BONDI JUNCTION
GREEN INFRASTRUCTURE MASTER PLAN

Achieving sustainability through partnerships

Funding assistance received from NSW Planning Reform Fund
Creating a sustainable future for Bondi Junction through a collaborative approach to energy, water and waste
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### Waste
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  - Waste generation in Bondi Junction
  - Waste solutions
  - Automated Waste Collection System
  - Key amenity benefits of Automated Waste Collection System
  - Solar compacting bins in public places

### Energy
- **Context & Solutions**
  - How much energy is consumed in Bondi Junction?
  - Energy solutions
  - Lighting upgrades
  - Renewable energy
  - Heating and ventilation systems
  - Central energy plants
  - Electric vehicle charging stations
  - Energy efficient street lighting
  - Off-site renewable energy

### Water
- **Context & Solutions**
  - What is the water use in Bondi Junction?
  - Water Solutions
  - Leak detection
  - Bioretention raingardens
  - Cooling tower optimisation
  - Improved building performance
  - Energy & water saving upgrades

### Implementation Plan
- **Implementation plan**
- **References**
- **Acronyms**
Bondi Junction: The Heartbeat of the East

Bondi Junction is the heartbeat of Sydney’s Eastern suburbs. As part of our vision, Waverley Council aims to demonstrate environmental excellence and leadership.
Why focus on Bondi Junction?

Because Bondi Junction represents:

- **37%** of Waverley community Greenhouse gas (GHG) emissions
- **36%** of community mains water use
- **11%** of waste collected by Council
Bondi Junction at a glance

Bondi Junction centre is our hub of commercial, residential and retail activities and our focus for environmentally sustainable growth and renewal.

3,638 Residents\(^1\)

36.8 is the median age\(^1\)

64\% increase in bike riders (from 2010–2014)\(^2\)

Bondi Junction is the 8th busiest train station in NSW\(^3\)

28\% travel by car to/from work\(^1\)

45\% use public transport to/from work\(^1\)

More than 65,000 train and bus passengers use the Bondi Junction interchange every day.
Bondi Junction at a glance

48% of all economic turnover in retail across the eastern suburbs

23 MILLION visits to Westfield/year

8182 BUSINESSES

8964 JOBS

2561 RESIDENTIAL DWELLINGS

1,033,957m² Total Floor space

Breakdown of floor space

- Residential: 349,366m² (34%)
- Commercial: 320,032m² (31%)
- Retail: 307,867m² (30%)
- Industrial: 36,914m² (3%)
- Vacant: 19,777m² (2%)

1,033,957m²

Bondi Junction Green Infrastructure Master Plan
Our plan for a sustainable Bondi Junction

The Green Infrastructure Master Plan is our plan for the next 15 years and beyond, to create a sustainable future for Bondi Junction and showcase an integrated approach to energy, water and waste.

What is a Green Infrastructure Master Plan?

It looks at various opportunities in terms of solutions and scale.

**TYPE OF SOLUTIONS**
- Building performance
- Infrastructure
- Policy

**SCALE**
- Building scale
- Cluster scale
- Precinct scale

The Green Infrastructure Master Plan aims to:

1. Establish the energy, waste and water component of the Bondi Junction: Heartbeat of the East vision
2. Work towards achieving our environmental targets
3. Create ongoing partnerships to ensure a sustainable future for Bondi Junction
Our vision and targets

Demonstrate environmental excellence by delivering on ambitious environmental targets, through low carbon energy and efficient waste and water management.

Community environmental targets

Waverley Council is committed to developing partnerships and identifying solutions to deliver our waste, water and energy targets.

- 30% reduction in greenhouse gas emissions
  Based on 2003/04 levels
- 75% of all waste recycled
- ZERO increase in mains water use
  Based on 2005/06 levels of mains water consumption
- IMPROVED stormwater quality
Waverley Council is already leading the way, managing initiatives that deliver our vision for improved transport, great places and sustainability.
Partnerships and participation

Council cannot achieve a sustainable Bondi Junction alone. It requires a collaborative approach between a wide range of stakeholders.

The Master Plan is both strongly evidence-based and the result of the collaboration with our partners.

Technical Working Group provide technical direction and input into the technical studies.

Building Futures Partnership help to set the strategic direction for the Green Infrastructure Master Plan.

The Master Plan

- Technical Working Group provide technical direction and input into the technical studies.
- Building Futures Partnership help to set the strategic direction for the Green Infrastructure Master Plan.

- Utilities
- Technical experts
- NSW government
- Council experts

- Low Carbon and Energy Efficiency Solutions
- Waste Solutions
- Sustainable Water Solutions

- BONDI JUNCTION HEARTBEAT OF THE EAST
- GREEN INFRASTRUCTURE MASTER PLAN

- Political representatives
- Key property owners
- Industry groups
To develop the Master Plan, a comprehensive process of evidence gathering, modelling and analysis has been undertaken.

Information in the Master Plan is based on high level analysis. Detailed investigations of underground services, site technical feasibility and ownership structures will be undertaken at the next delivery stage.

An integrated approach
The integrated approach to energy, waste and water enabled a holistic view which helped capture synergies across systems.

The recommended solutions involve both implementation of new infrastructure, improving the performance of buildings and policy to support their development.

Efficiencies combined with local generation of energy and water resources will reduce the precinct overall demand compared with business as usual (BAU). Waste solutions aim to increase recycling capacity, improve amenity and improve collection efficiency.

Identification and assessment of the problems and challenges in Bondi Junction
Development of criteria and weightings to evaluate the solutions in consultation with key stakeholders
Identification of the preferred sustainable solutions based on a multi criterion analysis with stakeholder
Development of shortlisted solutions
Development of a business case and case studies for the recommended solutions

Monitoring and reporting
To measure progress, Council will report annually on:

1. Progress on delivery of the actions outlined in the Master Plan
2. Bondi Junction’s electricity, gas and water consumption
3. Local Government Area environmental targets
What the Green Infrastructure Master Plan is proposing

- Cleaner, quieter streets and increased liveability
  - Underground Automated Waste Collection System
  - Solar compacting bins in public places

- Reduced Greenhouse gas emissions
  - Central energy plant, in the future Civic Heart project
  - Electric vehicle charging stations
  - Solar energy system on Waverley Library
  - Offsite renewable energy
  - Large scale solar energy system on 10 buildings
  - Central energy plant servicing the top energy using building
  - Energy efficient street lighting
  - Small-scale solar energy system on 20% buildings

- Increased energy and water efficiencies in buildings
  - Improved standards and/or incentives for improved building performance of new developments
  - Lighting, Heating, ventilation and air conditioning (HVAC) and leak detection in Council buildings
  - Energy and water saving upgrades in the top 15 residential buildings
  - Lighting upgrades in the top 10 commercial and retail buildings
  - Heating, ventilation and air conditioning tuning and retrofitting in the top 4 buildings
  - Leak detection
  - Cooling tower optimisation

- Improved stormwater discharge and stormwater quality
  - Bioretention raingardens and tree pits with biofilter
  - Improved stormwater quality management for new developments
What is the Greenhouse gas emissions reduction potential in Bondi Junction?

- **Bondi Junction Green Infrastructure Master Plan**

2020 Target for Waverley LGA: 30% reduction of 2003/04 baseline levels

- **Total reduction Potential**: -33.5%

### Consumption Comparison

- **BJ 2012/13 Consumption**: 154,000 TCO₂-e/year
- **BJ BAU 2020 Consumption**: 143,389 TCO₂-e/year
- **Improved standard and incentives**: -6.9%
- **Central energy plant**: -2.1%
- **Offsite renewable**: -6.3%
- **HVAC retrofit**: -6.8%
- **Lighting upgrades**: -6.3%
- **Onsite PV**: -4.5%
- **Residential energy saving upgrades**: -0.7%
- **Street lighting**: -0.1%
- **Total reduction Potential**: -33.5%
What is the water consumption reduction potential in Bondi Junction?

