero carbon outcomes through key interventions across:

1. **High performance, future proofed buildings**

2. **Resilient infrastructure**

3. **Cool, green precincts**

These strategies are proposed through LEP and DCP controls for the precincts as well as coordination with state government and utility providers.

The combination of these strategies is expected to deliver a zero-carbon outcome by 2050, alongside creating a low water and green, cooler community.

Based on our analysis it is expected that these requirements could be delivered for a capital cost of approximately $6,500 to $9,000 per dwelling for building level interventions, saving households over $1,000 per year in energy, water and transport costs.

Precincts Overview.

Kinesis and Canada Bay Council are leveraging the opportunity presented by the Parramatta Road Corridor Urban Transformation Strategy to deliver a clear sustainability strategy for the Homebush North, Burwood-Concord and Kings Bay precincts.

The vision for the three precincts is described below:

1. **Homebush North**: Sitting between Sydney's two main CBDs, Homebush can be transformed into an active and varied hub, blending higher density housing and a mix of different uses, supported by a network of green links and open spaces with walking access to a train station.

2. **Burwood-Concord:** Burwood-Concord Precinct will be a commercial gateway to Burwood town centre based around the enlivened spine of Burwood Road building upon existing amenity for new residents.

3. **Kings Bay:** Kings Bay will be a new residential and mixed-use urban village on Parramatta Road, with an active main street and strong links to the open space network along Sydney harbour.

Council has a unique opportunity to implement best practice sustainability measures and deliver on its vision for three precincts.

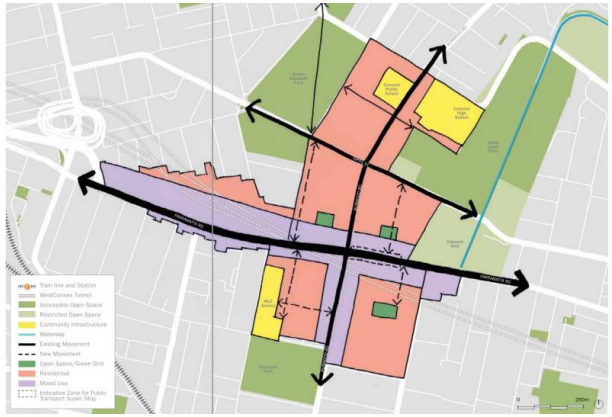
The proposed land use yield in these precincts is shown in Table 1 and the spatial context of each of the three precincts is shown in the figures to the right.

	Kings Bay	Homebush North	Burwood-Concord
Apartments	3,351 dwellings	4,867 dwellings	4,581 dwellings
1 bed	1,005 dwellings	1,374 dwellings	1,460 dwellings
2 bed	2,011 dwellings	2,749 dwellings	2,920 dwellings
3 bed	335 dwellings	458 dwellings	487 dwellings
Car parks	3,049 spaces	4,169 spaces	4,429 spaces
Population	7,372 people	10,707 people	10,078 people
Employment	824 jobs	1,841 jobs	3,877 jobs

Table 1: Land use yield of the three precincts

KINGS BAY

HOMEBUSH NORTH



BURWOOD-CONCORD

Figure 1: Spatial context of the three precincts

Context.

In 2016, the NSW Government released The Parramatta Road Corridor Urban Transformation Strategy (PRUCTS), a long-term vision for developing population and employment growth in the Parramatta Road Corridor. The Homebush North, Burwood-Concord and Kings Bay Precincts analysed in this report are identified for release between 2016 and 2023.

PRCUTS Sustainability Implementation Plan

The PRCUTS is supported by the Implementation Tool Kit – four documents that guide and inform how the Strategy is to be implemented by Council. The PRCUTS Sustainability Implementation Plan outlines key sustainability requirements for the delivery of precincts along the corridor, covering buildings, infrastructure and public domain. The key sustainability requirements outlined in PRCUTS are documented below:

High performance buildings

Residential standards:

- BASIX Water 50 for all dwellings (and up to 60 where recycled water is available)
- BASIX Energy 40 for buildings of 6 storeys or greater
- BASIX Energy 50 for buildings of 4 to 5 storeys
- BASIX Energy 55 for buildings of 3 to 4 storeys
- BASIX Energy 60 for single dwellings.

Commercial building standards (>10,000 GFA):

- NABERS Energy 5-star (whole building)
- NABERS Water 4-star (whole building)
- NABERS Water 5-star where recycled water is available (whole building)

Shopping Centre Development:

- NABERS Energy 5-star (base building)
- NABERS Water 4-star (base building)
- NABERS Water 5-star where recycled water is available (base building)

Strategic Parking Strategies

1. Minimise parking
2. Adopt flexible parking ratios
3. Unbundle parking from dwelling and building ownership
4. Adopt and enable car share
5. Share parking
6. Decouple parking

The overall intent of these parking strategies is to:

- Reduce car dependence, car ownership and household costs
- Improved air quality and reduced greenhouse gas emissions
- Reduce construction costs and improved development feasibility
- Increase housing choice
- Improve the business case for private investment in car share
- Reduce common area energy demands from underground parking lighting and ventilation, delivering lower electricity costs and strata fees

Urban Resilience and Sustainable Infrastructure

Addressing urban heat island through water sensitive design:

- Maximise canopy cover - targeting canopy over at least 60% of all pedestrian spaces
- Maximise the use of vegetation on buildings – including green roofs, walls and materials with high solar reflexivity, targeting at least 50% of the surfaces on all buildings (with a focus on western and northern facades)
- Support water sensitive urban design (WSUD) treatments

Support urban greening with recycled water:

Where the scale and staging of development allows, recycled water should be pursued at the Precinct scale. Where recycled water infrastructure is expected, dual reticulation to enable recycled water for both internal and external uses should be required at building construction.

District and Future Energy Opportunities:

Urban resilience and sustainable infrastructure should also consider emerging energy technologies. New development is designed to accommodate future energy infrastructure and emerging technologies such as battery storage.

Additional Context

Since the development and delivery of the PRUTS, several strategies and policies have been developed which should be taken into consideration in the application and implementation of the PRUTS sustainability strategies across the Homebush North, Burwood-Concord and Kings Bay Precincts. The following key strategies have been reviewed for consideration in the development of sustainability solutions for the three precincts:

- Canada Bay Emissions Reduction Action Plan (Draft)
- Sydney Region Plan
- Eastern City District Plans
- NSW Net Zero Emissions
- AEMO projections

Canada Bay Emission Reduction Action Plan

On March 17 2020, Canada Bay Council endorsed its latest Emission Reduction Action Plan that establishes emission reduction targets for Council assets and the Community.

This plan is developed to align with the UN Sustainable Development Goals, Paris Agreement and the IPCC 1.5 degree Special Report, and establishes the following targets for Canada Bay:

- Net zero emissions by 2030 for Council operations
- Net zero emissions by 2050 for the broader community

The community action plan identifies the following key priority areas that should be considered for the Homebush North, Burwood-Concord and Kings Bay Precincts:

- Grid decarbonisation (see AEMO Integrated System Plan below)
- Generating local renewable energy
- Incorporating energy efficiency
- Designing for sustainable transport
- Waste management

In addition, the precincts should aim to deliver and /or contribute to Council's goal to achieve net zero emissions by 2050.

Canada Bay Urban Tree Canopy Strategy

The Urban Tree Canopy Strategy identifies future planting priorities across Canada Bay. Based on this assessment. Homebush North and Burwood-Concord are located in the highest priority areas for increased canopy cover and include adjacent streets with lowest amount of canopy. In addition, all precincts identify key green grid priority links.

The strategy identifies the following targets and actions for the LGA:

- 25% canopy cover by 2040
- Ensure that Master Plans and Precinct Plans include provisions for achieving 25% canopy cover.
- Develop a tree offset policy that requires an increased replanting ratio for trees removed on private land at a ratio of 4:1 (i.e. 4 trees replanted for every tree removed).

The Greater Sydney Region Plan & Eastern District Plan

The Greater Sydney Region Plan, *A Metropolis of Three Cities*, is a legislative document which sets a 40-year vision (to 2056) and establishes a 20-year plan to manage growth and change for Greater Sydney in the context of social, economic and environmental matters.

