

Annexure I: Sustainability Technical Report

Sustainability Technical Report

Sydney Olympic Park Master Plan 2050

Revision 07, September 2024



Acknowledgment

We acknowledge the Traditional Owners of Country throughout Australia, recognising their continuing connection to land, waters, skies, and community.

We acknowledge especially the Gadigal People of the Eora nation and the Bunurong Boon Wurrung and Wurundjeri Woi Wurrung peoples of the Eastern Kulin Nation, custodians of the lands where our offices are located.

We are inspired by and learn from knowledge and stories of Country.

We pay our respects to Traditional Owners, their cultures, and to Elders past, present, and emerging.

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Executive summary

This Sustainability Report serves as a vital continuation of the Sydney Olympic Park Vision and Strategy 2050, poised to transform the park into Sydney's Beating Green Heart—a thriving nexus of everyday energy, Country-centric focus, and nature-positive attributes.

The Sydney Olympic Park Master Plan 2050 Sustainability Report (Sustainability Report) has been prepared to extend and operationalise the Sydney Olympic Park 2050 Vision and Strategy (the Vision). It aims to embed sustainability deeply within the Sydney Olympic Park Master Plan 2050 (Master Plan 2050), aligning it with contemporary urban development needs, expectations, and ecological imperatives. The report also serves to fulfil the specific Study Requirements set forth for the project, ensuring a comprehensive and accountable approach to sustainable development.

The central focus of this report is to address the significant challenge of transitioning Sydney Olympic Park into a leading example of sustainable urban development. This is rooted in a detailed analysis of the current context, including environmental, social, and economic factors, providing a comprehensive evidence base that informs the design of the sustainability framework and strategy. Key issues addressed include improving resource efficiency, mitigating environmental impacts, and enhancing community engagement amidst rapid urban development and environmental shifts.

The strategy employed encompasses a detailed sustainability framework, integrating diverse themes and principles into the fabric of development within Sydney Olympic Park. This is further bolstered by the application of independent third-party sustainability rating tools such as Green Star and NABERS, which provide a structured approach to measuring and advancing sustainability initiatives. The report's in-depth resource use modelling sheds light on the complex dynamics of electricity, water, waste, and emissions management, offering a clear perspective on the park's current and future resource footprint.

The report lays out a series of pragmatic recommendations that bridge aspirational sustainability goals with practical implementation. These recommendations are designed to integrate sustainability considerations across all development phases of Sydney Olympic Park. Emphasis is placed on establishing clear performance targets and development control provisions within Master Plan 2050 to achieve the stated sustainability objectives. This approach not only addresses immediate sustainability challenges but also steers Sydney Olympic Park towards continuing as a sustainable, inclusive, and vibrant urban precinct.

In essence, this Sustainability Report is a comprehensive guide that extends beyond mere policy formulation, serving as a blueprint for actualising a sustainable, resilient future for Sydney Olympic Park. It encapsulates a vision for a sustainable urban environment that is not only responsive to current challenges but also anticipatory of future urban and ecological dynamics.

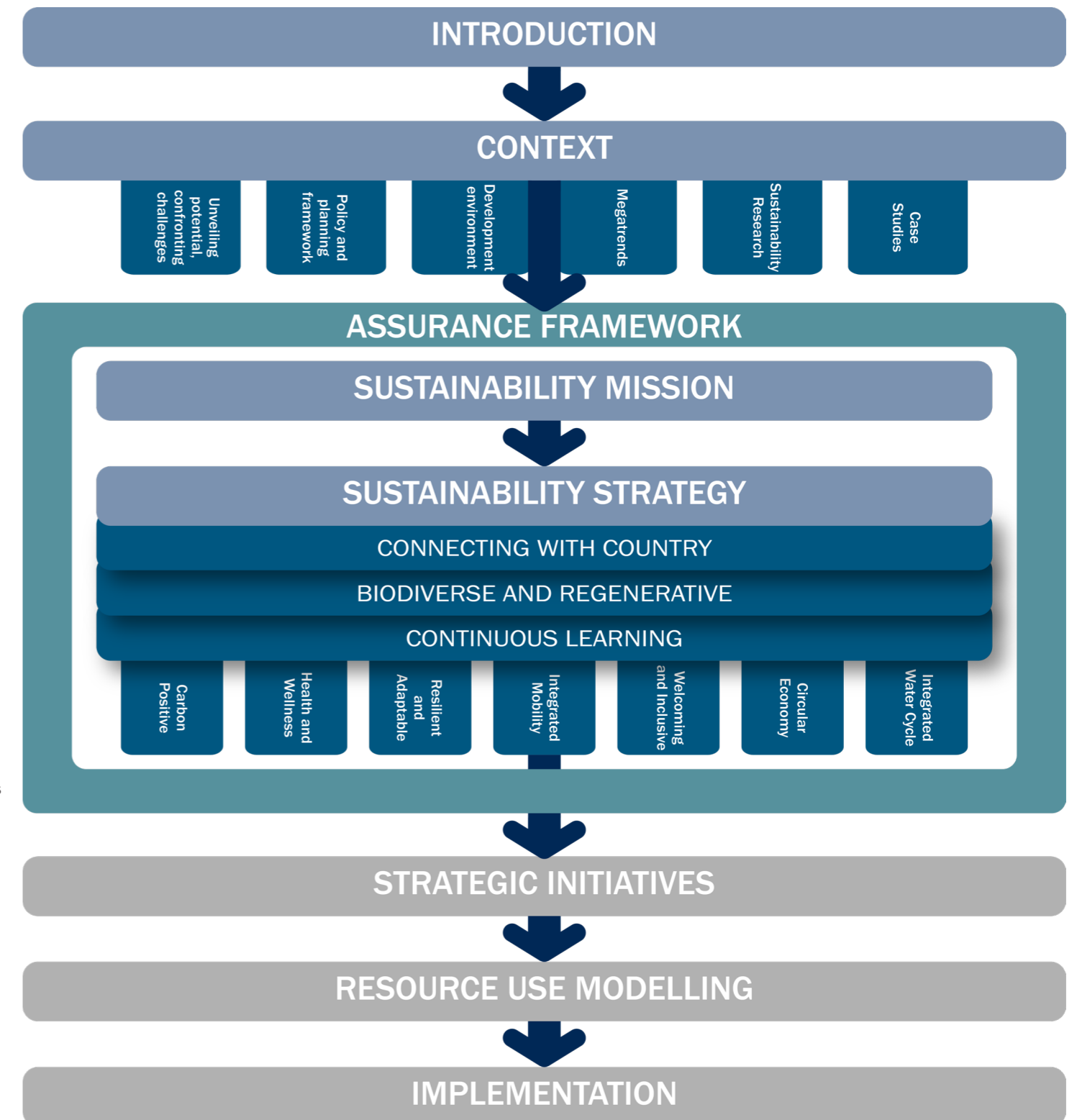


Figure 1.1 Sydney Olympic Park Master Plan 2050 Sustainability Ambition

01 INTRODUCTION

1.1 Purpose and approach

1.1.1 Purpose

This report plays a crucial role in bringing the Sydney Olympic Park Vision and Strategy 2050 to life. The aim is to establish Sydney Olympic Park as a hub of sustainability and natural beauty, showcasing Sydney's commitment to ecological and urban harmony. The report outlines a clear sustainability mission for the Master Plan 2050, organised into key areas:

- **Embedding Sustainability in the Public Realm:** This involves integrating sustainable practices into the physical public spaces and urban landscapes of Sydney Olympic Park, ensuring an environmentally conscious design approach.
- **Guidance for Building Projects:** To provide developers with detailed planning controls and design opportunities. These go beyond the statutory requirements, offering creative ways to implement sustainability in various building projects.
- **Operational Sustainability Guidance for SOPA:** The report offers comprehensive guidance to the Sydney Olympic Park Authority (SOPA) on sustainable operations. This includes a range of operational strategies, from simple implementations to more complex initiatives, highlighting SOPA's ongoing sustainability efforts and suggesting ways to enhance and expand these practices.
- **Compliance with Department of Planning, Housing and Infrastructure:** The report also addresses the specific study requirements set by the Department of Planning, Housing and Infrastructure, ensuring that our sustainability strategies align with state-level planning and environmental goals.

1.1.2 Project introduction

SOPA is a statutory authority established by the NSW Government, under the *Sydney Olympic Park Authority Act 2001* (the SOPA Act). SOPA is responsible for fulfilling the objectives of the Act including those in respect to any future development activities within the precinct. These objectives are to:

- ensure that Sydney Olympic Park becomes an active and vibrant centre within metropolitan Sydney, and
- ensure that Sydney Olympic Park becomes a premium destination for cultural, entertainment, recreation and sporting events, and
- ensure that any new development carried out under or in accordance with this Act accords with best practice accessibility standards and environmental and town planning standards, and
- ensure the protection and enhancement of the natural heritage of the Millennium Parklands.

SOPA plays a key role in guiding the continued evolution of Sydney Olympic Park into an active and vibrant suburb that the NSW Government's investment in the precinct returns the best social, environmental and economic returns while maintaining its Olympic legacy.

Sydney Olympic Park is transforming into a thriving suburb strategically located in the centre of Greater Sydney. It is a suburb that benefits from a diversity of land uses, proximity to both Sydney and

Parramatta central business districts, and is of national significance, all of which have played an important role in its evolution since hosting the Sydney 2000 Olympic and Paralympic Games. As the 640-hectare site continues to evolve into vibrant neighbourhoods, it will reconnect with its Wangal roots and extensive natural assets to provide a meaningful connection to Country.

The Sydney Olympic Park 2050 Vision & Strategy (the Vision) was released in June 2022 and serves as a roadmap to inform decision-making for the next three decades. Sydney Olympic Park Master Plan 2050 (Master Plan 2050) is the next stage of strategic planning for Sydney Olympic Park. Master Plan 2050 will ensure a coordinated, long term development plan is prepared for the whole precinct.

The most recent iterations of a master plan for Sydney Olympic Park were completed in 2018 and 2021, to support the delivery of Sydney Metro West. Building upon the Vision, Master Plan 2050 considers Sydney Olympic Park holistically, seeking opportunities to integrate thinking about the parklands and urban core together, enhancing its role in Greater Sydney.

The Vision articulates an aspiration to position Sydney Olympic Park as Sydney's Green Beating Heart: a place that is energised with everyday life, is Country-first, nature positive and where Sydney comes to play.

In 2050, Sydney Olympic Park will be a complex, layered suburb offering a rich and varied range of experiences. Many will live and work here, others will visit for events, diverse attractions or for everyday retail and entertainment. Master Plan 2050 aims to balance certainty with flexibility enabling Sydney Olympic Park's future to be resilient, dynamic and able to leverage future opportunities and technologies not yet known.

Atelier Ten is part of the master planning and urban design team leading and developing the Master Plan 2050. This Master Plan 2050 builds on the Vision work and for the first time, brings the Town Centre (210ha) and Parklands (430ha) under one comprehensive whole of site Master Plan (total 640ha).

The intent of Master Plan 2050 is to ensure a coordinated, long term development plan is prepared for the whole neighbourhood, building on the Vision, and will be the strategic planning blueprint for the sustainable development.

1.1.3 Approach

In developing the Master Plan 2050, the approach was divided into three stages. Stages 1 and 2 aimed to meet the goals of the Master Plan 2050 Brief, while Stage 3 focused on specific Study Requirements.

Stage 1 – Structure Plan (Strategic Place Framework)

Stage 1 involved analysing existing sustainability studies. This analysis looked at physical, environmental, and social aspects in the



Figure 1.1 Sydney Olympic Park Master Plan 2050 Sustainability Ambition

area, making sure these aligned with the larger sustainability goals of the Master Plan 2050 Brief. This stage was key in finding gaps and creating a detailed plan, which helped guide the sustainable development of the master plan.

Stage 2 – Master Plan 2050

Stage 2 set out a sustainability mission for Sydney Olympic Park. The team developed key sustainability values and themes, which shaped specific goals and design plans. An important part of this stage was suggesting planning controls and guidelines. These were crucial for including sustainability in the Master Plan 2050 and guiding the urban design team in their work.

Stage 3 – Sustainability, Water & Waste Management, and Resilience Study

Stage 3 concentrated on a detailed study about sustainability, water and waste management, and resilience, following the DPE's study requirements. This involved a thorough assessment of the sustainability implications of the proposed changes to the Master Plan 2050, making sure these changes aligned with sustainability goals and worked well with the environment.

1.2 Sustainability at Sydney Olympic Park



SOPA is committed to making Sydney Olympic Park one of the most liveable suburbs in NSW. This goes beyond the commitment to net zero emissions and aims to make Sydney Olympic Park a great place to live, work and play while delivering best practice sustainability across the precinct.

Sustainability practice at Sydney Olympic Park is guided by an initial commitment to the 'Green Games' and a number of current documents. The purpose of this Sustainability Report is to extend and deepen that initial commitment. It plays a crucial role in shaping the Sydney Olympic Park Master Plan 2050 by integrating and enhancing existing sustainability practices. The report not only aligns with, but also supports and strengthens other related reports.

Its primary function is to apply these sustainability principles directly to the development of the 2050 Master Plan. Furthermore, it identifies and examines future opportunities to incorporate these sustainable practices into both the ongoing development and operational phases of Sydney Olympic Park.

1.2.1 A legacy of sustainability leadership

The bid for the Sydney 2000 Olympic Games in Sydney and a commitment to a 'Green Games' and sustainable Olympic village catalysed Australia's green building movement. More than 20 years later SOPA, part of the NSW Government, is building on that legacy to deliver greater sustainability and reduced carbon emissions.

The 'Green Games', was the catalyst for Sydney Olympic Park's transformation from a badly degraded area into a world-recognised environmental showpiece, and resulted in:

- Successful remediation of 160 hectares of contaminated land and on-site containment of nine million cubic metres of excavated waste in Australia's largest land remediation project

- Creation of one of the largest urban parklands in Australia (430 hectares)
- Development of world class venues and facilities for the Sydney 2000 Olympic and Paralympic Games, designed with a strong focus on: energy and water conservation, sustainable materials selection, pollution control, and waste management and minimisation
- Establishment of Australia's first large scale urban water recycling system, saving approximately 850 million litres of drinking water each year
- Extensive use of renewable energy across the Park
- Restoration of remnant eucalypt forest and estuarine wetlands
- Design and construction of new grassland, wetland, forest, saltmarsh and intertidal habitats including habitats for the endangered Green and Golden Bell Frog.
- Development of environmental education, interpretation and research programs.

1.2.2 Sydney Olympic Park Environmental Guidelines 2008

The Sydney Olympic Park Environmental Guidelines (2008) are the environmental guidelines referred to in Section 4 of the NSW SOPA Act. These guidelines replaced the 1993 version, which was integral to Sydney's successful bid to host the 2000 Olympic Games, resulting in numerous environmental legacies that define the park today.

The 2008 Guidelines apply to all land identified as Sydney Olympic Park under the Act. Section 18 requires SOPA to maintain a master plan consistent with these guidelines, while Section 20 mandates that any proposed development be assessed for compliance before proceeding.

These guidelines have no expiry date and can be amended as needed. They emphasise a series of General Commitments that include involving people, social capital, liveable places, environment protection, development planning and design, adaptive management, and asset functionality. These are followed by eight key sustainability issues:

- Water Conservation
- Energy Conservation
- Material Selection
- Waste Management
- Transport
- Pollution Control
- Biodiversity
- Public Open Space

These commitments and issues guide the development, infrastructure, and activities within Sydney Olympic Park, ensuring sustainable management and environmental stewardship as the park evolves into a modern new township, premier events precinct, and world-class parkland.

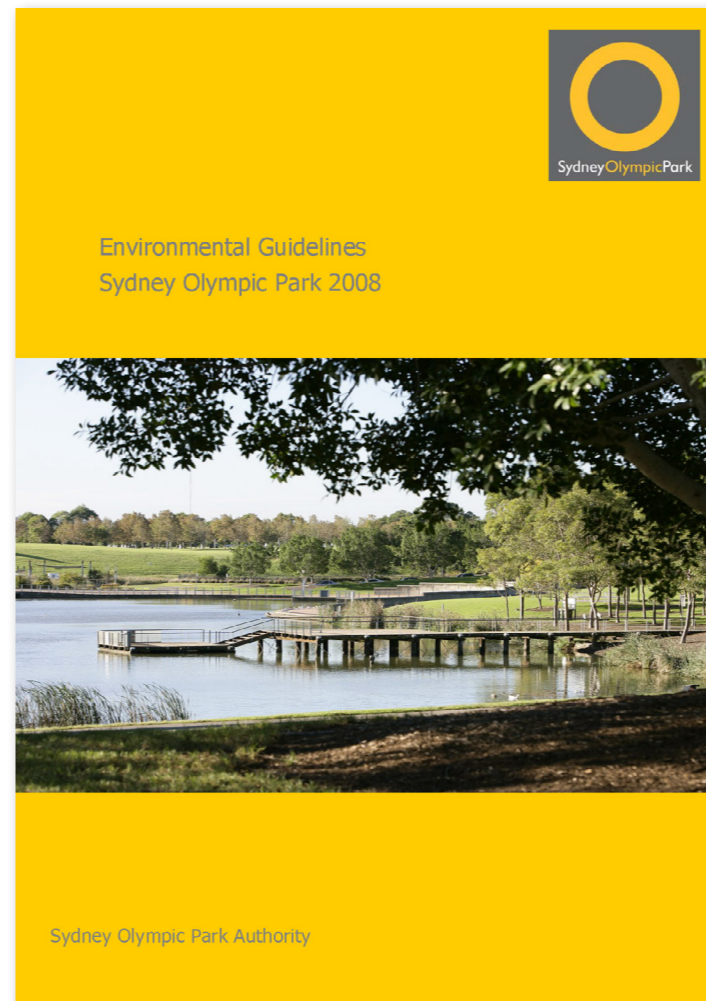


Figure 1.2 Sydney Olympic Park Environmental Guidelines 2008 in force (Source: SOPA)

1.2.3 Sydney Olympic Park Master Plan 2030 (Interim Metro Review)

With a new Sydney Metro Station announced for Sydney Olympic Park, there is an opportunity to breathe new life into this iconic location. The Master Plan 2030 (Interim Metro Review) is required to enable a new integrated Metro station and precinct development.

The Master Plan 2030 (Interim Metro Review) outlines changes to the built form and street network impacted by the location of the new Metro station. This includes:

- changes to land use and planning controls to integrate the Sydney Metro West station into the Central Precinct of Sydney Olympic Park
- a new pedestrian plaza linking the Metro Station to Olympic Boulevard
- a bus interchange on Figtree Drive
- changes to the street network to improve access to the Metro station
- changes to connect the Central Urban Park to the Abattoir Precinct.

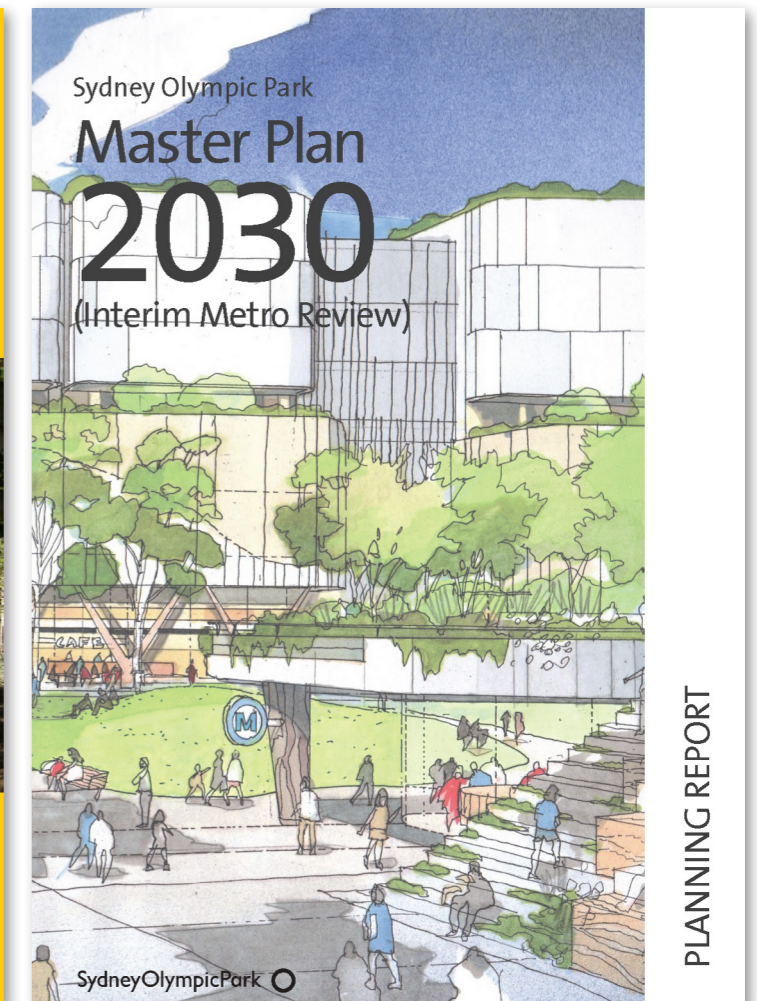


Figure 1.3 Sydney Olympic Park Master Plan 2030 (Interim Metro Review) (Source: SOPA)



Figure 1.4 Central Precinct and Metro Site Area (Source: Hatch/Roberts Day)

1.2.4 Sydney Olympic Park Master Plan 2030 (2018 Review)

Master Plan 2030 is a comprehensive plan guiding the long-term development of Sydney Olympic Park. This Plan is reviewed every five years to ensure it remains relevant as required by the SOPA Act.

In its next stage of development, Sydney Olympic Park has an important role to play to support the Greater Sydney Commission's Three Cities approach and has been identified as a "lifestyle" precinct within Greater Parramatta and the Olympic Peninsula.

Master Plan 2030 (2018 Review) is a plan for the revitalisation of Sydney Olympic Park with a vibrant new town centre, educational facilities, shopping precinct, new homes, more jobs and increased open space and community facilities. Building upon this, Master Plan 2050 offers a holistic review and expansion of the Master Plan 2030 (2018 Review), furthering its vision and adapting to emerging trends and requirements."



Figure 1.5 Sydney Olympic Park Master Plan 2030 (2018 Review) (Source: SOPA)



Figure 1.6 Artist's Impression of Master Plan 2030 (2018 Review) – Illustrative Plan (Source: SOPA)

1.2.5 Parklands Plan of Management 2010

The Parklands Plan of Management is a strategic document that guides the development and management of the Parklands at Sydney Olympic Park. It underscores the significance of environmental stewardship, community engagement, and cultural preservation in the face of Sydney's rapid urban expansion. The plan emphasises the need for adaptive management strategies that can respond to increasing population pressures and changing urban dynamics.

It suggests that the sustainability strategy should prioritise the creation of inclusive and flexible spaces that can evolve with the community's needs while preserving ecological and cultural integrity. This involves striking a balance between enhancing recreational and educational facilities and conserving natural habitats and historical sites.

Additionally, the plan's focus on health and wellbeing, social cohesion, and community resilience provides a framework for developing sustainable urban spaces that cater to the physical and mental wellbeing of residents and visitors.

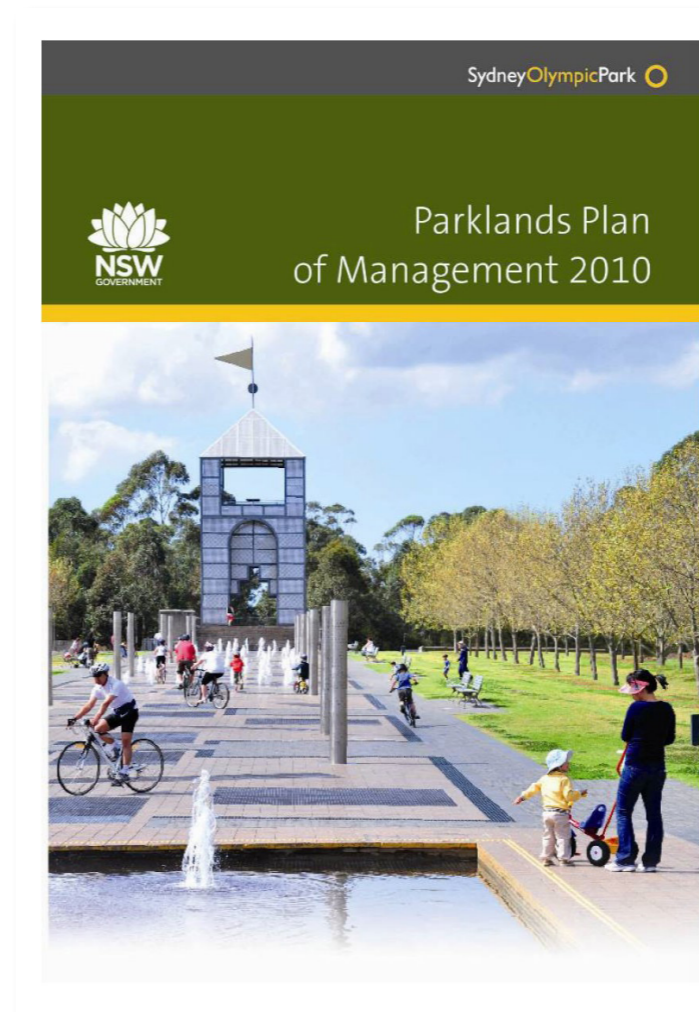


Figure 1.8 Parklands Plan of Management 2010 (Source: NSW)



Figure 1.7 Variety of parklands at SOP (Source: Parklands Plan of Management 2010)

1.2.6 Green Star Communities

In 2019, Sydney Olympic Park achieved a 6 Star Green Star Communities certification, signifying world leadership, with a score of 97 points from a possible 110.

The 6 Star Green Star Communities rating set a goal to achieve net zero emissions for SOPA by 2030 and the precinct as a whole by 2050, through the development of a comprehensive Greenhouse Gas (GHG) Emissions Response Strategy (see “1.2.5 GHG Emissions Response Strategy” on page 11).

Precinct and land development projects are complex and can take a long time to deliver. For this reason, Green Star Communities certification lasts a maximum of five years, after which the project can recertify. This allows projects to re-assess their approach, improve on their approach, and be recognised for progress made in delivering on the ground.

While Green Star Communities will continue to be updated, projects are recertified with the version of the rating tool under which they achieved their previous certification. As such, project teams are not subject to clarifications or amendments made as part of later revisions.

Retaining Sydney Olympic Park’s 6 Star Green Star Communities rating during recertification in 2024 is a critical part of SOPA’s sustainability ambition and represents a non-negotiable.

The newest version of the Green Star Communities tool (version 2) is due to be released in 2024. When re-certifying, SOP is not required to upgrade to the latest version of the tool, however, may consider it for several reasons:

- ensuring operations are aligned with the most up to date best practice sustainability initiatives
- ensuring the 2050 Master Plan can embed (or at least not preclude) any potential spatial considerations
- remaining competitive and a leader in the global market for precincts



Figure 1.9 Sydney Olympic Park Green Star Communities 6 Star rating certificate (Source: SOPA / GBCA)

1.2.7 GHG Emissions Response Strategy

Master Plan 2030 proposed a significant increase in development in the Sydney Olympic Park precinct. By 2030, the precinct will see a 6-7-fold increase in the number of dwellings and a 2-3-fold increase in the number of jobs. The associated energy demand from this development is projected to increase current emissions by nearly 80%.

The Greater Sydney Commission aims to make Sydney Olympic Park a “Lifestyle Super Precinct”. In line with this objective, SOPA intends to deliver best practice sustainability across the precinct and has an aspiration to achieve net zero emissions across Sydney Olympic Park by 2030.

To support this Kinesis was engaged by SOPA to develop an emissions response strategy that leverages its functions to deliver on this aspiration. The strategy involves three key interventions and a series of steps within them:

- Deliver high performance buildings
 - Energy-efficient building controls across all new buildings in Sydney Olympic Park.
- Install on-site renewables to deliver energy cost reductions and emissions reductions
 - leverage SOPA’s sphere of influence to install renewables on SOPA assets.
 - Facilitate solar PV installation on other buildings in Sydney Olympic Park.
 - A 5 MWh battery can limit peak export and enable energy arbitrage.
- Explore off-site renewables / Power Purchase Agreement (PPA) to address the deficit to net zero emissions
 - Identify the administrative options for the delivery of PPAs across SOPA assets or Sydney Olympic Park.
 - Identify potential ‘buying group’ partners and generator partners in the market.
 - Initiate a procurement plan that identifies SOPA’s energy requirements in the short and long term.

The Greenhouse Gas Strategy sets out the following actions:

- Green Star, NABERS and BASIX requirements are mandated for all new buildings within the precinct. Allowing only certified high-performance, energy efficient buildings is projected to deliver a 23% reduction in GHG emissions.
- Installing on-site solar PV on SOPA assets (from 7.425 MW to a potential 32 MW). The building and carpark footprint of SOPA assets is almost 60% of the total building footprint in Sydney Olympic Park.
- Installing on-site solar PV on non-SOPA assets (potentially up to 23 MW). On-site solar (on both SOPA and non-SOPA assets) is projected to deliver a 16% reduction in emissions as well as other benefits such as operational savings for precinct occupants.
- Off-site renewable energy purchasing of a minimum of 140GWh of clean electricity equivalent to a 133 MW solar array. This is expected to deliver up to a 38% reduction in emissions.

Currently, SOPA is making steady progress in implementing the GHG strategy, with ongoing additions of rooftop solar PV to SOPA-owned assets and active discussions for solar integration on other buildings. Efforts are also underway to explore Power Purchase Agreements (PPAs) to address emission deficits.

While the revision or update of this strategy was not a direct focus of the Master Plan 2050 process, efforts have been made to support and enable its objectives, including the incorporation of appropriate planning controls and strategic initiatives such as the development of a Microgrid and District Thermal Energy systems.

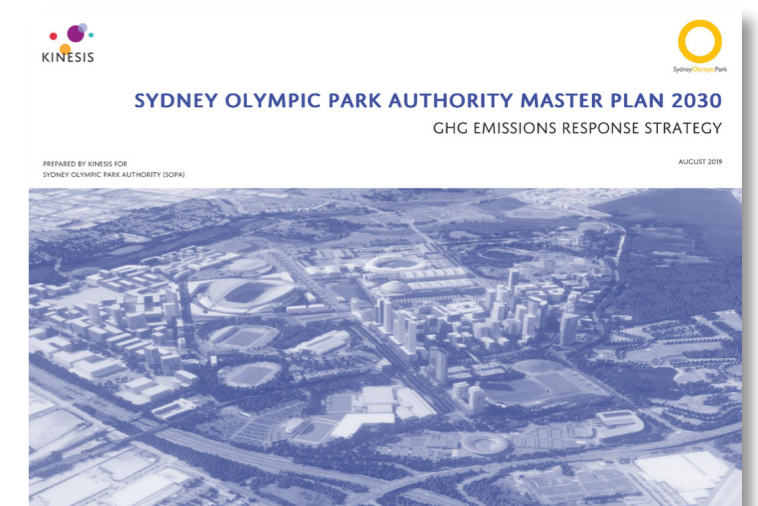


Figure 1.10 Sydney Olympic Park GHG Emissions Response Strategy (Source: SOPA / Kinesis)

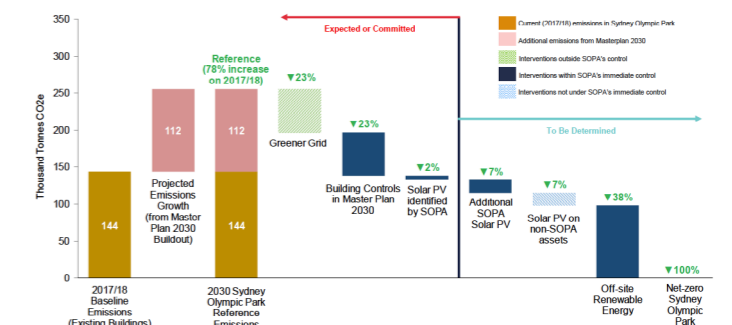


Figure 1.11 Sydney Olympic Park’s pathway to net zero emissions (Source: SOPA / Kinesis)

1.3 Sydney Olympic Park 2050 Vision and Strategy

The Vision sets out an over-arching and ambitious vision for what Sydney Olympic Park will be in 2050. It provides a roadmap that will inform decision-making across Sydney Olympic Park in the coming decades, for government, business and the community. It advocates for a holistic approach to planning for the future that leverages the unique natural, built and governance characteristics of this place.