2020 Target for Waverley LGA: zero increase in mains water use based on 2005/06 baseline

Bondi Junction Green Infrastructure Master Plan

- BJ 2014/15 consumption: 975 Megalitres/year
- Increased residential, retail & commercial services: +8%
- BJ BAU 2020 consumption: 1,055 Megalitres/year
- Leak detection: -12.6%
- Residential water saving upgrades: -3.4%
- Cooling tower optimisation: -1.9%
- Total reduction Potential: -17.9%
How much waste is generated in Bondi Junction?

15,507 tonnes/year total estimated waste

65% Commercial Waste

35% Residential Waste

3.2% yearly projected increase in total tonnes of waste until 2020
Who collects the waste?

- 27% of the total waste generated in Bondi Junction centre is recycled
- 49% of total waste is collected by Council in Bondi Junction
- 22% of commercial waste is collected by Council
- 78% of commercial waste is collected by private contractors
- 100% of residential waste is collected by Council
Residential waste

What is the composition of residential waste?

- **65%** General Waste
- **28%** Co-mingled Recycling
- **7%** Bulky cardboard

What is the percentage of residential waste recycled?

- **30%** Currently recycled
- **57%** General Waste
- **13%** Additional waste that could be recycled

5,427 tonnes/year of residential waste
What is the composition of commercial waste?

15% Bulky cardboard
3% Food Organics
19% Co-mingled Recycling
63% General Waste
1% Single Stream Glass

What is the percentage of commercial waste recycled?

24% Currently recycled
48% General Waste
28% Additional waste that could be recycled

10,080 tonnes/year of commercial waste
Who generates what and where?

Estimated total tonnes of waste generated within existing buildings each year:

- 0-150
- 150-300
- 300-450
- 450-600
- >600

Estimated total tonnes of waste by waste stream generated within existing buildings each year:

- Glass
- Bulky Cardboard
- Co-mingled Recycling
- General Waste

Bondi Junction Green Infrastructure Master Plan
In Bondi Junction, 27% of the waste is recycled. Increased recycling at source is the key to meeting our 75% resource recovery target. The Master Plan considers the solutions to achieve this.

<table>
<thead>
<tr>
<th>Diversion from landfill (in %)</th>
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<tr>
<td>Business as usual in Bondi Junction</td>
<td>47%</td>
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<tr>
<td>Advanced waste treatment</td>
<td>25%</td>
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<tr>
<td>Increased recycling at source</td>
<td>100%</td>
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Where does the waste go?

Council collects waste and recycling from:
- All residential properties
- Commercial properties where engaged as the service provider

Recycling is currently processed at Smithfield Materials recycling facility. From 2017, 51% of general waste will be diverted from landfill via Advanced Waste Treatment.
Waste Solutions

We want to deliver an efficient waste management system that improves amenity and maximises the recovery of resources in Bondi Junction.

Shortlisted solutions
A variety of waste infrastructure solutions were assessed against the current system according to the following criteria:

1. Increase in recycling
2. Collection of increasing amounts of waste
3. Cost effectiveness
4. Cleaner and quieter streets
5. Reduced number of bins on the footpath
6. Safe and accessible operation
7. Free up space in buildings used for garbage bin storage

The Automated Waste Collection System was identified as the best long term solution for Bondi Junction.

Solar compacting bins in public places was identified as a short term solution to implement public place recycling in Bondi Junction and to free up trucks from the collection of public place waste to deliver other services.

What is an Automated Waste Collection System?
The system consists of a series of waste disposal inlets all connected to a central waste collection station by a network of underground pipes. The waste is sucked from the inlets through to the pipes to the collection station. The waste collection station is an enclosed facility where collected waste is compacted and loaded onto trucks for transportation.

What would be the advantages of installing an Automated Waste Collection System in Bondi Junction?
1. Cleaner, quieter streets, reduced number of bins on the footpath and reduced number of trucks on the road
2. Increased recycling capacity
3. Improved waste management—decreased footprint of waste storage areas
4. Ease of use
5. Ability to cater for current and future projected waste generation
6. Enables real time data monitoring for reporting

EXPLORED SOLUTIONS

Policy
Education and engagement
Reporting and governance
Infrastructure and technology
Potential location of the waste pipelines

These systems have been installed successfully in thousands of places around the world, including in Europe, Asia and United States of America. They are particularly suited to high-density areas. Some installations have been operating effectively since the early 1970s.
Automated Waste Collection System

What is it and how does it work?
Waste is placed in a series of disposal inlets and sucked through an underground network of pipes to a central collection station.

1. Indoor waste inlets
   - Wall mounted or free-standing inlets
   - Depth: 1-1.5m

2. Outdoor waste inlets
   - Outdoor waste inlets situated at 40-50m intervals
   - Internal diameter: 0.5m

3. Underground pipe network
   - Waste transported at up to 70km/h to a collection station within 2km
   - Chutes automatically open when pipes are full

4. Waste collection station
   - Waste collection station can be above or below ground
   - Transported to the waste treatment facility

- 16 tonnes of compressed waste
- Waste and recyclables are sucked through to different compactors
- Air filtered and released clean
How would an Automated Waste Collection System work?

1. System operates 24 hours, 7 days a week, 365 days per year, and during severe weather
2. Separate general waste and recycling inlets
3. 1.6km of pipeline
4. 34 inlets (17 x 2 for each waste stream)
5. 40-50m between each waste inlet
6. 1 collection station within 2 km of main pipeline
7. 30 years of operational lifetime

Waste Inlets to dispose of waste

Both outdoor and indoor waste inlets would be utilised throughout Bondi Junction:

- Outdoor waste inlets on footpaths and in pedestrian malls for public access
- Outdoor waste inlets on footpaths with user key or password for residential and commercial access.
- Indoor wall-mounted or free-standing waste inlets with user key or password within buildings for residential and/or commercial access. Existing garbage chutes can be connected to the system, reducing costs

Waste inlets take smaller bags of garbage. User support will be provided to help with this change.

Improved resourcing available for truck collection of single stream glass, cardboard and bulky waste.

A network of underground pipes to transport the waste:

Pipeline installations required:

1. Pipe material in carbon steel
2. Waste transported at high speed: 60-70km/hour
3. Typical pipe diameter: 500 mm. 300 mm with integrated compactors in the waste inlets
4. Trench depth: 1m to 1.5m

Underground services would need to be identified to work out where the underground pipes may be located.

Construction may be integrated into other works to minimise disruption and cost.

A collection station to store the waste:

1. Located within 2 km of the underground pipeline system
2. Different configurations: above/below ground, 1 or 2 storeys
3. No odour with waste movement from pipes to fully sealed waste storage containers

Reduced garbage truck collections due to collection station:

1. Located outside central area
2. Waste storage capacity
3. Collection only when full
What are the key amenity benefits of an Automated Waste Collection System?

Based on a 50% waste uptake by the waste infrastructure, there would be:

**Main Waste Collection Network**

The following costs include all the direct and indirect costs for installation, design and construction of the main waste collection system. However, this does not include the cost of a collection station.

- Estimated capital costs (CAPEX): $13.9 million
- Estimated operational and maintenance costs (OPEX) per year: $600,000
- Payback period: 11 years
- Internal Rate of Return: 6%

**Main Waste Collection Network + Collection Station**

- Estimated capital costs (CAPEX): $13 million
- Total estimated capital costs: $26.9 million
- Estimated operational and maintenance costs (OPEX) per year: $600,000
- Payback period: 19 years
- Internal Rate of Return: 0%

The cost of the collection station has been estimated for a standalone design and construction building. This cost, and therefore the payback period, would be significantly reduced should the collection station location be integrated in any future Council project.

The cost effectiveness of the underground automated waste collection system depends on the ownership structure and collection station location. The recommendation is therefore to review the business case should a collection station location be feasible as part of any future Council project.

All cost estimates are based on a 50% waste uptake by the new infrastructure with 50% waste managed as per BAU.