The Greater Sydney Region Plan includes two key objectives which require the need for new buildings to deliver more efficient resources and emissions and seek to support the delivery of the state's net-zero emissions by 2050 objective:

- Objective 33: A low-carbon city contributes to net-zero emissions and mitigates climate change
- Objective 34: Energy and water flows are captured, used and re-used

Specifically, these Objectives include the action to support initiatives that contribute to the aspirational objective of achieving net-zero emissions by 2050 especially through the

establishment of low-carbon precincts in Planned Precincts, Growth Areas and Collaboration Areas.

In giving effect to The Greater Sydney Region Plan, the Eastern City District Plan includes Planning Priorities E18, E19 and E20 which include several key actions that require state government and Council to work together to delivery more efficient, low carbon and low water development across Sydney, specifically:

- Action 65 - Expand urban tree canopy in the public realm.
- Action 68 - Support initiatives that contribute to the aspirational objective of achieving net-zero emissions by 2050, especially through the establishment of low-carbon precincts in Planned Precincts, Collaboration Areas, State Significant Precincts and Urban Transformation projects.
- Action 69 - Support precinct-based initiatives to increase renewable energy generation, and energy and water efficiency, especially in Planned Precincts, Collaboration Areas, State Significant Precincts and Urban Transformation Projects.
- Action 70 - Protect existing and identify new locations for waste recycling and management.
- Action 71 - Support innovative solutions to reduce the volume of waste and reduce waste transport requirements.
- Action 72 - Encourage the preparation of low-carbon, high efficiency strategies to reduce emissions, optimise the use of water, reduce waste and optimise car parking provision where an increase in total floor area greater than 100,000 square metres is proposed in any contiguous area of 10 or more hectares.
- Action 76 - Mitigate the urban heat island effect and reduce vulnerability to extreme heat.

Considerations for Homebush North, Burwood-Concord and Kings Bay Precincts:

- *Identify opportunities for the precincts to be a low-carbon, high performance precinct, delivering net-zero emissions by 2050.*
- *Identify opportunities for energy and water to be captured, used and reused locally.*
- *Identify opportunities for local innovative waste solutions.*
- *Optimise parking to improve place outcomes, affordability and transport emissions.*
- *Identify opportunities to mitigate urban heat, specifically through urban greening and canopy.*

NSW Net Zero by 2050

The *NSW Climate Change Policy Framework* sets out the aspirational long-term objective for NSW to achieve net-zero emissions by 2050. This objective is support by Net Zero Plan Stage 1: 2020–2030 which sets out how the NSW Government will deliver on significant emission reductions over the next decade.

Specifically, for the Homebush North, Burwood-Concord and Kings Bay Precincts, Net Zero Stage 1 outlines a commitment by the state government to:

- Improve the National Construction Code (NCC) and Building Sustainability Index (BASIX) to provide a pathway to deliver cost-effective, low emissions outcomes for residential, commercial and public buildings.
- Support the uptake of renewable energy, energy efficiency and demand/peak shifting technologies
- Support amendments to National Construction Code (NCC) and Building Sustainability Index (BASIX) to ensure new buildings are EV ready
- Manage organic waste through composting and food/garden waste management infrastructure.
- Lead a strategy to achieve net zero embodied carbon in building materials

Considerations for Homebush North, Burwood-Concord and Kings Bay Precincts:

- *Increase BASIX targets and other standards to improve building performance and increase renewable energy, and reduce peak demand.*
- *Identify opportunities for future-proof technologies such as EV and battery infrastructure.*
- *Identify opportunities for organic waste management.*

AEMO Integrated System Plan

The Australian Energy Market Operator's (AEMO) Integrated System Plan (ISP) outlines five scenarios to describe expected changes to the electricity grid in the future.

All five scenarios decarbonise the grid at different rates through the closure of coal power stations and their substitution with large scale and distributed renewable energy generation. Figure 1 shows the projected emissions factor of electricity (kg CO2-e per kWh) under the five scenarios investigated in the ISP.

All scenarios project a rapid decarbonisation by 2036, reducing the emissions intensity of the electricity supply from approximately 0.8 kg CO2-e/kWh to 0.1 kg CO2e/kWh.

Considerations for Homebush North, Burwood-Concord and Kings Bay Precincts:

- *The pathway to net zero emissions should consider understanding what can be delivered within the precinct and understand the changes that are occurring to the emissions intensity of electricity across the network. This has implications for the use of gas and planning for electric vehicles.*

Sydney Metro

The NSW Government recently announced the location of proposed Metro Stations for the Metro West project, including 3 within the Canada Bay LGA.

Burwood North Metro Station, is located within the PRCUTS Precinct area and another two Metro Stations are within close proximity to Kings Bay and Homebush North precincts

Considerations for Homebush North, Burwood-Concord and Kings Bay Precincts:

- *Analysis and strategies should assume high accessibility to rapid rail infrastructure, which will be reflected in a reduction in resident car use and the need for parking.*

AEMO PROJECTIONS FOR DECARBONING THE GRID

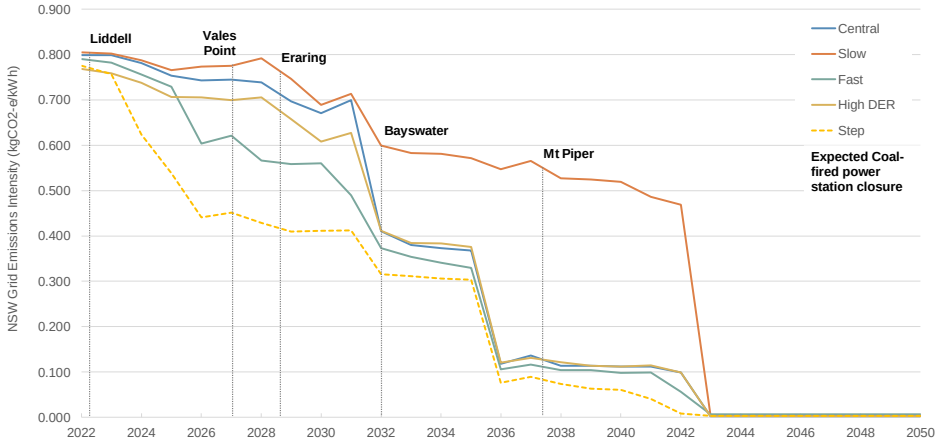


Figure 2: Electricity emissions factor changes over time. Source: Kinesis analysis of AEMO ISP 2020 (draft)

Key Criteria & Targets for the Precincts.

Based on the above review, the following performance targets and best practice criteria were considered for the sustainability strategies for the Homebush North, Burwood-Concord and Kings Bay Precincts.

While several of these targets and criteria are established for the metropolitan or local government area as a whole, Kinesis has investigated the application and veracity for implementation through the Homebush North, Burwood-Concord and Kings Bay Precincts.

Precinct:

- The delivery of the Homebush North, Burwood-Concord and Kings Bay Precincts as a Low Carbon, High Performance Precincts (Region and District Plans).
- Net zero emissions by 2050 (Canada Bay Council).
- Consideration of short, mid and long-term changes to the electricity grid (AEMO).

Buildings:

- BASIX requirements that meet, at a minimum, the following performance standards identified in PRCUTS:

  BASIX Water 50 for all dwellings (and up to 60 where recycled water is available)
  BASIX Energy 40 for buildings of 6 storeys or greater
  BASIX Energy 50 for buildings of 4 to 5 storeys
  BASIX Energy 55 for buildings of 3 to 4 storeys

- Non-residential building requirements were not a focus due to the low amount of non-residential floor space proposed for the Homebush North, Burwood-Concord and Kings Bay Precincts. For any major commercial or shopping centre development (>10,000 m2) the PRUCTS targets are applicable.

- Future proof buildings for emerging technologies such as EVs and battery storage (NSW Government).

Infrastructure:

- Recycled water and/or water reuse (PRCUTS)
- Waste management solutions, including organics (Canada Bay).
- Innovative parking solutions (PRCUTS) with consideration of Sydney Metro stations.

Public Domain:

- 25% canopy cover target (Canada Bay)
- Green/cool roofs and walls, with a focus on northern and western facades
- Tree offset for trees removed on private land at a ratio of 4:1
- Increased greening linked to a resilient water supply

These strategies and targets have been modelled for their application across the Homebush North, Burwood-Concord and Kings Bay Precincts. The results of this analysis is outlined in the following section.

A Pathway to Sustainable Precinct Delivery.