The vision gives effect to the aspirations outlined within a number of state district and local policies and strategies. The aspirations for Sydney Olympic Park in 2050 is presented in four parts: the Vision, Place Pillars, Strategic Directions and Key Moves.

The Vision includes several Directions with key sustainability implications for the park. This section will not cover all Directions, but will concentrate on those most relevant to the park's sustainability objectives.

The Vision

The vision outlines what Sydney Olympic Park would like to be known as by 2050. It draws together the aspirations outlined within the Place Pillars and Strategic Directions.

Place Pillars

The Place Pillars reflect the DNA of Sydney Olympic Park and the foundations from which everything is built upon. The Pillars act as values - the lens through which all decision-making will be made as Sydney Olympic Park progresses toward its vision.

Strategic Directions

These ten Strategic Directions will shape the future of Sydney Olympic Park. These highlight a series of opportunities that leverage Sydney Olympic Park's natural and built features, its engaged community and unique governance structure.

These Strategic Directions are supported by a series of actions that provide a framework for bringing the vision to life.

Key Moves

Five Key Moves are initial steps that can be taken to transition Sydney Olympic Park towards its vision as Sydney's Beating Green Heart. Some of these Key Moves focus on longer term outcomes while others are more short term interventions which provide opportunities to test, experiment and catalyse change.

Sustainability is embedded in all layers of the Vision, and here we have highlighted the strategic directions with a particular focus, highlighting the measures of success and actions that support their delivery.

As with the Environmental Guidelines these provide guidance for setting minimum targets, and opportunities and initiatives for their delivery in the Master Plan 2050.

SYDNEY OLYMPIC PARK IS SYDNEY'S BEATING GREEN HEART

Wangal

Respect and care for Country

Dynamic

A place that adapts to changing needs

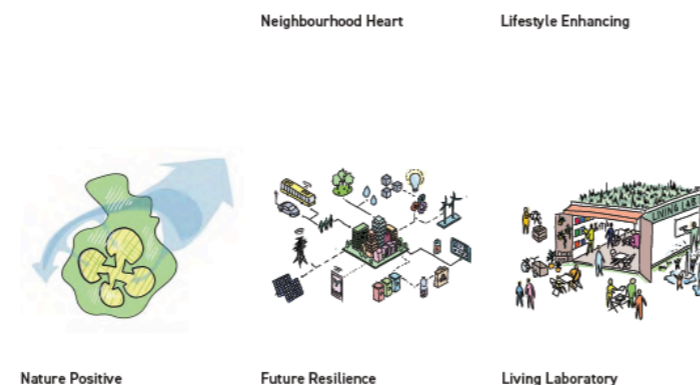
Thriving

A regenerative exemplar



Key Moves

Five key moves are initial steps that can be taken to transition Sydney Olympic Park towards its vision as Sydney's Beating Green Heart. Some of these key moves focus on longer term outcomes while others are more short term interventions which provide opportunities to test, experiment and catalyse change.



2. A liveable and complete community

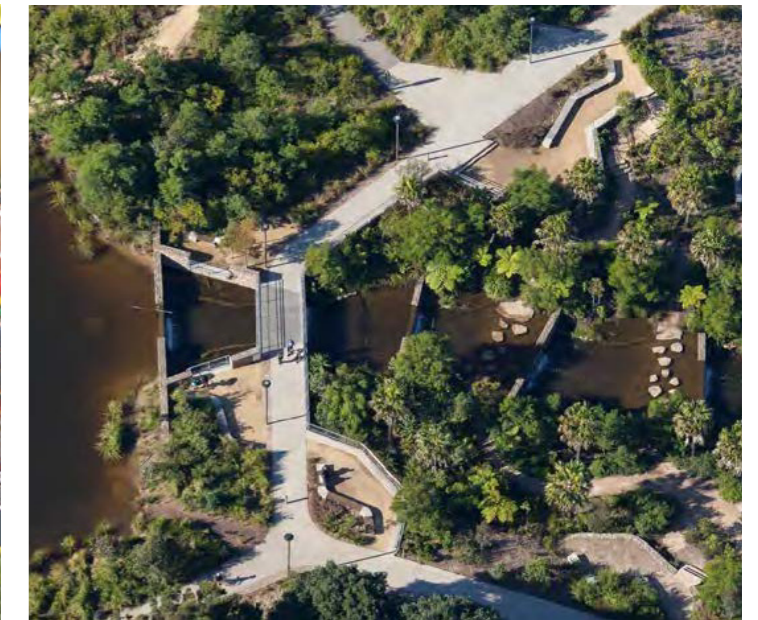
A suburb that future generations are proud to call home

Measures of success

- Sydney Olympic Park will demonstrate maintained or improved outcomes against social indicators developed in a future Social Cohesion Framework

Actions

- Provide social infrastructure to support a growing population and connect the Olympic Peninsula
- Activate the public domain with spaces for informal participation in and out of event time and create the conditions for local community use
- Provide a range of smaller spaces and events that cater to local interest and deliver new social infrastructure for creative and cultural production and participation
- Embed ongoing community participatory design and idea exchange processes into future planning and design activities



3. Connected, pedestrianised and intuitive

A highly connected and car-lite suburb

Measures of success

- Sydney Olympic Park becomes a Faster Rail station location
- The majority of trips into and out of Sydney Olympic Park are made via public or active transport modes.
- All local trips within Sydney Olympic Park are made via walking, cycling or other personal mobility means

Actions

- Create pedestrian priority zones across Sydney Olympic Park's town centre
- Ensure direct active transport connections to public transport
- Connect Sydney Olympic Park to adjacent neighbourhoods
- Support innovative approaches to personal mobility across Olympic Park
- Establish a strong connection to regional NSW



6. A living laboratory for urban innovation

A place that embeds education, experimentation and innovation into its DNA - a smart place with learning at its core

Measures of success

- Sydney Olympic Park is constantly accommodating research, prototyping, testing or supporting other experimental processes
- Sydney Olympic Park has attracted universities, research institutions and programs domestically and globally specifically because of its role as a living lab

Actions

1. Sydney Olympic Park will be known as a laboratory for urban experimentation by NSW Government, universities, and industry
2. Embed Smart City capabilities across Sydney Olympic Park to create continuous feedback and improvement system for monitoring
3. Provide infrastructure that enables smart places and knowledge sharing
4. Target attraction of universities, educational and research institutions aligned with specialised activities in Sydney Olympic Park
5. Embed the education of Wangal Country and Indigenous culture throughout Sydney Olympic Park



8. Carbon Positive and Circular

An exemplar carbon-positive suburb that leads the way in innovative responses to addressing climate and resource challenges

Measures of success

- By 2030 all new built environments delivered as net-zero carbon
- By 2050, all residual fossil fuel uses eliminated within Sydney Olympic Park
- By 2050, ambition is to offset all historical embedded and operations carbon emissions
- By 2050, 100 per cent of energy is renewably supplied
- No potable water used for non-potable needs
- By 2050, 100 per cent waste is diverted from landfill – all composted or recycled

Actions

1. Achieve a substantial reduction in greenhouse gas emissions
2. Actively encourage circular economy innovations and technologies
3. Eliminating potable water where not essential
4. Develop a Sustainability as a Service model for residents and businesses



9. The Green Lungs of Sydney

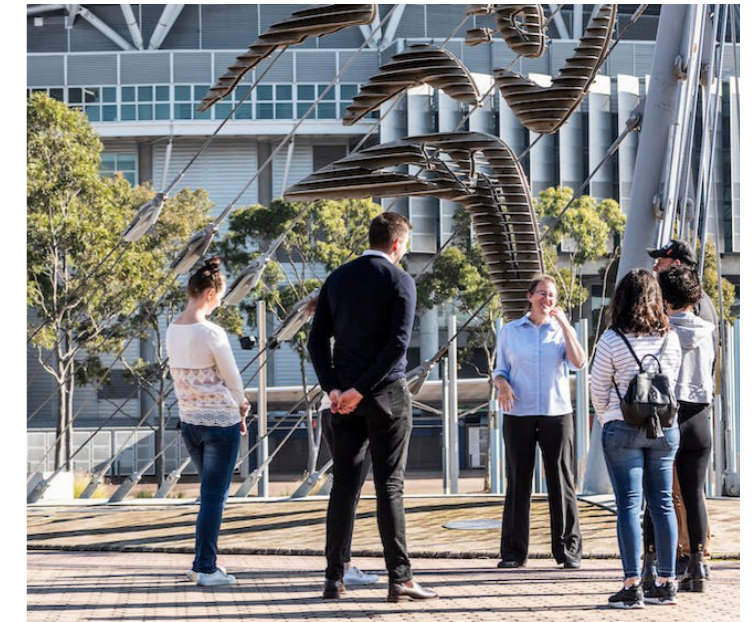
A cool, green and nature positive place, responding to Wangal Country, with parklands and waterways embedded into the built environment

Measures of success

- Developable site area across the Town Centre is replaced one-for-one with green and/or blue coverage through green roofs, green walls and open space
- The existing urban town centre boundary does not expand into the Parklands
- There is a net increase in public vegetated green spaces across the built environment of Sydney Olympic Park
- There is a net increase in tree canopy coverage across the built environment of Sydney Olympic Park

Actions

1. Parklands to continue ecological and cultural regeneration, enhancing thriving environments and ecological refuges
2. Plan for climate change-driven ecosystem migration and change
3. Create nature positive urban areas that enhance ecological connections, enable positive human centred interactions with nature and build a green legacy
4. Connect Sydney Olympic Park to Regional NSW's agricultural and ecological systems
5. An exemplar naturally-cooled built environment
6. Restore and regenerate estuarine and freshwater systems



10. A delivery model fit for the future

An effective and tailored governance and funding model to deliver the 2050 vision

Measures of success

- Sydney Olympic has a governance structure and supporting funding model that delivers the vision and is sustainable

Actions

1. Evolve to a governance framework that enables the delivery of the 2050 Place Vision and Strategy
2. Retain the freehold of remaining publicly-owned land, where feasible
3. Increasing the opportunity for existing and future facilities to meet community and visitor needs alike
4. Set up ongoing monitoring and implementation processes, based on different horizons
5. Establish and measure performance indicators

1.4 Study Requirements

The Sydney Olympic Park Authority (SOPA) Act 2001 Act requires the preparation of a Master Plan and its approval by the Minister for Planning to give it effect.

In line with this, Clause 28 of the State Environmental Planning Policy (Precincts—Central River City) 2021 requires SOPA to undertake a review of a master plan five years from the date the master plan has effect and report the outcome of the review to the Minister, with the current version of the Master Plan being the 2018 review and Interim Metro Review.

“Table 1.1 Sustainability, Water & Waste Management and Resilience Study Requirements” provides a summary response and identifies where in this report relevant study requirements are addressed.

This report does not cover requirements related to contamination, or noise and vibration. These specific aspects are comprehensively addressed in separate supporting technical reports.

Table 1.1 Sustainability, Water & Waste Management and Resilience Study Requirements

Study Requirement	Summary Response	Where addressed
Demonstrate how the Master Plan will contribute to the NSW Water Quality Objectives (WQO) for Sydney Harbour and the Parramatta River catchment.	Sydney Harbour and Parramatta River Water Quality and River Flow Objectives are noted as minimum targets for the Integrated Water Cycle Sustainability Theme, the Principles are aligned with NSW Water Quality Objectives (WQO) for Sydney Harbour and the Parramatta River catchment: <ul style="list-style-type: none">- Embrace integrated approach respecting water system interconnectedness, including surface water, groundwater, and stormwater.- Prioritise aquatic habitat preservation, harmonising human activities with the natural environment.- Champion water efficiency to minimise waste, safeguard resources for present and future generations.- Empower community through education, involvement, fostering shared water stewardship.- Strategically plan for challenges like flooding and climate change, enhancing adaptability.- Utilise cutting-edge technology and practices for optimal water management.- Design water-centric spaces for culture, recreation, and aesthetics, enhancing precinct quality of life.	“3.11 Integrated Water Cycle” on page 42
Helps deliver initiatives, such as Let’s Make Parramatta River Swimmable Again by 2025.	“Help deliver initiatives, such as Let’s Make Parramatta River Swimmable Again by 2025” is one of the minimum targets for the Integrated Water Cycle Sustainability Theme and Master Plan Potential Initiatives, design opportunities, and operational opportunities present tangible ways to deliver this outcome.	“3.11 Integrated Water Cycle” on page 42
Understand resource consumption outcomes, including energy, water, waste, climate change resilience and greenhouse gas emissions.	Likely resource consumption implications of the proposed 2050 Master Plan are modelled in “6.1 Resource use model”. Current weather data and future climate scenarios are detailed in “Appendix D Climate Adaptation Plan”.	“6.1 Resource use model” on page 65, “Appendix C Resource and Emissions Assumptions” on page 96, and “Appendix D Climate Adaptation Plan” on page 100
Investigate opportunities to reduce waste generation and create circular economy clusters through the choice and location of land uses under the Master Plan.	The Circular Economy Sustainability theme set principles, benchmarks, and present Master Plan Potential Initiatives, design opportunities, and operational opportunities to reduce waste and facilitate a circular economy. Strategic Initiatives proposes two specific strategic initiatives to deliver beyond business as usual (BAU) circular economy outcomes - Sharing Economy Hub, and Circular Repair Hub.	“3.10 Circular Economy” on page 41, “4.1.4 Sharing Economy Hub” on page 51, and “4.1.3 Circular Repair Hub” on page 49
Propose pragmatic sustainability initiatives within the precinct and consider strategies such as maximum use of passive solar shading and natural ventilation in dwellings to improve passive resilience, mitigation of urban heat island impacts through building design and landscape treatments.	The Carbon Positive, and Resilient and Adaptable Sustainability themes set principles and benchmarks, and present Master Plan Potential Initiatives, design opportunities, and operational opportunities to improve passive resilience and mitigation of urban heat island impacts through building design and landscape treatments.	“3.5 Carbon Positive” on page 36, “3.7 Resilient and Adaptable” on page 38
Explore the viability of higher sustainable water (including the viability of the existing water recycling system for increased development), energy targets and pragmatic sustainability initiatives within the precinct.	Higher energy and water targets utilising Green Star and NABERS rating tools are proposed. Planning controls in 3.5.1 Water systems state “Have dual-reticulation with an alternative water supply to all approved uses. Developments are to connect to a recycled water network wherever it is available.” The Carbon Positive, and Integrated Water Cycle Sustainability themes set principles and benchmarks, and present Master Plan Potential Initiatives, design opportunities, and operational opportunities to reduce energy and water consumption.	“3.11 Integrated Water Cycle” on page 42, “3.5 Carbon Positive” on page 36, and “7.1.1 Performance targets” on page 72
Explore the viability of alternate energy generation and use.	Green Star Buildings tool offers potential points for incorporating roof mounted solar photovoltaic systems in the Grid Resilience, and Energy Use – Residential pathway credits, and requires that all energy used is 100% renewable. Planning controls section 3.5.4 Environmental performance and sustainability requires “Building roofs must contribute to sustainability outcomes by being either green, usable open space, solar PV, or a combination of these, and not contribute to urban heat island (UHI) by incorporating materials with a low solar reflectance index (SRI).” Two Strategic Initiatives explore in more detail opportunities related to precinct scales energy generation, storage, and renewable energy supply - Microgrid, and Sustainability-as-a-Service Strategy.	“3.5 Carbon Positive” on page 36, “4.1.1 Microgrid” on page 45, and “4.1.6 Sustainability-as-a-Service Strategy” on page 55

Study Requirement	Summary Response	Where addressed
Address sustainability considerations identified in Region Shaper 6 – Six Cities Region Discussion Paper.	Links between the Six Region Shapers and Sustainability Values and Themes herewith include: <ul style="list-style-type: none">- An embedded First Nations voice - Connecting with Country- A connected Six Cities Region - Integrated Mobility- Housing supply, diversity and affordability - Welcoming and Inclusive- Inclusive places linked to infrastructure - Integrated Mobility, and Welcoming and Inclusive- Climate-resilient green cities - Carbon Positive, Resilient and Adaptable, Integrated Mobility, Circular Economy, and Integrated Water Cycle	“1.A.2 Six Cities Region Discussion Paper, Greater Cities Commission” on page 76, “3.1 Sustainability Strategy” on page 32
A Resiliency Strategy that identifies potential shocks (e.g., flooding, fire, extreme heat, drought, etc) and stresses (e.g., housing affordability, ageing infrastructure, sea level rises, unemployment, etc.) and outlines suitable mitigation strategies including through the masterplan design.	A discrete Climate Adaptation Plan in line with NSW Government requirements, ISO and AN/ZS Standards, and third-party sustainability rating tools was produced and is appended to this report. Specific initiatives and opportunities are captured in the Resilient and Adaptable Sustainability Theme.	“3.7 Resilient and Adaptable” on page 38, and “Appendix D Climate Adaptation Plan” on page 100
The sustainability report is to take into consideration the NSW Government Circular Economy Policy Statement and take any opportunities to ensure that the Master Plan 2050 (2022 Review) is consistent with the policy.	The Circular Economy Sustainability theme set principles, benchmarks, and present Master Plan Potential Initiatives, design opportunities, and operational opportunities to reduce waste and facilitate a circular economy. Strategic Initiatives proposes two specific strategic initiatives to deliver beyond BAU circular economy outcomes - Sharing Economy Hub, and Circular Repair Hub.	“1.A.3 NSW Circular Economy Policy Statement, NSW Government” on page 77, and “3.10 Circular Economy” on page 41 “4.1.4 Sharing Economy Hub” on page 51, and “4.1.3 Circular Repair Hub” on page 49
Benchmarked results making comparisons to “Business as Usual” and “Metropolitan Averages” against the above key indicators to demonstrate the regional contribution of the precinct strategy.	Likely resource consumption implications of the proposed 2050 Master Plan are modelled in “6.1 Resource use model”.	“6.1 Resource use model” on page 65, and “Appendix C Resource and Emissions Assumptions” on page 96
The report is to undertake resource-use modelling (carbon, energy, water, waste forecasts) based on GFAs in the precinct. This will compare business as usual against proposed higher standards for all use types	Likely resource consumption implications of the proposed 2050 Master Plan are modelled in “6.1 Resource use model”.	“6.1 Resource use model” on page 65, and “Appendix C Resource and Emissions Assumptions” on page 96

02 CONTEXT

2.1 Unveiling potential, confronting challenges

As we embark on the visionary journey of crafting a new master plan for Sydney Olympic Park in 2050, we are presented with an exceptional canvas upon which to blend innovation, sustainability, and community engagement.

This section delves into a comprehensive assessment of our project's internal dynamics and external landscape, identifying key strengths, weaknesses, opportunities, and threats that will shape our approach. By carefully navigating these facets, we aim to forge a blueprint that not only revitalises the park's essence but also sets a global benchmark for sustainable urban development.

Here we start to explore the intricate interplay of factors that will guide our decisions, ensuring that the reimagined Sydney Olympic Park harmonises seamlessly with nature, technology, culture, and the aspirations of the communities it serves.

2.1.1 Strengths

- Diversity of land use and building stock which can encourage diversity of uses from many types of businesses and support the expansion of a more robust ecosystem
- Existing cultural heritage contributing to a distinct local identity
- Existing infrastructure from the Sydney 2000 Games provides a strong foundation for redevelopment.
- Historic significance and recognition on the global stage due to hosting previous Olympic Games.
- A diverse range of ecosystems and green spaces within the park area.
- Strong local community engagement and a history of public events.
- Existing sports and recreational facilities that can be upgraded and re-purposed.
- Opportunity to showcase innovative sustainable technologies and practices.
- Potential for mixed-use development, combining residential, commercial, and recreational spaces.

2.1.2 Weaknesses

- Car-oriented mobility, and lack of public and active personal transport infrastructure.
- Ground contamination that limits actions in some areas to avoid vegetation disturbance that might release pollutants.
- Need for continued protection of sensitive ecosystems in the face of increased population and visitation growth.
- Aging infrastructure may require substantial updates and renovations.
- Limited available space for expansion within the existing park boundaries.
- Potential conflict between development goals and environmental conservation efforts.
- Balancing the needs of various stakeholders, including local residents, businesses, and environmental advocates.
- Possible disruption to ongoing events and activities during the

redevelopment process.

- Need for careful planning to ensure inclusivity and accessibility for all community members.

2.1.3 Opportunities

- Galvanise stakeholders' existing sustainability ambitions and catalyse for greater outcomes.
- Drive community growth through social procurement, partnering with businesses that prioritise social impact, job creation, and diversity, thereby intertwining physical and social development at Sydney Olympic Park.
- Increased public health and quality of life for new and existing community members.
- Parklands, residential, and sports facilities on site providing valuable social and utility infrastructure
- Environmental, social and economic resilience through a coordinated approach
- Precinct-scale resource sharing efficiencies
- Sydney Metro West and Parramatta Light Rail extension will be transformative the way people access Sydney Olympic Park.
- Incorporation of smart city technologies to enhance efficiency and resource management.
- Promotion of active transportation options, such as pedestrian pathways and cycling lanes.
- Development of mixed-income housing, including affordable housing, to encourage a diverse and inclusive community.
- Enhancement of public spaces, cultural venues, and recreational areas for increased community engagement.
- Incorporation of green building practices and nature-based solutions to address climate resilience.
- Collaboration with local universities and research institutions for innovative solutions.

2.1.4 Constraints

- The existing urban town centre boundary does not expand into the Parklands.
- Opposition from local communities or environmental stakeholders concerned about potential negative impacts on the ecosystem.
- Economic uncertainties that could impact funding and investment for the redevelopment.
- Potential for conflicts between different land uses and interests within the park.
- Competition for resources and attention with other urban development projects in Sydney.
- Adverse weather events and climate change impacts that could disrupt construction and future operations.
- Public resistance to changes that may alter the park's nostalgic or historic value.



Figure 2.1 Sydney Olympic Park regional context (Source: Vision 2050)

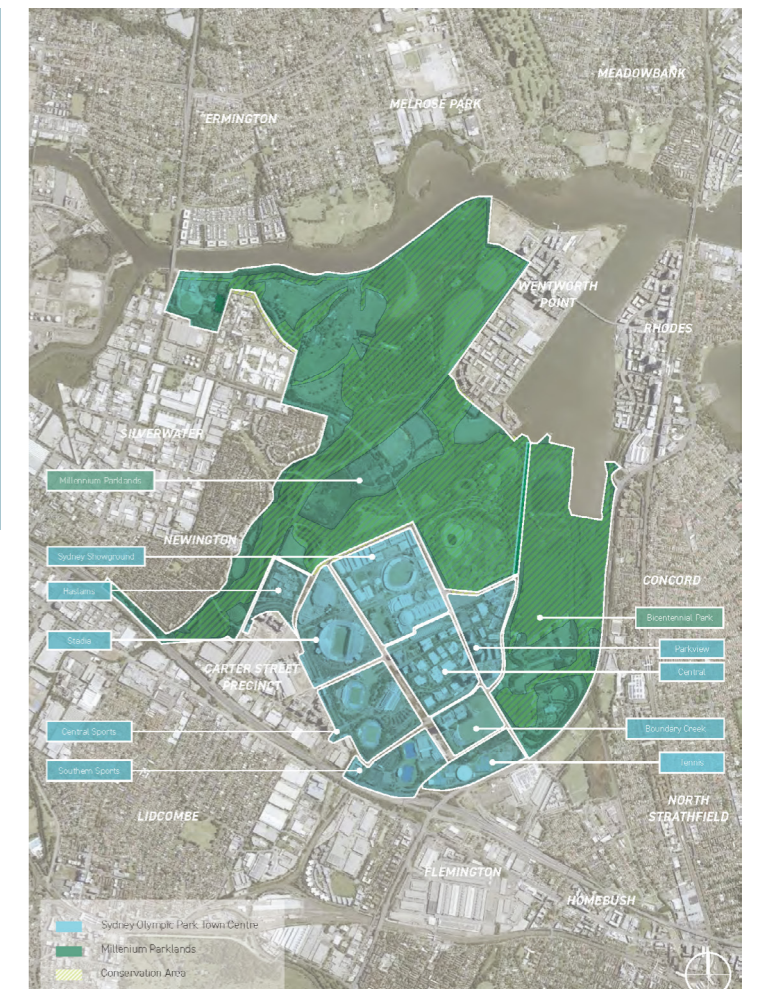


Figure 2.3 Neighbourhoods of Sydney Olympic Park (Source: Vision 2050)



Figure 2.2 Nature, Residential and Sports areas at Sydney Olympic Park (Source: Vision 2050)

These themes guide our path, shaping Sydney Olympic Park's future in a fabric woven with sustainability, resilience, and progress.

SOPA



2.3 Development environment

Understanding the industry context is paramount to the successful delivery of the 2050 Master Plan.

2.3.1 Industry

Understanding the industry context is pivotal for the 2050 Master Plan's success. Industry leaders, along with influential non-governmental organisations (NGOs), are setting ambitious objectives beyond statutory requirements, driving innovation, and sustainable development. Aligning with these ambitions meets market demand for eco-friendly development, attracting sustainability-focused stakeholders. Incorporating sustainable practices enhances reputation and long-term profitability.

Implications for Master Plan 2050

- Collaborate with industry groups for innovation.
- Identify novel eco-friendly opportunities.
- Prioritise sustainability alignment to meet market demands.
- Engage with communities and businesses.
- Integrate industry-driven sustainability criteria.
- Maintain transparency and accountability.
- Create incentives for sustainable practices.
- Continuously monitor industry trends.

2.3.2 Rating Tools

Third-party rating tools ensure sustainability in the Master Plan 2050 development. Many tools, local and international, are updated to incorporate industry preferences, climate goals, and post-COVID responses. Even without certification goals, understanding these tools is vital. They measure and achieve sustainability rigorously, aiding performance optimisation.

Implications for Master Plan 2050

- Consider third-party tools for sustainability assurance.
- Stay informed about evolving criteria.
- Use tools to identify sustainable development areas.
- Showcase sustainability commitment through certification.
- Communicate environmental, social, and economic benefits.
- Collaborate with industry leaders endorsing specific systems.
- Encourage certification within the park.
- Leverage certification for stakeholder attraction.
- Continuously evaluate performance.
- Align sustainability goals with tool criteria.

A detailed review of the [Industry](#) and [Rating tools](#) documents is included in "Appendix B | Development Context" on page 85. For each, a short summary is provided, as well as potential implications or actions for realising them in the Master Plan 2050.



2.4 Megatrends

Megatrends are major global, long-term movements or patterns that are slow to form but have a major impact in the macroenvironment.

They are the great forces that are evident in world leading development, and will affect the future in all areas throughout the world over the coming decades.

Identified megatrends that will directly affect planning for Sydney Olympic Park to 2050 and beyond come from:

- United Nations
- CSIRO
- World Economic Forum
- Organisation for Economic Co-operation and Development (OECD)



2.4.1 Climate change

Anthropogenic (human-induced) climate change resulting in increase frequency and intensity of severe weather events and the global imperative for mitigation, adaptation, and disaster preparedness.

Sydney Olympic Park will need to be robust enough to deal with increasingly intense and unpredictable weather including warming air and water temperatures, severe storms, and bushfires, critical infrastructure failure, civil disturbance, shifts in business models, social stresses, at nested scales from park, to building, to equipment.



2.4.2 Biodiversity collapse

Climate change coupled with global urbanisation leading to declines in species, habitats and ecosystems from physical, chemical, and biological pressures.

Sydney Olympic Park faces the challenge of biodiversity decline due to climate change and urbanisation pressures. Managing increased urban development is crucial to protect the park's ecology and preserve regional ecosystem benefits.



2.4.3 Resource scarcity

Global consumption has increased dramatically over the past century increasing demand for resources such as water, food, energy, land and minerals causing scarcity and inherent cost increases.

Sydney Olympic Park will need to address and reconsider dependence on raw materials and resources, find new ways of operating, and use alternative resources, leveraging benefits from its scale



2.4.4 Ageing populations

Growth in the proportion of older people caused by improvements in public health, social and economic developments, and medical advancements, coupled with declining fertility rates.

Sydney Olympic Park will need to ensure a diversity of residential models and typologies suitable for older Australian, and incorporation of allied services and infrastructure such as pathology, therapy, and fitness.



2.4.5 Health and wellness

Acceleration in preventative health and holistic wellness with a broader focus on nutrition, exercise, mental well-being and lifestyle.

Sydney Olympic Park residents and community will expect the built environment to support their physical, mental, emotional, and cognitive wellbeing, and its role as a space for respite in the region will become more important in the future.



2.4.6 Rising inequality

Income disparities and lack of opportunities create vicious cycles of inequality, exacerbating the risks of divisions and hampering economic and social development.

Sydney Olympic Park will need to ensure it supports an inclusive community by delivering social infrastructure, implementing sustainable procurement models, and exploring options for culturally appropriate and safe spaces.



2.4.7 Urbanisation

The rapid rise in the number of people living in urban areas is leading to increased pressure on infrastructure, competition for resources, and social isolation.

Sydney Olympic Park will need to foster community cohesion and resilience, ensure urban design throughout the precinct is people-focused, empower workers, residents, and visitors to have a say on the future of the precinct, and identify opportunities to co-design elements of the place.



2.4.8 Digital technology

Technical progress, constant further development of the internet, and increasing globalisation emerging as a result of digitalisation have a considerable impact on society.

Sydney Olympic Park will need to enhance social and environmental performance and disclosure through emerging digital technology and the internet of things by developing a data platform and sensor strategy, providing a way-finding platform, and supporting the development of a Living Lab.

2.5 Sustainability Research

This section explores key concepts that can significantly enhance the development of Sydney Olympic Park's Master Plan 2050.