**Increased recycling capacity and environmental performance**

- Increased recycling rates (increased by 50% in some cities where Automated Waste Collection Systems have been implemented)
- Unlimited bin capacity
- Reduced odour & vermin
- Reduced air pollution associated with traditional garbage truck collection

**Financial impact**

- 40% reduction in garbage truck fuel GHG emissions from reduced truck movement
- Despite an increase in emissions due to electricity consumption to operate the system, there are opportunities to reduce GHG emissions, currently caused by truck movements, by 50%. This could be achieved by using renewable energy to power the collection station.

**Impact on GHG emissions**

- 40% reduction in garbage truck fuel GHG emissions from reduced truck movement
- Despite an increase in emissions due to electricity consumption to operate the system, there are opportunities to reduce GHG emissions, currently caused by truck movements, by 50%. This could be achieved by using renewable energy to power the collection station.

**Bondi Junction Green Infrastructure Master Plan**

- 65% reduction in waste and recycling bins
  - 2700 bins reduced to 855 bins
- 349 truck movements available for other services

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  - 2700 bins reduced to 855 bins
- 349 truck movements available for other services
**Why would building owners join the Automated Waste Collection System?**

### Westfield case study

If Westfield was to connect to the system:

1. Public general waste and recycling inlets in the food court areas for ease of use of shoppers
2. Commercial waste and recycling inlets on each floor with user access control systems for retailers
3. Retailers continue to transport their waste to inlets in similar locations to the existing waste storage areas
4. Automated transfer of waste to collection station replaces current manual transfer of bins on each floor to the loading docks for emptying

**Improved waste management would provide Westfield with:**

- 50% reduction in annual waste management operational cost (resourcing for bin management and services for waste collection)
- Payback period of 9 years to cover the capital cost of retrofitting the building to install the system
- Increase available floor space by consolidating existing waste storage areas
- Increase active loading dock space through removal of existing waste compactors and bins
- A reduction of 1,875 garbage truck movements per year
- Quicker goods deliveries (reduced waiting times) which translates to money saved for suppliers
- Reduced noise and better air quality
- Avoided nuisance odour
- Potential for increased recycling and associated cost savings for waste disposal
- Reduced greenhouse gas emissions

### Eastgate Gardens residential towers case study

If Eastgate Gardens residential towers was to connect to the Automated Waste Collection System:

1. General waste and recycling inlets located in basement carpark near lifts
2. User control system accessible only by residents
3. Residents transport own bags of waste via the lift to inlet locations in basement carpark

**Improved waste management from this system would provide Eastgate Gardens with:**

- 50% reduction in annual waste management operational cost compared to current disposal into waste storage areas on each floor
- Payback period of 4 years to cover the capital cost of installing the waste inlets in the basement
- A reduction of 2,190 garbage truck movements per year
- Reduced noise and better air quality
- Avoided nuisance odour
- Increase available floor space through redundancy of existing waste storage areas on each floor
- Increase active basement space (and potential revenue from lease or sale) through removal of existing waste storage area
Solar compacting bins were identified as the optimal short term waste infrastructure solution for public places in Bondi Junction. They address the challenges of servicing a high visitation area with peak waste volumes.

Solar compacting bins will assist in reducing littering in Bondi Junction by keeping the streets clean and free of overflowing bins.

Each station has one red waste bin and one yellow recycling bin, to keep consistent with the Australian standard bin colours residents have at home. An internal compactor, powered by solar panels squashes the rubbish or recycling so more can fit inside.

Where?

Council has installed 10 dual solar compacting bins stations in Bondi Junction
Why install solar compacting bins?

1. Improved street amenity
2. Introduces recycling in public places in Bondi Junction
3. Reduced number of bins required - solar bins hold 5 times the volume of a standard street litter bin (totalling the equivalent of about 600L)
4. Built-in sensors provide real time bin fullness levels to efficiently manage collection
5. Frees up trucks for other services
How much energy is consumed in Bondi Junction?

619,382 GJ⁹ (Gigajoule) of electricity and gas which results in 153,000 tCO₂-e/ year of greenhouse gas emissions

Where do our GHG emissions come from?

Projected BAU decrease in GHG emissions by 2020

This decrease is linked to local government regulation, efficiency standards and reduced carbon intensity of the grid.

Bondi Junction Green Infrastructure Master Plan
The majority of GHG emissions in Bondi Junction come from retail businesses and commercial entities.

Total GHG emissions for electricity and gas use:
- Retail: 62,614 tCO2-e/yr
- Commercial: 54,661 tCO2-e/yr
- Residential: 23,325 tCO2-e/yr
- Industrial: 4,292 tCO2-e/yr
- Gas: 18 tCO2-e/yr

Total energy consumption by building types:
- Retail: 250,000 GJ/yr
- Commercial: 300,000 GJ/yr
- Residential: 200,000 GJ/yr
- Industrial: 50,000 GJ/yr

14 properties (2%) out of 485 properties consume 50% of the total energy in the Bondi Junction centre.
Energy breakdown

Retail Buildings

- 15% Equipment*
- 27% Lighting
- 23% HVAC
- 7% Lift & Misc
- 2% Carpark ventilation & lighting
- 5% DHW
- 10% Space heating
- 11% Space cooling

Commercial buildings

- 6% Space heating
- 12% Space cooling
- 20% Equipment*
- 23% HVAC
- 26% Lighting
- 9% Lift & Misc
- 3% Carpark ventilation & lighting
- 1% DHW

*Equipment=appliances, devices, TVs, computers...
Energy breakdown

Residential Buildings

- 20% Space heating
- 9% Space Cooling
- 6% Lift & Misc
- 4% HVAC
- 8% Carpark ventilation & lightning
- 12% DHW
- 31% Lighting
- 30% Equipment*

Industrial buildings

- 18% Space cooling
- 24% Equipment*
- 9% HVAC
- 5% Carpark ventilation & lightning
- 3% DHW
- 9% Lift & Misc

*Equipment=appliances, devices, TVs, computers...
How much energy does each building use?

Retail and commercial assets in Bondi Junction are the main GHG emitters. Most greenhouse gas emissions are from electricity used in providing building services. Greenhouse gas emissions from gas use is relatively minor in the study area.
Energy solutions

These cost effective and practical solutions will enable us to achieve an energy efficient Bondi Junction that reduces our GHG emissions.

How have the solutions been selected?

Shortlisted solutions

Shortlisted solutions were assessed in detail to determine their high level feasibility according to their:

- GHG emissions savings
- Energy savings
- Location
- Capital cost
- Operating cost
- Return on investment (ROI)
- Risk
- Demonstration of leadership
- Support from key building owners
### GHG emissions reduction solutions

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<tr>
<th>Number</th>
<th>Solution Description</th>
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<tr>
<td>1</td>
<td>Heating, ventilation and air conditioning (HVAC) tuning and retrofitting in the top 4 buildings</td>
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<tr>
<td>2</td>
<td>Lighting upgrades in the top 10 commercial and retail buildings</td>
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<tr>
<td>3</td>
<td>Energy saving upgrades in the top 15 residential buildings</td>
</tr>
<tr>
<td>4</td>
<td>Solar energy system on Waverley Library</td>
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<tr>
<td>5</td>
<td>Large scale solar energy systems on 10 buildings</td>
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<tr>
<td>6</td>
<td>Small scale solar energy system on 20% of buildings</td>
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<tr>
<td>7</td>
<td>Offsite renewable energy</td>
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<td>Energy efficient street lighting</td>
</tr>
<tr>
<td>12</td>
<td>Electric vehicle charging stations in public carparks</td>
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The most effective solutions to reduce our GHG emissions in buildings in Bondi Junction are:

**Why not a precinct scale energy network for Bondi Junction?**

Theoretically all of the heating and cooling and part of the electrical demand could be met by a Central Energy Plant (CEP). This is not considered to be financially viable as it would require significant capital infrastructure cost and spatial requirements without certainty of take up by building owners.
An energy efficient Bondi Junction

- **Offsite renewable energy**: This would offset electricity supply which cannot be obtained through energy efficient or onsite generation.