This study aims to give Council a clear pathway to achieve high sustainable performance in the three precincts. To develop this pathway, we analysed the performance of the three precincts under three scenarios:

1. **Business-as-usual (BAU)**: A reference case scenario simulating current BASIX compliance standards

2. **PRCUTS Target**: The Parramatta Road Urban Corridor Transformation Strategy prescribes a set of BASIX targets higher than just compliance.

3. **Stretch**: Going beyond the PRUCTS targets to achieve sustainability best practice. This is modelled as an all-electric scenario given that the emissions intensity of gas will be higher than electricity beyond 2036.

The detailed interventions applied under the three scenarios is described in Table 2. Kinesis and Council engaged in a series of workshops to understand the key opportunity areas and constraints for each of the three precincts and prioritise a set of strategies and interventions that can be applied for the three precincts.

Each strategy proposed in this report was tested for its applicability on the built form proposed for each precinct. The Roberts Day PRCUTS Built Form Testing & Outcomes reports were used as a basis for understanding this built form[1]. Given the varied nature of development and expected variability in building design and precinct development, strategies focused on building by building solutions that could reasonably be delivered in all building types. This is particularly important for strategies such as the amount of available roof space for solar PV. Recycled water, however, was one strategy that was included that requires a precinct-level solution. This is discussed further on page 22 of this report.

In addition, strategies considered Council's sphere of influence and alignment to broader local, state and federal sustainability priorities as identified in the Context section.

GAS VS ELECTRICITY EMISSIONS INTENSITY IN THE FUTURE

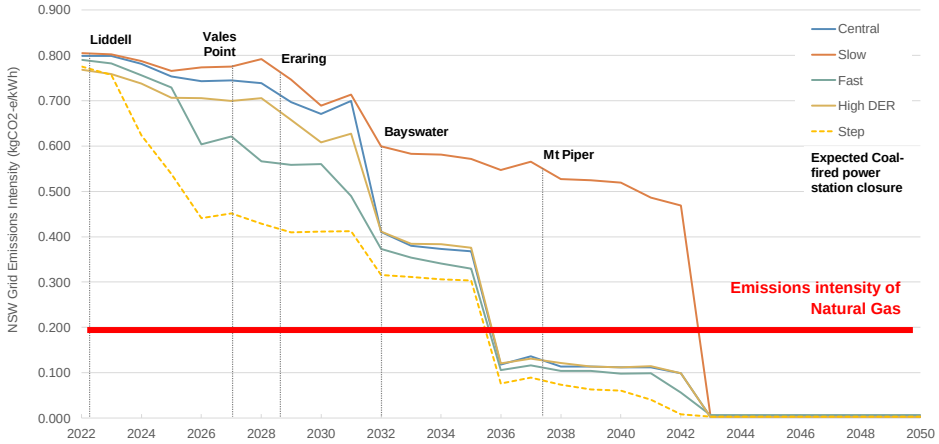


Figure 3: Electricity emissions factor becomes equal to gas emissions factor around 2036.
Source: Kinesis analysis of AEMO ISP 2020 (draft), NGER Emission Factors

[1] Roberts Day PRCUTS Controls Built Form Testing & Outcomes

INTERVENTIONS APPLIED UNDER DIFFERENT SCENARIOS

Assumptions used in scenario modelling	Base Case	PRCUTS Target	Stretch
Thermal Efficiency (NatHERS)	6 * NatHERS	7 * NatHERS	7 * NatHERS
Space conditioning	2.5 * RCAC	5 * RCAC	5 * RCAC
Hot Water	Gas Instantaneous	Gas Instantaneous	Electric Heat Pump
Lighting	Standard (Halogen/ CFL)	Efficient LED	Efficient LED
Cooking	Gas cooktops, Electric oven	Gas cooktops, Electric oven	Electric cooktop, Electric oven
Appliances	No appliances installed	5* Energy & Water Fridge, Washing Machine, Dishwasher and Heat pump clothes dryer	5* Energy & Water Fridge, Washing Machine, Dishwasher and Heat pump clothes dryer
Water Fixtures	Best Practice (4- 5 star WELS taps, shower heads and toilets)	Best Practice (4- 5 star WELS taps, shower heads and toilets)	Best Practice (4- 5 star WELS taps, shower heads and toilets)
Irrigation Efficiency	Low water use species	Low water use species	Additional greening delivered through recycled water
Solar PV	None	None	0.5 kW per dwelling
Water Reuse	None	None	Recycled Water for irrigation, toilet, laundry
Parking*	0.9 cars per dwelling	0.9 cars per dwelling	Zero Parking
EV Charging	None	Not included	Each space
BASIX Outcomes			
BASIX Energy	**25**	**40**	**50**
BASIX Water	**40**	**50**	**60**

Table 2: Interventions applied under each scenario

*Note: Parking under the Base Case and PRCUTS Targets scenarios represent the weighted average parking rate obtained from the PRCUTS Planning and Design Guidelines

Precinct Performance.

The performance of the precincts under the three scenarios were analysed against the following sustainability indicators:

- Stationary or Building emissions
- Transport emissions
- Water consumption

Stationary or Building emissions

The stationary emissions for the three precincts under the three scenarios is shown in Figure 4. The red lines represent the performance of the precincts if the dwellings performed similar to an average dwelling across Metro Sydney.

Under the PRCUTS Target scenario, all three precincts achieve the prescribed emissions targets outlined in the Parramatta Road Urban Transformation Sustainability Implementation Plan.

The Stretch scenario results show that the precincts can exceed the targets developed in the Parramatta Road Urban Transformation Strategy. It should be noted that the Stretch Scenario incorporates interventions that are currently available in the market and implemented in dwellings.

When the expected change in the electricity grid are factored in, the cleaner electricity use will drive the precincts to achieve net zero emissions beyond 2043. However, a temporal view must be held when thinking about emissions reduction. That is, emissions reduction achieved earlier rather than later will have a significant impact on global warming and climate change. The Intergovernmental Panel on Climate Change released a special report for policy makers which suggests the use of a “carbon budget” or a quota of carbon emissions for the world which can be trickled down to local governments[2].. Council led action to limit emissions early rather than waiting for changes to the grid will help Canada Bay meet its carbon budget

STATIONARY EMISSIONS

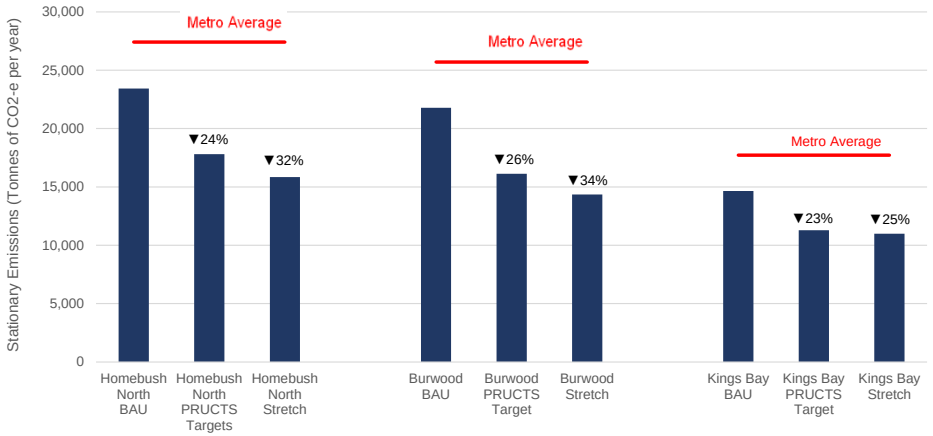


Figure 4: Stationary emissions performance under the three scenarios in each precinct

[2] IPCC Special Report on 1.5 Degrees, https://www.ipcc.ch/sr15/

Transport Emissions

The three precincts are strategically located close to major public transport nodes including existing train lines and proposed future metro stations. The proximity of these precincts to public transport nodes can be leveraged to limit car use and resulting transport emissions.

A strategic way Council can affect car use is through the design and delivery of parking in these precincts. Our view is that parking should reflect car ownership and accessibility patterns of the future. Kinesis has modelled the expected car ownership rates in these future precincts and they align well with the recommended parking rate under the PRCUTS planning and design guidelines.

The transport emissions of the three precincts under the three scenarios is shown in Figure 5. The red lines represent the performance of the precincts if the dwellings performed similar to an average dwelling across Metro Sydney.