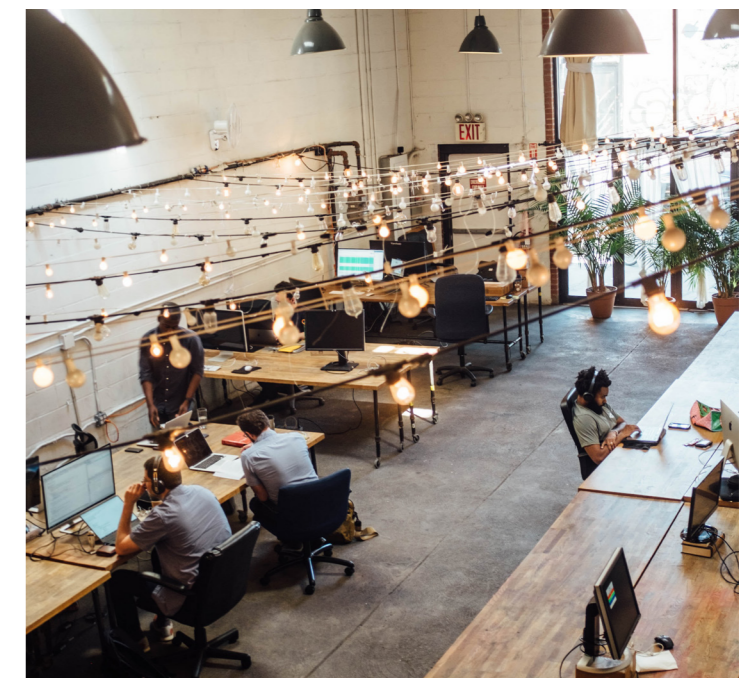
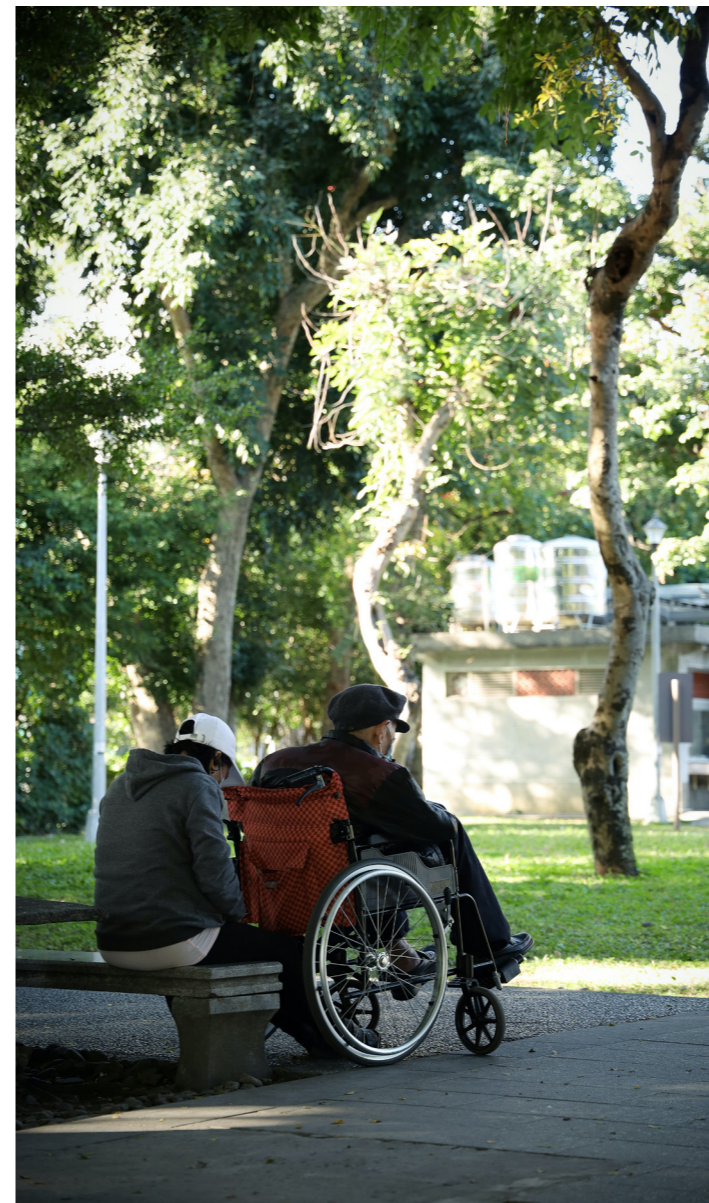
These concepts are rooted in research fields such as climate science, ecology, and sociology. They highlight the growing importance of considering the environment and societal factors in our planning.

They emphasise that our planning should extend beyond the suburb's boundaries. By doing so, we can create a more resilient and sustainable Sydney Olympic Park, better prepared for the challenges of the future.

They set the stage for a deeper understanding of sustainability approaches and concepts, which are summarised in the following sections, guiding our vision for a resilient and sustainable Sydney Olympic Park.

Key Lessons and Actions

- Living within Carrying Capacity of the Planet:
 - Employ ecological footprint analysis to gauge the park's sustainability thresholds.
 - Devise growth strategies that harmonise with the park's ecological limits.
- Supporting Social and Economic Inclusion:
 - Integrate mixed-income housing to foster social diversity.
 - Design inclusive public spaces that promote social cohesion.
- Designing with Consideration for Natural Systems:
 - Leverage biophilic design principles to create a seamless integration with local ecosystems.
 - Develop stormwater management strategies based on the natural hydrological patterns.
- Actively Reversing Environmental Damage:
 - Implement regenerative landscaping practices to restore biodiversity.
 - Integrate renewable energy sources and sustainable building materials.
- Fostering Shared Prosperity:
 - Establish partnerships with local businesses to bolster economic growth for the community.
 - Incorporate shared workspace concepts to stimulate entrepreneurship and innovation.
- Advancing Local Growth with Holistic, Interconnected Strategies:
 - Integrate transportation planning to facilitate multimodal connectivity.
 - Develop comprehensive waste management infrastructure to minimise environmental impact.



2.5.1 Doughnut Economics

Doughnut economics is an economic concept developed by economist Kate Raworth in 2012. The concept proposes a new economic model that takes into account both social and ecological aspects of sustainability. The idea is that instead of striving for endless growth, we should aim to create a “safe and just space for humanity” by meeting the needs of all people while respecting the limits of the planet’s resources. The “doughnut” represents this space, with the outer ring representing the planet’s ecological limits, and the inner ring representing the basic needs of humanity.

Since its development, the concept of doughnut economics has gained popularity and has been implemented in various ways. For example, Amsterdam became the first city to officially adopt the doughnut economics model in 2020. Other cities like Portland and Philadelphia have also incorporated the concept into their sustainability plans. In addition, businesses and organisations have also started using the doughnut economics model in their decision-making processes.

Considering doughnut economics in the development of a new master plan for Sydney Olympic Park is important because it encourages a more holistic and sustainable approach to development. By prioritising the needs of both people and the planet, the doughnut economics model can help ensure that development is not only economically viable but also socially and environmentally responsible. This can lead to a more resilient and equitable community in the long run.

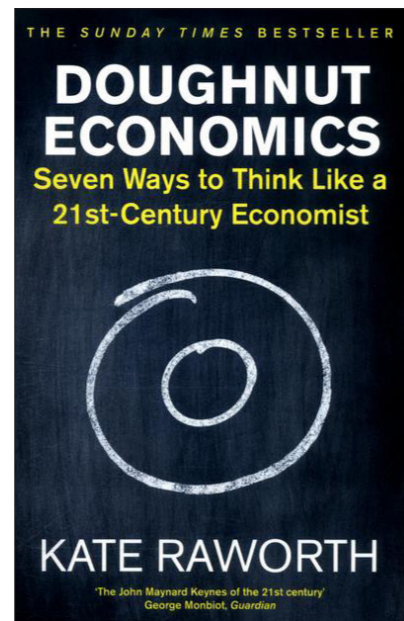


Figure 2.4 Doughnut Economics: Seven Ways to Think Like a 21st-Century Economist by Kate Raworth (Source: Doughnut Economics Action Lab (DEAL))

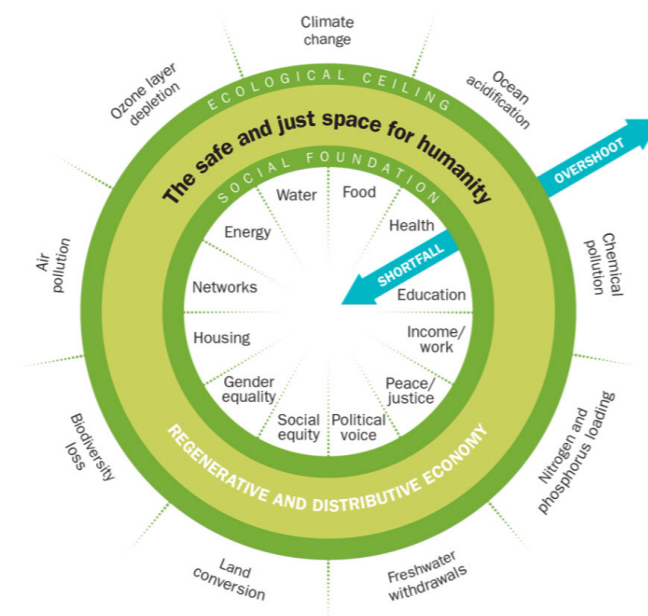


Figure 2.5 The Doughnut of social and planetary boundaries (Source: Doughnut Economics Action Lab (DEAL)).

2.5.2 Regenerative Development and Design

Regenerative development and design is an approach to urban planning and design that aims to create sustainable and regenerative communities. It was developed in response to the negative impacts of conventional development practices on the environment and human health. The concept focuses on creating communities that are integrated into their natural systems and use resources in a way that supports and enhances the health of the environment. It is a holistic approach that seeks to address social, economic, and environmental issues simultaneously.

Regenerative development and design has its origins in the sustainable development movement of the 1980s and 1990s. It was further developed in the early 2000s by a group of architects and planners who sought to go beyond the limits of sustainable design and create truly regenerative communities. Since then, it has gained popularity among urban planners, architects, and policymakers who see it as a way to create communities that are resilient to climate change and other environmental and social challenges.

Examples of ways regenerative development and design has been implemented include:

- Using green infrastructure, such as rain gardens and green roofs, to manage stormwater and improve air quality
- Creating mixed-use developments that combine residential, commercial, and community spaces to reduce dependence on cars
- Incorporating renewable energy sources, such as solar and wind power, into buildings and communities
- Promoting local food systems through community gardens and urban agriculture
- Designing buildings and communities that are adaptable and resilient to changing climate conditions

It is important to consider regenerative development and design in the development of a new master plan for Sydney Olympic Park because it provides a framework for creating a sustainable and resilient community. By incorporating regenerative principles into the planning and design process, the master plan can ensure that the development is integrated with its natural systems and that resources are used in a way that supports the health of the environment. This can help to mitigate the impacts of climate change and other environmental and social challenges, while also creating a vibrant and thriving community for residents and visitors alike.

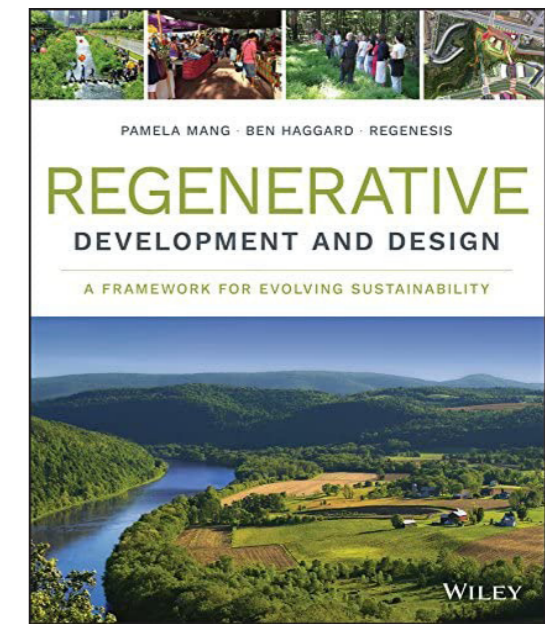


Figure 2.6 Regenerative Development and Design: A Framework for Evolving Sustainability by Pamela Mang, Ben Haggard, and Regenesi (Source: Wiley)

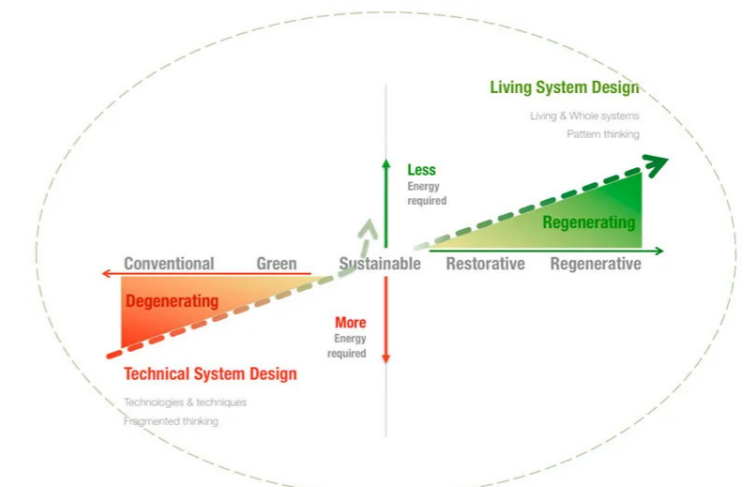


Figure 2.7 The spectrum of sustainability practices: From less bad to more good. (Source: Regenesi)

2.5.3 Transformative Placemaking

Transformative placemaking is a concept that emerged as an approach to urban development that puts community engagement and empowerment at the forefront. The idea is to transform places by creating spaces and buildings that are designed with people in mind, and that are inclusive, equitable, and sustainable. The concept has its roots in urban planning and design, but it has evolved to encompass a range of practices and disciplines, including architecture, landscape architecture, and social and environmental sciences. Transformative placemaking has become important because it provides a way to address complex social and environmental issues, such as inequality, climate change, and biodiversity loss, by focusing on the relationships between people and their built and natural environments.

Examples of ways that transformative placemaking has been implemented include:

- Community-led design processes that involve local residents and stakeholders in the development of new public spaces, such as parks and plazas.
- Adaptive reuse of existing buildings to create new community spaces, such as cultural centres, co-working spaces, and community kitchens.
- Sustainable and resilient design strategies that incorporate green infrastructure, such as rain gardens, green roofs, and urban forests.
- Inclusive design practices that prioritise accessibility and safety for people of all abilities and backgrounds.
- Collaborative partnerships between government, community organisations, and private developers to create shared visions for the future of neighbourhoods and cities.

In the development of a new master plan for Sydney Olympic Park, transformative placemaking is important because it offers a way to create a sustainable and vibrant community that meets the needs of all residents and stakeholders. By engaging with the local community and incorporating their ideas and values into the planning process, the master plan can create a sense of ownership and pride among residents. Furthermore, by prioritising sustainability, accessibility, and resilience, the master plan can help to mitigate the impacts of climate change and improve the quality of life for current and future generations.



Figure 2.8 Why We Need to Invest in Transformative Placemaking by Jennifer Vey (Source: The Brookings Institution)

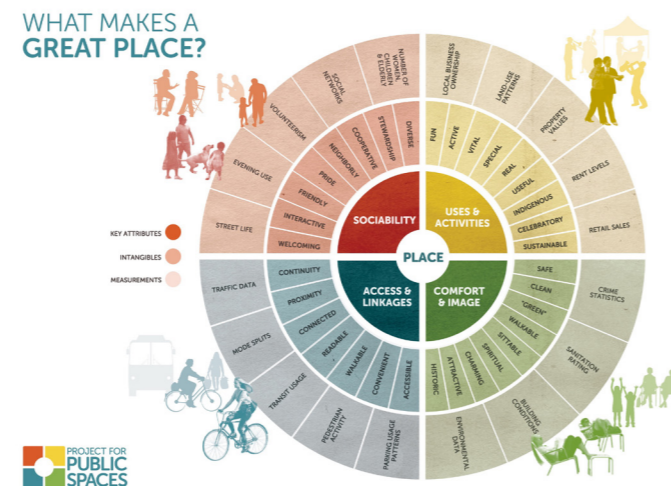


Figure 2.9 Public Spaces and Placemaking Approach: The Implementation Strategies (Source: Project for Public Spaces)

2.5.4 Panarchy

Panarchy is a concept that describes how complex systems, like ecosystems, economies, or societies, change and adapt over time. The term was first coined by the ecologist C.S. Holling in the 1990s and draws on the idea of nested, interdependent systems.

According to the theory of panarchy, systems exist at multiple scales, each with its own set of dynamics and feedback loops. These scales are connected in a hierarchical way, with smaller scales nested within larger ones. The concept of panarchy emphasises that the health and resilience of a system depend on the interactions between these different scales. When a disturbance occurs at one scale, it can have ripple effects throughout the entire system, creating both risks and opportunities for change and transformation.

Since its inception, the concept of panarchy has been applied to a range of systems, including ecological, economic, and social systems. It has become increasingly important in fields such as sustainability, conservation, and urban planning, as it provides a framework for understanding the complex dynamics of these systems and for developing strategies to manage them more effectively.

Examples of ways that panarchy has been implemented include:

- Ecological restoration projects, where the panarchy framework is used to identify the different scales of the ecosystem, the interactions between them, and the key drivers of change.
- Fisheries management, where the panarchy approach is used to understand the different scales of the fishery system, including the fish population, the fishing industry, and the regulatory framework, and to develop strategies that promote sustainable fishing practices.
- Urban planning, where the panarchy framework is used to identify the different scales of the urban system, including the natural environment, the built environment, and the social and economic systems, and to develop strategies that promote the long-term sustainability and resilience of the city.

In the development of a new master plan for Sydney Olympic Park, it is important to consider the concept of panarchy because the suburb is a complex system that exists at multiple scales. The health and resilience of the park depend on the interactions between these different scales, including the natural environment, the built environment, and the social and economic systems that exist within and around the park. By using a panarchy approach, planners can identify the key drivers of change in each of these scales and develop strategies that promote the long-term sustainability and resilience of the park as a whole. This can help to ensure that the park remains a vibrant and valuable asset for the community for many years to come.

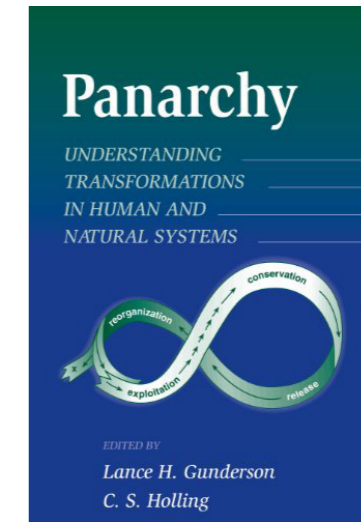


Figure 2.10 Panarchy (Source: C.S. Holling and Lance H. Gunderson)

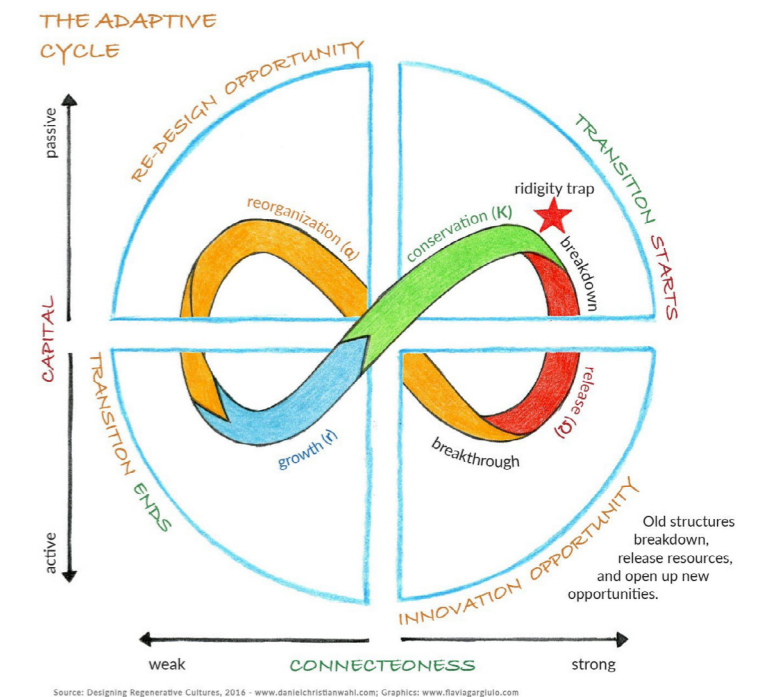


Figure 2.11 The Adaptive Cycle (Source: Designing Regenerative Cultures)

2.6 Case Studies

This section includes a comprehensive exploration of benchmark projects that resonate with the innovative spirit and sustainable aspirations of Sydney Olympic Park.

This series of case studies shines a spotlight on exceptional endeavours from around the world, each offering a unique perspective on relevant aspects crucial to the evolution of Sydney Olympic Park. While few projects provide a holistic comparison, we've curated a selection that resonates with the park's ethos. The following pages provide insights, actionable strategies, and visionary approaches that can propel Sydney Olympic Park into a thriving future.

Sustainable Infrastructure and Transformation:

- **Sydney Olympic Park:** At the forefront of Australian sustainable infrastructure, Sydney Olympic Park showcases visionary urban planning that integrates eco-consciousness into every facet of its development.
- **Queen Elizabeth Olympic Park and Wembley Park, London:** These re-purposed spaces transitioned from event venues to multi-use precincts, offering lessons in sustainable operation and creating resilient communities.

Holistic Urban Design and Community Integration:

- **Central Park, Sydney:** Leverages multi-building systems for low energy use and automation, exemplifying the power of shared space and economies of scale.
- **Kings X, London:** Diverse site uses, collaborative art installations, and low carbon operation showcase community-focused integration within a large-scale development.

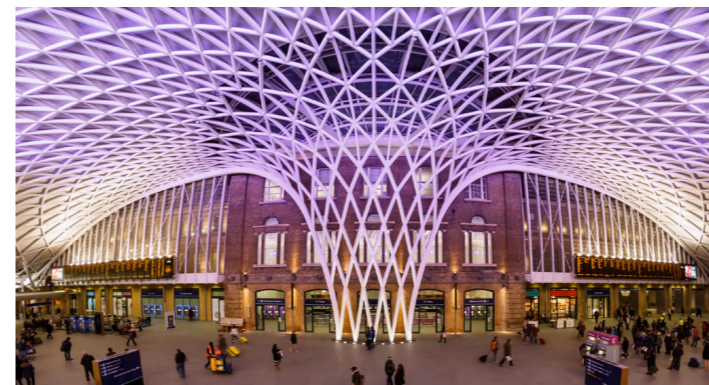
Eco-Friendly Lifestyle Precincts:

- **Sentosa, Singapore:** Balances ambitious environmental goals with leisure space, focusing on public transport links and innovative energy and waste management programs.

Ecological Remediation and Biodiversity Enhancement:

- **Bishan-Ang Mo Kio Park, Singapore:** Transformation from a concrete storm drain to a biodiverse river park echoes Sydney Olympic Park's habitat reconstruction efforts.
- **Olympic Forest Park, Beijing:** Post-Olympic re-purposing emphasises ecological restoration, native habitats, and harmonious fusion of nature and recreation.
- **Fresh Kills Park, New York City:** Landfill transformation into an ecological haven showcases habitat restoration, native plantings, and public engagement.

Each of these projects resonates with relevant aspects for the development of Sydney Olympic Park's 2050 Master Plan, offering tangible insights and shared experiences that can guide its transformation into a sustainable and vibrant ecosystem.



2.6.1 Sydney Olympic Park to date

At the forefront of Australian sustainable infrastructure, Sydney Olympic Park showcases visionary urban planning that integrates eco-consciousness into every facet of its development.

With a legacy rooted in nature preservation and responsible resource management, the park sets the stage for a resilient community. As we envision the 2050 Master Plan, our focus remains on building upon these foundations and propelling sustainable practices beyond boundaries.

Sydney Olympic Park was chosen as a case study due to its exceptional track record in pioneering sustainable practices and its pivotal role as a model for sustainable urban development in Australia.

Stadium Australia

- Stadium Australia exemplifies sustainable design with its iconic saddle-shaped roof, natural light utilisation, and ecological considerations.
- Rainwater harvesting for the pitch and recycled water for toilets showcase resource efficiency.
 - Low PVC usage and life cycle assessments on materials highlight mindful choices.
 - Co-generation plants and innovative Towers of Power set sustainability benchmarks.

Newington

- Newington embodies a sustainable living vision through Australia’s largest solar installation during its time and passive design principles.
- Solar hot water systems, cycle ways, and walkways integrate renewable energy and connectivity.
 - Smart water use includes recycled water for irrigation and toilets.
 - High waste recycling rates during construction underline eco-responsible practices.

Sydney Olympic Park Train Station

- The train station showcases sustainable mobility and architecture, driven by passive design, recycled materials, and energy-efficient features.
- Equitable access, natural ventilation, and plant species that do not need a significant amount of water to thrive emphasise sustainability.
 - Reflectors enhance natural lighting, reducing the need for artificial illumination.
 - Permeable paving and water harvesting contribute to eco-friendly station design.

Water Reclamation and Management Scheme (WRAMS)

WRAMS marks a pioneering urban water treatment achievement, revolutionising water management within the park.



- The first large-scale urban water treatment scheme produces recycled water for various uses.
- Parklands, entertainment venues, and habitats benefit from reclaimed water.
- WRAMS leads with over 80% of total water use being recycled water.

Comprehensive Water Conservation

- Sydney Olympic Park’s holistic water conservation strategy integrates wastewater reprocessing, stormwater harvesting, and demand reduction.
- Stormwater harvesting supports diverse ecosystems and curbs downstream impacts.
 - Collaboration with the Sydney Catchment Authority, Landcare, and other environmental groups to ensure responsible water management and habitat restoration.
 - Mandated WRAMS connection for new developments advances sustainable water management.

Pioneering Energy Management

- Striving for net zero carbon emissions by 2050, the park demonstrates responsible energy management.
- Installation of 1.5 MW solar photovoltaic systems at key sites,

- projecting \$300K annual savings and 1,640 tons reduction in emissions.
- Comprehensive energy-efficient lighting installation, improved heating and cooling systems, and LED upgrades for higher illumination with optimised energy consumption.
- Creative energy autonomy exemplified by solar panels and batteries in ‘Music Box’ activation.

Contamination and remediation

- Sydney Olympic Park’s transformation from industrial sites to an ecological haven is rooted in meticulous remediation efforts.
- Ten managed landfills ensure compliance and integrity.
 - Leachate treatment and stormwater filtration protect water quality.

Waste Reduction and Circular Practices

- The Authority’s Waste Management Strategy propels waste reduction through innovative measures.
- Active litter collection safeguards waterways and habitats.
 - A three-bin system and sorting infrastructure enhance waste diversion.
 - Grass clippings composting and education campaigns promote community engagement.

- Riverside Scavenge events foster litter collection and awareness in partnership with the Ethnic Communities’ Council of NSW (ECCNSW).
- Collaboration with the UNSW Centre for Sustainable Materials Research and Technology (SMaRT Centre) to transform waste textiles and glass into ceramic tiles showcases circular economy practices.

Biodiversity and Ecosystems

- Sydney Olympic Park’s conservation efforts preserve vital habitats and protect endangered species.
- Collaboration with the Department of Planning and Environment’s Saving Our Species program for the annual Green and Golden Bell Frog technical workshop.
 - Community engagement programs, such as the Ecofriend program and Neighbours Nurturing Nature, foster public involvement in environmental conservation.
 - Collaborations with external agencies, including Macquarie University, Newcastle University, University of Sydney, and RSPCA NSW, fuel vital research on wildlife behaviour, habitat health, and feline safety.

2.6.2 Queen Elizabeth Olympic Park, London

Originally built for the 2012 Summer Olympic and Paralympic Games, the park is a re-purposed complex of residential and commercial buildings as well as sporting venues located in London's East End. It spans 560 acres (225 hectares), with about 26 acres (10 hectares) of woods.

Relevance

This is the project with which we can draw the most parallels with Sydney Olympic Park. Both Olympic Parks have transitioned from events venues into multi-use precincts with residential and community spaces as well as large blue and green areas.

Environmental Initiatives

- Low energy, low water housing, built from low-embodied carbon, non-toxic materials
- Energy Centre on site that provides low-carbon heat and cooling to venues, commercial spaces, and neighbourhoods in and beyond the Park
- Use of green roofs to keep things cool, build resilience against flooding and create more open space. PVs provide electricity
- Homes are connected to the low carbon distribution heating system
- Electric charging points for cars are provided
- All homes meet Zero Carbon criteria

Social Initiatives

- Residents can grow food in community gardens
- Streets and public realm are designed to favour pedestrians and cyclists
- 35% of the housing across the park is affordable
- 100% are lifetime homes and 10% are wheelchair accessible
- Every home is within 350m of a bus stop

Assurance

- Building Research Establishment Environmental Assessment Method (BREEAM) Excellent standard on all venues



2.6.3 Wembley Park, London

Located at Brent and North West London, Wembley Park is a vibrant urban heart developed on 34.4 hectares of what used to be car parking used on events days only. Since 2004, £2bn (\$AUD3.8bn) have been invested to transform it into a place with retail, residential, commerce, and recreational areas.

Relevance

Known most widely as an events space, the public realm, housing and retail spaces have been developed to create a globally renowned entertainment district.

Environmental Initiatives

- Envac automated vacuum waste management system, first of its kind in the UK
- Highly energy efficient site-wide district energy system
- The single energy centre feeds approximately 20 separate buildings linked to a district heating network approximately 3.5 km in length
- Piled raft solution under each of the towers for foundations which reduced the number of piles needed by over 30%
- By 2050, Wembley Park will be more than 50% blue (ponds, puddles, canals, rivers and lakes) or green space (parks, gardens and woodlands)

Social Initiatives

- Wembley Park has evolved to create a brand new neighbourhood that brings business, people, experiences, education and employment together
- 8,500 homes expected to be built by 2027
- Implementation of The Yellow, Wembley Park's community hub
- Space for the Brent Foodbank, one of the largest foodbanks operating in the London Borough of Brent
- The Royal Philharmonic Orchestra at Wembley Park provides visitors and the local community with free and accessible musical experiences across Wembley Park

Assurance

- BREEAM Excellent on student accommodation development



2.6.5 Olympic Forest Park, Beijing, China

Situated in Beijing, China, the Olympic Forest Park spans a substantial area following the 2008 Olympic Games.

Covering an impressive 6.8 square kilometres, the park seamlessly integrates sports facilities, public spaces, and expansive woodlands. The project's timeline highlights its post-Olympic transformation, underscoring the importance of re-purposing sporting venues into a harmonious fusion of nature and recreation.

Relevance to Sydney Olympic Park

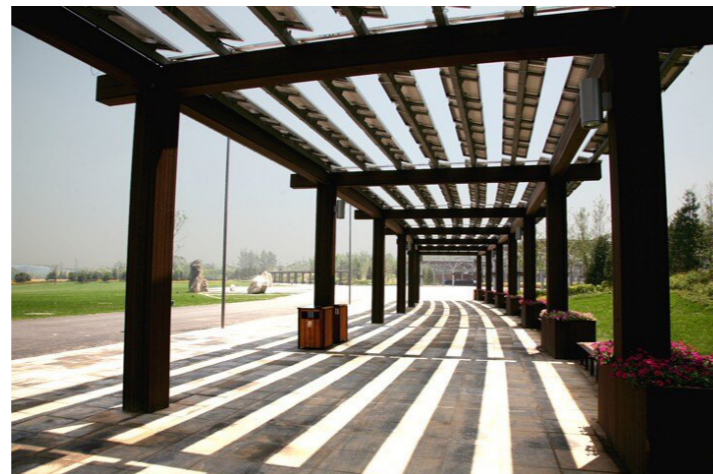
Olympic Forest Park offers pertinent insights to the Sydney Olympic Park master plan, showcasing post-Olympic site re-purposing that prioritises ecological restoration and habitat preservation. Both sites share the challenge of converting sports-centric areas into ecologically diverse and community-focused spaces while ensuring sustainable urban development.