- **Central Energy Plant in key buildings**: Trigeneration simultaneous produces electricity, heat, and cooling from a single fuel source.

- **Energy efficient street lighting**: Multi-function Poles with controllable energy efficient LED lighting will be installed.

- **Small and large scale solar system**: Solar systems use a renewable energy source, reducing GHG emissions and generating long-term cost savings.

- **Energy savings upgrades**: Retrofitting existing buildings will increase their efficiency and reduce energy demand.

- **Lighting upgrades**: Lighting accounts for 30% of the GHG emissions in Bondi Junction centre. Upgrades to new technology would greatly reduce this.

- **Heating Ventilation and air conditioning tuning and retrofitting**: It is the highest energy use and accounts for 43% of the GHG emission in Bondi Junction centre.

- **Improved building standards and incentives**: Heightened energy efficiency standards will be applied to new buildings through policy instruments to boost performance of new developments.

- **Electric vehicle charging stations**: Electric vehicle reduces GHG emissions, local air pollution and noise pollution.
Lighting upgrades in the top 10 commercial and retail buildings

To reduce lighting consumption, the following lighting technologies will be used:

- Light Emitting Diode (LED) lighting, a highly energy-efficient lighting technology,
- Lighting sensors that detect movement in the space and turn lights on and off or sensors that monitor the amount of natural light entering the building and dims the lighting accordingly,
- Timers that can be programmable and switch lights on and off at specific times.

Both base building and tenancies will be targeted. Base building lighting is directly controlled by the building owner and is generally in common areas of a building. Collectively, tenanted lighting generally consumes more energy than base building lighting but responsibility is often fragmented between multiple building tenants and/or the building owner.

A lighting expert will be required to evaluate the building’s current lighting and recommend energy efficient fit for purpose replacement luminaires, sensors and timers.
### Why upgrade lighting?

1. **Up to 9,000 tCO₂-e of GHG emissions savings (6.3% of the predicted 2020 GHG emissions)**

2. **Positive return on investment of 6% to 25%**

3. **Energy savings on lighting can be improved by an average of 50%**

4. **Reduced maintenance costs due to significant longer lifetimes of luminaires**

5. **Reduced heat load and associated cooling costs**

6. **Improved lighting levels, including compliance with building codes**

7. **Proven technology with low risk**

8. **75 percent of lighting is located in retail and commercial buildings**

### Where?

Focus on ten commercial and retail buildings that:

- Emit over 400 tonnes of GHG emissions each year from lighting
- Achieve greater than 50 tonnes of GHG emissions savings each year
- Have lighting greater than four years old

### Where?

**Westfield commercial towers case study**

25% of commercial tower energy use is from lighting.

Upgrading lighting to LEDs with sensors and timers would realise the following for Westfield:

- 2.5 year payback period to cover lighting upgrade cost
- 30% reduction in lighting energy use
- 6% reduction in total energy use
- Reduced maintenance costs
- Improved lighting quality benefits to tenants and building users
- Reduction in internal heat load and associated cooling
Renewable energy: solar energy systems

The climate in Sydney enables solar systems to supply high levels of solar energy at very attractive returns on investment.

There is approximately 22.3 kW of installed solar system capacity in the Bondi Junction centre, providing less than 1% of the current annual energy consumption.

Solar energy systems offer the potential to increase renewable energy generation in Bondi Junction through increased use of suitable rooftop areas.

They can be deployed on a number of scales with alternative procurement and management models.

A Clean Energy Certified professional and structural engineer will be required to evaluate a building’s capability to install solar energy systems.
Why install solar energy systems?

1. Up to 6,400 tCO₂-e of GHG emissions savings per year (4.5% of the predicted 2020 GHG emissions)

2. 4 to 8 years payback period

3. Reduced operational costs and increased resilience to rising electricity prices

4. Network efficiency benefits (by reducing peak energy demand from the grid)

5. Proven and viable renewable energy technology with low risk

6. Existing financial incentives include the Australian Government’s Small-scale Technology Certificates (STCs) or Large-scale generation Certificates (LGCs)

7. Potential thermal comfort benefits from solar panels shading carpark or roof structure

8. Declining cost of on-site solar system produced energy and increasing cost of fossil fuel produced energy distributed via the electricity grid

Where?

Suitability of roof areas is influenced by solar access, building services, accessibility, structural capacity and ownership

Two opportunities to focus on:

Small scale solar energy system (5-15 kW) on 20% of individual buildings (both residential and commercial) in Bondi Junction centre:

- Up to 3,840 tCO₂-e of GHG savings per year
- Avoid potential retail and network charges associated with electricity grid distributed electricity

Large scale solar energy system (100kW) on buildings with large roof areas in Bondi Junction centre (represents 17,000m² of roof areas)

- Up to 2,560 tCO₂-e of GHG savings per year
- A 100kW solar system needs approximately 900m² of panel area and provides 141 MWh/year at a capital cost of around $170,000
- Service on-site energy demand and/or can export energy to the electricity grid, with the potential to be utilised in the future through battery storage and/or Local Energy Trading (LET), subject to market rule changes and distributor buy-in

Local Energy Trading is an arrangement whereby generation at one site is “netted off” at another site on a time-of-use basis, so that Site 1 can ‘sell’ or assign generation to nearby Site 2. This will reduce the combined energy and retail portion of electricity bills for local generation.

In total 4,660kW of solar systems could be installed by 2020 generating a total of 6,600 MWh/year
### Waverley Library case study

Waverley Library has installed a solar system with a capacity of 70kW, the expected benefits will be:

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>10% savings on electricity costs</td>
<td></td>
</tr>
<tr>
<td>95,000kWh/year generated</td>
<td></td>
</tr>
<tr>
<td>8-10% of the building’s energy consumption would be renewable</td>
<td></td>
</tr>
<tr>
<td>90 tonnes (9%) reduction of GHG emissions per year</td>
<td></td>
</tr>
<tr>
<td>9 year payback period to cover capital cost of installing the solar system</td>
<td></td>
</tr>
<tr>
<td>$11,000/year saving on electricity costs</td>
<td></td>
</tr>
</tbody>
</table>

### Bondi RSL Club case study

If Bondi RSL Club were to install 113 panels (28.25kW of solar), the expected benefits would be:

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>25% of energy saving costs</td>
<td></td>
</tr>
<tr>
<td>35,883kWh/year generated</td>
<td></td>
</tr>
<tr>
<td>21% of the building’s energy consumption would be renewable</td>
<td></td>
</tr>
<tr>
<td>35 tonnes (30%) reduction of GHG emissions per year</td>
<td></td>
</tr>
<tr>
<td>8 year payback period to cover capital cost of installing the solar system</td>
<td></td>
</tr>
<tr>
<td>$4,700/year saving on electricity costs</td>
<td></td>
</tr>
</tbody>
</table>
Heating, ventilation and air conditioning

Heating, Ventilation and Air Conditioning (HVAC) is the highest energy use in Bondi Junction centre and is responsible for 43% (66,000 tCO₂-e) of the GHG emissions in Bondi Junction centre.

HVAC refers to all the different systems and infrastructure that are used to regulate the indoor temperature and air quality such as heating, ventilation and air conditioning. The majority of buildings in Bondi Junction have ageing HVAC installations, and the potential to achieve significant energy savings through improvements.

The opportunities for tuning and retrofitting HVAC systems are dependent on a number of factors including the condition and age of the existing systems and the controls within the buildings.

There are various degrees of retrofitting opportunities depending on cost, complexity and capacity to reduce the energy consumption of the building.