The Business-as-usual and the PRCUTS Target scenario both assume the parking rate proposed under the PRCUTS planning and design guidelines.

Under the stretch scenario, we have assumed zero parking in the developments – this is expected to be the best-case performance scenario and is discussed further in the next section of this report. It is also important to consider changing trends and shifts in mobility which may further reduce the need for car parking across these precincts (see Box 1)

The Stretch scenario also assumes a 30% EV take up (reflective of expected take up around 2036 as per the Australian Electric Vehicle Market Study published by Energia).

Limited car use and switching to electric vehicles drive a significant reduction in travel emissions under the Stretch scenario. Travel emissions decrease by over 95% relative to the BAU and PRCUTS Target scenarios.

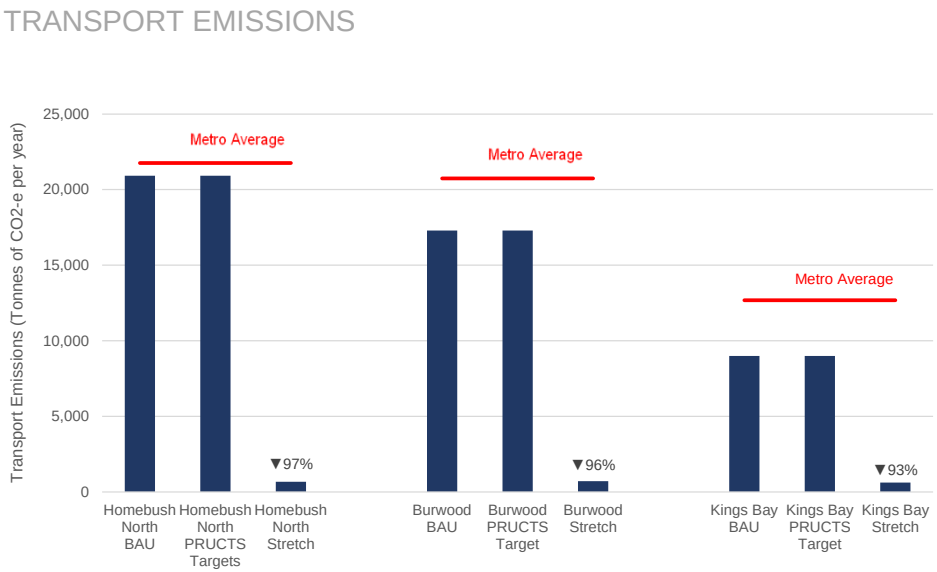


Figure 5: Transport emissions performance under the three scenarios in each precinct

Box 1 - Changes in trends in mobility

For the first time in Australia's history, young adults are less likely to have a car licence than their parents. Globally studies and data are showing a steady decline in young people's desire to get a driver's licence and own a car. Recent analysis of licence data across Metropolitan Sydney highlights:

- A general and consistent reduction in all licence types for those aged 20 to 39.
- The highest reductions in those aged 20 to 29.
- Nearly 1 in 4 people aged 20 to 34 do not have a licence.

Recently, this has been further exacerbated by COVID-19. The way we move has changed under the pandemic. In a post pandemic world, this change may last. In a future where an increasing number of people work from home, there is a reduced need for a car. This is further complemented with the growth in Mobility as a Service (MaaS) option including car share and ride share services.

Water Consumption

The water consumption of the three precincts under the three scenarios is shown in Figure 6. The red lines represent the performance of the precincts if the dwellings performed similar to an average dwelling across Metro Sydney.

Under the PRCUTS Target scenario, all three precincts achieve the prescribed emissions targets outlined in the Parramatta Road Urban Transformation Sustainability Implementation Plan.

The Stretch scenario results show that the precincts can exceed the targets developed in the Parramatta Road Urban Transformation Strategy. It should be noted that the Stretch Scenario incorporates interventions that are currently available in the market and implemented in dwellings.

The Stretch scenario assumes the delivery of recycled water infrastructure in the precincts. Given the fragmented land ownership and incremental build out of the precincts, delivering this infrastructure may be challenging, However, there are examples of this successfully delivered in other high density precincts in Sydney including Green Square, Central Park, Shepherds Bay, etc. These implementation mechanisms are discussed further in the following sections.

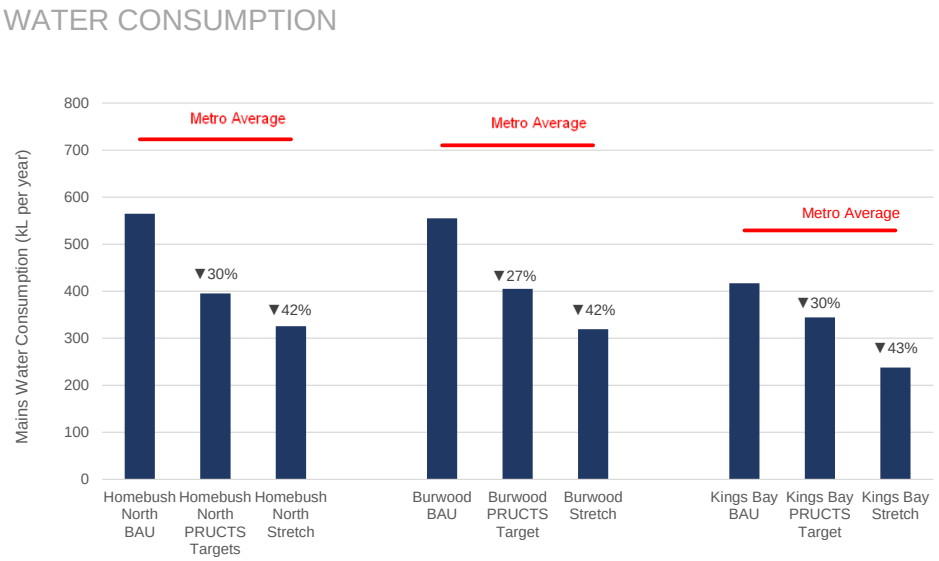


Figure 6: Water consumption performance under the three scenarios in each precinct

Costs and Benefits of each Scenario

The improved performance outcomes delivered by the Stretch Scenario will require additional marginal capital costs for developers, as well as deliver increased utility savings to households. The tables below outline the marginal capital costs for each additional strategy outlined in this report, as well as the additional cost savings to residents. Overall:

- **The PRCUTS Target scenario** is expected to cost an additional $8,000 per dwelling, with a household saving of over $200 per year.
- **The Stretch scenario** is expected to cost an additional $12,000 per dwelling, with a household saving of over $500 per year.

COST BENEFIT ANALYSIS OF PRUCTS SCENARIO

Assumptions used in scenario modelling	Base Case	PRCUTS Target	Marginal Capital Cost ($ per dwelling per year)	Operational benefit ($ per dwelling per year)
Thermal Efficiency (NatHERS)	6 * NatHERS	7 * NatHERS	$420	$29
Space conditioning	2.5 * RCAC	5 * RCAC	$400	$16
Hot Water	Gas Instantaneous	Gas Instantaneous	-	-
Lighting	Standard (Halogen/ CFL)	Efficient LED	$630	$36
Cooking	Gas cooktops, Electric oven	Gas cooktops, Electric oven	-	-
Appliances	No appliances installed	5* Energy & Water Fridge, Washing Machine, Dishwasher & Heat pump clothes dryer	$2,094	$153
Water Fixtures	Best Practice (4- 5 star WELS taps, shower heads & toilets)	Best Practice (4- 5 star WELS taps, shower heads & toilets)	-	-
Solar PV	None	None	-	-
Water Reuse	None	None	-	-
Parking*	0.9 cars per dwelling	0.9 cars per dwelling	-	-
EV charging	None	Not included	-	-
Total cost/ savings			**$3,544**	**$234**
BASIX Energy	**25**	**40**		
BASIX Water	**40**	**50**		

Table 3: Interventions applied under each scenario

*Note: Parking under the Base Case and PRCUTS Targets scenarios represent the weighted average parking rate obtained from the PRCUTS Planning and Design Guidelines