Environmental Initiatives

- Restoration of native vegetation, emphasising local plant species and biodiversity.
- Creation of diverse habitats, including wetlands, meadows, and woodlands.
- Implementation of water-efficient irrigation systems and sustainable landscaping practices.
- Incorporation of wildlife corridors and nesting sites to support indigenous fauna.
- Careful management of stormwater to minimise ecological impact.

Social Initiatives

- Public engagement programs promoting environmental education and appreciation.
- Eco-friendly visitor centres and interpretive installations highlighting local ecosystems.
- Walking trails, jogging paths, and recreational areas for community gatherings.
- Hosting of ecological-themed events, raising awareness about conservation efforts.
- Artistic installations that blend culture, history, and nature to create a sense of place.



2.6.4 Central Park, Sydney

5.8-ha site includes high-density commercial development, housing, open space, connections to surrounding streets and neighbourhoods, and adaptive re-use of heritage buildings. Designed around a network of lanes, streets, parks and important heritage buildings.

Relevance

As a site featuring a diverse range of commercial spaces, significant public areas, and complex development, Central Park provides insights into the challenges and opportunities of large-scale urban projects, particularly relevant to addressing the increased density and development within the town centre of Sydney Olympic Park. Like Sydney Olympic Park, Central Park was developed in a bustling urban centre with existing infrastructure, reflecting the complexities of urban planning in such contexts.

At Central Park, the large scale of the site has been leveraged to allow for the use of multi-building systems, allowing for economies of scale to reduce energy use and increase automation.

Environmental Initiatives

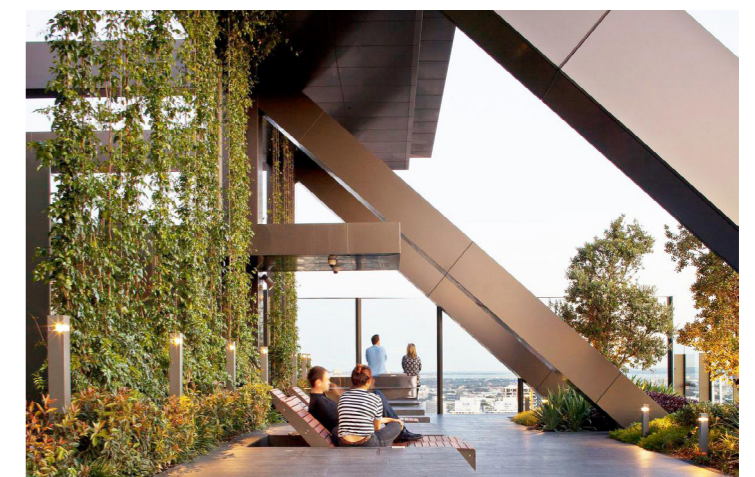
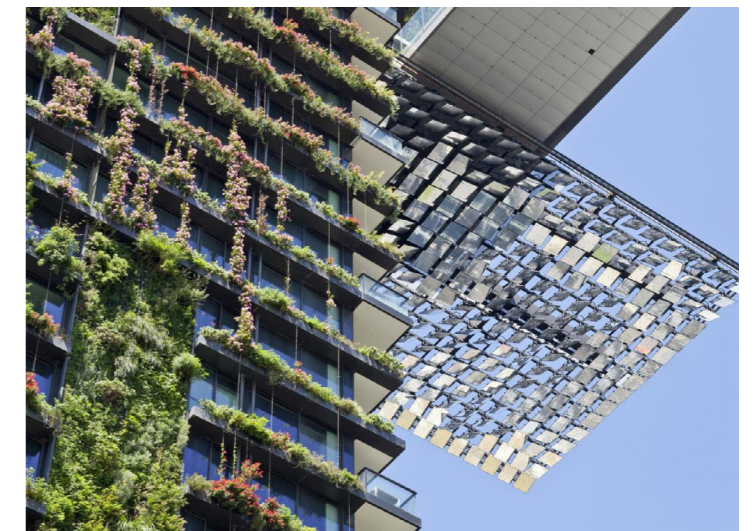
- Membrane Bioreactor (MBR) recycled water facility
- Can be completely controlled remotely
- Provides constant and stable water and chilled water flows
- Low carbon electricity to the complex and its properties
- Smart metering screens to provide interactive, real-time monitoring of electrical, gas and water consumption
- Thermal analysis for reduction in mechanical services and improvement in occupant comfort

Social Initiatives

- Strong social connectivity with surrounding neighbourhoods and communities
- Delivery of community infrastructure
- Creation of high-quality open spaces and amenities
- Provision of student housing, delivered under the National Rental Affordability Scheme (NRAS).

Assurance

- 5 Star Green Star ratings for its retail and residential sections



2.6.6 Sentosa, Singapore

Located at the southern tip of Singapore, Sentosa is a 500-hectare resort island with commercial, high-end residential sport facilities and green and blue public space, 40 hectares of protected nature areas, and a sustainable development model.

Relevance to Sydney Olympic Park

Sentosa in Singapore demonstrates high quality leisure space combined with environmental awareness and ambitious carbon goals.

Transport links provide car-free access, and innovative tidal energy and waste up-cycling programs reduce environmental impact.

Environmental Initiatives

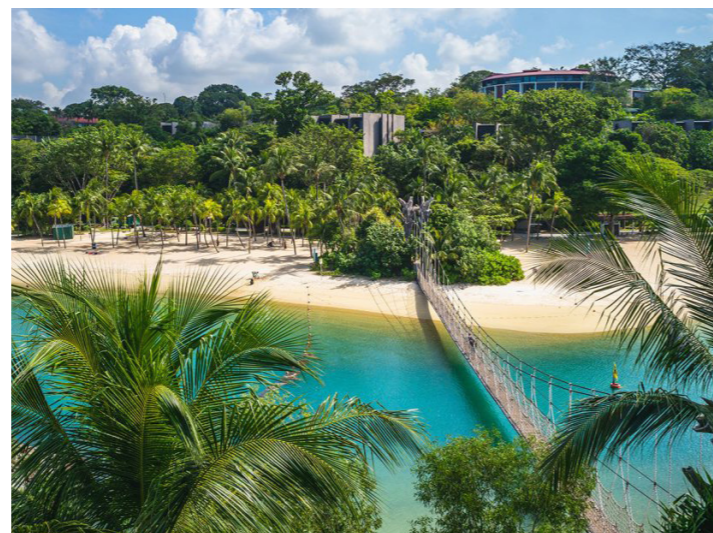
- Carbon neutral by 2030
- Solar and tidal energy from underutilised locations
- Up-cycling waste to synthetic gas for electricity
- Closes the waste loop through test bedding innovation, education and partnering with stakeholders to influence climate friendly behaviours
- Electrification of public transport fleet underway

Social Initiatives

- Enables an inclusive society through Corporate Social Responsibility (CSR) initiatives and corporate volunteerism
- Sustainability-themed tours that aim to increase the appreciation and protection of nature, biodiversity, and heritage on Sentosa
- Partnerships with Social Service Organisations and NGOs to support underprivileged beneficiaries

Assurance

- All new Sentosa Development Corporation (SDC)-owned buildings will be “Green Mark Platinum Super Low Energy (SLE) certification
- Target to be a certified sustainable destination against Global Sustainable Tourism Council (GSTC) standards



2.6.7 Bishan-Ang Mo Kio Park, Singapore

Between 2009 and 2012, a concrete storm drain was turned into a city centre river park, creating green space, reducing flood risk, and significantly improving biodiversity through habitat creation.

Relevance to Sydney Olympic Park

The project to transform the park included restoring original natural features and responding to climate stresses in a sustainable way. By creating new habitats it is estimated that biodiversity increased by 30%.

Environmental Initiatives

- Uses a water-sensitive urban design approach which allows for sustainable rainwater management
- The parkland surrounding the river serves as a flood plain during times of heavy rain
- Soil bioengineering used to control erosion
- Artificial planted wetland purifies river water and runoff
- Vegetated bioswales used as natural drainage channels
- Biodiversity increase of 30% since the redesign
- Park now home to 60 species of wildflower, 50+ species of bird and 20+ species of dragonfly
- Otters have been seen in the river, and wild boar in the park
- A butterfly habitat within the park is home to 30+ species

Social Initiatives

- During the park's pilot phase, educational activities were organised for children to learn about and engage with the local flora, fauna, and water features.
- Community groups work to keep the park clean and educate others about their impact
- Used as part of the ABC Waters Learning Trails which interactively teaches students about conservation and biodiversity
- Used by Guangyang Secondary School as a teaching location
- Allotment gardening plots are provided
- Therapeutic garden and nature playgrounds can be found within the park



2.6.9 Kings X, London

The 67 acre (27 ha) redevelopment has 26 acres (10.5 ha) of open space. Principal uses include 3.4 million square feet (316,000 sq m) of office space, 2,000 residential units, 500,000 square feet (46,400 sq m) of retail and leisure space, a hotel, and educational facilities.

Relevance

The wide diversity of site uses at Kings X, along with the large shared space, makes it an interesting study.

The shared space here has been used to collaborate with local non-profits and hold art installations. Low carbon operation is also a cornerstone of operations.

Environmental Initiatives

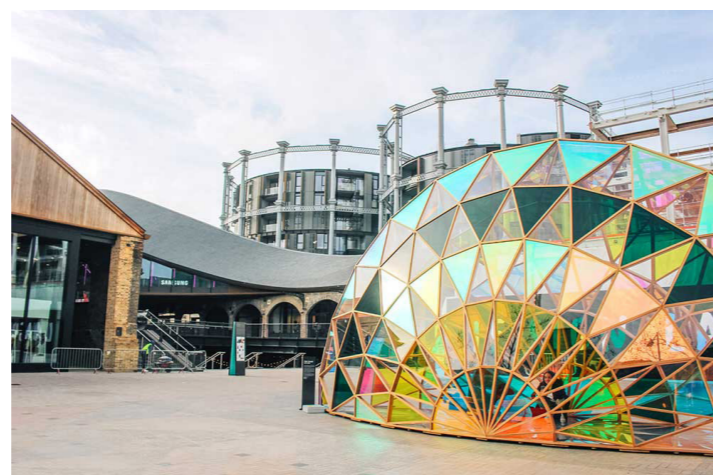
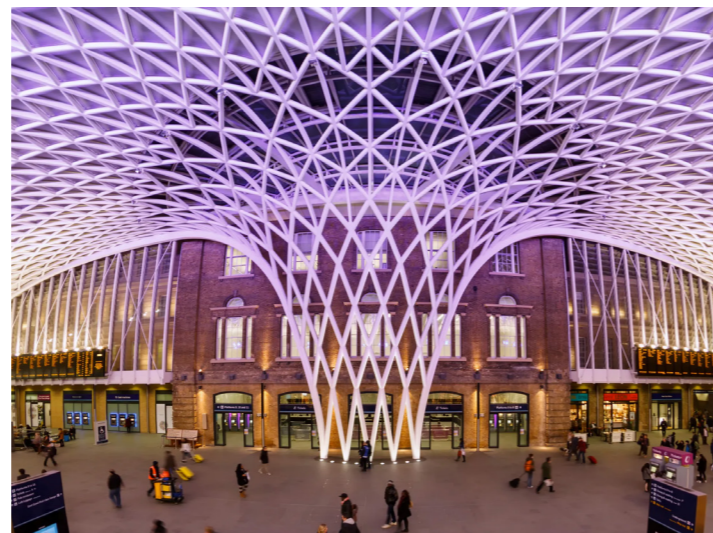
- District Combined Heat and Power (CHP)
- 90% of construction waste was diverted from landfill
- 40% of the 67-acre development is given over to open space
- Monitors biodiversity and water quality
- Whole site is carbon neutral, and it sends zero waste to landfill
- Offsets historic emissions

Social Initiatives

- Deep and wide-ranging community engagement
- Minimal car parking, pedestrianised public space, bike lanes and over 700 cycle parking spaces
- Community garden run by non-profit group

Assurance

- Office buildings designed to a BREEAM rating of “Very Good”
- New buildings targeted to achieve BREEAM rating of “Excellent and Outstanding”



2.6.8 Fresh Kills Park, New York City, USA

Fresh Kills Park, located on Staten Island within New York City, USA, spans an expansive area of approximately 2,200 acres (890 hectares).

Formerly a landfill, the park's transformation into a dynamic and ecologically rich space serves as a noteworthy model for the revitalisation of industrial sites. Over the years, the park's development has been guided by a comprehensive and phased approach, allowing for the gradual realisation of its diverse program. Beginning in the early 2000s, the project's multi-phase timeline has included the reclamation and restoration of various landscapes, creation of recreational facilities, establishment of stormwater management systems, and integration of sustainable practices. This long-term endeavour demonstrates how patient and thoughtful planning can lead to the successful conversion of large-scale post-industrial areas into thriving and sustainable public spaces.

Relevance to Sydney Olympic Park

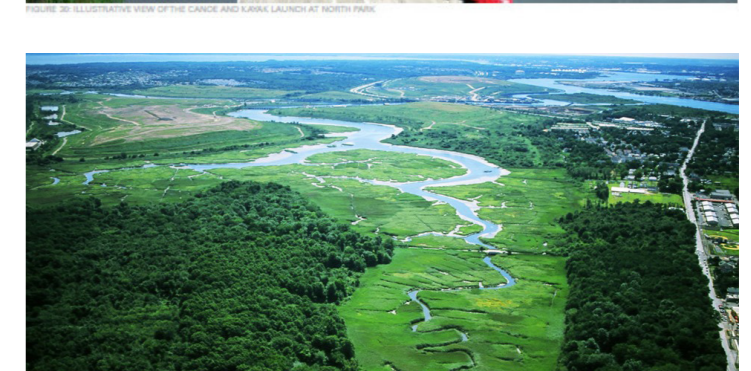
Fresh Kills Park offers valuable lessons for the Sydney Olympic Park master plan due to its transformation from a landfill to a sustainable ecological haven. Both sites face the challenge of converting former industrial areas into vibrant, ecologically sensitive spaces that balance recreation, preservation, and habitat restoration.

Environmental Initiatives

- Restoration of native wetlands and grasslands.
- Creation of wildlife habitats, including bird nesting sites and habitats for small mammals.
- Innovative stormwater management systems and wetland filtration.
- Establishment of a robust composting program for organic waste management.
- Native plantings to enhance biodiversity and support local ecosystems.
- Preservation and adaptive reuse of industrial artefacts as sculptural elements.

Social Initiatives

- Engagement programs promoting public awareness of environmental issues.
- Interpretive centres and educational facilities highlighting ecological and sustainable practices.
- Recreational amenities like trails, sports fields, and cultural spaces for community gatherings.
- Art installations that intertwine ecology and creativity, fostering a sense of place.
- Integrated pathways connecting different zones, encouraging active transportation.



2.7 Shaping the Sustainable Future: Unveiling Sydney Olympic Park's Pathway

The preceding context analysis has been instrumental in understanding the multifaceted landscape surrounding Sydney Olympic Park.

As we move forward, we aim to summarise and synthesise these findings. Our focus is on distilling the key sustainability considerations that have emerged from our comprehensive analysis.

This synthesis is not just a recapitulation of what has been learned; it is a strategic effort to translate these insights into a cohesive and actionable sustainability strategy. This strategy has played a pivotal role in guiding the development of the Master Plan 2050.

Our goal is to ensure that the Master Plan 2050 is not only reflective of the current context but is also forward-thinking, resilient, and aligned with the principles of sustainable development.

2.7.1 Defining Attributes of Excellence

We have combined insights from policy frameworks, industry trends, major global trends, sustainability research, and case studies to identify key characteristics. These characteristics will guide the sustainable growth of Sydney Olympic Park, shaping it into a top-notch innovation hub. They bring together common themes found in different sections and sources:

- **Climate Resilience and Adaptation:** It's essential to tackle human-made climate change. This means having strong infrastructure, being ready for disasters, and being able to adapt, especially as extreme weather events become more frequent.
- **Biodiversity Conservation:** Keeping ecosystems healthy in urban areas is a key goal. This helps nature and city development exist together peacefully.
- **Resource Efficiency and Circular Economy:** Using resources wisely is becoming more important. This involves reducing waste, recycling more, and buying sustainable products.
- **Community Well-being and Inclusivity:** Creating communities that are inclusive and socially healthy is crucial. This includes having green spaces and cultural activities that improve people's lives, whether they live, work, or visit here.
- **Technological Innovation and Digitalisation:** The growing influence of digital technology is seen in smart city projects. Technology helps make better decisions, save energy, and improve quality of life.
- **Economic Resilience and Equity:** It's important to address economic differences. Creating sustainable jobs and ensuring everyone has equal opportunities helps build a strong and fair community.
- **Cultural Heritage and Connection:** Respecting cultural heritage is essential. Including indigenous knowledge and cultural spaces is a key part of sustainability.
- **Holistic Health and Well-being:** The overall health of people is a top priority, seen in various studies and research. The way we build our environment should support physical, mental, and emotional health.

These characteristics, drawn from a wide range of sources, lay the groundwork for the upcoming Sustainability Strategy.

2.7.2 Formulating the Sustainability Framework

Building on our comprehensive analysis, we propose a set of Sustainability Values and Themes. These are aligned with the Place Pillars and the sustainability-focused Strategic Direction outlined in the Sydney Olympic Park Vision and Strategy 2050. This alignment is demonstrated in Figure 2.6 Sustainability Synthesis Diagram.

Our proposed Sustainability Values and Themes form our Sustainability Framework. This framework serves as the foundation for the next stage of our work. It provides the organising principles that will guide the detailed exploration and development in the upcoming Section 03 Sustainability Strategy.

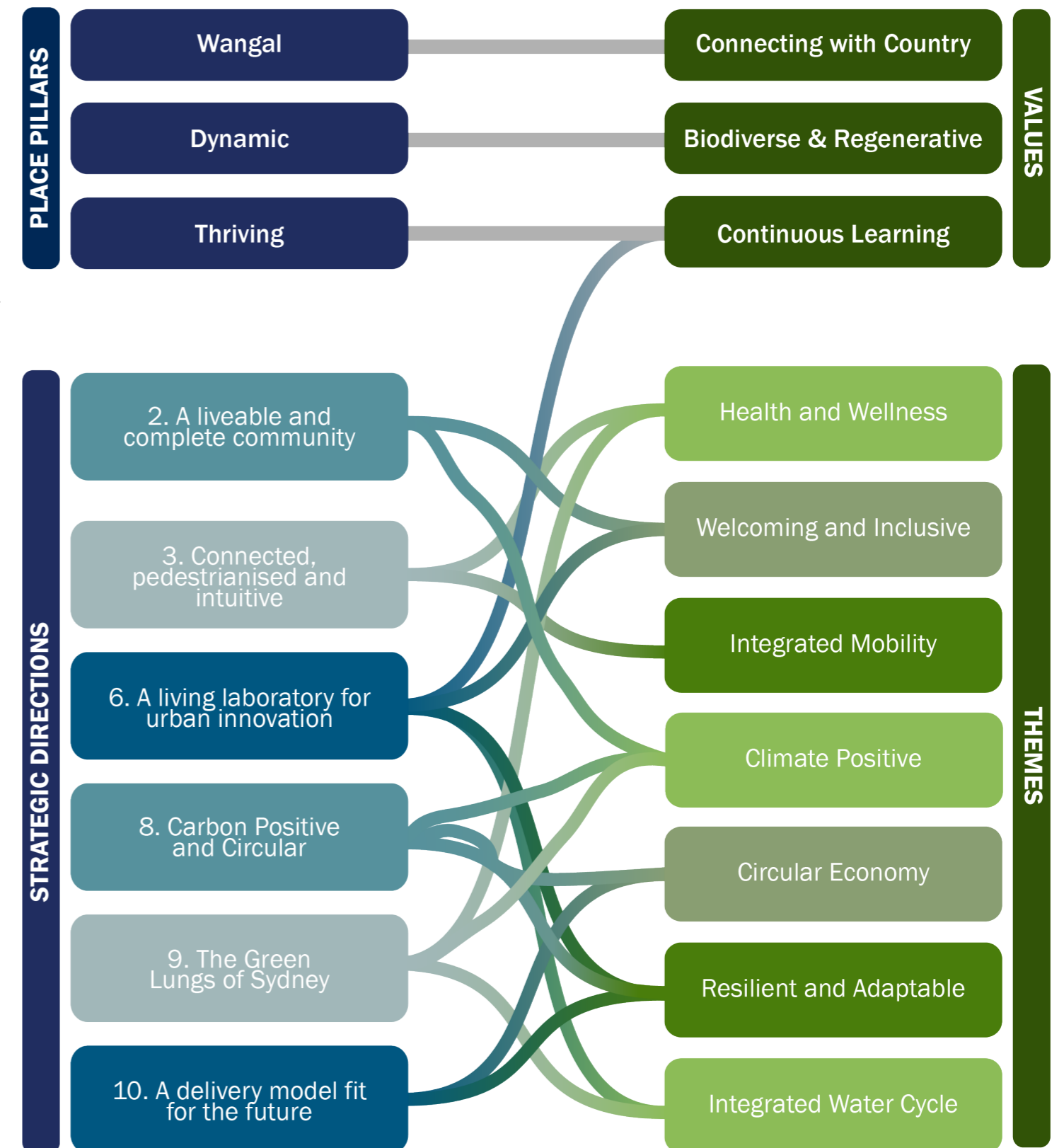


Figure 2.12 Aligning Vision and Strategy 2050 Place Pillars and sustainability-focused Strategic Directions with proposed sustainability Values and Themes

03 SUSTAINABILITY STRATEGY

3.1 Sustainability Strategy

The Sustainability Strategy is a key component of the Master Plan 2050. It turns the vision and goals set out in the Sydney Olympic Park Vision and Strategy 2050, along with the extensive research from the Context section, into practical actions.

This strategy is designed to guide the project team in the preparation of Master Plan 2050, applicants in formulating development proposals and SOPA in their day to day operations. It outlines specific initiatives with spatial implications, suggests potential planning controls, and advises the Sydney Olympic Park Authority on implementing the vision in their operations. It ensures that every aspect of the master plan development, both public and private, aligns with the aim of a vibrant, sustainable future for Sydney Olympic Park.

3.1.1 Sustainability Mission Statement

Our sustainability mission is to cultivate a vibrant and inclusive community that harmoniously coexists with its natural surroundings, champions cultural heritage, and drives innovation. By prioritising environmental stewardship, social equity, and economic vitality, we envision a precinct that stands as a model for holistic, forward-looking urban development.

3.1.2 Framework of Values and Themes

The sustainability ethos of Sydney Olympic Park is structured around three core values that underscore our commitment to meaningful and enduring progress:

- **Connecting with Country** – Embracing the profound cultural significance of this land, we honour its Indigenous heritage, fostering a deep-rooted relationship between people and place.
- **Biodiverse and Regenerative** – With nature as our guide, we envision a thriving ecosystem where biodiversity flourishes, local ecology thrives, and regeneration is embedded in every facet of development.
- **Continuous Learning** – By embracing the spirit of innovation and collaboration, we are dedicated to a culture of perpetual learning, drawing insights from stakeholders, research, and partnerships to drive ongoing improvement.

Within this framework, seven distinct Sustainability Themes guide our path forward, each encapsulating a targeted area of focus:

- **Carbon Positive** – Championing net-zero carbon emissions, resource efficiency, and innovative sustainability measures to lead the charge toward a climate-resilient future.
- **Health and Wellness** – Nurturing public health and well-being through thoughtfully designed spaces that prioritise physical

- activity, mental health, and a holistic sense of vitality.
- **Resilient and Adaptable** – Steadfast in the face of challenges, we fortify our community to withstand shocks and stresses, ensuring a resilient, adaptable, and future-ready precinct.
- **Integrated Mobility** – Seamless, sustainable, and well-connected transportation networks form the backbone of a mobility solution that harmonises accessibility, efficiency, and environmental stewardship.
- **Welcoming and Inclusive** – Crafting an environment that embraces diversity, ensures inclusivity, and radiates warmth, where every individual is celebrated and feels an integral part of our vibrant community.
- **Circular Economy** – Pioneering a circular approach, we minimise waste, optimise resource utilisation, and propel the precinct toward a regenerative and restorative economic model.
- **Integrated Water Cycle** – Cherishing and managing our water resources, we holistically integrate water systems, promoting stewardship, conservation, and resilience.

3.1.3 Structure of the Sustainability Themes

The subsequent pages detail each Value or Theme and are structured as follows, providing a clear and focused overview of our sustainability approach:

- **Vision Statement:** A clear expression of our overarching goals and aspirations for each sustainability theme.
- **Description:** An overview of each theme, highlighting its significance and transformative potential in our community.
- **Principles:** Fundamental guidelines that shape our approach and commitment to each sustainability theme.
- **Benchmarks:** Benchmarks from established external sources as flexible guidance, not as fixed targets, allowing us to stay informed and adaptable in our sustainability efforts.
- **Master Plan Potential Initiatives:** Practical, actionable strategies demonstrating how the 2050 Master Plan actively advances each theme.
- **Design Opportunities:** Insights into architectural and design possibilities that guide future detailed planning and private developments.

This structured approach leads us into an in-depth exploration of each Value and Theme, laying the foundation for our comprehensive journey towards sustainability.



Figure 3.1 Sustainability Values and Themes diagram

3.2 Connecting with Country

Connecting with Country underpins all of the sustainability concepts and ambitions at Sydney Olympic Park.

A strong understanding of and connection to Country will produce a development that has a distinct identity, shaping a unique sense of place that is necessary to attract investment and ensure longevity, social justice and inclusion. A place that actively engages in connecting with Country will continually be contributing to sustainability and resilience.

Principles

- **Sydney Olympic Park Authority Reconciliation Action Plan (RAP) Delivery:** Commitment to the Reconciliation Action Plan is demonstrated through practices that respect, acknowledge, and integrate Aboriginal and Torres Strait Islander cultures and histories.
- **Adherence to the NSW Government / Government Architect NSW Connecting with Country Framework:** Alignment with the Connecting with Country Framework involves embracing traditional practices and Aboriginal knowledge systems, fostering a respectful and continuous relationship with Country in the project's life cycle.
- **Acknowledging Traditional Custodians:** The plan acknowledges and honours the Traditional Owners and other Aboriginal communities, cultivating a relationship of respect and collaboration.
- **Preserving Cultural Heritage:** Cultural heritage sites are protected, accessible, and used for ongoing cultural practices, fostering a living connection between past and present.
- **Ecosystem Regeneration:** Indigenous ecosystems endemic to the area are regenerated, enhancing biodiversity and revitalising the natural environment.
- **Cultural Integration:** Indigenous culture, heritage, and knowledge are woven into the built and cultivated environments, reflecting a harmonious coexistence with the land.
- **Creating Opportunities:** The development continually creates opportunities for Indigenous communities, ensuring their active participation and benefit from ongoing growth.

Benchmarks

- Develop and implement an Aboriginal and Torres Strait Islander Employment and Retention strategy, to create a workplace that reflects the percentage of Aboriginal and Torres Strait Islander Peoples in the wider community (approx. 3%) (SOPA RAP).
- Develop and implement an Aboriginal and Torres Strait Islander cultural awareness training strategy (SOPA RAP).
- At least 3-5% of total project budget allocated to Indigenous engagement, including consultation, employment, training and/or community investment programs (Reconciliation Australia)
- 100% compliance with Indigenous Heritage Protection Requirements, as determined by relevant state or territory legislation (Reconciliation Australia)
- 80% satisfaction with the level and quality of engagement with Indigenous stakeholders (Reconciliation Australia)

- Cultural competency training for 100% staff, contractors, and partners to promote understanding of Aboriginal and Torres Strait Islander cultures, histories, and current issues (Reconciliation Australia)
- At least 10% Indigenous-owned businesses in SOPA supply chain (Supply Nation)

Master Plan Potential Initiatives

- Provide direction Connection to Parramatta River with opportunity to 'touch the water'
- Providing direct access to the creek; spaces along the edge for people to gather
- Naturalise creek edges.
- Bush tucker and medicinal plant species throughout precinct but specifically in key public facing location. Integrate 'Native Farm Gate'.
- Purpose built, centrally located cultural centre to celebrate Wangal Country - Integrate 'Welcome to Country'
- Integration of healing places in areas around cultural centre
- Regenerate existing degraded creeks and increase access to the creeks
- Create amenity for the creeks and waterways such as watersports opportunities that also consider aquatic life
- Implement clear and legible wayfinding throughout the precinct, especially nature trails, by using Aboriginal names for the places and sharing place-specific Aboriginal culture and history on the wayfinding signage
- Create public spaces that utilise traditional language, cultural stories and locally native ecologies.

Design opportunities

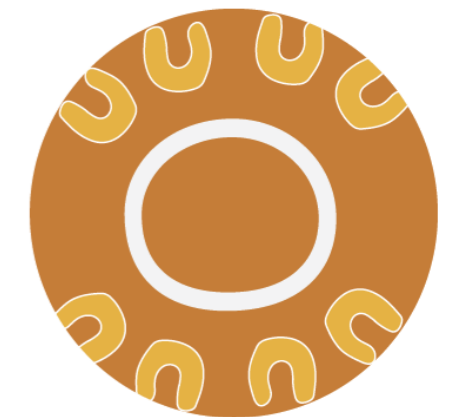
- Create and maintain places for Aboriginal People to practice their culture, within open spaces and built facilities, in consultation with Aboriginal designers and the local Aboriginal community such as the existing Murama Dance Ground
- Reinstate Aboriginal names for places, and help stakeholders understand, pronounce and value these names.
- Multi-lingual signage incorporating local Aboriginal dialects.
- Public art integrating Aboriginal and Torres Strait Islander artists.
- Wayfinding and signage strategy sharing the stories of Country to connect a diverse community and local industry to deep sense of knowledge about this place.
- Colour palette for built form inspired by Country.
- Natural materials belonging to Country.



MOVEMENT OF WATER



GREEN HEART



CULTURAL CONNECTIONS

Figure 3.2 SOPA key themes for Connecting with Country (Source: Yerrabingin)



Figure 3.3 Connecting with Country through design at Haslam's Creek (Source: Yerrabingin)



Figure 3.4 Connecting with Country through design at the Royal Agricultural Society (Source: Yerrabingin)

3.3 Biodiverse and Regenerative

Sydney Olympic Park landscapes will create a new urban quarter of indigenous ecologies enhancing the quality of the public realm and its active transportation pathways.

Prioritising indigenous ecologies and nature-based solutions fosters resilience, enriches urban life, and aligns with global sustainability goals, creating a regenerative ecosystem for a vibrant and enduring urban development.

Principles

- Safeguard and uphold existing natural ecosystems, protecting the foundation of local biodiversity.
- Amplify urban ecology by seamlessly integrating native flora and fauna within the built environment.
- Cultivate a biophilic environment that envelops residents, visitors, and workers in continuous interaction with nature.
- Strive for maximum mature tree canopy and vegetation coverage across public spaces, contributing to a healthier environment.
- Prioritise nature-based solutions across all facets of design and operation.
- Eliminate pollutant discharge into waterways from wastewater and stormwater.