**Opportunities to focus on:**

### Tuning and minor upgrades (low cost solutions that can be implemented in short time frames)

- Optimum start/stop programming
- Space temperature set points
- Chiller staging to match the capacity of the operating chillers to the demand of the field equipment that consumes chilled water
- Duct static pressure reset to use variable speed drives to control supply air fans to reduce fan energy consumption
- Regular maintenance inspections
- Chilled water temperature reset

### Intermediate retrofits (medium cost initiatives)

- Rebalancing air distribution systems to ensure there is no overheating or overcooling and that the systems operate as efficiently as possible
- Demand controlled ventilation to control ventilation rates through CO₂ or CO sensors
- Provision of economy cycle that uses outdoor air directly for space cooling to reduce cooling energy consumption
- Duct sealing to prevent leakage

### Major retrofits or replacement (include design and installation costs)

- Upgrade or replacement of Building Management Control System which can provide control to manage and optimise HVAC strategies
- Replacement of chiller, air handling unit and air distribution system

An independent HVAC contractor will be required to undertake a detailed audit and develop a targeted action plan with a high degree of cost accuracy.
Why upgrade heating, ventilation and air conditioning?

1. Up to 9,700 tCO₂-e of savings (6.7% of the predicted 2020 GHG emissions)

2. Average payback period depends on the level of retrofitting:
   - 4 year payback period for tuning and minor upgrades
   - 7 year payback period for intermediate retrofits
   - Longer payback period for major retrofit or replacement however they will be required in the near future as equipment reaches the end of their operational life and will represent significant energy savings

3. Improved air quality and occupant comfort

4. Reduced energy consumption and GHG emissions

5. Reduced operating costs associated electricity and maintenance cost savings

6. Positive return on investment

Westfield case study

On average 65% of energy consumed in shopping centres is using for cooling and ventilation purposes.

Westfield Bondi Junction have implemented an ultraviolet treatment technology in the air conditioning units in order to keep the equipment free of dust and bacterial agents.

This allows the air to move through the unit more efficiently and it remains cleaner. The treatment also avoids repetitive maintenance throughout the lifecycle of the plant.

The implementation of the technology was successful with the following results:

- 20% annual reduction in cooling demand
- 360,000 kWh energy usage saving or equivalent annual consumption of 62 Australian average households
- 339 tCO₂-e GHG emissions savings
- Healthier indoor environment and cleaner indoor air quality
- Reduced maintenance costs

Focus on top 4 HVAC users that:
- Have HVAC systems using more than 82,000 GJ/ year of energy
- Represent 30% of the total HVAC energy use of Bondi Junction and 14.5% of total energy use in Bondi Junction
- These top 4 HVAC users are commercial and retail buildings.

Where?

Where?
Central energy plants

A Central energy plant (CEP) typically includes a thermal reticulation network and a tri-generation system which produces low carbon electricity, hot water to heat the building, and chilled water to cool the building.

The system captures waste heat from the electricity generation process and uses it locally for the heating, cooling and hot water services of buildings.

Natural gas would be used as the interim energy source as high pressure gas mains are available within Bondi Junction and provides a cost efficient lower carbon energy supply. In the long term, it is anticipated that renewable energy sources (biomass, hydrogen fuel cell, etc) for a CEP will become more cost effective.

Using CEPs in specific locations within Bondi Junction would significantly reduce GHG emissions. Detailed feasibility studies will be required taking into consideration simultaneous need for electric power and thermal energy, difference between the price of purchasing electric power from the grid and the cost of natural gas, operating hours and location to determine return on investment and viability.
Why implement a Central Energy Plant?

1. Up to 2,880 tCO₂-e of GHG emissions savings (2.1% of the predicted 2020 GHG emissions)

2. Approximately three times as efficient as a coal-fired power station

3. Reduced GHG emissions by 50% compared to a coal fired power station

4. Reduced GHG emissions of up to 10kgCO₂/m²/year for commercial users/spaces

5. 80% of the gas energy in a trigeneration system is converted to either heat or electricity whereas only 34% of coal energy is converted to electricity

6. Electricity is made near where it is used reducing transmission losses compared to grid electricity

7. Network efficiency benefits by reducing peak energy demand from the grid

8. Existing financial incentives through the Energy Saver Scheme or the Emission Reduction Fund to reduce the capital costs of the installation

9. Renewable energy sources becoming more cost effective. Gas is used as an interim energy source

Where?

Focus on top energy demand locations in Bondi junction which have the energy density and ability to influence implementation:

- Future Bondi Junction Civic Heart project
- Top energy using building in Bondi Junction

A Whole of Life business case will be required.
Electric vehicle charging stations

In the last three years, all major car manufacturers have launched or commenced development of electric vehicles (EVs).

While the number of EVs on Australian roads is small at present, there is expected to be a major uptake as the technology improves and purchase price continues to decline.

2 potential sites are being investigated for the implementation of Electric Vehicle charging stations as part of road upgrades

1. Spring street
2. Brisbane street square

An EV charging charging station is already available for valet customers in Westfield Bondi Junction.
Why implement Electric Vehicle charging stations?

Provision of convenient charging infrastructure will encourage EV uptake by providing owners with:

1. Quick and easy top up of their vehicle’s batteries
2. Visibility to encourage more widespread adoption
3. Reduced GHG emissions—an electric vehicle will emit around 22% less GHG emissions than new passenger vehicles
4. Reduced noise and no tailpipe emissions which will lead to improvements in air quality
5. Further GHG emissions reductions if charged using renewable energy sources such as GreenPower or on-site solar

EV charging station requirements

- Availability of parking spaces
- Free or low parking fees
- High pedestrian traffic (to control vandalism and maximize awareness)
- Good security
- EV socket chargers (opposed to tethered lead chargers)
- Capacity to deliver 3-phase power
- Provision of additional power socket as a backup supply
- Ability to support both Type 1 and Type 2 charge port (Type 1 are restricted to single-phase power while type 2 stations can also provide 3-phase power which means at least 3 times faster charging)
- Option for charging (by time) enabled via EV charge station software
- Provision to regulate amps that can be drawn if charge stations are connected to a series of charge stations in the future
Energy efficient street lighting

To reduce electricity consumption, the following lighting technologies will be used:

1. Light Emitting Diode (LED) luminaires, a highly energy-efficient lighting technology
2. Lighting controls to schedule dimming at hours of low use with a step down effect from 100% output to 70% output and 40% output if appropriate

Street lighting is responsible for approximately 190 tCO₂-e of the GHG emissions in Bondi Junction centre.
Case Study on Controls Implementation

Why upgrade street lighting?

1. Over 100 tCO\textsubscript{2}-e of GHG emissions savings each year (with LED luminaires and control systems)

2. 40% energy savings on lighting compared to standard luminaire and an additional 15% energy saving using a control system

3. Maintenance cost saving of $50,000/year due to longer lifetimes of LED luminaires

4. Appropriate lighting levels for safety and reduced sleep disruption

5. Increased opportunities for night time activities

6. Improved monitoring and control to meet events’ needs, outage alerts and emissions tracking

7. Ability to use with multi-function poles for amalgamation of street assets and decluttering of the streetscape

8. Proven technology with low risk

9. Integration with ongoing streetscape upgrades

Lighting Control Systems allow council to remotely control the amount of light each streetlight needs at different times. Control systems allow for scheduling of lighting to dim at scheduled times, to be remotely controlled, for real time fault monitoring and a range of other applications that allow for ‘smart city’ management approaches such as parking monitoring, events coordination etc.

Additional $5,000/year and 15% energy saving by implementing controls on street lighting

Cost savings on maintenance due to longer lifetime of LED luminaires

Improved maintenance scheduling, GHG emissions tracking, and lighting failure identification

Improved lighting intensities based on hours of use

Over 25 tCO\textsubscript{2}-e of GHG emissions savings depending on the dimming schedule
Off-site renewable energy purchase

- 619,382 GJ of energy (electricity and gas) is consumed in Bondi Junction
- 153,507 tonnes of GHG emissions emitted
- 80% is due to electricity consumption
Why purchase off-site renewable energy?