COST BENEFIT ANALYSIS OF STRETCH SCENARIO

Assumptions used in scenario modelling	Base Case	Stretch Scenario	Marginal Capital Cost ($ per dwelling per year)	Operational benefit ($ per dwelling per year)
Thermal Efficiency (NatHERS)	6 * NatHERS	7 * NatHERS	$420	$30
Space conditioning	2.5 * RCAC	5 * RCAC	$400	$16
Hot Water	Gas Instantaneous	Electric Heat Pump	$2,700	$180
Lighting	Standard (Halogen/ CFL)	Efficient LED	$630	$36
Cooking	Gas cooktops, Electric oven	Electric cooktop, Electric oven	-	-
Appliances	No appliances installed	5* Energy & Water Fridge, Washing Machine, Dishwasher and Heat pump clothes dryer	$2,094	$154
Water Fixtures	Best Practice (4- 5 star WELS taps, shower heads & toilets)	As per Base Case	-	-
Solar PV	None	0.5 kW per dwelling	-	-
Water Reuse	None	Recycled Water connection	$1,000	$55
Parking*	0.9 cars per dwelling	Zero Parking	-	-
Total cost/ savings			**$7,240**	**$470**
BASIX Energy	**25**	**50**		
BASIX Water	**40**	**60**		

Table 4: Interventions applied under each scenario

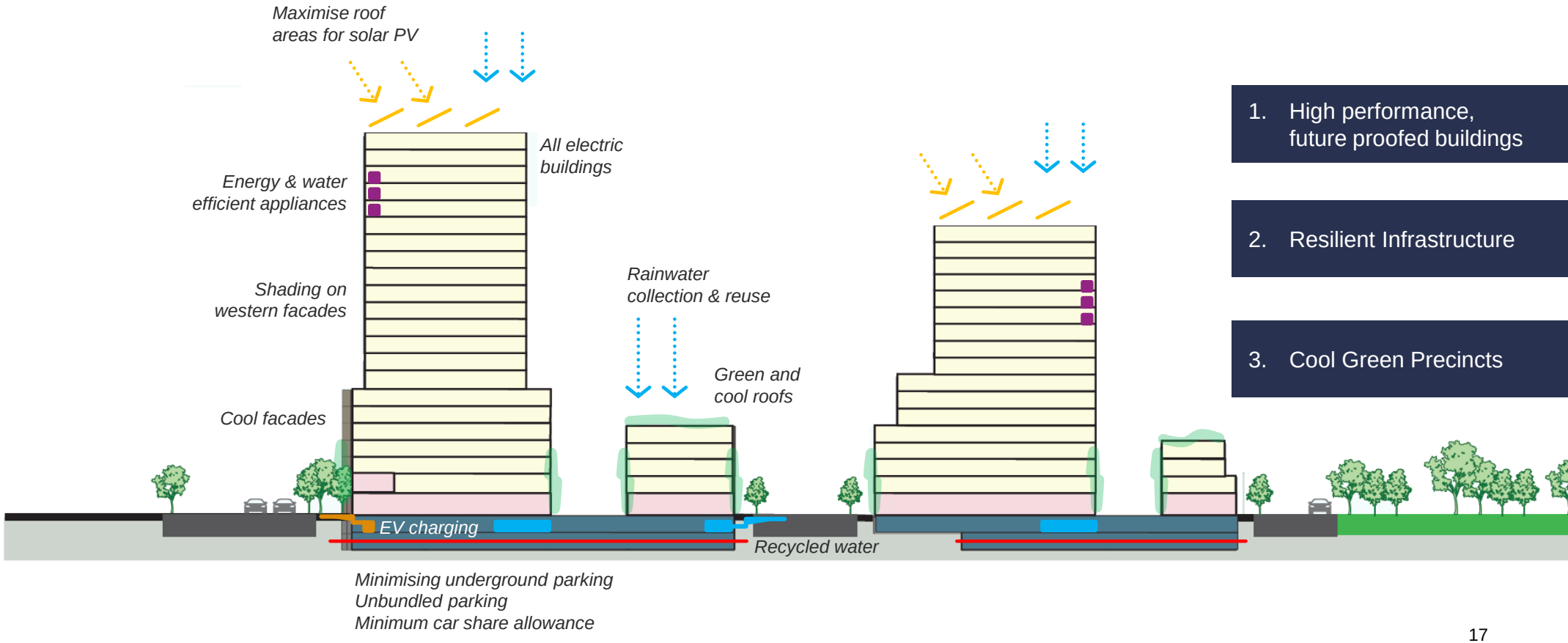
*Note: Parking under the Base Case and PRCUTS Targets scenarios represent the weighted average parking rate obtained from the PRCUTS Planning and Design Guidelines

A Pathway to Zero Carbon, High Performance Precincts.

The previous section outlines how the Homebush North, Burwood-Concord and Kings Bay Precincts can achieve a zero-carbon outcome by 2050, alongside creating a low water outcome. This section documents the key implementation requirements to achieve these outcomes across:

1. **High performance, future proofed buildings**
2. **Resilient infrastructure**
3. **Cool, green precincts**

This section also discusses the broader environmental, social and economic benefits of these strategies, optimised for the precincts. Importantly, the strategies focus on Council-led mechanisms to inform amendments to the Canada Bay LEP and DCP for each precinct.



1. High Performance, Future Proofed Buildings.

This strategy focuses improving the performance of new buildings and future proofing these buildings to enable residents the opportunity to make use of new technologies.

Increase BASIX targets

Delivered initially in 2004, the NSW Building Sustainability Index (BASIX) establishes energy (greenhouse gas emission) and water performance requirements for all new residential development across NSW. Implementing higher environmental performance for new residential development will require an increase to BASIX targets.

For all precincts, BASIX Energy and Water targets should be increased as follows:

- 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)

This increase is expected to require the inclusion of energy and water efficiency as well as renewable energy and water reuse. Increase BASIX targets as outlined above is expected to:

- **Cost an additional $5,000 to $7,500 per dwelling**
- **Save residents up to $500 per year in household utility bills.**

These targets should be implemented by DPIE through the BASIX SEPP and online tool. BASIX has been designed to enable place-based variation in targets, with variation already included in BASIX to address local climate zones and different dwelling typologies. It should be noted that these targets are higher than what was originally proposed in PRCUTS Sustainability Implementation Plan, and reflect current best practice, cost-effective solutions for residential buildings.

It is understood from DPIE that the next update of BASIX is expected to be delivered in 2022. However, the potential increase in performance due to this update is uncertain.

The findings in this report will enable Canada Bay Council to engage with other Councils currently engaged in similar investigations, and DPIE to lift BASIX targets for the proposed precincts and other renewable precincts within the LGA boundary.

Should Council wish to pursue higher BASIX without changes to the BASIX SEPP and online tool, alternative options would require Council to incentivise or voluntarily require developers meeting the higher performance outcomes. Several Councils have pursued this approach through Voluntary Planning Agreements or Floor Space Bonuses. It is not recommended that these options are pursued by Canada Bay Council as these options would require an additional burden on Council or additional floor space or height offered to developers.

Analysis in this report outlines one pathway for compliance with the higher BASIX targets. Alternative pathways are available to deliver the outcomes recommended above.

Example Clauses:

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.

Future proofing buildings

BASIX as established to address stationary energy emissions and water consumption. Additional solutions can embed technology that tackle transport related emissions and future proof dwellings for emerging technology.

Where 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. The benefits of electric vehicles are substantial both in terms of carbon reductions (shifting from petrol consumption to electricity consumption) and household cost savings. Including charge points in parking spots is expected to:

- **Cost approximately $500 per space**
- **Save residents who switch to an EV approx. $1,100 in household fuel costs.**
- **Save resident transport emissions by over 40%**

In addition, considering the Australian Energy Market Operator's (AEMO) Integrated System Plan (ISP) projections for the decarbonisation of the electricity grid, switching to EVs would enable transport related emissions to further decarbonise over time from approximately 0.8 kg CO2-e/kWh to 0.1 kg CO2e/kWh.

An additional future proofing strategy includes the delivery of recycled water through the precincts. This would require buildings to provide third pipe through the buildings for all non-potable uses, including irrigation, toilet, laundry and car washing. This is further discussed in **Resilient Infrastructure** below.