Benchmarks

- No net loss of threatened species habitats, no habitat degradation or increased edge effects caused by new parklands developments, maintaining dark areas (2050 Place Vision and Strategy)
- Developable site area across the Town Centre is replaced one-for-one with green and/or blue coverage through green roofs, green walls and open space (2050 Place Vision and Strategy).
- The existing urban town centre boundary does not expand into the Parklands (2050 Place Vision and Strategy).
- There is a net increase in public vegetated green spaces across the built environment of Sydney Olympic Park (2050 Place Vision and Strategy).
- There is a net increase in tree canopy coverage across the built environment of Sydney Olympic Park (2050 Place Vision and Strategy).
- Elevate urban tree canopy to 40-70% within streets and 30-40% within public open spaces (Master Plan 2050)
- Protecting and enhancing the natural heritage and ecological integrity of Sydney Olympic Park – targeting priority species and communities, places of high biodiversity value, and biodiversity generally (Environmental Guidelines 2008)
- Applying an adaptive management approach to stewardship of Sydney Olympic Park's biodiversity assets (Environmental Guidelines 2008)
- Ensuring conservation of biological diversity and ecological integrity is a fundamental consideration for new developments, activities, levels or types of use, or management practices that affect the ecosystems of Sydney Olympic Park (Environmental

Guidelines 2008)

- Promoting the ecological, aesthetic and educational value of an urban site with high species diversity and abundance (Environmental Guidelines 2008)
- Conserving and enhancing the remnant woodland and wetland habitats of Newington Nature
- Reserve in accordance with the Newington Nature Reserve Plan of Management, and managing adjoining lands in sympathy with the Reserve (Environmental Guidelines 2008)
- Maximising the habitat values of native plantings by promoting priority species and communities, providing structural complexity and plant species diversity, avoiding habitat fragmentation; promoting habitat linkages and large core areas; and prioritising the use of indigenous species in landscape planting schemes in the Parklands (Environmental Guidelines 2008)

Master Plan Potential Initiatives

- Encourage unstructured open space to allow for native flora, fauna and ecosystems to thrive, whilst workers and the community can enjoy these places
- Protect existing significant trees and remnant vegetation.
- Preserve and enhance green space and waterways of the precinct to improve biodiversity and mitigate the urban heat island effect.
- Protect and enhance the existing habitats at SOP including key habitats: estuarine and wetlands, remnant eucalypt forest, saltmarsh meadows and woodland bird habitats
- Ensure sustainable recreational use of the Parklands, through walking and cycling trails and the provision of visitor facilities that minimise environmental impact.
- Protect priority habitat corridors and refuge areas to protect mobile species, and migratory birds and fish.
- Protect and enhance natural assets like the wetlands, and the associated heritage such as the Brickpit Ring Walk and incorporate similar interactive features into the design of new open spaces
- Avoid overshadowing of habitats by new buildings, particularly where adjacent lands are zoned for environmental conservation and management.
- Encourage ground water recharge through permeable ground cover.
- Building roofs actively contribute to sustainability ambitions: solar PV, green roofs, usable terraces.

Design opportunities

- Reduce risk of bird-strike in building design; incorporate low-reflectivity glass and other design innovations.
- Ensure landscaping species palettes are consistent with SOPA policy, and do not include SOPA-declared exotic and native weeds.
- Wayfinding and signage strategy providing information about flora and fauna species, remnant and constructed ecologies, and environmental management efforts.

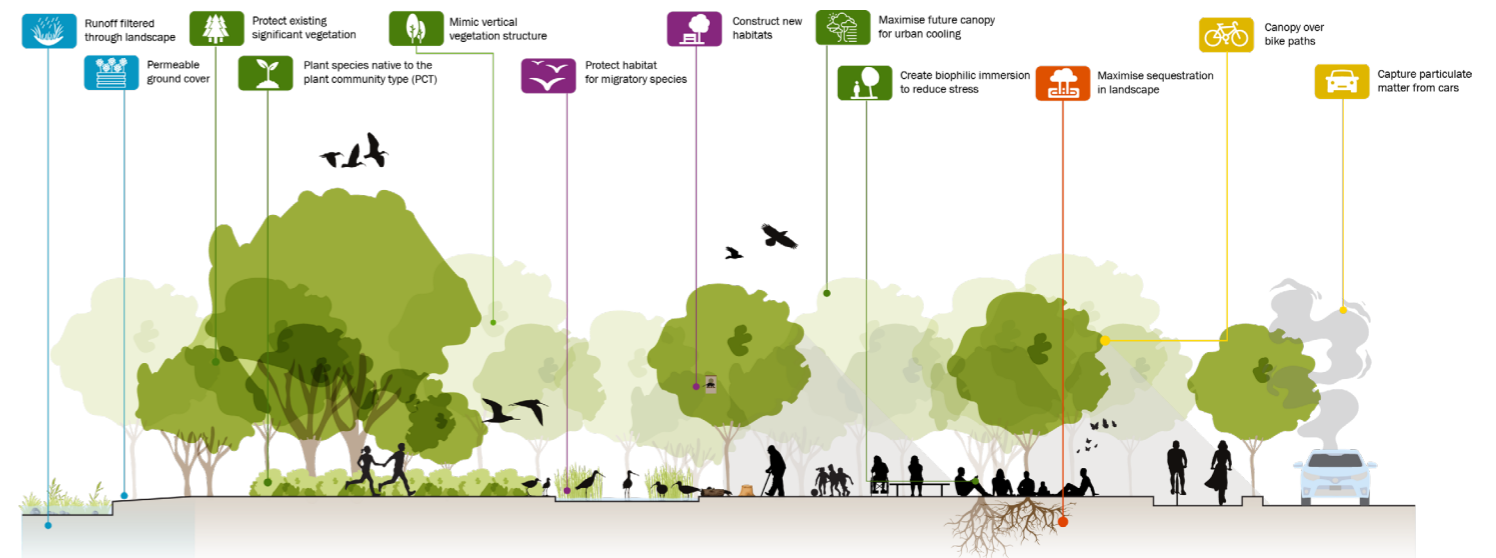


Figure 3.5 Opportunities for integrating regenerative landscapes and biodiversity in the built environment (Source: Atelier Ten)



Figure 3.6 SOP 2050 artist's impression - urban core (Source: Master Plan 2050 / Mark Gerarda)

3.4 Continuous Learning

Sydney Olympic Park Master Plan 2050 will provide a platform for integrated real-world, real-time research, including the facilities and infrastructure that enable world-class research initiatives and programs.

A Living Lab approach to developing a user-centred, iterative, open-innovation ecosystem which builds upon existing stakeholders' deep knowledge of health and wellness will create a precinct that not only benefits community health and wellness but also actively works towards continuous improvement.

Principles

- **Culture of Experimentation:** Foster a culture of experimentation and innovation, encouraging continuous exploration and learning to drive sustainable advancements.
- **Collaborative Knowledge-Sharing:** Promote collaboration and knowledge-sharing among stakeholders, creating a dynamic ecosystem of expertise and insights.
- **Embedded Sustainability:** Embed sustainability into decision-making processes, ensuring that every choice contributes to the ongoing improvement of the precinct's environmental and social performance.
- **Engagement and Participation:** Promote engagement and participation from residents, visitors, and the wider community, nurturing a sense of ownership and collective responsibility for the precinct's continuous learning journey.

Benchmarks

- Develop an investment attraction strategy that actively seeks out partners domestically and internationally (2050 Place Vision and Strategy).
- Develop a governance framework that is geared towards investment, partnership support and curation (2050 Place Vision and Strategy).
- Sydney Olympic Park is constantly accommodating research, prototyping, testing or supporting other experimental processes (2050 Place Vision and Strategy).
- Sydney Olympic Park has attracted universities, research institutions and programs domestically and globally specifically because of its role as a living lab (2050 Place Vision and Strategy).

Master Plan Potential Initiatives

- Use SOP as a test bed to promote innovation and the trial of new technologies
- Embed innovation in the education of visitors of Wangal Country and Indigenous culture. Collaboration of entrepreneurs and the Indigenous community to then use SOP as a test bed for these innovations e.g. temporary smart cultural exhibition, digital wayfinding inclusive of Wangal Country and culture
- Connect Sydney Olympic Park to Regional NSW's agriculture, through enabling agricultural opportunities within Sydney

Olympic Park and expanding on the Royal Agricultural Society of NSW showground activities.

- Sensing, monitoring and control of:
 - Mobility (bicycle parking, mobility-as-a-service (MaaS) availability, curb space, deliveries)
 - Utilities (energy, ICT, water, lighting)
 - Public realm (occupancy detection, cleanliness, security)
 - Environment (air quality, temperature, humidity, stormwater, ventilation)
 - Waste (quantity, quality, location)
- Support mobile and outdoor working with frequent interior and exterior power outlets, charge stations, and a variety of spaces for individual and collaborative working - "I" and "we" spaces.
- Dynamic digital displays situated throughout building and public domain to communicate building, precinct, Indigenous culture, history and contextual information
- Ability to add sensors throughout spaces targeted for investigation by potential Living Lab opportunities.

Design opportunities

- Build a community innovation centre for students, inventors and entrepreneurs to collaborate together.
- Develop a purpose-built building in a strategic location within the commercial core which provides curated and affordable office space/labs for new and innovative enterprises.
- Explore affordable office space opportunities for start-ups within existing institutions to facilitate collaboration and sustainable use of existing spaces.



Figure 3.8 Smart solar bench with digital wayfinding and precinct educational information (Source: Hola Systems)

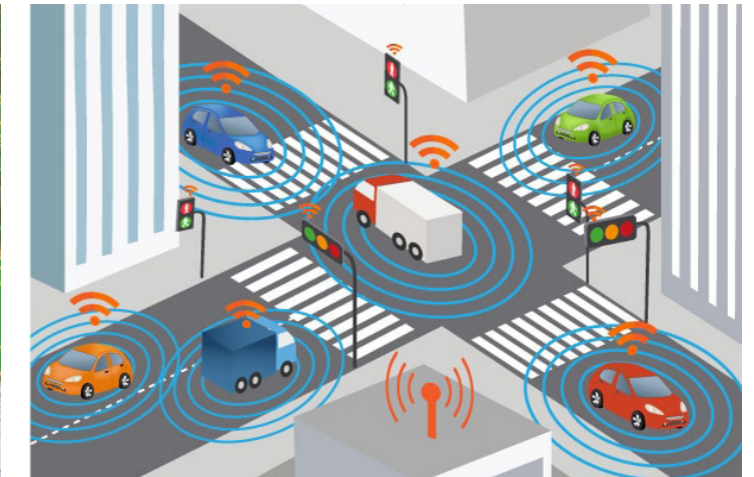


Figure 3.7 Mobility sensing for traffic management and Vehicle to Infrastructure (V2I) (Source: Mouser Electronics)



Figure 3.9 Maker spaces for innovation centre (Source: Cherokee Maker Space)



Figure 3.10 Trialling new technology in public domain such as smart road marking for pedestrian crossing (Source: STEPVIAL)

3.5 Carbon Positive

Sydney Olympic Park Master Plan 2050 envisions a future where every facet of construction, operation, and engagement contributes positively to the climate, pioneering innovative practices that uphold environmental well-being and global sustainability goals.

The profound significance of the Carbon Positive theme lies at the heart of the Sydney Olympic Park Master Plan 2050. It serves as an unequivocal response to the urgent global imperative of combating climate change.

Principles

- **Low Embodied Carbon:** Minimise upfront greenhouse gas emissions in construction materials and processes.
- **Operational Efficiency:** Prioritise passive design and cutting-edge systems for reduced operational energy consumption.
- **Fossil Fuel-Free Future:** Eliminate on-site fossil fuel combustion.
- **Mechanical Systems Excellence:** Integrate adaptable, efficient, and resilient mechanical systems.
- **Power Generation and Storage:** Maximise on-site renewable energy generation and storage.
- **Carbon Sequestration:** Maximise landscapes and aquatic habitats designed to capture and store carbon.

Benchmarks

- Minimising overall public domain energy and peak load demand levels at Sydney Olympic Park (Environmental Guidelines 2008)
- Prioritising in developments the use of passive solar design, natural ventilation and selection of energy efficient materials to enhance thermal performance (Environmental Guidelines 2008)
- Requiring energy-efficient: heating and cooling systems, building management systems, lighting, and energy consuming appliances to be incorporated in all new building projects at Sydney Olympic Park (Environmental Guidelines 2008)
- Adapting and applying best available environmental design principles, technology, demand management, and procurement practices to progressively and significantly reduce greenhouse gas emissions (Environmental Guidelines 2008)
- 20% reduction in embodied carbon for all new developments (Green Star)
- All new development powered by 100% renewable energy (Green Star)
- Reduce embodied carbon by 40% compared to a conventional development (GBCA)

Master Plan Potential Initiatives

- Facilitate Sydney Olympic Park to be a hub for innovation and research, supporting emerging climate positive technologies and innovations like renewable energy at SOP (e.g. autonomous shuttles).

- Implement energy-aware urban planning, strategically locating buildings and infrastructure to maximise passive solar gain and minimise energy demand.
- Prioritise timber and other plant-based building materials that sequester carbon in their growth.
- Choose low embodied carbon materials and products.
- Minimise operational energy through climate responsive design.
- Explore energy storage solutions, such as battery systems, to store excess renewable energy for use during peak demand periods.
- Expand landscapes and prioritise sequestration in landscape.
- Encourage sustainable modes of transport, such as walking, cycling, and public transport, by improving infrastructure and reducing car dependence; to reduce emissions and pollutants.
- Encourage the use of electric vehicles (EVs) by providing ample EV charging infrastructure throughout the precinct.
- Leverage SOPA's sphere of influence to install renewables on SOPA assets.
- Facilitate solar PV installation on other buildings in Sydney Olympic Park.
- Building roofs actively contribute to sustainability ambitions: solar PV, green roofs, inhabitable terraces.
- Building massing and form designed to optimise seasonal outdoor airflow in the public domain.
- Building massing and form designed to maximise daylight on the ground plane.
- Mandatory minimum green building and infrastructure ratings for all built environment.

Design opportunities

- Prioritise low embodied carbon materials and products.
- Employ construction methods that reduce carbon emissions, such as prefabrication or modular construction techniques.
- Opt for building materials/products that are recyclable, low in embodied carbon, and have minimal negative environmental impacts.
- Integrate a lifecycle assessment approach to quantify the carbon savings achieved.
- Facilitate on site electric vehicle (EV) charging.

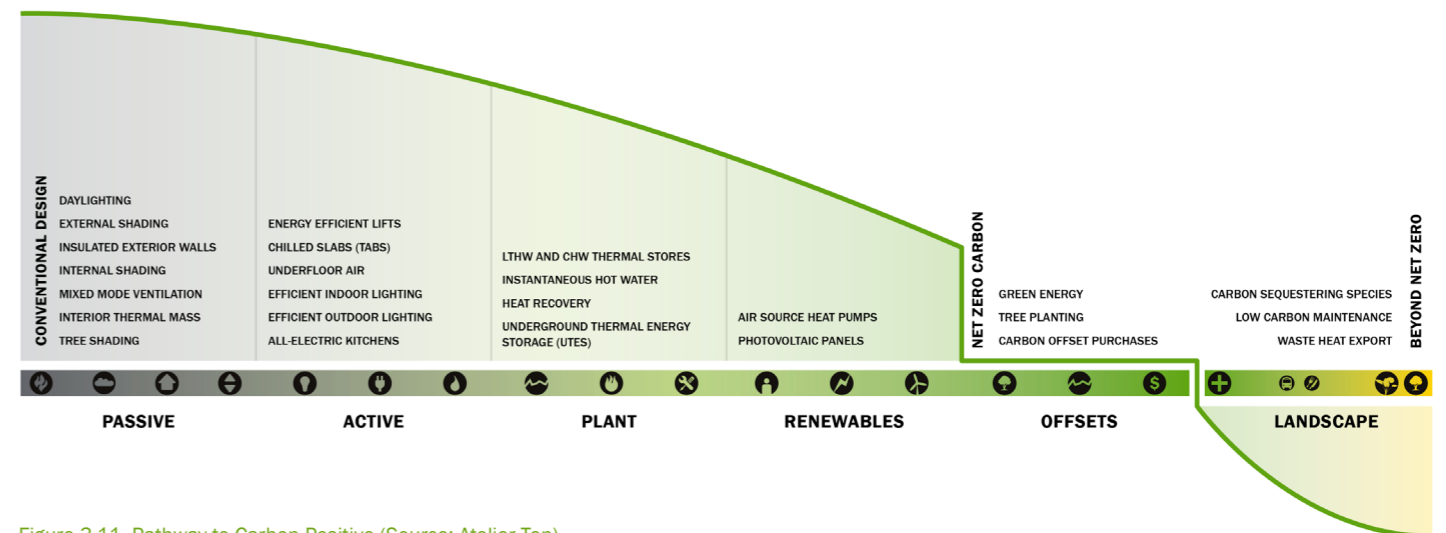


Figure 3.11 Pathway to Carbon Positive (Source: Atelier Ten)



Figure 3.12 Green roofs at SOP artist's impression (Source: SOP)



Figure 3.14 Autonomous precinct shuttle (Source: ZDNET)



Figure 3.13 EV charging (Source: infrastructure magazine)

3.6 Health and Wellness

Enriched by its legacy as a former Olympics site Sydney Olympic Park enhances the well-being of residents, guests, workers, visitors, and the community, while also providing a sustained advantage for athletes and sports enthusiasts.

Focusing on physical and mental well-being, the Master Plan 2050 involves crafting inclusive, health-enhancing environments, utilising innovative design and community-focused initiatives to support the diverse needs and foster the overall health of our community.

Principles

- Uphold the legacy of the site's Olympic history by safeguarding and revitalising existing sporting infrastructure, ensuring its continued contribution to health, wellness, and recreation.
- Seamlessly integrate the iconic Olympic facilities into modern design, repurposing them for a variety of health and wellness activities and events, while celebrating their storied past.
- Improving physical activity by encouraging active mobility and recreational exercise.
- Improving local air quality by transport electrification, large-scale urban greening and eliminating on-site combustion.
- Improving mental health through connection to nature, biophilia, safety, sense of belonging and enhancing social engagement.
- Passively designed building envelope to deliver thermal comfort which offers comfort and wellness with minimal energy and user input.

Benchmarks

- Sydney Olympic Park will demonstrate maintained or improved outcomes against social indicators developed in a future Social Cohesion Framework (2050 Place Vision and Strategy).
- Promoting and increasing the recreational, historical, scientific, educational and cultural values of the parklands, while recognising the intrinsic values of public open space in addition to its utility services values (Environmental Guidelines 2008)
- Encouraging the appropriate use, benefit and enjoyment of the parklands by the public, facilitating opportunities to improve physical health and well-being, social cohesion, cultural expression, and a diversity of leisure experiences (Environmental Guidelines 2008)
- Maintaining public access to the parklands whilst ensuring the protection, restoration, and improvement of the environmental features, heritage items, and ecological elements (Environmental Guidelines 2008)
- Minimising light pollution by limiting use of lights at inappropriate times, locations, and intensities; and avoiding loss of habitat values or natural ambience for open spaces (Environmental Guidelines 2008)
- High density development (over 60 dwellings per hectare) should be located within 200 metres of quality open space, and all dwellings should be within 400 metres of open space (Greater Sydney Commission).
- 80% of residents able to walk to a public transport stop within

800 metres (Green Star)

- Minimum of 50% of residents able to walk to basic amenities such as shops, cafés and schools within 1 kilometre (Green Star)
- Minimum 75% of residents in the development have access to healthy food options within 800 metres (WELL).

Master Plan Potential Initiatives

- Provide free access to structured and unstructured open space to encourage all people to engage in physical activity
- Integrate diverse physical social infrastructure and exercise facilities e.g. playground, benches
- Build wellness facilities and encourage wellness businesses to complement the existing sporting infrastructure e.g. physiotherapy, massage/spa. This will also provide more jobs and enable the area to become more activated with associated retail like cafés to cater for these new businesses.
- Expansive, high quality, universally accessible precinct green and blue spaces encourage healthy activities and lifestyles.
- All built environment is free from a wide range of hazardous chemicals contained in materials.
- Provide adequate shading to limit sunlight direct sun.
- Suburb is walkable, permeable and people-focused with cycling to encourage 'unstructured' physical activity
- Celebrate natural materials through biophilic design.

Design opportunities

- Incorporate natural elements such as indoor plants, natural light, and views of green spaces to create a more biophilic indoor environment, enhancing occupants' mental and emotional wellbeing.
- Integrate staircases as prominent features within buildings to encourage physical activity and reduce reliance on elevators, promoting healthier habits.
- Design buildings with accessible entrances, ramps, and elevators to ensure inclusivity and accommodate individuals with diverse mobility needs.
- Create outdoor work and leisure spaces equipped with comfortable seating, Wi-Fi, and shade, allowing occupants to work, socialise, and relax while benefiting from fresh air and nature.
- Design flexible interiors that can be easily adapted for various activities, providing occupants with options for different work styles and enhancing overall comfort.



Figure 3.15 Pathway from conventional design to healthy buildings



Figure 3.16 Sporting Precinct and for athletes and community (Source: Turf)

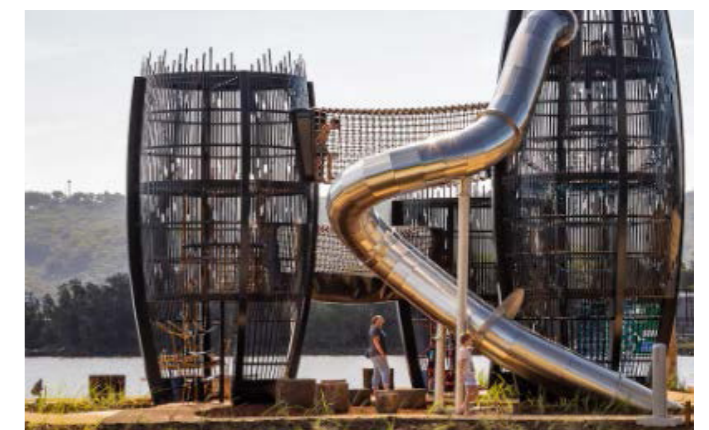


Figure 3.17 Structured play in open space (Source: Turf)



Figure 3.18 Active and public transport at SOP (Source: Turf)

3.7 Resilient and Adaptable

Sydney Olympic Park Master Plan 2050 will exemplify forward looking development by mitigating exposure to foreseen risks, being resilient to disruption, recovering rapidly, and being adaptable to societal advancement.

Principles

- Resilient to short term shocks (extreme weather, utility failures).
- Adaptable to long term stresses (climate change, increasing energy costs).
- Flexible to changing market conditions and environmental performance expectations.

Benchmarks

- Complying with all relevant statutes and regulatory requirements (Environmental Guidelines 2008).
- Ensuring wherever possible that spaces are used and managed in such a way that both the land and its natural resources (including water, soil, flora, fauna and scenic quality) are sustained in perpetuity (Environmental Guidelines 2008).
- Protecting and enhancing the natural and cultural (Aboriginal and non-Aboriginal) heritage of the Park, particularly the Parklands (Environmental Guidelines 2008).
- Giving priority to multi-use of places and spaces, and avoiding where possible the occupation or disposal of public open space for purely private purposes (Environmental Guidelines 2008).
- Increase the number of community gardens and green roofs by 50% by 2030 (Resilient Sydney)
- 100% of urban areas have integrated resilience strategies that are regularly updated and improved (Resilient Cities Network)
- 100% of the urban population has access to early warning systems and emergency response plans (Resilient Cities Network)
- 100% of the urban population has access to basic services during and after disasters (Resilient Cities Network).

Master Plan Potential Initiatives

- Integration of Sydney Olympic Park with surrounding areas, including Parramatta, Rydalmere, and Camellia, to create a connected urban centre for resilient communities
- Sustainable and resilient development, including reducing carbon emissions, enhancing green spaces and waterways, and adapting to climate change impacts.
- Implement economic diversity and job creation, with a focus on knowledge-based services, advanced manufacturing, and creative industries
- Collaborate and consult with stakeholders from across the community, government, and private sectors to ensure everyone's voice is heard
- Engage with local communities in the development of the new master plan, and ensuring that their needs and aspirations are taken into account.
- Improve access to affordable housing and promoting social

inclusion.

- Support diversity in programmatic choices, mechanical systems, and ecosystems, and redundancy in electricity, water and transportation.
- Extensive vegetation to mitigate urban heat island effects and protect against increasing peak temperatures.
- Locate all critical equipment and services above Probable Maximum Flood (PMF) levels.
- Design all structures below PMF to survive flooding.
- Overland flow integrated into landscape and urban design.
- Significant canopy and vegetation cover to mitigate urban heat island (UHI) effects.
- Consider space for future community battery (electrical or thermal batteries).
- Integrate community facilities that can serve as gathering places during emergencies and interruptions in services.
- Prioritise materials with low thermal mass or high solar reflectance index (SRI) to reduce urban heat island (UHI) effects.
- Landscapes balance drought tolerant low evapo-transpirative species, and high evapo-transpirative species that provide local cooling.
- Develop a Climate Adaptation and Community Resilience plan for the Precinct.

Design opportunities

- Utilise a climate responsive design approach, optimise building envelope for passive climate control.
- Allow islanding of any onsite generation and batteries, and standby power circuit to enable limited building operations without utility power.
- Provide redundant water supplies or water storage for use during emergencies.
- Flexible layout to allow for changing occupier requirements.
- Incorporating sustainable design principles into any new infrastructure development, such as the use of recycled materials, water-saving features, and renewable energy sources.
- Green roofs designed to reduce peak rainwater runoff.
- Buildings collect rooftop rainwater for onsite reserve water source during emergencies.

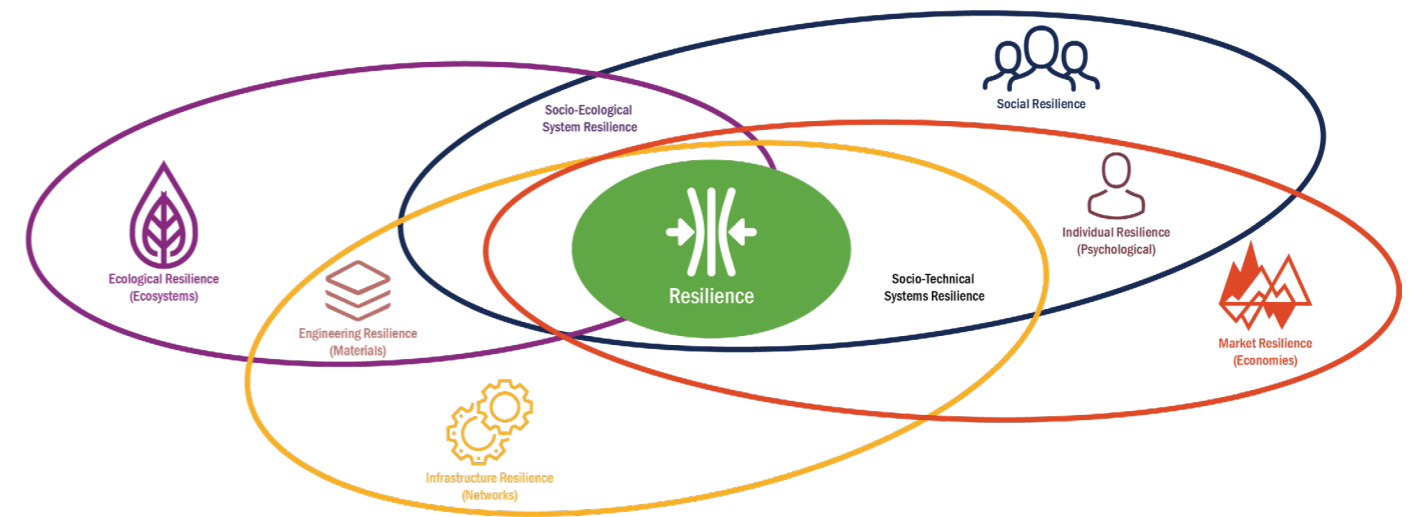


Figure 3.19 Multidisciplinary overview of urban resilience



Figure 3.20 NSW Rural Fire Service Headquarters (Source: Martin Vinzce)



Figure 3.22 Vaccination Hub at SOP (Source: Reuters)



Figure 3.21 NSW Fire Service (Source: NSW Gov)



Figure 3.23 Increased flood events (Source: Nine)

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3.9 Welcoming and Inclusive

Just as the ‘volunteer Olympics’ championed inclusivity and community engagement, the Sydney Olympic Park Master Plan 2050 will create an environment that is welcoming to all people, regardless of their age, size, gender, culture, disability or ability, so they become part of the community.

Principles

- Built environment is welcoming to diverse user communities.
- All built environment is fully physically accessible and inclusive.
- Public spaces and amenities support gathering, socialising and collaboration.
- Provide spaces that can be used for community activities and services.
- Precinct development and operations promote responsible labour practices and support human rights throughout SOPA's many supply chains.
- Foster a vibrant, cohesive social environment that is reflective of community history and identity.

Benchmarks

- Encouraging the appropriate use, benefit and enjoyment of the parklands by the public, facilitating opportunities to improve physical health and well-being, social cohesion, cultural expression, and a diversity of leisure experiences (Environmental Guidelines 2008).
- Protecting and enhancing the natural and cultural (Aboriginal and non-Aboriginal) heritage of the Park, particularly the Parklands (Environmental Guidelines 2008).
- Designing new developments at Sydney Olympic Park to be as ‘walkable’ as possible, connecting transport nodes to walk-ways and cycle-ways, and ensure cycle-ways accommodate the needs of recreational cyclists, pedestrians and workplace commuters (Environmental Guidelines 2008).
- Total visitor numbers to Sydney Olympic Park on an annual basis increase beyond pre-COVID levels (2050 Place Vision and Strategy).
- There is an increase in the proportion of visitors coming to Sydney Olympic Park for non-sporting, events or park-land usage reasons, to reflect its increased diversity of uses (2050 Place Vision and Strategy).
- The window of activity in Sydney Olympic Park widens before and after event, to reflect more people coming early and staying later (2050 Place Vision and Strategy).
- The public domain in the town centre is active every day and evening with a diversity of formal and informal activities (2050 Place Vision and Strategy).
- Future sites for freehold sale should have 30% affordable housing target, not necessarily within a single structure (SGS)

- Embed public art of varying forms and scales into the fabric of the development.
- Consult with local Aboriginal community, designers and place-makers to define distinctive sub-places/open spaces within SOP to connect and educate the public to Aboriginal culture. E.g. through design such as distinctive signage, ground paving, art, plant types, seating and other urban features.
- Consult with the disabled community and organisations to cater for this community in the built and urban environment, such as having an adequate amount of sensory rooms available in all entertainment spaces
- Activate the precinct after-hours to cater for all people and ensure safety and good design
- Generous footpath widths to support mobility aids, and commercial and social activity.
- Diverse public space types to ensure equity of access regardless of socioeconomic background.
- Extensive accessible street furniture and physical artefacts (e.g. ledges, planters) to allow visitors to stop and rest.
- Legible wayfinding system suitable for all abilities.
- Unobstructed lines of sight and visual connection to create a sense of openness.
- Areas of refuge from environmental conditions or the main flow of activity.
- Substantial and creative public lighting to enforce safety, orientation, drama, and accessibility.
- Public restrooms located in public spaces
- Sporting equipment, gyms and outdoor gyms cater for all people including disabled, elderly and women

Design opportunities

- Design public restrooms with features such as accessible stalls, changing stations, and sensory-friendly amenities to accommodate diverse user needs.
- Integrate designated quiet spaces and retreat areas within building interiors, offering serene environments for relaxation and sensory relief.
- Incorporate multi-sensory elements, such as textured surfaces, visual art installations, and auditory cues, to create enriching experiences for individuals with varying sensory sensitivities.
- Design outdoor spaces with inclusive playground equipment and play structures that cater to children of all abilities, encouraging social interaction and play.
- Integrate cultural elements and artistic expressions from diverse communities within building architecture, interiors, and public spaces to celebrate inclusivity and heritage.
- Exterior power points to support informal community gathering.