1. Up to 9,000 tCO₂ of GHG savings per year (6% of the predicted 2020 GHG emissions)³

2. Demonstrates significant community leadership

3. Aggregated demand could potentially reduce the cost of the green energy premium over current energy cost

Off-site renewable energy reduces the GHG intensity of the electricity supply which cannot be eliminated through energy efficiency and on-site renewable energy.

Options considered included:

- Purchase of large-scale generation certificates (LGCs)
- Purchase of GreenPower (electricity fed into the mains grid from renewable sources) from the market through a retailer
- Aggregating demand and establishing a direct purchase link with a renewable energy generator (existing or new) for example through a power purchase agreement (PPA)

Where?

Council already has an aggregated greenpower and electricity purchase agreement through SSROC.

Opportunity exists for building owners to expand their purchase of greenpower, purchase LGCs or to aggregate their electricity demand with building owners and tenants within Bondi Junction in a shared procurement process for off-site renewable energy purchase (through a PPA).

The demand would then be large enough to have a group purchase with potentially a direct link with a renewable energy generator.

Off-site renewables purchase case study

If all of Council’s assets in Bondi Junction centre were to be fuelled by 100% renewable energy

- 4,500 tCO₂-e GHG savings per year (3% of total GHG emissions in Bondi Junction)
- Strong leadership message
- Additional cost of $283,000/year compared to BAU (representing an indicative abatement cost of $63 tC02-e).
Water Solutions + Context
What is the water use in Bondi Junction?

- **Rainfall**
  - Natural state: 487 ML/yr
  - Altered state: Reduced evaporation and infiltration, 123 ML/year
- **Stormwater runoff**
  - To Double Bay: 214 ML/year
  - To Centennial Park Yacht Pond: 151 ML/year
- **Waste water discharge**
  - 930 ML/year
- **Imported potable water**
  - 975 ML/year

95% of the water used is discharged as wastewater to the sewer. 365 ML/year of stormwater runoff is generated from rainfall. 151 ML/year of stormwater drains to Centennial Park Yacht Pond. 214 ML/year of stormwater drains to Sydney Harbour via Double Bay.
Where is our water consumed?

- **Non drinking water quality demand**
  - Commercial: 130 ML/year
  - Retail: 270 ML/year

- **Drinking water quality demand**
  - Commercial: 290 ML/year
  - Retail: 285 ML/year

**Total water consumption**

- **2014/2015**
  - Non drinking water quality demand: 575 ML/year
  - Drinking water quality demand: 400 ML/year

- **BAU 2020**
  - Non drinking water quality demand: 593 ML/year
  - Drinking water quality demand: 412 ML/year

- **975 ML/year of mains water is used**
- **575 ML/year is used for drinking water quality demand**
- **400ML/year is used for non-drinking water quality demand**
- **Projected 3% increase in water consumption by 2020**
- **9 properties use 50% of the total water used in the Bondi Junction centre**
- **476 properties use the remaining 50%**
How do residential buildings in Bondi Junction perform compared to industry benchmarks?

Residential building performance (in kL/m²/year)
The residential buildings in Bondi Junction are performing slightly below the industry average.

Industry average for residential buildings
Bondi Junction residential buildings

Water use in Residential buildings
- 3% Dishwashers
- 42% Showers/baths
- 14% Taps
- 5% Other
- 5% Leakage
- 3% Irrigation
- 14% Cooling Towers
- 10% Toilets

Other incorporates all other water uses, including uses such as firefighting water, wash down water and industrial water use.
How do commercial and retail buildings in Bondi Junction perform compared to industry benchmarks?

Commercial and retail building performance (in kL/m²/year)

Non-residential buildings in Bondi Junction are performing better than industry average with the two biggest water users, Westfield and Eastgate Shopping Centre, on par with best practice.

Water use in Commercial and retail buildings

- 32% Toilets
- 19% Leakage
- 13% Taps
- 15% Cooling Towers
- 1% Washing Machine
- 3% Dishwashers
- 5% Showers/baths
- Other incorporates all other water uses, including uses such as firefighting water, wash down water and industrial water use.
How much water do services in each building use?

- **Total water usage (KL/year)**
  - 40,000
  - 20,000
  - 10,000

- **Drinking and non-drinking water quality demand (KL/year)**
  - 40,000
  - 20,000
  - 10,000

Bondi Junction Green Infrastructure Master Plan
Water solutions

These cost effective and practical solutions will enable us to achieve a water efficient Bondi Junction that reduces our mains water consumption and improves stormwater quality.

How have the solutions been selected?

Shortlisted solutions

Solutions were assessed to determine their high level feasibility according to their:

- Water savings
- Water quality impact
- Location
- Capital cost
- Operating cost
- Return on investment (ROI)
- Risk
- Demonstration of leadership
- Support from key building owners

EXPLORED SOLUTIONS

- Building performance
- Infrastructure
- Policy

VARIOUS SCALES

- Building scale
- Cluster scale
- Precinct scale
Water consumption reduction solutions

1. Leak detection
2. Cooling tower optimisation
3. Water saving upgrades in the top 15 residential buildings
4. Improved standards and/or incentives for improved building performance for new developments

Opportunities to improve stormwater discharge and stormwater quality was also identified through the implementation of:

1. Bioretention raingardens and tree pits with biofilter
2. Stormwater quality management for new developments

The most effective solutions to reduce our water consumption in buildings in Bondi Junction are:

Why not a precinct recycled water network for Bondi Junction?

A recycled water network (blackwater or greywater recycling) includes infrastructure for harvesting, treatment and a distribution network. A recycled water demand of a minimum of 1 ML/day is required for such a system to be cost effective.

Bondi Junction has a demand of only 400 kL/day. Such a scheme is also better suited to new development due to the technical challenges and cost associated with retrofitting recycled water supply to existing buildings. Therefore, a recycled water network is not feasible for Bondi Junction.
A water efficient Bondi Junction

Water savings upgrades
Leak fixing, showerhead and tap upgrades and reducing toilet flush volumes will increase water efficiency and reduce water demand of existing buildings.

Leak detection program
Installation of water sub-meters, monitoring equipment and software will enable rapid leak detection and remediation. Leak detection has the potential to reduce water use by more than 12%.

Tree pits with biofilter
Tree pits with biofilter collect stormwater run-off and remove pollutants through filtration media.

Cooling tower optimisation program
Efficient cooling tower operation and maintenance has the potential to reduce water use by 2%.

Bioretention raingardens
Raingardens are natural stormwater treatment systems, designed to capture run-off from roads, driveways and roofs and remove pollutants through filtration media and plants.

Improved building standards and incentives
Leak detection program

Leaks are responsible for approximately 16% (160ML) of the water consumption in Bondi Junction centre.

Leaks are typically due to failing fixtures, broken control valves and pipes, or ongoing and unchecked poor management practices.

Monitoring interval data also enables building owners and tenants to measure the effectiveness of the actions they have taken to reduce energy and water use.

How to detect leaks

To detect leaks, the following technologies will be implemented:

Monitoring systems: Data loggers and telemetry are small devices with sensors fitted to water meters which can save or send information at regular intervals or real-time on water flow (via the internet network, wifi or SIM card) to a software monitoring system or a Building Management Systems (BMS). The building manager or tenant accesses the data via a monitoring system or BMS to understand where and when water is used. Some systems also send alerts via SMS or email when water use anomalies outside a pre-defined range occur.

Water sub-metering: Multiple water sub-meters (i.e. meters in addition to the utility water meter) with monitoring are useful in larger buildings (where it would take longer to identify where a leak was occurring), tenanted buildings, buildings with equipment responsible for a significant amount of water use (such as pools, irrigation, car wash, showers etc), buildings at risk of vandalism and buildings with a high number of users (where infrastructure is subject to regular leaks through wear and tear).
Why leak detection?

1. Up to 133ML/year of water savings (13.5% of total water consumption)
2. $110,000 potential combined water savings per year
3. 5-6 year payback period
4. Provides accurate data for improved measurement and reporting
5. Proven technology with no risk

Water leakage represents an estimated 2,300kL/year, about 20% of the building’s total water consumption. If a leak detection program was to be carried out, the expected benefits would be:

- $5,400 of water saving costs
- 16% reduction in total water consumption
- 4 year payback period
- 80% reduction in water leakage
- Improved monitoring and reporting

Where?