Example Clauses:

Inclusions of EV ready infrastructure is proposed in the precinct DCPs. An example clause is outlined below drawn from recent draft DCP provisions from various Councils:

Type of development	Type of charging facility	Minimum number of charging facilities
Residential	• Level 1 • Regular 240V wall socket (10amps). • No specialist installation required. • 16 – 20 hours to fully charge average vehicle.	1 per parking space
Multi dwelling housing, Residential flat building, Shop top housing	• Level 2 AC • Directly wired into a dedicated circuit (16amp – 40amp). • Level 2 provides between 18km to 110km of charge per hour. • Total charge time of between 4 – 12 hours depending on the vehicle.	1 per parking space
Commercial, Industrial	• Level 1 • Regular 240V wall socket (10amps). • No specialist installation required. • 16 – 20 hours to fully charge average vehicle.	1 per parking space
Commercial, Industrial	• Level 2 AC • Directly wired into a dedicated circuit (16amp – 40amp). • Level 2 provides between 18km to 110km of charge per hour. • Total charge time of between 4 – 12 hours depending on the vehicle.	1 shared facility per 500sqm of non-residential floor space

2. Resilient Infrastructure.

Resilient Infrastructure looked at the inclusion of best practice solutions to buildings that support resilient communities.

Recycled Water

The inclusion of recycled water requires a coordinated response between Council, a water utility and the development and delivery of the precincts. The benefits of recycled water were outlined in the PRCUTS and include:

- Resilient water supply
- Green and drought proof public and private spaces

Over many years we have seen the difficulty of actual implementation when it comes to recycled water schemes delivery, particularly for urban regeneration projects. There are however, a number of good examples to draw upon (Central Park, Green Square, Shepherds Bay, Sydney Olympic Park) particularly with respect to the impact those projects have had on environmental performance, landscape quality and resilience.

Recycled water is not a business as usual infrastructure and requires a minimum amount of development for a new recycled water system to be feasible.

Each of the Homebush North, Burwood-Concord and Kings Bay Precincts are of such a scale that it would appear both prudent and feasible to explore governance and implementation scenarios to provide both the service and infrastructure to match the potential and sustainability aspirations of the corridor. While all precincts provide this minimum yield, development will not be delivered by a single developer or land owner. Therefore, facilitation is required to enable recycled water across these precincts.

This report identifies a Council-led approach to facilitate recycled water by undertaking a market sounding for public and private sector recycled water providers with terms and incentives that could include:

- Council would mandate 3rd pipe installation (not connection) for all new residential and non-residential construction (in appropriate areas). Council could additionally incentivise third pipe connection through a rates incentive as part of encouraging resilience.
- Council would connect adjacent public domain and open space to recycled water as a major customer (similar to a power purchase agreement). Council would provide easements in footpaths/roads for infrastructure and coordinate infrastructure delivery with programmed capital works projects for improved public domain works (i.e. widened footpaths, cycle ways, increased canopy cover, WSUD works etc).
- Council could further require green roofs/facades for new development (see 3. Public Domain below) to be connected to recycled water. It is possible here that the recycled water provider and/or council may be part of the service and maintenance regime for these assets. This would be explored further in the market sounding process.

Exploration of the above would maximise the likelihood of getting a commercially viable multi utility network offering within the desired urban regeneration catchments. At the very least, this would give Council and prospective tenderers a clear framework to assess what level of in kind, policy and capital and/or recurrent support would be required (or not) to make the project feasible.

Enabling recycled water across the precincts is expected to:

- **Cost an additional $1,000 per dwelling in pipe and meters**
- **Enable unlimited water for irrigation**
- **This strategy is unlikely to save residents significant costs in utility bills due to the low cost of water.**

Example Clauses:

The inclusion of recycled water requires several levers as outlined above, including market sounding 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

Parking

The Region and Eastern District Plans discuss the potential for optimised parking in key precincts to deliver benefits across:

- Cost and time of construction as underground parking adds to project costs and significant time for excavation. An underground parking space can cost between $50,000 and $200,000 per space to build.

- Housing choice, enabling people to purchase a home with or without parking. An underground parking space can add up to $100,000 to the cost of a new apartment.

- Street design and pedestrian activity due to parking entrances to buildings which impacts on street activation.

- Building energy demands and associated strata fees from underground parking lighting and ventilation demands, impacting cost of living. An underground parking space can add up to $300 per year in energy costs to a resident.

To optimise parking for the Homebush North, Burwood-Concord and Kings Bay Precincts, the following parking design principles are proposed:

- All parking is unbundled from the sale of apartments.
- Minimise underground parking, with no minimum parking within 800m of metro and other rail stations, and no parking within 400m (consistent with East Rhodes DCP).
- Any above ground parking delivered through the project should be designed to be reconfigured to other uses, including commercial and residential floorspace.

To support these strategies at a building level, Council should identify key on-street parking spaces for car share adjacent or within the new precincts. It is recommended that new car share spaces are provided on-street (rather than in building) to ensure maximum use by the surrounding community.

These design principles are supported by the PRUCTS Strategy and further enabled through the delivery of new Metro stations through the LGA.

The delivery of these strategies are not expected to incur additional development costs and in fact should save in costs of construction and save residents in energy demands.

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 Rhodes East 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.

3. Public Domain.

Urban trees have a critical role in creating healthy cities. They provide shade and shelter, improve air quality, absorb carbon and rainfall, cool local environments, and support wildlife[3] (see Figure 7). The recently released draft Greener Places Design Guide sets out potential opportunities for increased greening and canopy cover in precinct development, including:

- Adopt revised LEP and DCP provisions for urban tree canopy
- Apply mechanisms and controls to improve tree canopy provision on private land
- Develop and adopt minimum tree replacement policies for new development in LEPs and DCPs

In addition, this guide establishes canopy cover targets for different precinct types, recommending a 25% canopy cover target for medium to high density residential, mixed use areas.

Canada Bay Urban Tree Canopy Strategy identifies Homebush North, Burwood-Concord and Kings Bay Precincts as priority areas for increased canopy cover. Green setbacks identified in PRUCTS will ensure adequate space for street tree planting and canopy along key roads within the precincts. In addition, it is recommended that a 25% canopy target is established for all precincts in line with the Greener Places Strategy for medium to high density areas.

The 25% canopy cover target will be required to be achieved at a precinct scale, with some sites delivering higher canopy cover and others that are more constrained. To enable this, a tree offsetting policy of a 4:1 ratio recommended by Council's Tree Canopy Strategy could help facilitate offsetting where sites are constrained.

In addition, to support the overall precinct target, landscape design guidelines could be prepared which consider:

- Minimum deep soil planning areas
- At least 75% of the site (in plan view) is a combination of green and cool surfaces (see Green Building Council Green Star Communities example to the right)
- Encourage green roofs and green walls at low levels (first 3-4 storeys) which impact pedestrian level heat.

[3] Draft Greener Places Deign Guide, NSW Government Architects (2020)

These recommendations are in line with the draft Greener Places Design Guide, Canada Bay Council's Urban Tree Canopy Strategy and are supported by the delivery of recycled water to deliver a drought-proof green urban environment.

BENEFITS OF URBAN GREENING

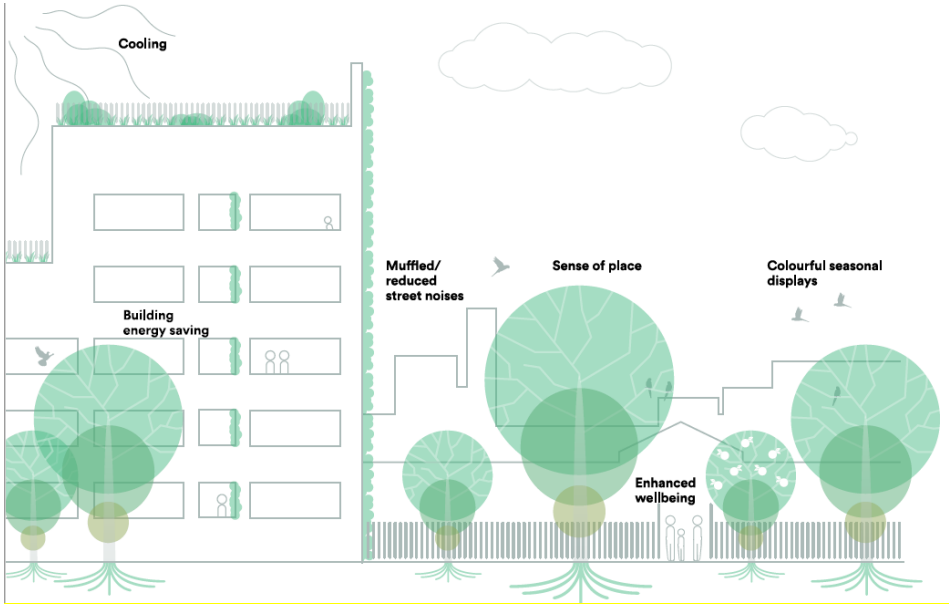


Figure 7: Benefits of urban greening

Example Clauses:

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.