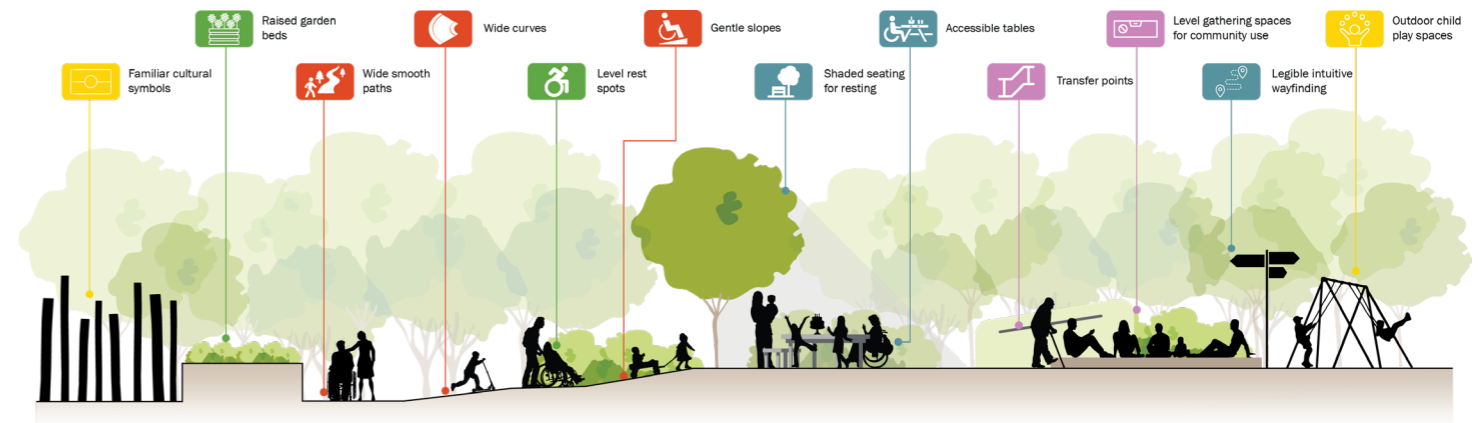


Figure 3.29 Physical elements of an inclusive public space



Figure 3.32 Outdoor community sports (Source: Turf)



Figure 3.31 Integrated play elements (Source: Turf)



Figure 3.30 Active open space and sports facilities (Source: SOPA)

Master Plan Potential Initiatives

3.10 Circular Economy

The Sydney Olympic Park Master Plan 2050 is committed to establishing a circular economy, focusing on a system where resources are efficiently recycled and reused.

This approach ensures that materials are kept in use for as long as possible, reducing waste and promoting sustainable resource management.

Principles

- Built environment accommodates sharing economy practices.
- Built environment enables alternative future uses buildings and landscapes
- Buildings are designed for disassembly and reuse of components.
- Buildings incorporate high percentage of recycled/renewable construction materials and products.
- Construction waste practically eliminated.
- Operational waste separated for recovery and recycling.
- Zero organic waste to landfill.

Benchmarks

- Considering whole-of-life impacts on the environment when selecting materials for development and operations (Environmental Guidelines 2008).
- Maximising the use of recycled and recyclable materials in developments and operations, including for consumer packaging (Environmental Guidelines 2008).
- Encouraging material re-use for major event overlay (design for disassembly and re-use) (Environmental Guidelines 2008).
- Maximising appropriate opportunities to increase the proportion of recycling for waste produced in the public domain including green waste collection, re-use, and composting (Environmental Guidelines 2008).
- Requiring waste management performance and recycling targets for all developments throughout design, construction and operational activities, with a minimum of 80 percent of construction and demolition waste to be recycled or re-used for each development (Environmental Guidelines 2008).
- Encouraging public domain concessionaires and service providers to minimise where practical the packaging of foodstuffs for visitor consumption, and otherwise to use non-toxic, recyclable, and biodegradable packaging and materials for their products (Environmental Guidelines 2008).
- Educating visitors, workers and residents regarding waste minimisation and management issues, and working in cooperation with venues and businesses to minimise waste generation and maximise recycling of materials (Environmental Guidelines 2008).
- Minimum 80% diversion of construction and demolition waste from landfill (Green Star)
- Minimum 20% recycled content in building materials (Green Star)
- Divert 80% of waste from landfill by 2030 (National Waste Policy

Action Plan)

- Zero organic waste to landfill by 2030 (NSW Waste and Sustainable Materials Strategy 2041)

Master Plan Potential Initiatives

- Integrate waste management and resource recovery principles.
- Spatial planning that allows for modification, replacement or exchange of different functions over time
- Flexible structural system that can be amplified to permit increased floor weight.
- Designate spaces within the precinct for reuse and repair facilities, where residents and businesses can access tools, expertise, and resources to extend the lifespan of products and materials.
- Allocate space for on site waste management and processing.
- Allocate space for private growing of food and/or edible landscapes.

Design opportunities

- Maximise recycled content in materials, and reclaimed materials for non-trafficable visual surfaces.
- Reducing waste generation and promoting recycling and reuse of materials.
- Implement water-saving features, and renewable energy sources.
- Implement a food waste collection system for commercial and industrial premises.
- Building products and components are passported to facilitate future reuse.
- Buildings designed for disassembly.
- Buildings designed for alternative second- and third-life uses.
- Modular construction of buildings and spatial plan that allows for modification, replacement or exchange of different functions over time.
- Implement dynamic building envelope solutions, such as adjustable shading systems and responsive façades, to optimise energy efficiency and thermal comfort.
- Develop comprehensive end-of-life strategies for building components and materials, ensuring that they are properly disassembled, recycled, or re-purposed at the end of their useful life.
- Prioritise building materials and products that have obtained Cradle-to-Cradle certification, ensuring their environmental impact is minimised throughout their life cycle.

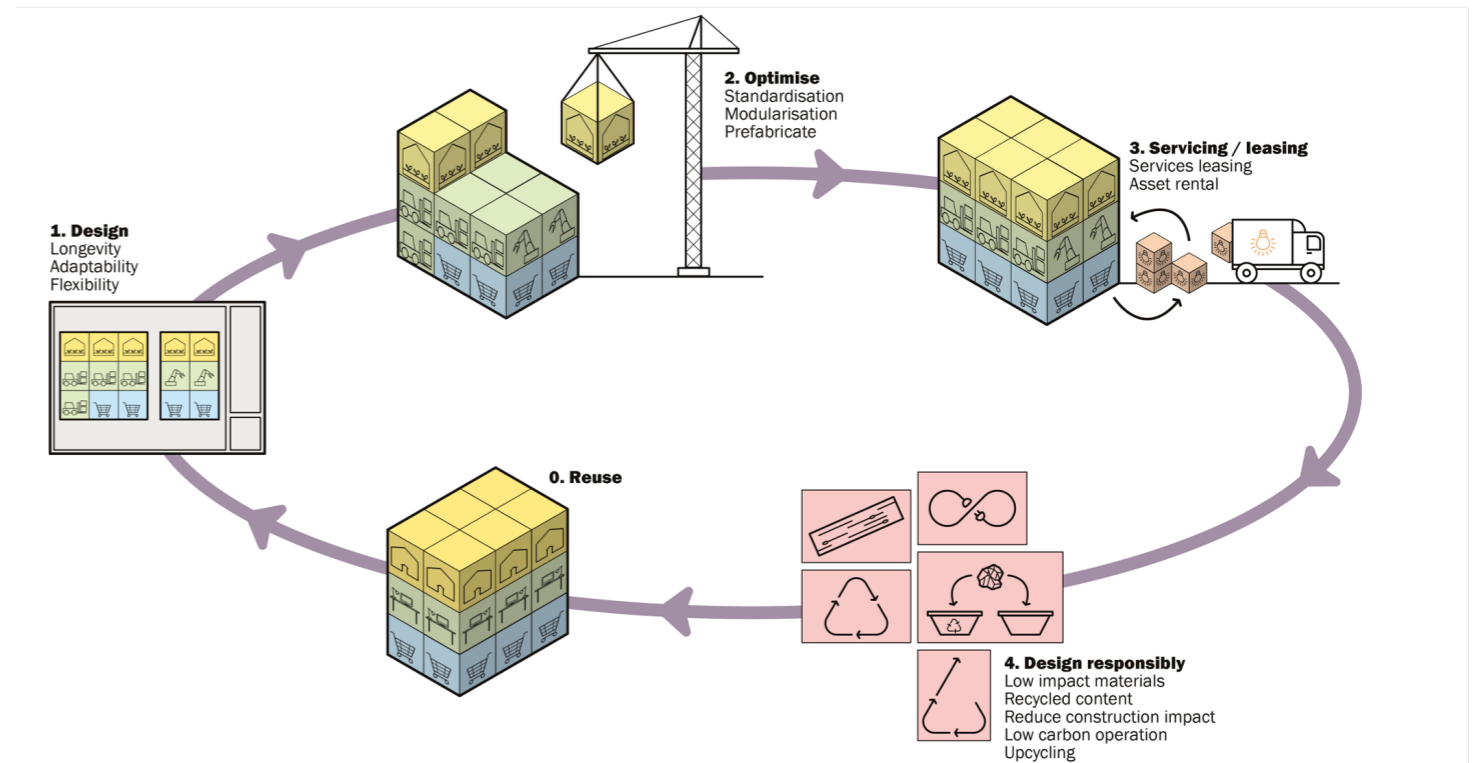


Figure 3.33 Circular economy process in the built environment

3.11 Integrated Water Cycle

Empowering a harmonious coexistence between water, nature, and community, Sydney Olympic Park envisions a sustainable future where water, an element of Wangal Country, is a unifying force, nurturing ecosystems, enhancing well-being, and fortifying resilience for generations to come.

Principles

- Embrace integrated approach respecting water system interconnectedness, including surface water, groundwater, and stormwater.
- Prioritise aquatic habitat preservation, harmonising human activities with the natural environment.
- Champion water efficiency to minimise waste, safeguard resources for present and future generations.
- Empower community through education, involvement, fostering shared water stewardship.
- Strategically plan for challenges like flooding and climate change, enhancing adaptability.
- Utilise cutting-edge tech and practices for optimal water management.
- Design water-centric spaces for culture, recreation, and aesthetics, enhancing precinct quality of life.

Benchmarks

- Minimising overall public domain water use at Sydney Olympic Park (potable and non-potable water) using best practice environmental design principles, innovative technology, water sensitive urban design, water efficient landscaping and other demand management practices (Environmental Guidelines 2008).
- Requiring all new developments to maximise opportunities for building and infrastructure design to incorporate water collection and recycling systems (Environmental Guidelines 2008).
- Avoiding adverse impacts on water quality or quantity in local streams, wetlands and groundwater from operations, developments, and major event activities at Sydney Olympic Park (Environmental Guidelines 2008).
- Working with lead agencies in the promotion of sustainable water resource management practices through integration of water infrastructure, sharing knowledge and experience, and supporting education and research programs (Environmental Guidelines 2008).
- Protect aquatic ecosystems, visual amenity, secondary contact recreation, primary contact recreation, in the longer term, 10 years or more (Sydney Harbour and Parramatta River Water Quality and River Flow Objectives)
- Protect pools in dry times (Sydney Harbour and Parramatta River Water Quality and River Flow Objectives)
- Protect natural low flows (Sydney Harbour and Parramatta River Water Quality and River Flow Objectives)
- Maintain wetland and floodplain inundation (Sydney Harbour

- and Parramatta River Water Quality and River Flow Objectives)
- Mimic natural drying in temporary waterways (Sydney Harbour and Parramatta River Water Quality and River Flow Objectives)
- Maintain natural flow variability (Sydney Harbour and Parramatta River Water Quality and River Flow Objectives)
- Maintain natural rates of change in water levels (Sydney Harbour and Parramatta River Water Quality and River Flow Objectives)
- Minimise effects of weirs and other structures (Sydney Harbour and Parramatta River Water Quality and River Flow Objectives)
- Help deliver initiatives, such as Let's Make Parramatta River Swimmable Again by 2025

Master Plan Potential Initiatives

- Naturalise Haslam's Creek edges, and provide direct access to creek; spaces along the edge for people to gather
- Establish areas for cultural practice and other events adjacent to creek edges.
- Improving and increasing connected natural water systems throughout the site.
- Naturalise waterway edges and where possible reverse land reclamation.
- Integrating Sustainable Urban Drainage Systems (SUDS) to capture and clean storm water before feeding into the water system.
- Create pathways, access points and educational interpretation for people to connect to waterways.
- Integration of storytelling in the Badu Mangroves.
- Mangrove and other endemic vegetation restoration.
- Ensure all built environment has recycled water infrastructure suitable for future Sydney Water mains connection.
- Optimise local collection, storage and use of stormwater in catchments that are not part of a centralised stormwater harvesting system.
- Reduce the volume and manage the quality of stormwater discharged to creeks and wetlands from buildings, roads, carparks and paving to protect the habitats of receiving waters, and with consideration of environmental flow requirements.

Design opportunities

- Integrate green roofs and rain gardens into building design to capture rainwater, reduce runoff, and enhance urban greenery.
- Incorporate water-efficient landscaping with native plants to conserve water and support local biodiversity.
- Develop façades that channel rainwater for cooling, irrigation, or other beneficial purposes, optimising water use.
- Use permeable pavements and surfaces to allow rainwater infiltration, reducing runoff and enhancing groundwater recharge.
- Incorporate water features like ponds or waterfalls into building design for aesthetic appeal and improved microclimates.
- Design versatile spaces that double as temporary water storage during heavy rainfall while serving community needs.



Figure 3.34 Newington Armoury (Source: SOPA)



Figure 3.35 Waterfront walks and resting place (Source: Yerrabingin)



Figure 3.36 WSUD, Rain Garden (Source: Yerrabingin)

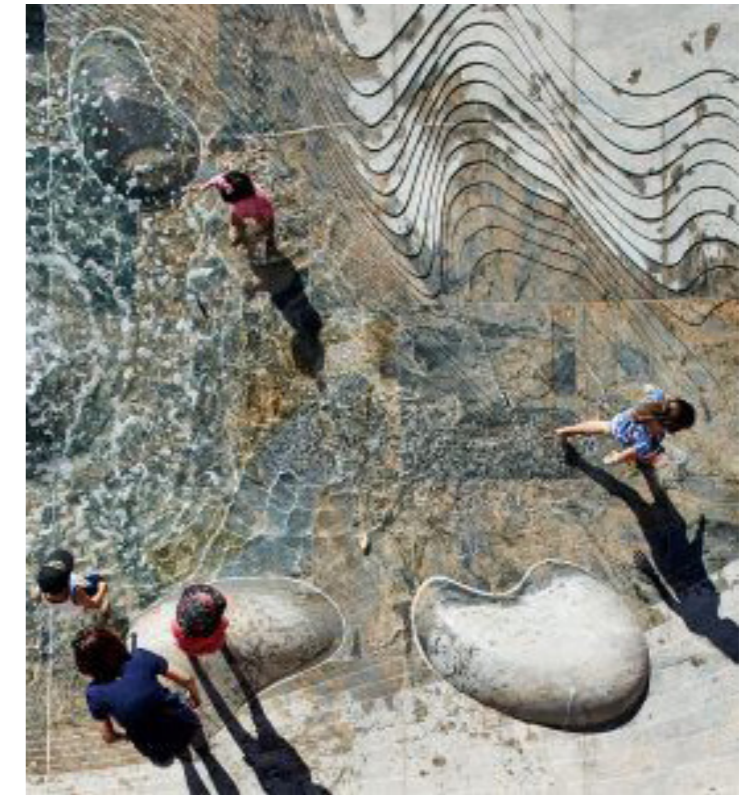


Figure 3.37 Water play feature (Source: Yerrabingin)



Figure 3.38 Movement of water at SOP (Source: Yerrabingin)

04 STRATEGIC INITIATIVES

4.1 Strategic Initiatives

In this section, we focus on a select few Strategic Initiatives within Sydney Olympic Park’s 2050 Master Plan. These initiatives are the cornerstone efforts that will channel our resources and attention.

While the Sustainability Strategy outlines a broad range of actions, this section pinpoints key initiatives that, due to their scale and impact, significantly advance the sustainability values and themes.

4.1.1 Core Strategic Initiatives

These Strategic Initiatives are not just actions but major moves designed to create a significant impact across multiple areas of sustainability. They are carefully chosen for their potential to contribute substantially to the Vision 2050 pillars and strategic directions, ensuring that efforts are not dispersed but are concentrated where they can be most effective.

4.1.2 Pathways to Future Implementation

As Sydney Olympic Park continues its legacy as a leader in sustainability, we recognise that the Strategic Initiatives presented in this section are ambitious and extend beyond the immediate scope of the Master Plan 2050. These initiatives are not just plans for the future but are integral to the ongoing journey towards sustainability, potentially extending their influence beyond 2050.

From its inception, Sydney Olympic Park has been an exemplar of sustainable development. These initiatives are a testament to this enduring commitment, offering pathways for SOPA, the NSW Government, and all stakeholders to further this legacy. They are designed to inspire and guide actions from now until 2050, potentially setting the stage for future endeavours.

These Strategic Initiatives represent bold steps in continuing Sydney Olympic Park’s leadership in sustainable urban development. They provide a vision for how the Park can maintain its role as a pioneer in this field, influencing sustainable practices both within NSW and globally. Their successful implementation will require collective effort and sustained commitment, reinforcing our position as a model of environmental stewardship and innovation.

4.1.3 Types of Strategic Initiatives

- The initiatives fall into three categories:
- **Enhancing the Master Plan:** These initiatives build on the existing Master Plan 2050. For example, the Sharing Economy Hub increases resource sharing and efficiency, while the Circular Repair Hub supports sustainable material use and waste reduction.
 - **Improving Authority Operations:** These initiatives improve the operations of the Sydney Olympic Park Authority. The Living Lab, for instance, is a research and innovation platform with local

- and global influence. The Sustainability-as-a-Service Strategy and NSW Centre of Resilience Excellence extend beyond the park, promoting sustainable practices in wider areas.
- **New Infrastructure Development:** These initiatives involve creating new infrastructure and would require a detailed business case to validate feasibility and risks. The Microgrid project aims to develop an advanced energy distribution network, and the District Thermal Energy System seeks to create an efficient heating and cooling network.

4.1.4 Structure and Presentation

- Each Strategic Initiative is outlined with:
- **Vision:** A concise statement encapsulating the ambitious goal of the initiative.
 - **Description:** An overview of the initiative’s functionality and its role within the Master Plan where relevant.
 - **Rationale:** The key reasons why each initiative is integral to the Master Plan.
 - **Objectives:** Specific targets and outcomes that the initiative aims to achieve.
 - **Opportunities and Challenges:** A realistic assessment of the feasibility and potential obstacles.
 - **Spatial Integration:** How the initiative fits spatially and functionally within Sydney Olympic Park.
 - **Case Studies:** Real-life examples demonstrating the initiative’s potential transformative impact.

4.1.5 Strategic Overview

These Strategic Initiatives represent a focused and impactful approach to sustainability at Sydney Olympic Park. By concentrating on these key areas, we aim to achieve significant strides towards our overarching sustainability goals, setting a precedent for urban development and sustainable practices.

	Sharing Economy Hub	Circular Repair Hub	Living Lab	Sustainability as a Service Strategy	NSW Centre of Resilience Excellence	Microgrid	District Thermal Energy System
Connecting with Country							
Biodiverse and Regenerative							
Continuous Learning							
Carbon Positive							
Health and Wellness							
Resilient and Adaptable							
Integrated Mobility							
Welcoming and Inclusive							
Circular Economy							
Integrated Water Cycle							

4.1.6 Microgrid

Transform Sydney Olympic Park into a resilient, sustainable and self-sufficient community through the establishment of a microgrid, which serves as a model for future urban energy systems.

Description

Empower Sydney Olympic Park as a self-sufficient, sustainable community through the pioneering Microgrid initiative. A Microgrid is an integrated energy network that can operate both independently and collaboratively with the main grid. It incorporates renewable sources like solar panels, wind turbines, and energy storage to provide electricity, heating, cooling, and hot water. Managed by advanced software, the Microgrid optimises energy usage for the community's diverse needs.

Rationale

Sydney Olympic Park, a vital emergency and event hub, requires uninterrupted power supply. The Microgrid ensures consistent energy during emergencies and peak events. Beyond resilience, it aligns with sustainability objectives by reducing carbon emissions, promoting renewable energy, and achieving the New South Wales Government's net-zero emissions goal. As a cost-effective solution, the Microgrid bolsters energy security, sets a sustainable precedent, and cements the park's leadership in urban development.

Objectives

- Enhance power reliability and resilience for essential infrastructure, residents, and businesses.
- Slash greenhouse gas emissions, driving a sustainable future.
- Integrate renewable energy sources into the local energy mix.
- Diminish peak energy demand, alleviating grid pressure.
- Strengthen the main grid during instability and frequency fluctuations.
- Showcase Microgrid benefits for urban environments.
- Boost energy security for the Mass Care Facility and emergency services.
- Ensure continuous essential services during outages, including events.
- Foster seamless resource sharing among emergency services during crises.

Opportunities

Easier

- Install ~7 MW solar PV on SOPA assets.
- Explore additional ~25 MW solar PV potential on SOPA assets.
- Deploy a ~5 MWh battery storage system with ~12 MW nominal power.
- Establish quick connects for temporary power sources.
- Conduct energy audits to curb waste and inefficiencies.
- Implement motion sensors for automatic light control.
- Launch demand response programs during high-energy periods.
- Promote energy conservation through awareness campaigns.

- Adopt green procurement policies for energy-efficient equipment.
- Evaluate Microgrid feasibility through technical, economic, and environmental studies.

Harder

- Innovate a Microgrid business model to incentivise renewable investment and community participation.
- Equip shelter-in-place facilities and on-site organisations with extended disruption resources.
- Explore up to 23 MW solar PV potential on other park buildings.
- Retrofit existing structures with solar PV.
- Develop an operational smart power provider.
- Establish a community-based energy trading platform.
- Create a Microgrid control system for efficient energy balance.
- Formulate a regulatory framework for Microgrid operation and renewable incentives.
- Implement Microgrid resilience strategy for uninterrupted critical infrastructure function.
- Design a comprehensive monitoring and evaluation framework.

Spatial Considerations

- Maximise ecologically rich green roofs, not just solar PV.
- Identify precinct battery locations per the 2050 Master Plan.
- Optimise proximity to existing power grid for connections.
- Leverage natural resources like wind, solar, or geothermal energy.
- Adhere to zoning regulations and land use restrictions.
- Conduct environmental impact assessments for minimal disruption.
- Seamlessly integrate with existing infrastructure, utilities, and safety measures.
- Mitigate potential community impact with noise and pollution control.
- Balance accessibility for maintenance with security measures.

Challenges

- Establish remote Microgrid monitoring and control capabilities.
- Ensure redundancy and backup systems for reliability.
- Develop emergency response plans for power outages or incidents.
- Future-proof Microgrid expansion for evolving energy needs.
- Engage stakeholders—residents, businesses, and event organisers—in planning and execution.



Deakin Waurn Ponds Campus Renewable Energy Microgrid

Deakin University, in collaboration with AusNet Services and Mondo Power, has successfully established a Renewable Energy Microgrid on its Waurn Ponds Campus. This innovative project incorporates solar energy generation, storage, and a research center. The microgrid contributes to Deakin's commitment to becoming carbon neutral by 2030 and serves as a vital research and educational platform.

Key Information

- The Renewable Energy Microgrid comprises a 7-megawatt solar energy farm, a 0.25-megawatt rooftop solar generation and storage system, and a Research, Teaching, and Visualisation Centre.
- The microgrid became operational in early 2021.
- It aims to reduce the campus' greenhouse gas emissions by 12,000 tonnes annually and supply approximately 54% of the campus' power consumption.
- Deakin utilises the microgrid for high-value research, student learning opportunities, and employment pathways. It fosters collaborative research with AusNet Services and other strategic partners.
- Deakin's microgrid aligns with its goal to achieve carbon neutrality by 2030 and serves as a model for sustainable power generation and grid stability.

Challenges

- Commissioning works for the solar farm were initially on hold, awaiting Powercor's approval, presenting a challenge in project scheduling.
- Ensuring the cybersecurity of microgrid systems is critical, considering the increasing reliance on digital control and monitoring.
- Coordinating the high voltage infrastructure and grid applications for the solar farm and battery storage required careful planning and execution.
- Addressing social challenges such as equity and community participation in new energy opportunities posed challenges in research and implementation.
- Demonstrating the economic benefits of microgrids to both the campus and the wider community is crucial for long-term sustainability.
- Exploring additional technological possibilities like hydrogen storage and electric vehicle integration for the microgrid requires further research and investment.



Figure 4.1 Solar farm positioned on 14.5 hectares at the rear of the campus (Source: Deakin University)

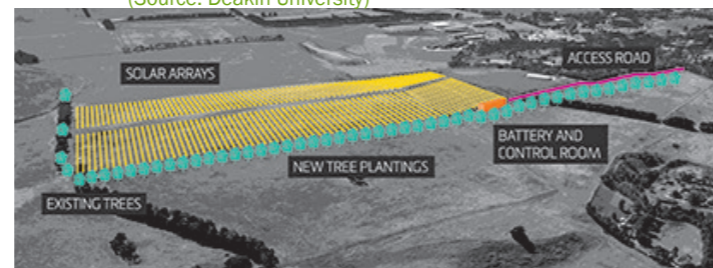


Figure 4.2 7 megawatt solar energy farm and battery storage system (Source: Deakin University)



Figure 4.3 Solar farm positioned at the rear of the campus (Source: Deakin University)



Figure 4.4 0.25 megawatt rooftop solar and battery storage systems installed on existing campus buildings (Source: Deakin University)

Monash Smart Energy City

Monash Smart Energy City is an innovative microgrid project located on the Monash Clayton campus in Melbourne, Australia. This project exemplifies the integration of renewable energy sources and advanced technologies to reduce reliance on coal-fired energy and contribute to a sustainable future. Here, we present a brief case study of Monash Smart Energy City, outlining its key features and challenges.

Key Information

- The microgrid has a 1-megawatt capacity, consisting of 8 solar PV systems with capacities ranging from 30kW to 260kW. This integration of solar power allows the microgrid to harness energy from various renewable sources.
- Monash Smart Energy City boasts Australia's first 'hybrid' energy storage system, combining vanadium redox flow and lithium-ion technologies with a 1MWh capacity. This system enables efficient energy storage and distribution.
- The microgrid incorporates electric vehicle chargers, enabling users to participate in transactive market events. This feature promotes sustainable transportation and enhances the microgrid's economic viability.
- In collaboration with global tech company Indra, the project aims to control distributed energy resources, including at least 1 MW of solar panels, 20 buildings, electric vehicle charging stations, and 1 MWh of energy storage. Indra's grid management platform enables real-time monitoring and optimisation of these assets.
- The microgrid is connected to a transactive energy market developed by Monash University's eResearch Centre, allowing each asset to independently buy and sell electricity based on pricing signals.

Challenges

- The project faces significant cybersecurity challenges, given the digitalisation of energy systems and the need to protect sensitive data. Developing robust cybersecurity measures and data governance frameworks is paramount.
- Assessing the maturity of various technologies and ensuring operational and data readiness are underestimated challenges. Early-stage technology adoption can lead to unforeseen development efforts and delays.
- Managing large and sensitive datasets is a critical consideration. Data governance and integrity are crucial, as they impact the project's research capabilities and operational components.
- Energy systems' unique cybersecurity requirements must be thoroughly understood and assessed to protect against potential threats.
- Despite the project's success, barriers to microgrid adoption remain, including regulatory hurdles, asset management considerations, network visibility, and tariff structures.



Figure 4.5 Rooftop solar at Monash campus (Source: Monash University)



Figure 4.6 Introduction and Lessons Learned Reports (Source: Monash / Indra)

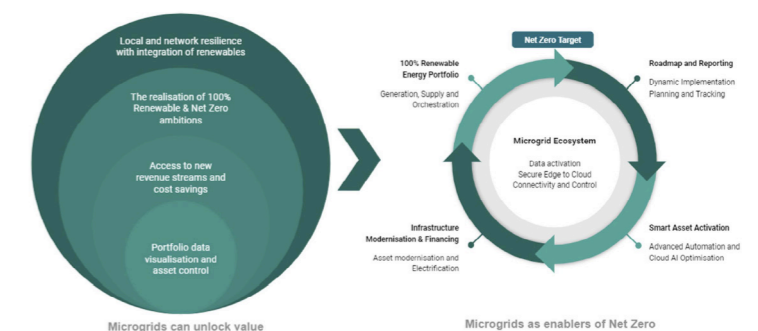


Figure 4.7 The value the microgrid technology stack can unlock are evolving to a broader enabler of Net Zero and business and system operation (Source: Monash / Indra)

4.1.7 District Thermal Energy

Inspired by innovation and driven by sustainability, the Master Plan 2050 envisions a dynamic urban landscape seamlessly integrated with a cutting-edge District Thermal Energy System, heralding a new era of efficient and resilient heating and cooling solutions.

Description

The District Thermal Energy System, now known as 5th Generation District Heating and Cooling (5GDHC), represents an advanced paradigm of urban thermal management. Characterising the visionary 2050 Master Plan, this system unites heating and cooling distribution through optimised hot and chilled water circulation, epitomising an era where urban dynamics seamlessly converge with innovative energy solutions.

Rationale

The 5GDHC system strategically addresses urban challenges by enhancing heating and cooling reliability. It counterbalances peak demand through efficient thermal energy storage while centralising cooling towers, liberating valuable rooftop space for functional and environmental augmentation, aligning seamlessly with a sustainable ethos.

Objectives

- To optimise urban spatial utilisation by releasing rooftop areas for enhanced amenity and ecological sustenance.
- To streamline infrastructural efficiency through integrated thermal energy networks, accommodating multifaceted urban functions.
- To pioneer progressive thermal energy storage solutions, facilitating adaptive load management and demand modulation.
- To champion emission reduction strategies, curbing operational carbon footprints and amplifying environmental stewardship.
- To bolster financial resilience by curtailing operational expenditures and augmenting energy efficiency.
- To embrace synergistic potential with the Western Sydney Recycled Water Augmentation Scheme (WRAMS), orchestrating an integrated water-energy nexus.

Opportunities

Easier

- Develop rooftop parks and gardens, fostering recreational spaces and urban greenery.
- Establish vibrant public squares and congregation zones within the park.
- Leverage rooftops for solar energy generation, boosting sustainability.
- Enhance aesthetics and insulation with rooftop gardens and vegetation.
- Foster biodiversity and pollination through rooftop beehives.

- Create elevated pedestrian walkways, connecting key destinations.
- Design open-air event arenas with panoramic park views.
- Curate al fresco dining and entertainment spots.
- Design engaging rooftop playgrounds and family-centric spaces.
- Implement photovoltaic-integrated roofing for sustainable power generation.

Harder

- Retrofit existing structures with thermal energy infrastructure to optimise energy utilisation.
- Harmonise with intricate utility networks and pre-existing infrastructure.
- Align with water reclamation systems for synergistic resource management.
- Integrate dynamic thermal storage and discharge mechanisms.
- Adapt to diverse architectural and urban planning styles.
- Coordinate with sustainable transit networks, like electric vehicle charging stations.
- Employ dynamic load balancing for varying energy needs.
- Conform to eco-friendly building certifications, augmenting sustainability.
- Establish thermal energy collaborations with neighbouring precincts.
- Fuse energy supply with demand response systems for peak efficiency.