Leak detection program on Council’s buildings and all major water users in Bondi Junction centre.

Staged approach:

- **Council’s buildings**: Benefits to be analysed and used to encourage uptake by other larger water users in Bondi Junction. Council’s involvement in this program should be to demonstrate effectiveness
- **Major water users** within Bondi Junction centre such as large residential and commercial buildings
Bioretention raingardens and tree pits with biofilter

Stormwater currently drains from a ridgeline running along Spring Street, either draining south to Centennial Park Yacht Pond or north to Double Bay and into Sydney Harbour.

Bondi Junction currently discharges about 151 ML/year of runoff to Centennial Park, and 214 ML/year of runoff to Double Bay. Approximately 100 tonnes per year of Total Suspended Solids (TSS), 186 kg/year of total phosphorus (TP) and 832 kg/year of total nitrogen (TN) flows from the study area into these receiving environments.

To improve detention of stormwater and stormwater pollutant removal, the following Water Sensitive Urban Design (WSUD) features will be implemented:

1. **Raingardens**: are designed to capture and hold stormwater (from roads and footpaths) to allow it to naturally filter through porous layers of filtration medium before being absorbed by the garden’s plants or flowing as clean stormwater into local ponds and the harbour.

2. **Tree pits with biofilter**: are either single tree pits with layers of filtration medium to treat the stormwater not absorbed by the tree or multiple conjoined tree pits where excess stormwater flows to a single biofilter to filter pollutants from the detained stormwater. Like the raingardens, these are self-watering, require minimal maintenance and clean excess stormwater flows into local ponds and the harbour.
Why implement bioretention raingardens and tree pits with biofilter?

1. Improved stormwater runoff quantity and quality from Bondi Junction

2. Environmental benefits, such as reduced urban heat island effect

3. Social benefits associated with improved public health and amenity

4. Provides green space for public amenity. The amenity and improved microclimate provided by green space promotes activity that contributes to improved public health outcomes

5. Improved removal of pollutants that would otherwise be discharged into the Centennial Park ponds and Sydney Harbour: pollutant removal rates of up to 85% TSS, 60% TP and 45% TN can be feasibly achieved

6. Reduced pathogens from stormwater. Research has shown that pathogen removal of 80% to >99% (using pathogen indicators) can be achieved through biofiltration

7. Improved stormwater runoff quality through treatment, and potential flooding benefits through detention and retention

Three raingardens already built in Bondi Junction

Waverley Council has three successful raingardens in Bondi Junction—one on the corner of Hollywood Avenue and Ebley Street, the others on either side of Gray Street and Bronte Road.

30% (11.4 ha) of Bondi Junction centre is public domain spaces (streets, parks, open space, public spaces). Integration of raingardens and tree pits with biofilters into these streetscapes will improve stormwater quality, make our streets greener, as well as reduce heat.

Raingardens and tree pits will be sized to have a filter area of approximately 2% of the catchment draining to the treatment element.

Council to take a leadership role on WSUD in the study area:

1. Incorporating WSUD as Business as Usual into public domain and road design standards

2. Integrating raingardens and tree pits with biofiltration into the design and construction of Bondi Junction public domain improvement projects

3. Retrofitting raingardens and tree pits with biofiltration into Bondi Junction streetscapes

The majority of the cost of installing WSUD in streetscapes is from bulk excavation, site layouts, project setup and other indirect costs. Council will achieve significant cost savings through implementing WSUD in the streets at the same time as the Complete Streets upgrades program.
Include WSUD in current concept proposals for Spring street to enhance amenity and public spaces.

The incorporation of WSUD features can be achieved with limited adjustment to the current proposals and without compromising the primary function of the street.

Use of rain gardens where sufficient space and contributing catchment is available, and plantings with passive irrigation for more constrained areas (where bioretention cannot be accommodated)

4200m² of contributing catchment, 245m² of treatment space available

85% of the street treated with minimal changes to the proposed layout and enhancements to safety and amenity of the space

$350,000 estimated cost

Improved liveability of Spring street

Improved pollutant removal: 80% TSS, 56% TP and 51% TN

Potential raingarden

Potential passively irrigated planting garden

Spring Street

Newland St

Eastgate Shopping Centre

Eastts Leagues Club

Bronx Rd

Bondi Junction Green Infrastructure Master Plan
Cooling Towers are responsible for approximately 10% (98 ML) of the water consumption in Bondi Junction centre.

Cooling towers are a system component of a building’s air conditioning process. Water consumption of cooling towers can be significantly reduced with regular maintenance and by adopting an effective cooling water treatment program.

To reduce water consumption of cooling towers, the following process will be required:

1. Installation of sub-metering and monitoring of the cooling tower to enable accurate data collection and benchmarking the building against industry best practice
2. Site inspections
3. Repairs
4. Optimisation through training of maintenance contractors

An experienced cooling tower auditor will be required to identify the issues, evaluate the possible improvements and train site managers to improve their understanding of the issues and how to best manage maintenance contract(ors) who regularly service cooling towers.
Why optimise cooling towers?

1. Up to 10 ML/year of water savings in total (1% of the 2020 water consumption)

2. Up to 6.5 ML/year of water savings in Building Futures Partnerships buildings

3. 10% water savings by monitoring and controlling the concentration of dissolved solids in the water

4. Payback period less than 10 years

Where?

The Building Futures Partnership buildings are estimated to use about 65ML/year in cooling towers, while other buildings in the study area are estimated to use about 33ML/year.

Focus:

1. Building Futures Partnership buildings with cooling towers (6 buildings): Benefits to be analysed and used to encourage uptake by other buildings in Bondi Junction

2. Major water users within Bondi Junction centre such as large residential and commercial buildings

East Leagues Club case study

- 30% reduction of cooling tower water use (486kL/year)
- 4% reduction of building total water use
- 4 year payback period
- Reduced treatment chemical used and energy costs
Improved building performance

Healthier, more productive and efficient building design, construction and operation will enable owners and tenants to realise greater financial, social and environmental benefits. It will also contribute towards achievements of our community environmental targets and demonstrate leadership in sustainability.

Improved standards and/or incentives for improved building performance of new developments

The NSW’s Government’s statutory Building and Sustainability Index (BASIX) requires residential developments to achieve minimum energy and water performance requirements as well as thermal comfort minimum standards.

Section J of the National Construction Code (NCC) establishes minimum energy performance requirements for non-residential developments.

Long term, there is an opportunity to demonstrate environmental leadership and work regionally, with NSW Government and with the building industry for:

- Sustainability performance requirements for non-residential development
- Improved BASIX performance requirements for residential development.

A complementary approach is to utilise incentives to encourage developers to invest time and funding into learning how to deliver sustainable buildings.

This overcomes the market barrier where building users will not pay a green premium for residential, retail or non-A grade office space which are the dominant development types in Bondi Junction.

There is an opportunity to incentivise delivery of buildings with improved environmental performance, such as buildings achieving Green Star certified ratings independently verified by the Green Building Council of Australia.
Why improve building performance?