Draft clauses for consideration are provided below:

- *Provide at least 25% canopy cover across the site, identified on the landscape plan and measured by the extent of canopy at maturity.*
- *Where surfaces on rooftops or podiums are used for community open space the development must demonstrate at least 50% of the accessible roof area is shaded by a structure or covered with vegetation, including tree canopy.*
- *Where surfaces on rooftops or podiums are not used for community open space, for example solar PV or heat rejection, the development must demonstrate at least 75% of the total roof area or podium is covered in vegetation, including tree canopy.*

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

Green Star Communities Credit on Heat Island Effect

This credit is to be applied across the whole project site. The credit requires an assessment in plan view, involving a calculation of the built environment and landscape treatment in the horizontal plane only. To meet the credit at least **75% of the site** comprises one, or a combination, of the following:

- Vegetation;
- Green roofs;
- Roofing materials, including shading structures that have minimum solar radiance

Precincts Playbook.

Based on the above analysis and recommended strategies, the following table summarises each mechanism and key next step for consideration by Council. Cost benefits included in this summary table are based on high-level costs and savings where available and that have a direct impact on the cost of dwellings and direct utility savings to residents.

Action	Detail	Potential Barriers and Solutions	Cost/Benefit per Dwelling
Increase BASIX targets	Increased BASIX targets for residential dwellings as follows: • 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)	• BASIX is currently regulated by the state government and managed by DPIE. Council will need to collaborate with DPIE to update BASIX targets for these as special precincts. • If delivered through incentives, see example clauses provided above.	Marginal capital cost - $3,500 to $7,500 Household saving - $200-500/year Payback – 15 years
EV ready buildings	Ensure provision of necessary EV charging infrastructure in the three precincts, including charging outlets in each parking space.	• No barriers identified • Amend DCP for each precinct to mandate EV charging outlets and infrastructure (see example clauses provided above).	Marginal capital cost - $500 Household saving – None currently but $1,100 in fuel if switch EV Payback – n/a
Recycled water infrastructure	Facilitate the delivery of recycled water in all three precincts, including: • Mandate the third (or purple) pipe in all new buildings through amendments to the LEP/DCP for each precinct. • Connect adjacent public domain/open space to recycled water as a major customer (similar to a power purchase agreement). • Provide easements in footpaths/roads for infrastructure and coordinate infrastructure delivery with programmed capital works projects for improved public domain works	Recycled water is not a business as usual infrastructure and requires a minimum amount of development for a new recycled water system to be feasible. While all precincts provide this minimum yield, development will not be delivered by a single developer or land owner. Therefore, facilitation is required to enable recycled water across these precincts. This report identifies a Council-led approach to facilitate recycled water by: • Undertake a market sounding for the provision of recycled water.	Marginal capital cost - $1,000 Household saving - Negligible Payback – n/a

Action	Detail	Potential Barriers and Solutions	Cost/Benefit per Dwelling
	• Require green roofs/facades for certain typologies and new construction in appropriate areas to be connected to recycled water.	• As part of the market sounding, commit to using recycled water on neighbouring Council assets as a major guaranteed customer (similar to a power purchase agreement) • Council to provide easements in footpaths/roads for infrastructure and coordinate infrastructure delivery with programmed capital works projects for improved public domain works (i.e. widened footpaths, cycle ways, increased canopy cover, WSUD works etc). • Amend LEP for each precinct to mandate the installation of the third (or purple) pipe in all new buildings for all non-potable uses (see example clauses provided above). The recycled water provider would then be required to liaise with developers and secure water license requirements etc as part of the usual water delivery for the site.	
Parking	• Minimise underground parking, with no minimum parking within 800m of metro and other rail stations, and 0 maximum parking within 400m. • Unbundle all parking from the sale of apartments to enable affordable housing and housing choice outcomes. • Any above ground parking delivered through the project should be designed to be reconfigured to other uses, including commercial and residential floorspace. • Identify key on-street parking spaces for car share adjacent or within the new precincts	• No barrier identified • Amend LEP/ DCP for each precinct (see example clauses provided above). • Work with car share providers to identify key on-street parking spaces for car share adjacent or within the new precincts but can also service broader catchments.	Marginal capital cost – Potential significant cost savings to construction. Household saving – Potential significant cost savings to households through improved housing choice. Payback – n/a

Action	Detail	Potential Barriers and Solutions	Cost/Benefit per Dwelling
Public Domain	• Establish 25% canopy targets for all precincts • Potential offsetting opportunity 4:1 ratio • These targets could be enhanced through design guidelines that reflect current industry best practice for urban greening.	• The 25% canopy cover target will be required to be achieved at a precinct scale, with some sites delivering higher canopy cover and others that are more constrained. This is require site-based design guidelines alongside precinct level monitoring to ensure overall precinct strategies are delivered (see Monitoring Precinct Performance below) • Amend LEP/ DCP to require developers to contribute to the 25% canopy cover targets required by Council (see example clauses provided above). • To support the overall precinct target, landscape design guidelines could be prepared which consider landscaping requirements, including, green roofs and walls.	Marginal capital cost – n/a Household saving – n/a Payback – n/a

Monitoring Precinct Performance.

While the sustainability and infrastructure strategies outlined in this report are designed with resilience and adaptation in mind, the expected outcomes will vary with changes in yield, mix of use and market responses. As a result, it will be important for Council to monitor both the private sector developer's response to these requirements, as well as the performance of these strategies on the ground.

In addition, while this report focuses on energy and water performance outcomes, broader social and economic benefits can be tracked in order to understand the broader benefits of environmental performance outcomes, including car ownership, travel patterns and pedestrian activity.

Based on the outcomes outlined in this report, the following key metrics have been identified for tracking and monitoring by Council (see Table right). These metrics provide the key indicators for whether or not the recommendations in this report are being delivered and the expected outcomes are being achieved.

To enable Council to respond to this data and adapt through the planning and implementation phases of the precinct, whilst ensuring it delivers on the outcomes and vision of the precincts, we recommend the establishment of a planning monitoring platform to help Council capture this data and precinct performance. This platform should provide:

- The ability to capture the draft metrics from public and Council datasets
- Benchmarked metrics allow to show how decisions will impact the precinct and LGA.
- The ability to run scenarios to review and adjust solutions as changes in yield, mix of use and the market responses, i.e. the ability to review Planning Proposals or Das against the recommendations and metrics outlined in this report.

DRAFT METRICS FOR DISCUSSION

Metric	Units	Potential Source	Link to Strategy
Core Environmental Metrics			
BASIX	Score	DPIE BASIX Data	Increase BASIX Targets & Recycled Water
Solar PV	kW/dwelling	DPIE BASIX Data	Increase BASIX Targets
Parking Rate	Spaces/dwelling	DA / BASIX Data	Parking
Greener Places	Link to draft Greener Places Policy	TBD	Public Domain
Landscaped Area	% of site area	DA / BASIX Data	Public Domain
Green roof area	% of site area	DA	Public Domain
Canopy Cover	% of site area (at mature tree)	DA	Public Domain
Broader Social & Economic Metrics (to be determined)			
Car ownership	Vehicles/household	ABS Census	
Containment	% people who travel to work locally or from home.	Journey to Work (ABS Census)	
Active transport	Number of trips by walking and cycling	Council trackers ABS Census	
Urban Heat Index	UHI	DPIE	

The core metrics can be delivered using a combination of tools available in the market including a simple excel spreadsheet, open-source spatial software such as QGIS, or software-as-a-service solutions. It is proposed that any systems developed by Council enables direct links to core datasets, including Council DA data, DPIE BASIX data and other public sources like the ABS Census.