Spatial Considerations

- District Thermal Energy systems excel in mixed-use neighbourhoods with balanced load profiles, yielding maximum efficiency.
- High-density developments adjacent to transport hubs optimise energy transmission and consumption.
- Strategically position thermal energy infrastructure to minimise transmission losses.
- Balance energy generation locations with energy demand centres to reduce transmission losses.

Challenges

- Securing ample funding for system implementation and integration into an established urban landscape.
- Harmonising the new energy infrastructure with the existing precinct, strategically aligning with diverse infrastructure and design elements.



Texas Medical Centre, Thermal Energy Corporation (TECO)

The Texas Medical Center (TMC) campus, operated by the Thermal Energy Corporation (TECO), serves as a remarkable example of efficient and sustainable district energy systems. TECO has been providing thermal utilities to the largest medical city globally for over five decades. This case study highlights key information and challenges faced by TECO in operating its combined heat and power (CHP) system.

Key Information

- TECO's CHP unit, boasting 48 megawatts of capacity, has successfully met 100% of TECO's electricity needs for nearly three decades, from 1992 to 2021, with a remarkable 100% system reliability, experiencing no unplanned outages during this period.
- The system includes an 8.8 million-gallon chilled-water thermal energy storage tank and a chiller building with 32,000 tons of installed capacity, expandable to 80,000 tons, ensuring efficient cooling for the extensive campus.
- To expand its distribution system, TECO constructed a utility bridge over Brays Bayou, enabling coverage of additional areas within the campus.
- TECO's CHP unit operates with a remarkable 72% efficiency, more than twice as efficient as conventional power plants, allowing the production of power and energy from a single fuel source.
- The thermal energy storage tank is charged during nighttime, taking advantage of lower electricity rates, and discharges during the day, contributing to substantial electricity cost savings.

Challenges

- One of the significant challenges faced by TECO is ensuring that the district energy system can accommodate the future growth of the Texas Medical Center while planning for necessary investments and expansions.
- TECO must maintain a delicate balance between ensuring the reliability and cost-effectiveness of its district energy system while upholding its commitment to environmental responsibility and sustainability.
- For the CHP system to function optimally, a reliable source of heat capture is essential, posing a continuous challenge for TECO.
- Considering the extensive piping distribution system, covering more than 35 miles, the construction standpoint, laydown area, and installation require meticulous planning, phasing, engineering, and construction management.



Figure 4.8 Aerial view of \$377-million expansion project (Source: TECO)



Figure 4.9 Ground view of \$377-million expansion project (Source: TECO)



Figure 4.10 Texas Medical Center's energy center control room (Source: TECO)

Singapore Marina Bay, Thermal Energy System

The Marina Bay District Cooling & Heating System in Singapore, operated by SP Group, serves as a compelling example of a district energy system that enhances sustainability and energy efficiency.

Key Information

- Marina Bay houses the world's largest underground district cooling network by SP Group. This centralised system boosts energy efficiency, cuts operational costs, and significantly lowers carbon emissions.
- Since 2006, the network has maintained zero supply disruptions. By 2027, it will serve 32 buildings, reducing annual carbon emissions by nearly 22,000 tonnes, equivalent to removing 17,672 cars from the road.
- Centralised chiller plants reduce costs by up to 15% compared to traditional cooling systems, freeing space for other purposes.
- SP Group seeks to expand capacity to 70,000 RT and enhance reliability with thermal storage tanks in the Central Business District, supporting renewable energy integration and grid stability.

Challenges

- One of the key challenges in scaling a district cooling and heating system is ensuring the seamless expansion of infrastructure to accommodate new buildings and developments. Careful planning and investment are necessary to maintain high reliability.
- Achieving substantial reductions in carbon emissions while expanding the network requires continuous innovation and optimisation in energy production and distribution. Balancing growth with sustainability goals is crucial.
- Incorporating energy storage solutions, like thermal storage tanks, into the network poses engineering and logistical challenges. Ensuring efficient operation and seamless integration with renewable energy sources is essential.
- Managing peak demand periods and optimising the system for demand response require a robust strategy to curtail electricity consumption during times of tight electricity supply.



Figure 4.11 Marina Bay (Source: SP Group)

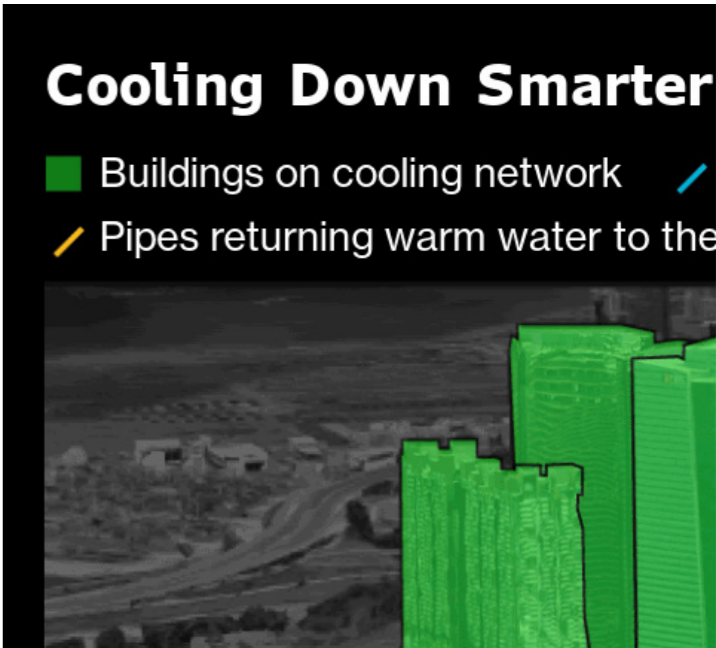


Figure 4.12 Cooling down smarter (Source: SP Group)



Figure 4.13 The expanded Marina Bay District Cooling network (Source: SP Group)

4.1.8 Circular Repair Hub

Establish a centralised hub dedicated to keeping products in use, eliminating waste, and create an end market for recycled products.

Description

Forge a centralised Circular Repair Hub at Sydney Olympic Park, championing product longevity, waste reduction, and recycled product markets. The Circular Repair Hub extends product lifecycles through repair and refurbishment, aligning with the circular economy's ethos of resource efficiency and value maximisation. By offering diverse repair services—ranging from electrical and mechanical fixes to carpentry and sewing—the hub curbs landfill waste, enhances local economic growth, and advances sustainability. The new Master Plan 2050 includes plans for this hub, ensuring its integration into the area's future development.

Rationale

Amidst Australia's heightened focus on waste reduction, resource efficiency, and circular economy models, the Circular Repair Hub aligns with national objectives. With backing from the Greater Cities Commission, Sydney Olympic Park's robust governing body positions it to pioneer this pivotal initiative. This hub showcases the park's commitment to sustainability and contributes to a regional network of Circular Economy Hubs, amplifying its impact across scales.

Objectives

- Propel circular economy principles by repairing, refurbishing, and reusing goods, spearheading waste reduction and environmental sustainability.
- Foster a collaborative space for repair professionals, businesses, and the community to share knowledge and expertise.
- Ensure accessible, affordable repair services, benefiting all, especially those with limited access to new goods.
- Promote durable and repairable products through education and awareness campaigns.
- Catalyse local economic growth by generating repair-related job opportunities.
- Minimise environmental impact tied to waste disposal and replacement, by offering proximate repair services.
- Elevate community resilience and self-sufficiency by promoting repair skills and knowledge-sharing.
- Engage with the community through outreach and education, amplifying the circular economy's benefits.
- Monitor and assess the hub's impact on waste reduction, economic growth, and socio-environmental sustainability.

Opportunities

Easier

- **Bicycle Repair Cafe:** Offers maintenance and repair services for bicycles, promoting sustainable transport and extending the life of cycling equipment.
- **Upcycle Studio:** Champions the transformation of discarded

materials and waste into unique and creative art pieces giving new life to what was once considered waste.

- **Garment Renewal Workshop:** Provides services for repairing and upcycling clothing, contributing to sustainable fashion and waste reduction.
- **Resource Redemption Point:** Acts as a collection and distribution centre for recyclable and reusable materials, supporting waste reduction and resource circulation.
- Conduct educational programs on circular economy and repair.
- Develop an online platform connecting repair providers and users.
- Incentivise product repair and recycling through consumer rewards.

Harder

- **Furniture Revival Hub:** Focuses on refurbishing and repairing furniture, reducing waste by giving old furniture new life.
- **Electronics Repair Hub:** Specialises in fixing and refurbishing electronic devices, combating electronic waste and promoting reuse.
- **Creative Reuse Studio:** Encourages the transformation of discarded materials into artistic creations, fostering creativity and reducing waste.
- **Innovation Incubator Hub:** Nurtures new sustainable ideas and technologies, focusing on circular economy solutions and environmental innovations.
- Collaborate with manufacturers to design easily repairable products.
- Engineer closed-loop systems for electronics with re-usability.
- Craft regional circular economy strategies involving multiple industries.
- Design hazardous waste collection and recycling programs.
- Establish a circular economy R&D centre for innovation.
- Develop construction waste material collection and reuse systems.

Spatial Considerations

- Coalesce existing initiatives (e.g., Return and Earn, charity bins) within limited spaces.
- Accommodate active repair set-ups in spaces like garages.
- Harness medium-sized warehouses (5,000m² - 10,000m²) for comprehensive circular hubs.
- Integrate technical, office, lab, and workshop spaces in urban centres.
- Ensure easy public access with transportation links and connectivity.
- Navigate zoning regulations and land use designations.
- Address waste generation with specialised waste management.

Challenges

- Secure funding for hub establishment and ongoing operation.
- Garner stakeholder and decision-maker support.
- Develop effective waste management strategies.
- Optimise user accessibility and convenience.
- Maintain repair equipment and infrastructure.
- Attract and retain skilled repair personnel.
- Cultivate community participation in repair practices.
- Tackle liability and warranty concerns.
- Operate the hub sustainably, mitigating impacts.



The Bower Reuse & Repair Centre, Sydney

The Bower Reuse & Repair Centre, located in Sydney, serves as a pioneering example of sustainable and circular economy practices. With a mission to divert usable resources from landfills, it operates as a cooperative, involving the community in reusing, repairing, and reselling a wide range of goods. The center has been instrumental in reducing waste and fostering environmental consciousness.

Key Information

- The Bower operates as a cooperative where community members own and control its assets. This unique model empowers the local community to actively engage in reducing waste.
- The center accepts donations of various goods in good, reusable condition, including furniture, electrical appliances, and architectural hardware. These items are repaired and resold, significantly extending their life cycle and minimising their carbon footprint.
- The Bower conducts workshops on recycled art, carpentry, furniture restoration, and repair. These educational initiatives equip individuals with skills to renovate, upcycle, or refurbish items that may be considered waste, promoting a culture of sustainability.
- The Marrickville Bower building is a sustainable marvel itself, being the first straw bale building in Sydney. Its construction involved recycled and reclaimed materials, setting an example of sustainable building practices.

Challenges

- Efficiently managing the intake and processing of donated goods while ensuring that the center only accepts items in good condition is a continual challenge.
- Encouraging broader community participation and awareness in reuse and repair practices requires ongoing effort, especially in urban areas like Sydney Olympic Park.
- Balancing operational costs and maintaining financial sustainability can be a challenge for reuse and repair centers, especially in the context of large-scale projects like Sydney Olympic Park.
- Adapting The Bower's cooperative model to fit the specific needs and scale of a Circular repair hub in Sydney Olympic Park may pose unique challenges related to governance and community involvement.



Figure 4.14 The Bower's straw bale building in Marrickville (Source: The Bower)



Figure 4.15 Furniture repair workshops (Source: The Bower)



Figure 4.16 Electrical repair workshops (Source: The Bower)

The Repair Café, Amsterdam, Netherlands

Repair Café Amsterdam is a pioneering initiative that has inspired a global movement of Repair Cafés. Founded by Martine Postma in 2009, it has become a symbol of community-driven sustainability and the circular economy. Repair Cafés provide free meeting spaces where people come together to repair a wide range of items, from clothing to appliances, with the help of expert volunteers. These hubs play a crucial role in reducing waste, extending the lifespan of products, and teaching valuable repair skills, ultimately contributing to a more sustainable and environmentally conscious society.

Key Information

- Repair Café Amsterdam was initiated by Martine Postma in 2009, marking the beginning of a global Repair Café movement.
- Repair Cafés offer tools, materials, and expert volunteers to assist visitors in repairing various items, from electronics to furniture.
- The movement has expanded significantly, with over 2,500 Repair Cafés worldwide in countries like the Netherlands, Belgium, Germany, France, the United Kingdom, the United States, India, Japan, and others.
- Repair Cafés aim to combat the throwaway culture by promoting repairability, reducing waste, and extending the lifespan of products.
- They contribute to the circular economy by minimising the consumption of raw materials and reducing CO₂ emissions associated with manufacturing and disposal.
- Repair Café volunteers also engage in educational activities, including repair lessons in schools, to promote a sustainable mindset among younger generations.
- The Repair Café model is not in competition with professional repair specialists but rather encourages people to consider repair as a viable alternative to disposal.

Challenges

- Establishing and maintaining a Repair Café requires coordination, resources, and volunteers, which can be challenging for new initiatives.
- Promoting the Repair Café concept and educating the community about its benefits can be a hurdle, especially in areas unfamiliar with the concept.
- Encouraging individuals to donate to Repair Cafés to cover costs and support sustainability efforts can be challenging in some regions.
- Ensuring that Repair Cafés remain true to their non-commercial, voluntary nature as they gain popularity is an ongoing challenge.
- The logistics of handling various repair requests and providing necessary tools and materials can be complex for organisers.
- Addressing the environmental impact of Repair Café visitors who may need to travel long distances to reach a Repair Café is a consideration for sustainability.



Figure 4.17 Sharpening knives and scissors (Source: Repair Cafe)

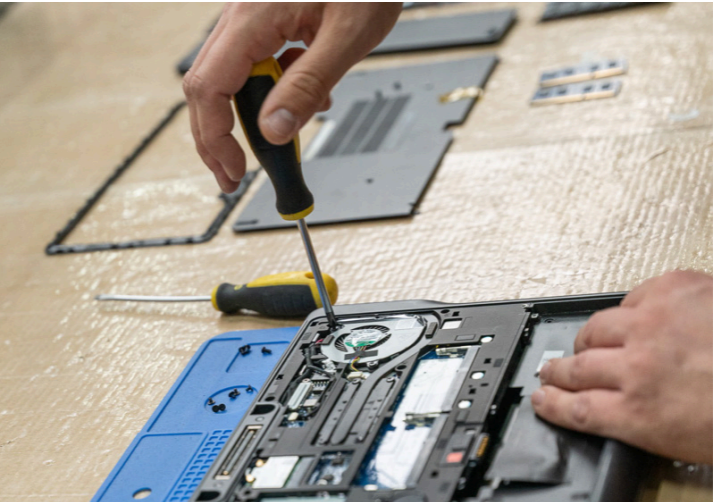


Figure 4.18 Extend the life of your laptop through proper maintenance and repair (Source: Repair Cafe)



Figure 4.19 Don't just throw away broken toys (Source: Repair Cafe)

4.1.9 Sharing Economy Hub

Create a community-driven space that promotes sustainable consumption and production, fosters social connections, supports local businesses, and contributes to a circular economy.

Description

Create a communal space to foster sustainable consumption, encourage social interactions, support local enterprises, and advance circular economy practices. Sharing economy hubs facilitate resource, goods, and service sharing, encompassing co-working spaces, tool libraries, and more. They enable access without sole ownership, reducing waste, promoting sustainable practices, and building community ties.

Rationale

A sharing economy hub echoes Sydney Olympic Park's sustainability aims and circular economy commitment. By nurturing resource and service sharing, it slashes waste, bolsters local commerce, and encourages sustainable transportation. These initiatives contribute to resilience, sustainability, and vibrant community building.

Objectives

- Increase shared resource access, curbing individual ownership.
- Foster a culture of collaboration and sharing.
- Offer a platform for individuals and businesses to share resources and services.
- Advocate sustainable consumption, reducing waste.
- Generate economic opportunities via resource and service sharing.
- Strengthen community bonds and connectivity.
- Cultivate innovation through novel sharing economy models.
- Diminish environmental impact by promoting shared resources.
- Ensure affordable resource and service access for lower-income community members.
- Enhance disaster preparedness through emergency resource sharing.

Opportunities

Easier

- **Mobility Share Point:** A centralised location for accessing a variety of shared transportation options such as bikes, e-scooters, and even watercraft, enabling residents and visitors to easily move around the community without the need for personal vehicles.
- **First Nations Community Garden:** A communal gardening space that not only cultivates local flora but also serves as a cultural hub for First Nations communities, offering workshops on traditional horticulture, indigenous plant uses, and environmental stewardship.
- **Festival and Performance Centre:** A multipurpose venue designed to host a variety of events ranging from local festivals and concerts to community gatherings and performances,

equipped with modular stages, seating arrangements, and state-of-the-art sound systems.

- **Culinary Event Space:** A fully equipped commercial kitchen available for rent to host cooking classes, culinary events, food tastings, and private parties, with ample indoor and outdoor spaces for dining and socialising.
- **Tool Lending Library:** An extensive repository of tools and equipment for home improvement, gardening, and DIY projects, available for community members to borrow, thus eliminating the need for individual tool purchases.
- **Toy Exchange Hub:** A playful and engaging space where families can exchange toys, games, and educational materials, keeping playtime fresh and exciting for children while fostering a sense of community sharing.
- **Community Resource Pool:** A versatile space within residential buildings offering a range of shared resources, from household appliances and electronic gadgets to camping gear and party supplies, available for short-term use by community members for various personal and group activities.
- Organise sustainability-themed workshops and events.
- Develop digital platforms for sharing goods and services.
- Promote local sharing initiatives through directories or guides.
- Educate the community on sharing economy merits.

Harder

- **Performance Rehearsal Hub:** This hub offers a dynamic, shared space for artists and performers to rehearse, create, and collaborate, featuring adaptable stages, sound systems, and lighting setups to cater to a diverse range of artistic needs.
- **Collaborative Studio Hub:** This innovative space provides artists, designers, and creators with access to shared studio facilities, including high-end equipment for digital fabrication, painting, sculpting, and multimedia work, fostering a vibrant creative community.
- Partner with existing sharing economy entities to offer incentives.
- Collaborate on legal frameworks and regulations.

Spatial Considerations

- Accommodate shared items storage and display.
- Allot space for tool maintenance and repair.
- Flexible layouts for diverse sharing activities.
- Meeting areas for group interactions.
- Accessible location with transport connectivity.
- Outdoor spaces for community gardening and events.
- Adaptable multi-use spaces.
- Inclusive design for community-wide participation.
- Adequate storage for items awaiting repair.
- Noise mitigation for shared tool use.
- Secure storage for high-value shared items.

Challenges

- Garner user trust and participation.
- Develop a sustainable hub business model.
- Manage inventory and maintenance.
- Ensure fair access and safety.
- Address legal and liability concerns.



The Library of Things, London, UK

Library of Things is a London-based social enterprise that has pioneered the concept of a sharing economy hub. This innovative initiative enables members to borrow a wide range of items, from tools to household appliances, promoting sustainability and reducing waste. It serves as a community-driven platform funded through grants, donations, and membership fees, catering to the needs of local residents, businesses, and government bodies. The Library of Things model includes a lending library, DIY workshops, community events, and partnerships with local businesses, emphasising the benefits of borrowing over buying.

Key Information

- Library of Things offers a diverse catalog of items available for borrowing, fostering a culture of sharing and reducing individual ownership.
- It operates on a membership-based system, allowing users to reserve items online and borrow them for a nominal fee.
- The initiative hosts DIY workshops and training programs to promote practical skills and encourages the sharing of expertise among members.
- Community events and outreach programs are organised to engage the local population in sustainable practices and the sharing economy.
- Partnerships with local businesses and organisations help promote Library of Things and further integrate it into the community fabric.
- The initiative focuses on affordability, convenience, and reducing clutter by providing access to high-quality items for various needs.
- Library of Things has expanded to multiple locations in London and Brighton, offering access to a diverse range of borrowing options.

Challenges

- Introducing the concept of borrowing over buying requires significant educational efforts to inform the community about the benefits and mechanics of Library of Things.
- Managing the borrowing and returning process, especially with a wide array of items, can be logistically challenging.
- Reliance on grants and donations for funding necessitates continuous efforts to secure financial support for sustainability.
- Ensuring that the inventory of borrowed items is maintained and kept in good condition is essential for the initiative's success.
- Building a strong community around Library of Things and encouraging active participation can be a hurdle.
- Expanding to new neighborhoods or regions requires careful planning and partnerships with local stakeholders.
- Encouraging people to shift from a culture of ownership to sharing can be challenging in a consumer-driven society.



Figure 4.20 Library of Things South London location (Source: Library of Things)



Figure 4.21 Library of Things Hackney Wick location (Source: Library of Things)



Figure 4.22 London location toy library (Source: Library of Things)

Inner West Tool Library, Sydney

The Inner West Tool Library (IWTL) is a vibrant community-driven initiative that opened its doors in 2019, serving the residents of Sydney's Inner West and surrounding areas. This unique "library of things" offers more than just tools; it provides access to a diverse inventory of equipment, encouraging resource-sharing and reducing unnecessary consumption. By fostering a culture of borrowing rather than buying, IWTL aims to reduce waste, save money, and strengthen community bonds.

Key Information

- IWTL operates on an annual membership model, with fees of \$75/year for adults and \$50/year for concessions. Members can borrow tools and equipment for various DIY projects, home improvements, and recreational activities.
- The library boasts an extensive inventory that includes power tools (e.g., drills, saws), gardening equipment, camping gear, cooking appliances, and more. Members can reserve items online and pick them up at the library's Petersham location.
- IWTL actively engages with the local community through volunteer-driven efforts. Volunteers, often referred to as "Tool Librarians," play a vital role in managing loans and ensuring the library's smooth operation.
- The library aligns with the principles of the sharing economy by promoting access over ownership. Members save money, reduce their environmental footprint, and contribute to a more sustainable future by sharing resources.

Challenges

- IWTL has faced space limitations, which can affect its ability to store and manage a growing inventory of tools and equipment efficiently. Expanding the physical space or exploring alternative storage solutions may be necessary.
- The library relies on volunteers for its day-to-day operations. Ensuring a consistent pool of volunteers and providing them with adequate support and recognition are ongoing challenges.
- While IWTL has made significant strides in engaging the local community, continued efforts are needed to raise awareness among potential members and donors. Effective marketing and outreach strategies may be required to sustain and expand the library's impact.
- Maintaining tools and equipment in good working condition, handling reservations, and addressing loss or damage can be resource-intensive. Implementing efficient resource management processes will be essential for long-term sustainability.



Figure 4.23 Located in the garage beneath Petersham Bowling Club (Source: IWTL)



Figure 4.24 IWTL's growing inventory has reached over 340 items (Source: IWTL)



Figure 4.25 Excerpt from IWTL Impact Report 2022(Source: IWTL)

4.1.10 Living Lab

Transform Sydney Olympic Park into a vibrant living lab, building upon its prior successes, where community members, businesses, researchers, and policy makers come together to co-create innovative and sustainable solutions that enhance the liveability, resilience, and economic vitality of the park and its surroundings.

Description

A Living Lab serves as a collaborative innovation platform, uniting citizens, researchers, businesses, and public entities to co-create, test, and validate new products, services, and systems in real-world scenarios. It empowers experimentation and collaboration, driving sustainable development and tailored solutions to intricate societal challenges.

Rationale

Expanding the Living Lab concept at Sydney Olympic Park is a natural progression, rooted in the acknowledgment of past achievements and a steadfast commitment to sustainability and innovation. By leveraging prior successes, the Sydney Olympic Park Authority embraces the potential for transformative change through collaborative, sustainable practices, and forward-thinking technologies.

Objectives

- Foster innovation by nurturing novel ideas and cutting-edge technologies.
- Bolster local and regional economies through job creation and pioneering ventures.
- Elevate Sydney Olympic Park as a global beacon of innovation and sustainability.
- Amplify economic prosperity by attracting investments and forging collaborations.
- Advocate for sustainable practices and technologies, embedding them in project development.
- Engage stakeholders and the wider community, ensuring inclusivity and responsiveness.
- Facilitate the exchange of knowledge, networking, and cross-sector partnerships.
- Yield positive social, environmental, and economic impacts through pioneering projects.
- Propel Sydney Olympic Park to the forefront of sustainable urban development and innovation leadership.

Opportunities

Easier

- Establish a representative precinct advisory panel with governmental, private, research, and community representation.
- Leverage robust ICT infrastructure, enabling high-speed, reliable connectivity to drive innovation.

- Develop an interactive online platform showcasing Living Lab initiatives, fostering engagement.
- Cultivate strategic partnerships with local universities, research institutions, and industry pioneers.
- Host an array of workshops, events, and seminars, nurturing continuous community involvement.
- Initiate a comprehensive branding strategy to raise awareness and stakeholder engagement.
- Forge dynamic shared workspaces and nurturing incubators, cultivating entrepreneurial growth.
- Implement seed funds or grants to catalyse the development of nascent start-ups and visionary concepts.
- Foster open data platforms, stimulating seamless collaboration and knowledge exchange.

Harder

- Innovate modular smart poles, enabling dynamic communication and seamless sensor integration.
- Secure sustainable funding from governmental bodies or private investors, sustaining Living Lab growth.
- Foster transformative partnerships with corporate giants and governmental entities, supporting ground breaking research initiatives.
- Establish a state-of-the-art research and experimentation hub, fostering hardware innovations and advancements.
- Develop meticulous impact assessment frameworks, quantifying and qualifying project outcomes.
- Champion cross-sector engagement, fostering inclusivity across diverse stakeholder backgrounds.
- Mitigate potential risks linked to real-world technology testing, prioritising participant safety and community welfare.
- Nurture community trust and active engagement, ensuring sustained local participation and support.
- Safeguard intellectual property rights while propagating valuable research insights for widespread impact.
- Forge a comprehensive legal and governance framework, fortifying the Living Lab's operational excellence.

Spatial Considerations

- Deliberate on spatial prerequisites encompassing cutting-edge ICT infrastructure, adaptable innovation spaces, and vibrant community engagement zones.

Challenges

- Procure continuous funding and resources, upholding the Living Lab's enduring operational efficiency.
- Effectively coordinate a broad spectrum of stakeholders, harmonising diverse priorities and objectives.
- Pioneering ethical and governance structures responsive to the evolving research landscape, ensuring ethically sound practices.
- Ensuring participant and community safety during real-world technology trials, upholding stringent safety protocols.
- Undertake comprehensive impact assessments, sculpting Living Lab strategies to yield optimal societal benefits.
- Instil and sustain community trust, engendering resident involvement from project inception onwards.
- Safeguard intellectual property rights whilst simultaneously democratising valuable research insights for broad accessibility.



Figure 4.26 Existing research initiatives at Sydney Olympic Park.

Fairwater Living Lab, Australia

The Fairwater Living Lab stands as a groundbreaking testament to sustainable community development in western Sydney, led by Frasers Property Australia. A multidisciplinary, three-year research project, this living laboratory explores the intersection of sustainability, resilience, well-being, and commerciality within a residential precinct, offering vital insights into sustainable urban living.

Key Information

- The heart of the study revolves around the application of ground source heat pumps, offering geothermal heating and cooling to 750 homes at Fairwater. This technology significantly reduces electricity consumption, demonstrating a 21% reduction in comparison to neighboring suburbs.
- Beyond geothermal tech, the study examines various sustainability aspects, including the impact of light-colored roofs on temperature reduction, the role of green space integration, and the potential for commercial value and energy savings at scale.
- One notable discovery is the technology’s potential to “smooth out” electricity grid usage, minimising peak demand during critical events, which could aid in preventing blackouts during extreme weather conditions.
- Residents report not only energy savings but also improved well-being, emphasising the holistic benefits of sustainable design and community-centric planning.
- The study’s findings are poised to inform government policies and encourage wider industry adoption of geothermal technology, potentially reshaping sustainable development practices across Australia.

Challenges

- The installation of geothermal technology involves initial costs, challenging developers to balance these costs with long-term energy savings and property value enhancement.
- Adapting and updating regulations to accommodate innovative sustainable technologies can be complex, requiring cooperation between industry players and policymakers.
- Ensuring residents actively participate in and benefit from sustainable initiatives while respecting their preferences and practices can be intricate.
- Achieving sustainable goals demands unwavering commitment from developers, governmental bodies, and residents to sustain energy-efficient practices and maintain community well-being.



Kansas City Living Lab

Description

- Kansas city’s 93,000 street lights were upgraded by weaving together a high bandwidth, low latency wireless sensor network that can move a large amount of data , while also providing Wi-Fi to both citizens and public servants.
- The city plans to turn these connections into solutions by partnering with Cisco Enterprise Mobility Services Platform (EMSP).
- The software platform helps unite infrastructure, mobile applications and cloud services to allow citizens to take ownership of decisions anywhere within their city to report issues, protect or revitalise their community.
- Further, using context-aware data and location-based services, EMSP stimulates opportunities for local businesses to promote personalised offers to citizens in their immediate vicinity.

Challenges

- Combining Cisco expertise with industry, citizens and government leadership to build solutions together.
- Planning for better traffic control, improved public safety, proactive infrastructure maintenance and theft prevention.
- Smart cities need high investment into leading technological infrastructure
- Ensuring the technology does not become redundant in the near future with the rapid transformation of innovation and industry.



4.1.11 Sustainability-as-a-Service Strategy

Empowering and enabling the community to adopt sustainable practices through accessible and affordable services, Sydney Olympic Park aims to create a resilient and regenerative future, fostering a sense of environmental stewardship among residents, tenants, and other stakeholders.

Description

Sustainability-as-a-Service (SaaS) revolutionises sustainability, providing stakeholder-tailored solutions for mutual gain. This progressive approach allows organisations to fulfil sustainability goals while generating revenue. SaaS spans renewable energy, waste reduction, carbon analysis, and more, using subscription models. This symbiotic strategy not only propels sustainability objectives but enhances the provider's status as a sustainability leader.

Rationale

Sydney Olympic Park, a bustling urban enclave, bears the mantle of advancing sustainability and community well-being. Adopting SaaS enables seamless access to sustainable solutions for residents, tenants, and stakeholders. Beyond ecological benefits, SaaS drives economic growth, job creation, and quality of life. By leveraging existing infrastructure, Sydney Olympic Park becomes a global sustainability beacon, luring sustainability-centric businesses and yielding economic dividends.

Objectives

- To slash greenhouse gas emissions and bolster energy efficiency park-wide.
- To elevate waste management practices, promoting recycling and composting.
- To champion sustainable transit options for visitors, tenants, and residents.
- To endorse sustainable water management, advocating conservation and reuse.
- To forge partnerships, curbing the park's collective environmental footprint.
- To educate and equip park users with sustainable practices, fostering a culture of sustainability.
- To invest in sustainable technologies for park operations and tenants, aligning with broader sustainability objectives.
- To rigorously track and report progress, gauging energy, waste, and water metrics.
- To contribute to global climate change mitigation and advocate a sustainable future.

Opportunities

Easier

- Develop a carbon offset program via on-site landscape sequestration.
- Sell renewable energy via on-site generation or power purchase

agreements.