1. 8,240 tCO₂-e GHG savings per year
2. Less than 5% increased build costs if focusing on cost effective energy and water initiatives
3. 20% reduction in energy usage costs and GHG emissions
4. 20% reduction in potable water consumption
5. Increased asset value
6. Improved building user thermal comfort

Benefits of improved building performance

Economic benefits
- Improved financial returns on investment by considering whole of asset life cycle costs from capital through to operating costs
- Higher rent and lower vacancy rates
- Competitive advantage in obtaining grant funding
- Reduced impact of climate change such as extreme rainfall and storms and increased extreme heat and coastal inundation
- Lower operating costs through energy and water efficiencies or renewable sources
- Reduced impact of rising utility costs
- Improve building design and construction, avoiding variations, defects and/or rectification works
- A more productive workplace, reduced absenteeism and an increased ability to attract and retain staff

Social benefits
- A healthier and more comfortable space for users
- Demonstration of environmental leadership
- Demonstration of financial responsibility
- Facilities that adapt to user needs and climate change resilience including extreme weather
- Improved developer and/or building owner reputation and a boost to staff and community pride

Environmental benefits
- Reduced greenhouse gas emissions
- Reduced waste to landfill
- Reduced demand for non-renewable resources such as water, materials and fossil fuel based energy
- Improved stormwater quality and receiving beach or harbour water quality
Energy and water saving upgrades

50% of water is consumed and 20% of GHG emissions are generated in Bondi Junction residential buildings and serviced apartments by a complex mix of owners (individuals and companies), tenants and strata owners corporations.

Focus on top 15 high user residential buildings that represent:

1. 30% or 304ML/year of Bondi Junction water consumption
2. Minimum 10ML/year individual building water consumption
3. 8% or 12,000 tCO₂/year of Bondi Junction GHG emissions
4. Minimum 500 tCO₂/year individual building GHG emissions

To achieve:

1. 36ML/year of water savings (3.4% of Bondi Junction predicted BAU 2020 total water consumption)
2. 0.7% or 1,000 tCO₂-e/year of GHG emissions savings
3. Cost savings on water and energy bills
Initiatives to reduce water consumption are:

1. Leak fixing
2. Cooling tower optimisations
3. Showerhead and tap upgrades
4. Reducing toilet flush volumes
5. Best practice swimming pool management
6. Irrigation efficiency

A partnership with Sydney Water WaterFix® program will be required to assess building services and uses, develop an action plan and support implementation of solutions tailored to each building with consideration of the:

- Ownership/rental ratio
- Strata owners corporation level of engagement
- Building capital works program

Initiatives to reduce energy consumption are:

1. Efficient lighting, sensors and timers
2. Efficient appliance selection
3. Hot water upgrades
4. Thermal insulation
5. Air conditioning upgrades
6. Standby power management

83% of water is consumed within apartments where decision making is made by owners, tenants or managing agents.

17% of water is consumed in strata common areas where decisions are made by the strata owners corporation.
4% of the total water consumption in Bondi Junction is consumed in Eastgate residential towers.

Implementing an energy and water assessment and upgrade would have the following benefits:

- 7ML/year of water savings (18% of water consumption in Eastgate Garden Residential and 0.7% of Bondi Junction total water consumption)
- 65% of the expected water savings would come from installing efficient flow shower heads
- 35% of the expected water savings would come from reducing toilet cistern volumes to 6/3L cisterns
- In common areas, installing a cover over the pool to reduce evaporation and adjusted irrigation rates
- 80tCO2-e/year of GHG emissions savings
- 10% GHG emission savings per year
- Estimated 3 year payback period

Sydney Water WaterFix Program

Sydney Water’s successful WaterFix® program now provides adaptable services for strata and standalone building owners and managers to enable implementation of tap and toilet repairs, installation of water efficient showerheads and fittings and dual flush toilets.

To overcome funding, access and time constraints, Sydney Water offers the following streamlined service:

1. A turn-key solution of qualified and experienced plumbers and project managers
2. Provision of a formal estimate for the work based on site inspection of a sample of apartments
3. Opportunity to defer WaterFix® charges in line with the value of accrued water savings for buildings that have met a minimum threshold
Implementation
Plan

This following section outlines the steps and priority actions required to implement the Green Infrastructure Master Plan solutions.

OVERVIEW

1. Project Stages
2. Stakeholder engagement

TO DETERMINE

1. Preconditions for change
2. Interventions required
3. Indicators for success

Change Framework

A Theory of Change framework will be utilised to ensure stakeholders will be part of the process to determine preconditions for change, interventions required and indicators for success.
### Green Infrastructure Master Plan Solutions

<table>
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<tr>
<th>2017</th>
<th>SHORT TERM</th>
<th>2018</th>
<th>MEDIUM TERM</th>
<th>2022</th>
<th>LONG TERM</th>
<th>2030</th>
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#### Reduced Greenhouse gas emissions
- Solar energy system on Waverley Library
- Electric vehicle charging stations
- Energy efficient street lighting
- Offsite renewable energy
- Large scale solar energy system on 10 buildings
- Small scale solar energy system on 20% buildings
- Central energy plant in the future Civic Heart project
- Central energy plant servicing the top energy using building

#### Increased energy and water efficiency in buildings
- Lighting, HVAC and leak detection in Council buildings
- Energy and water saving upgrades in the top 15 residential buildings
- Lighting upgrades in the top 10 commercial and retail buildings
- Leak detection
- Improved standards and/or incentives for improved building performance of new developments
- Cooling tower optimisation
- HVAC tuning & retrofitting in the top 4 buildings

#### Improved stormwater discharge and stormwater quality
- Improved stormwater quality management for new developments
- Bioretention raingardens and tree pits with biofilter

#### Cleaner quieter streets and increased liveability
- Solar compacting bins in public places
- Underground Automated Waste Collection System

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**Bondi Junction Green Infrastructure Master Plan**
Automated Waste Collection System

Project stages from initiation to implementation are depicted below. A review will be undertaken at the end of each project stage and inform decision making about proceeding to the next stage.

1. Ownership & operating structure options analysis
2. Underground services mapping
3. Collection station location options analysis
4. Building owner engagement
5. Procurement
6. Design
7. Construction

NEXT STEPS P.82
Central Energy Plant (Civic Heart), Central Energy Plant (top using energy building) and Electric vehicle charging stations

1. Building owner engagement
2. Feasibility Study & business case
3. Ownership & operation structure options analysis
4. Building owner engagement
5. Procurement
6. Design
7. Construction integration into Civic Heart Project
Energy efficient street lighting

1. Integration into streetscape upgrade scope
2. Lighting design
3. Agreement for decommissioning Ausgrid assets
4. Asset decommissioning & replacement integration streetscapes upgrades
Offsite renewable energy

1. Building owner engagement
2. Options analysis
3. Prepare business case
4. Building owner engagement
5. Procurement
6. Implementation

NEXT STEPS P.85
Renewable energy: solar systems, HVAC tuning and retrofitting and lighting upgrades in the top 10 commercial and retail buildings

1. Building owner engagement
2. Procurement
3. Technical assessment
4. Business case
5. Building owners & tenants engagement
6. Procurement
7. Implementation

NEXT STEPS P.86
Water and energy saving upgrades, Cooling tower optimisation and leak detection program

1. Building owner engagement
2. Procurement
3. Technical assessment
4. Building case
5. Building owners & tenants engagement
6. Procurement
7. Implementation

NEXT STEPS P.87
Bioretention rain gardens and tree pits with biofilters

1. Feasibility review as part of scoping streetscape upgrades
2. Procurement
3. Design
4. Procurement
5. Construction
Standards or incentives for improved building performance of new developments

1. Technical review
2. Stakeholder engagement
3. Integration into draft planning instruments
4. Public exhibition & Stakeholder engagement
5. Planning instrument amendment
6. Planning instrument endorsement/gazettal
7. Implementation
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Acronyms:

**BAU:** Business as Usual  
**BJ:** Bondi Junction  
**CAPEX:** Capital expenditure  
**CEP:** Central energy plant  
**EV:** Electric vehicle  
**GHG emissions:** Greenhouse Gas emissions  
**GJ:** Gigajoule  
**GW:** Gigawatt  
**HVAC:** Heating, Ventilation and Air Conditioning  
**kW:** kilowatt  
**LED:** Light Emitting Diode  
**LGA:** Local Government Area  
**MWh:** Megawatt-hour  
**NSW:** New South Wales  
**OPEX:** Operational expenditure  
**PV:** Photovoltaic  
**ROI:** Return on investment  
**tCO2-e/year:** tonnes of equivalent carbon dioxide emissions per year