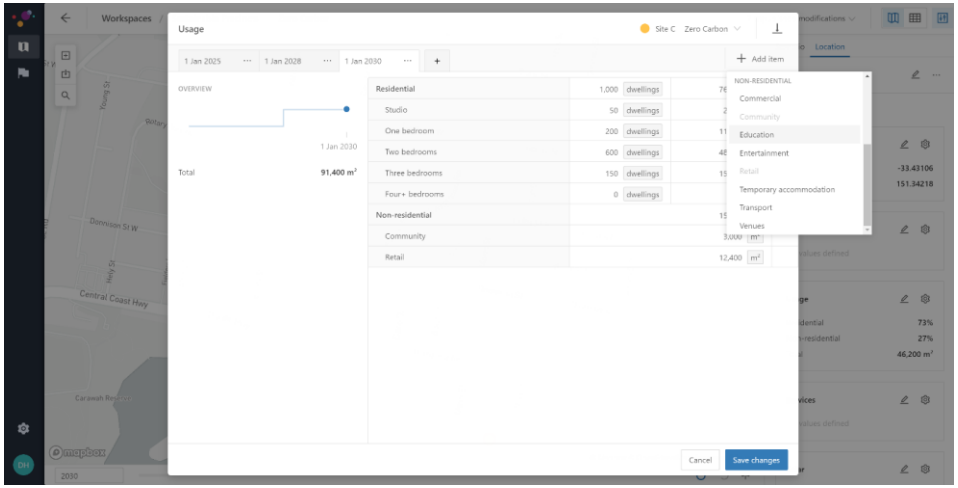
Our analysis for this project has been undertaken using the Kinesis Platform, which is specifically built to draw on and integrate diverse data and modelling to understand the impact of precinct strategies. The platform has the functionality to model as well as continually monitor ongoing precinct performance and delivery. For Canada Bay Council, the Kinesis Platform could provide a mechanism to;

- Keep an up to date, centralised source of truth of development and implementation of the sustainability strategies across the precincts.
- Enable ongoing analysis of the precincts
- Assess proposed developments and responses from the market, allowing Council to understand the impact of the proposed development in comparison to what was initially proposed or modelled and monitor the cumulative impact of development and growth.

Some example screenshots are provided below.

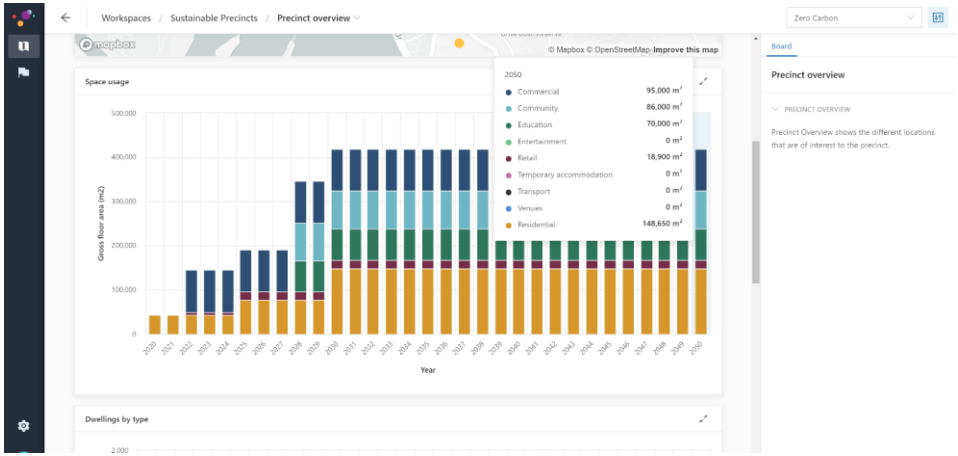
Maintaining a Living Master Plan

Easily input precinct planning inputs, such as development yields, dwellings and floorspace, maintaining a central source of truth for the precinct development.



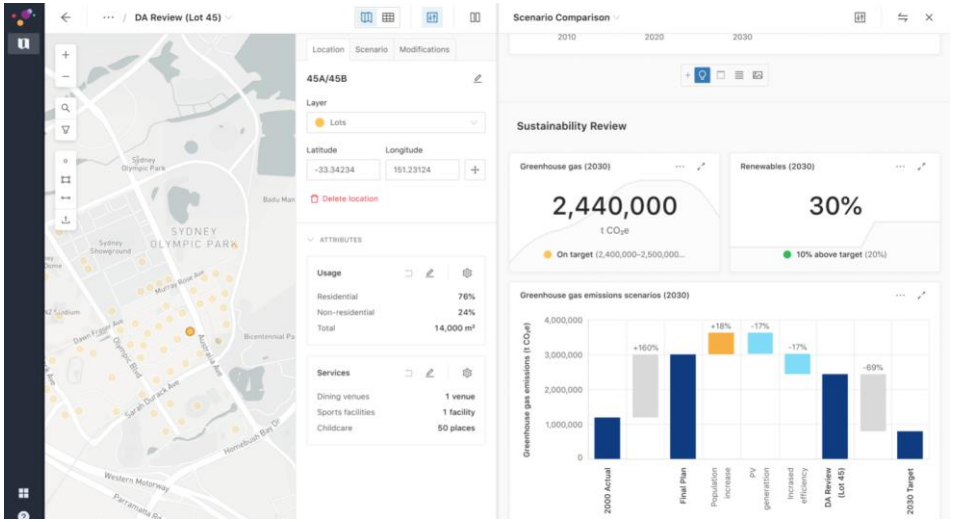
Understand the Impact of the precincts

Visualise development projections and staging or associated greenhouse gas emissions, resource demands and infrastructure implications over time.



Monitor progress towards Councils Net Zero Target

Assess development applications and planning proposals in their response to Council's net zero emissions targets. Screenshot below using the Kinesis Platform for net zero emissions analysis and progress towards a net zero outcome.



Appendix.

Metropolitan Sydney average benchmarks

Electricity	2,310 kWh per person/year
Gas	3,888 MJ per person/year
Water	201.9 L per person/day
Transport	19.2 km per person/day

Grid Co-efficient

Electricity	0.950 kgCO_2-e/kWh
Gas	0.064 kgCO_2-e/MJ

Tariffs and rates

Household cost savings outlined in this report are based on tariffs outlined below:

Residential Water	**Rate**	**Unit**
Mains tariff	2.04	$/kL
Recycled water tariff	1.817	$/kL
Service charge per dwelling	738	$/yr
Recycled water service charge	0	$/yr

Residential Grid Electricity	**Rate**	**Unit**
Applied tariff	0.314	$/kWh
Solar feed-in tariff	0.06	$/kWh
Service charge per dwelling	335.04	$/yr

Residential Gas	**Rate**	**Unit**
Gas (first 7,565 MJ per qtr/remaining)	0.0407/0.0275	$/MJ
Service charge per dwelling	229	$/yr

Residential Transport	**Rate**	**Unit**
Fuel	1.40	$/L
Annual capital costs (devaluation)	6,642	$/yr
Annual registration/insurance	2,172	$/yr

All results contained in this report are derived from Kinesis analysis using both the DPIE BASIX engine and the Kinesis PRECINX modelling platform.

PRECINX draws on local climate, land use and tariff data, and available utility, government, public and private sector datasets to calculate to performance of proposed developments, precincts, corridors and regions.

Important datasets used in the analysis include:

- Department of Planning and Environment, BASIX – www.basix.nsw.gov.au
- NSW Department of Planning (Ongoing) BASIX Report Data.
- Department of the Environment (Ongoing) National Greenhouse Accounts Factors
- Sydney Water Best Practice Guidelines for water conservation in commercial office buildings and shopping centres (2007) and Best Practice Guidelines for holistic open space turf management (2011)
- National Water Commission, 2011, National performance report 2009-2010: urban water utilities, National Water Commission, Canberra
- Department of Resources, Energy and Tourism, 2010, Energy in Australia – 2010, ABARE, Canberra
- Energy Use in the Australian Residential Sector, 1986 – 2020, Australian Government Department of the Environment, Water, Heritage and the Arts (DEHWA), 2008.
- National Construction Code (2010) Section J - Energy Efficiency Requirements
- Transport Data Centre (2006) The Development of a Sydney VKT Regression Model
- Department of Infrastructure and Transport, 2011, Road vehicle kilometres travelled: estimations from state and territory fuel sales, Australian Government, Canberra
- ABS (2010) 'Household Expenditure Survey, Australia: Summary of Results', catalogue number 65300DO001_200910, Australian Bureau of Statistics, Canberra.
- Kinesis (Ongoing) Water and energy end use data derived from first principle analysis of a range of metered residential and non-residential building types (ongoing, sourced from anonymised CCAP datasets from thousands of buildings, suburbs and cities across Australia), see: www.kinesis.org/ccap-integrated and www.kinesis.org/ccap-city