- Offer sustainable practice education for residents, tenants, and businesses.
- Facilitate waste reduction and recycling for park businesses and visitors.
- Cultivate community gardens for urban agriculture and carbon capture.
- Implement sustainable transit: bike-sharing, EV charging stations.
- Provide virtual energy audits, aiding energy reduction.
- Partner with local businesses for sustainable event food sourcing.
- Create a sustainability hub on the park's website.
- Enforce green procurement, reducing environmental impact.

Harder

- Establish biodiversity offset program to safeguard natural areas.
- Integrate carbon capture into park infrastructure.
- Pioneer blue and teal carbon projects, sequestering marine and coastal carbon.

Spatial Considerations

- Carbon offset program: designated on-site landscape areas.
- Renewable energy: space for panels, turbines, electrical grid integration.
- Education programs: rooms, facilities for demonstrations.
- Waste reduction: designated waste areas, awareness campaigns.
- Community gardens: land allocation, irrigation, composting.
- Sustainable transit: infrastructure for bikes, EV charging, accessibility.
- Sustainable food: local partnerships, storage, preparation.
- Green procurement: process changes, supplier ties, training.
- Biodiversity offset: ecological partnerships, restoration expertise.
- Carbon capture: infrastructure for emissions monitoring and safety.
- Blue/teal carbon projects: coastal/marine zones, ecological collaboration.

Challenges

- Funding establishment and operation.
- Stakeholder collaboration: governments, industries.
- Governance intricacies, conflict mitigation.
- Robust metrics for success evaluation.
- Ensuring ongoing viability.
- Managing stakeholder differences.
- Balancing innovation with practicality.
- Implementing in a dense urban setting.
- Equitable resource distribution.
- Adapting to climate hazards.



City of Sydney's Better Buildings Partnership

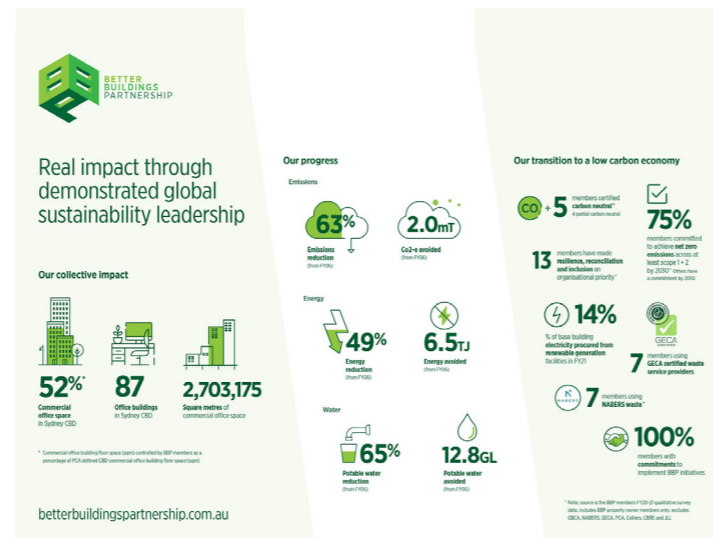
The City of Sydney's Better Buildings Partnership (BBP) stands as an exemplary model of a sustainability-as-a-service strategy, offering valuable insights for the SOPA.

Key Information

- The Better Buildings Partnership is a collaborative initiative involving commercial property owners, managers, and the City of Sydney. It aims to improve the sustainability performance of existing commercial buildings.
- The BBP provides members with tools, resources, and expert guidance to enhance energy efficiency, reduce water consumption, and decrease greenhouse gas emissions.
- The partnership collects and analyses building performance data to identify opportunities for improvement, enabling informed decision-making.
- Sharing: BBP members benefit from a platform for networking, knowledge sharing, and best practice exchange, fostering a culture of sustainability.
- Participating property owners and managers achieve operational savings and enhanced property value, while the City of Sydney advances its environmental and sustainability goals.

Challenges

- Engaging a diverse range of property owners and managers with varying priorities and interests requires tailored communication and collaboration strategies.
- Ensuring sufficient resources for ongoing support, data collection, analysis, and reporting is vital to maintaining the initiative's effectiveness.
- Accurate measurement and verification of sustainability improvements can be challenging, requiring robust data tracking and benchmarking methodologies.
- Encouraging participation and buy-in from stakeholders may require the development of financial incentives or mechanisms that demonstrate tangible returns on investment.
- Sustaining interest and engagement over the long term requires consistent efforts to demonstrate value and facilitate ongoing knowledge sharing.



Zero Waste Scotland's Resource Efficient Circular Economy Accelerator Programme

Zero Waste Scotland's Resource Efficient Circular Economy Accelerator Programme showcases how collaborative efforts and tailored support can promote circular economy practices.

Key Information

- The Resource Efficient Circular Economy Accelerator Programme targets diverse industries, providing tailored support to foster circular economy practices, resource efficiency, and waste reduction.
- The initiative offers businesses access to expert guidance, networking opportunities, and funding to implement circular economy projects, contributing to sustainable business growth.
- The programme develops and supports circular economy projects within sectors such as food, textiles, construction, and manufacturing, facilitating innovative approaches and knowledge exchange.
- Through workshops, training sessions, and knowledge-sharing events, participants gain insights into circular economy principles, innovative technologies, and sustainable business models.
- The programme measures and reports on the impact of circular economy projects, demonstrating the benefits of resource efficiency and waste reduction to participating businesses.
- Zero Waste Scotland collaborates with businesses, government agencies, and industry associations to drive collective action and promote the adoption of circular economy principles.

Challenges

- Encouraging businesses to understand and adopt circular economy practices requires comprehensive awareness campaigns and targeted education initiatives.
- Overcoming traditional linear business models and encouraging a shift towards circular practices necessitates addressing behavioural barriers and promoting mindset changes.
- Supporting circular economy projects often involves initial investment, necessitating the development of funding mechanisms and financial incentives to motivate participation.
- Implementing circular practices can be complex and require changes across supply chains, production processes, and consumer behaviour, requiring ongoing guidance and support.



4.1.12 NSW Centre of Resilience Excellence

Establish Sydney Olympic Park as the premier destination for resilience knowledge and leadership in NSW by creating a Centre of Resilience Excellence that cultivates innovation, fosters collaboration, and inspires action towards a more resilient future for communities, businesses, and the environment.

Description

The NSW Centre of Resilience Excellence at Sydney Olympic Park aspires to be an internationally acclaimed institution advancing urban resilience. By assembling multidisciplinary teams, it will drive research, best practices, and evidence-based guidance to bolster communities and infrastructure. Collaborating across sectors and engaging global stakeholders, the Centre will catalyse knowledge exchange. This initiative positions Sydney Olympic Park as a global role model in resilience and sustainable development.

Rationale

Crucial to the NSW Government's resilience commitment, the Centre fosters innovation in urban design and operations. Research and evidence-based guidance will fortify infrastructure and communities against future challenges. This Centre stimulates industry, jobs, and cross-sectoral synergy. As an international role model, Sydney Olympic Park will exemplify the power of resilience, fostering thriving, equitable communities.

Objectives

- To comprehensively understand factors driving resilience across different scales.
- To devise innovative strategies for resilience across sectors like infrastructure, emergency management, and health.
- To collaborate with industry, government, academia, and communities to share knowledge and solutions.
- To provide training and capacity-building programs for effective emergency response and resilience.
- To create and implement standards and guidelines for resilience in planning and decision-making.
- To monitor, evaluate, and improve resilience-building strategies and practices.
- To promote the Centre globally, contributing to the resilience knowledge pool.

Opportunities

Easier

- Develop an online database of urban resilience best practices.
- Deliver workshops and training for professionals.
- Create community engagement initiatives like gardens and waste reduction.
- Establish partnerships for resilience project development.
- Initiate research to address urban resilience challenges.
- Formulate a toolkit of resilience planning strategies.

- Establish a living laboratory for resilience experiments.
- Develop educational resources focusing on resilience.
- Introduce student ambassador programs.
- Organise resilience-themed events and tours.
- Forge internship partnerships with local universities.
- Collaborate with educational institutions for resilience promotion.

Harder

- Innovate financing mechanisms like resilience bonds.
- Design a comprehensive resilience rating system.
- Conduct large-scale experiments and simulations.
- Implement major infrastructure projects integrating resilience.
- Establish a research program for emerging resilience technologies.
- Partner with international organisations for knowledge exchange.
- Execute long-term impact studies on communities and environments.
- Develop specialised courses on resilience and design.
- Establish research partnerships with universities.
- Establish community and research funds.

Challenges

- Secure funding for Centre establishment and operations.
- Garner collaboration and support from stakeholders.
- Navigate complex governance structures and conflicts.
- Develop metrics to measure the Centre's impact.
- Ensure long-term sustainability and viability.
- Address scepticism from stakeholders with varying priorities.
- Balance cutting-edge research with real-world implementation.
- Overcome logistical challenges in a dense urban environment.
- Address equity concerns related to resource distribution.
- Adapt and mitigate impacts of climate change on resilience.

Spatial Considerations

- Potential utilisation of existing SOPA education and heritage assets.
- Integration with planned community and education facilities.
- Consideration of environmental and cultural impacts.
- Integration with the Sydney Olympic Park precinct and public engagement.
- Mitigation of potential impacts on local communities and stakeholders.



The Institute at the Golden Gate (IGG)

The Institute at the Golden Gate, situated within the Golden Gate National Parks Conservancy in San Francisco, serves as a dynamic model for advancing sustainability and resilience through multidisciplinary collaboration.

Key Information

- **Vision and Purpose:** The Institute at the Golden Gate functions as a nexus for promoting environmental sustainability, cultural vitality, and social equity by uniting diverse stakeholders, including governmental bodies, non-profit organisations, businesses, and local communities.
- **Collaborative Framework:** The Institute facilitates cross-sectoral engagement by convening experts, practitioners, and leaders from various domains. It fosters collaborative discussions, knowledge exchange, and innovative solutions to pressing sustainability challenges.
- **Programmatic Spectrum:** Through workshops, seminars, and conferences, the Institute addresses a wide spectrum of topics, spanning conservation, education, cultural preservation, and community engagement. Its approach mirrors the comprehensive focus of the NSW Centre of Resilience Excellence.
- **Knowledge Dissemination:** The Institute disseminates valuable insights and resources through research publications, case studies, and digital platforms, contributing to a broader understanding of sustainability and resilience principles.

Challenges

- **Stakeholder Engagement:** Effectively engaging a diverse array of stakeholders with varying priorities and perspectives requires tailored communication strategies and inclusive participation.
- **Resource Allocation:** Ensuring consistent funding and resources to support ongoing initiatives poses a challenge. Innovative funding models and strategic partnerships are essential for sustained operations.
- **Balancing Ambition:** Navigating the balance between ambitious goals and practical implementation necessitates careful prioritisation of projects and leveraging collaborative efforts for incremental progress.
- **Sustainable Impact:** Ensuring the Institutes's lasting impact demands continuous outcome tracking, performance assessment, and adaptive strategies to address evolving challenges and opportunities.



Figure 4.27 Climate science workshops at Golden Gate Park, San Francisco (Source: IGG)

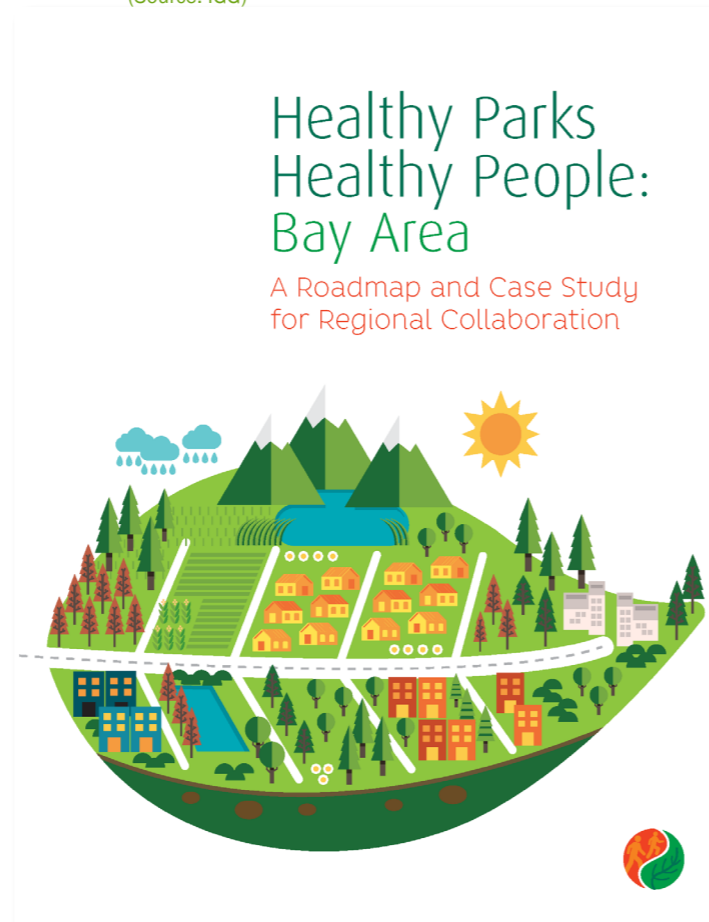


Figure 4.28 Healthy Parks Healthy People: Bay Area, A Roadmap and Case Study for Regional Collaboration uses the HPHP: Bay Area Collaborative Report (Source: IGG)

The Rockefeller Foundation's 100 Resilient Cities

The Rockefeller Foundation's 100 Resilient Cities (100RC) initiative exemplifies a pioneering effort to enhance urban resilience across the globe.

Key Information

- **Global Resilience Network:** The 100RC initiative facilitates a worldwide network of cities dedicated to building resilience against a spectrum of shocks and stresses, from climate change and economic disparities to public health challenges.
- **Holistic Approach:** The program emphasises a comprehensive approach to resilience, addressing not only physical infrastructure but also social, economic, and environmental dimensions. This aligns with the multifaceted focus of the NSW Centre of Resilience Excellence.
- **City-Specific Strategies:** Each participating city develops a customised Resilience Strategy, reflecting the unique challenges and opportunities of the local context. These strategies provide actionable roadmaps for building resilience.
- **Cross-Sectoral Collaboration:** The 100RC program fosters collaboration among diverse stakeholders, including governments, private sector, NGOs, and academia. This collaborative spirit mirrors the NSW Centre's objective of engaging various sectors.

Challenges

- **Complex Stakeholder Alignment:** Coordinating the interests and priorities of multiple stakeholders with varying agendas requires skilful negotiation and alignment strategies.
- **Long-Term Funding:** Ensuring sustainable funding for the implementation of resilience strategies over time presents a challenge. Identifying innovative financial mechanisms and securing long-term commitments is essential.
- **Cultural and Contextual Sensitivity:** Adapting global best practices to diverse local contexts demands a nuanced understanding of cultural, social, and economic dynamics. Tailoring solutions to suit different communities is crucial.
- **Measuring Resilience:** Developing robust metrics to measure and evaluate the effectiveness of resilience strategies poses a challenge. Defining clear indicators and monitoring progress requires rigorous methodologies.



Figure 4.29 100 Resilient Cities (Source: Resilient Cities Network)

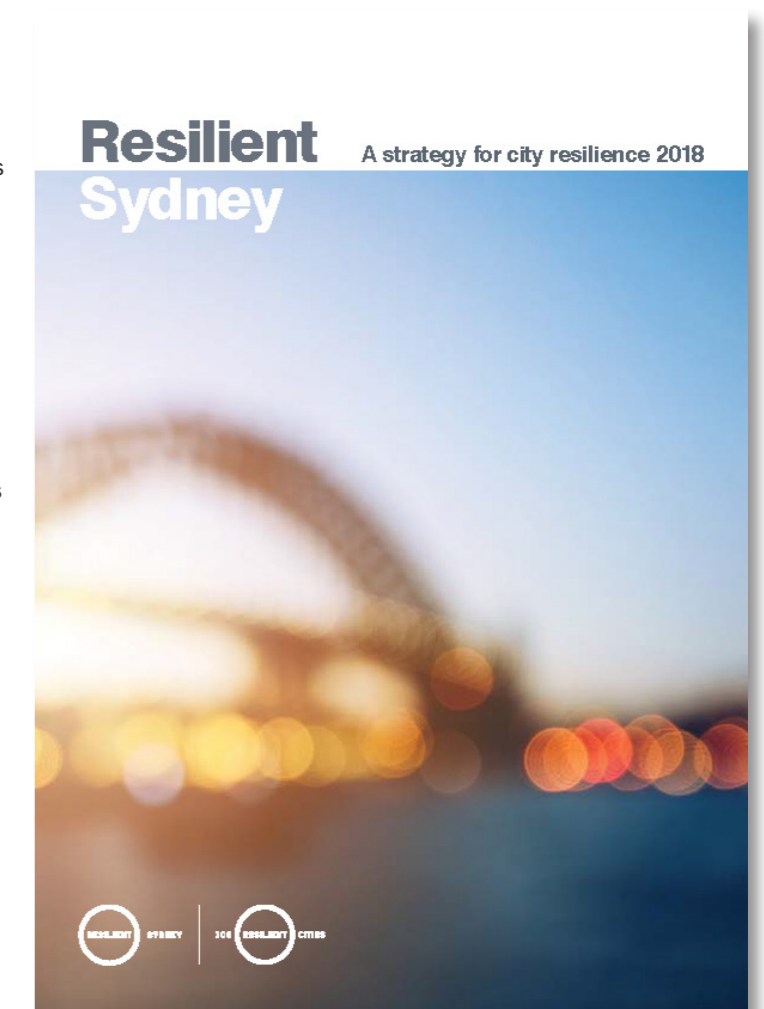


Figure 4.30 Resilient Sydney: A strategy for city resilience 2018 report (Source: City of Sydney)

05 ASSURANCE

5.1 Rating tools

It is imperative that sustainability objectives are backed up by an approach to assurance that gives absolute confidence that the claimed outcomes will be achieved. This requires a framework for assurance that covers the sustainability objectives and provides:

- independent review
- transparency of methodology
- accountability at each phase of the lifecycle

These rating tools are versatile, operating across different scales to drive sustainability outcomes:

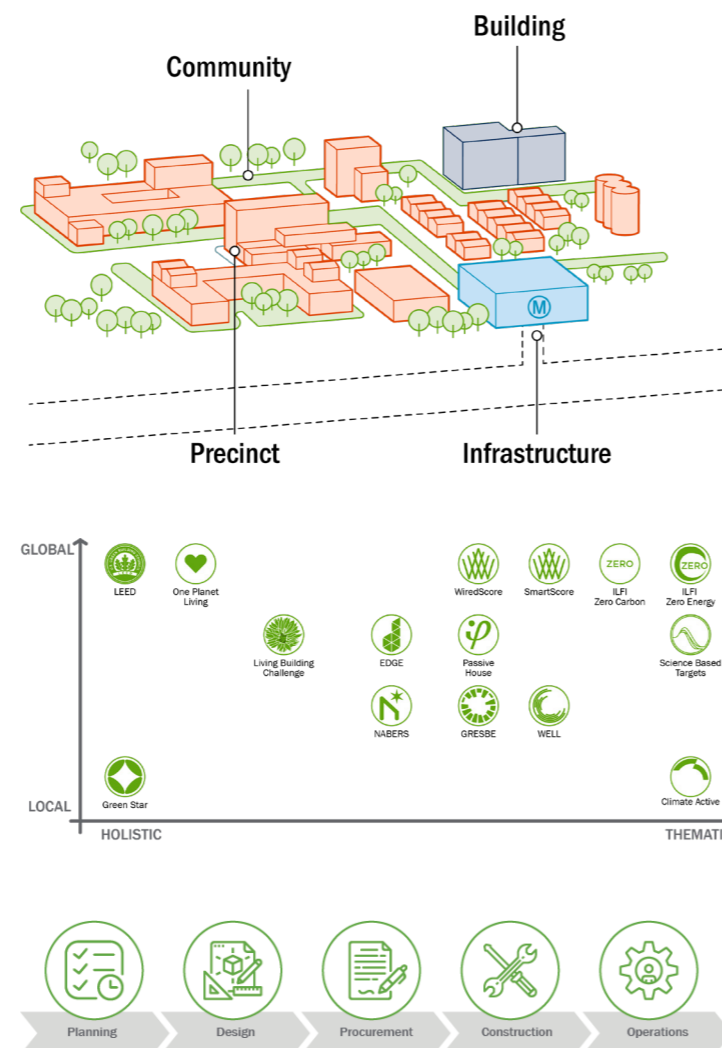
- **Precinct/Community Scale:** At this scale, holistic sustainability tools address a spectrum of interconnected themes. They evaluate the broader environmental, social, and economic impacts of an entire precinct or community, providing a comprehensive view of sustainable development.
- **Building Scale:** Sustainability assessment tools also operate at the building level, scrutinising aspects such as energy efficiency, materials usage, and indoor environmental quality. These tools ensure that individual buildings align with sustainability goals.
- **Interiors Scale:** For interior spaces, sustainability criteria focus on factors like indoor air quality, lighting, and ergonomic design. These tools promote healthy and productive indoor environments.
- **Operations Scale:** Beyond design and construction, these tools extend to the operational phase, ensuring ongoing sustainability performance. They encompass energy consumption, waste management, and maintenance practices, among other aspects.

Benefits are:

- the capacity to benchmark against national and global peers
- provide certainty for industry participants through the project lifecycle

Rating tools typically fall into one of two categories:

- holistic sustainability tools addressing several themes
- thematic tools focusing on just one theme



“SOPA is committed to achieving our goal of net zero emissions by 2030 for our own operations and Sydney Olympic Park as a whole, and we will continue to work towards better outcomes for the community across all aspects of sustainability.”

Sally Hamilton, Director, Environment and Planning, Sydney Olympic Park Authority

5.2 Green Star at Sydney Olympic Park

Sydney Olympic Park is currently certified with a 6 Star rating with the current Green Star Communities v1.1 tool.

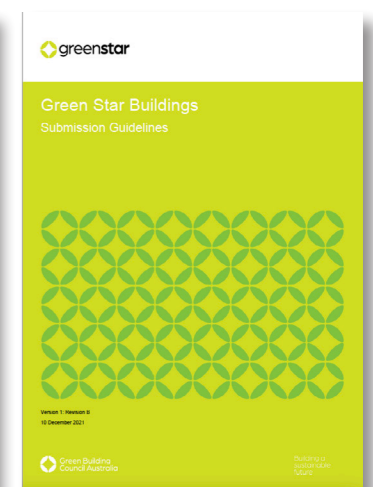
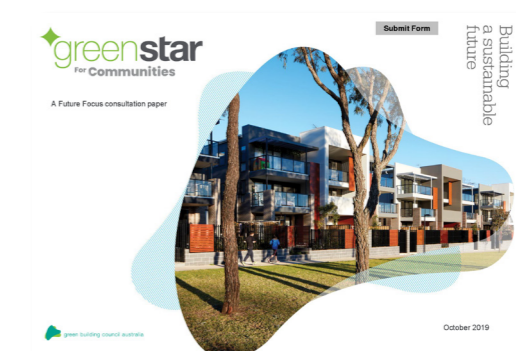
This rating will be due for recertification in 2024. However, this version of the tool is scheduled to be replaced by v2.0 in early-2024.

When re-certifying, SOPA is not required to upgrade to the latest version of the tool, however, may consider it for several reasons:

- ensuring operations are aligned with the most up to date best practice sustainability initiatives;
- ensuring the 2050 Master Plan currently underway can embed (or at least not preclude) any potential spatial considerations; and
- remaining competitive and a leader in the global market for precincts.

While the Green Building Council of Australia has only just begun public consultation, there is other relevant material in the public domain that we can review for insight:

- Green Star Future Focus, The Next Evolution of the Green Star Rating System, 2018
- Green Star for Communities: A Future Focus Consultation Paper, 2019
- Green Star Buildings v1, 2021
- Climate Positive Roadmap for Precincts, 2022



5.3 Green Star Future Focus

In March 2018, Green Building Council of Australia (GBCA) embarked on an ambitious journey to reshape the Green Star rating system and create the next evolution of the tools.

Green Star Future Focus will see the rating system evolve and adapt to ensure the sustainable built environment delivers what it needs to, whilst also responding to **global megatrends and emerging challenges**.

The Green Star Buildings tool, which replaced the Green Star Design & As Built tool in 2021, is the first of the GBCA's tools to be updated and provides key insight into what each new category will include.



World leadership in 2025

Our vision is for healthy, resilient and positive places for people and the natural environment. Therefore, we propose that all world-leading buildings, fitouts and precincts be:

Healthy – have amenities that enhance a person's well-being, encourage healthy and active transport and lifestyle decisions, mimic or connect with nature and provide a comfortable environment. They are conceived, built and operated to reduce or eliminate toxic materials, are well ventilated and lit.

Resilient – ready to address the future impacts of climate change and to respond positively to other changes and shocks. A world leading asset should be resilient to natural disasters and man-made impacts including changing technology and demographics. It should be resilient to long-term risks to its value. It should minimise exposure to risks negatively impacting people's health and human rights. It should continue working in the face of adversity. A world-leading asset should make the community and surroundings more resilient too.

Positive – focused on delivering a better environment for people and the planet. An asset that is positive is highly efficient with the use of our limited natural resources. It has lower energy consumption thanks to smarter design. Renewable energy powers the buildings and infrastructure (on-site or off-site). It is mostly fossil-fuel free and is carbon neutral by offsetting all its emissions. For new assets, this also includes reducing and offsetting its embodied carbon.

Places – able to respond to the needs of people and our planet. They should be smart, well-designed, managed and governed. They must be affordable. They must deliver on their commitments. They are safe, comfortable, inclusive and of high amenity. They improve the urban fabric, enhance the local infrastructure, and provide value to the community.

People – able to show that all are welcome, and people thrive in them. They are designed for everyone, beyond accessibility compliance laws. They are also designed to respect and celebrate our culture and our history. They help encourage reconciliation and help people connect with each other. Assets must be built with consideration of the rights of future occupants, the workers involved, those involved in the supply chain, and those in the surrounding community.

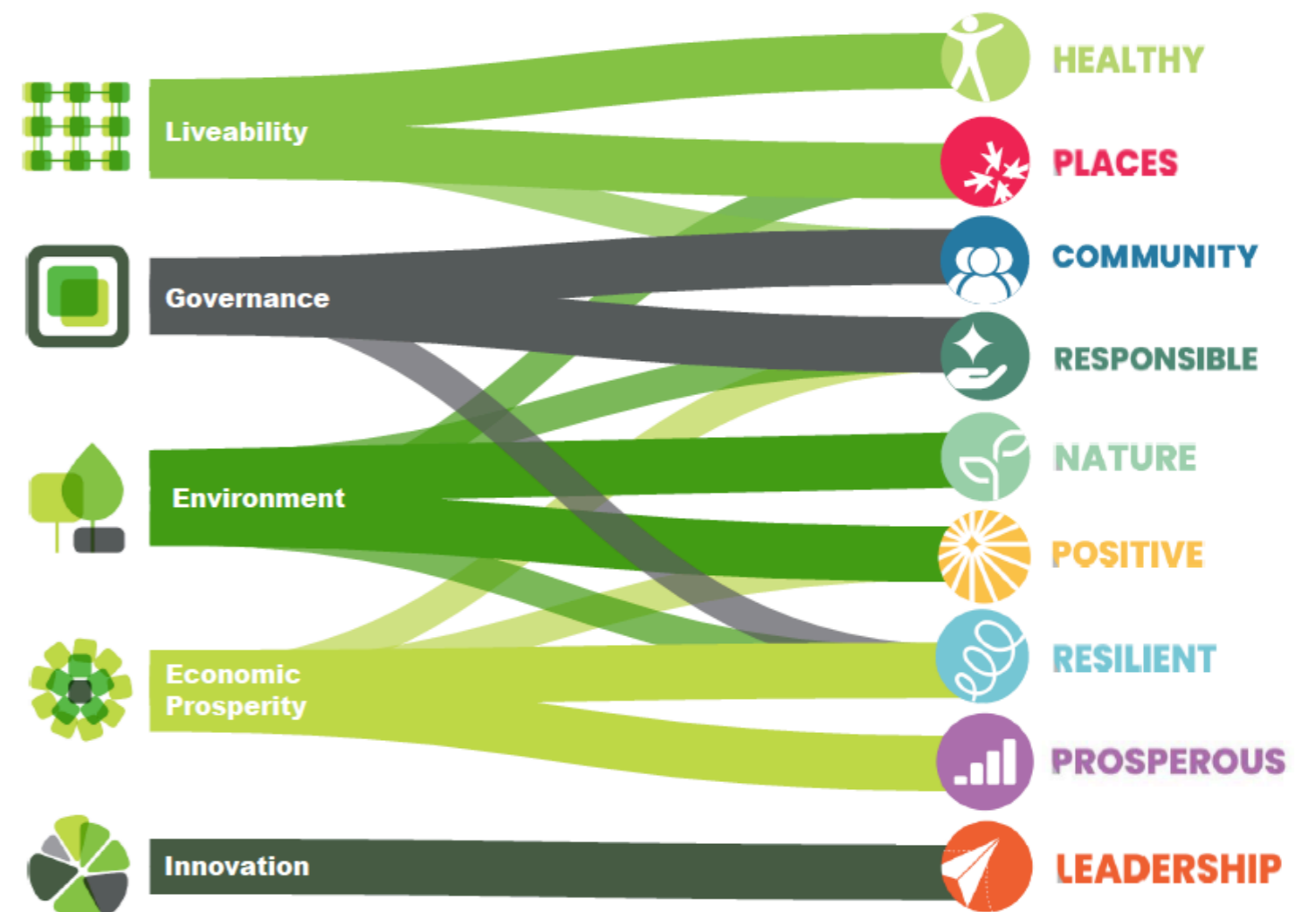
Natural environment – considerate of the current and historic impacts to our natural environment. They must reduce any impact on the site and enhance it as much as possible. A world leading asset contributes to increasing the ecological value and biodiversity of the site and beyond. They use their influence to connect green corridors in the city and work to enhance a city's biodiversity.

5.4 Green Star for Communities

Public consultation began mid-2023 and the release of the tool will be early-2024.

The five key changes proposed in the new Green Star for Communities are:

- **An approachable definition of a community:** a broader scope of issues with a clearer and more accessible language.
- **Delivering deep carbon reductions:** with all projects to deliver carbon reductions, and exploring the goal of net zero emissions precincts by 2030.
- **Including a focus on buildings:** the rating tool will place greater weight on the sustainability of built form, whilst acknowledging diverse levels of control across precinct types.
- **Meeting clear expectations:** ensuring that all projects deliver a minimum set of clearly defined outcomes that align with what stakeholders are wanting in a sustainable precinct, in the short and long term.
- **A more flexible certification process:** a nimble and streamlined certification process that can match development timing more effectively.



5.5 Climate Positive Roadmap for Precincts

5.6 Green Star Buildings v1

The Climate Positive Roadmap for Precincts contains a set of principles to guide precinct carbon reductions and ambitious targets for all new precincts to be climate positive by 2030 and existing precincts by 2050.

It spells out the five key actions to achieve climate positive precincts:

- 1. Embed climate positive pathways into all stages of planning.
- 2. Commit to fossil fuel-free precincts, and ensure policy and planning processes support this ambition.
- 3. Remove the barriers to low carbon precinct energy solutions.
- 4. Drive lower upfront carbon in materials and construction activity.
- 5. Commit to delivering low carbon buildings in all precincts.

Key areas of potential relevance to SOP are:

- Precinct-scale energy solutions
- Electric vehicles and supporting infrastructure
- Carbon reduction pathway

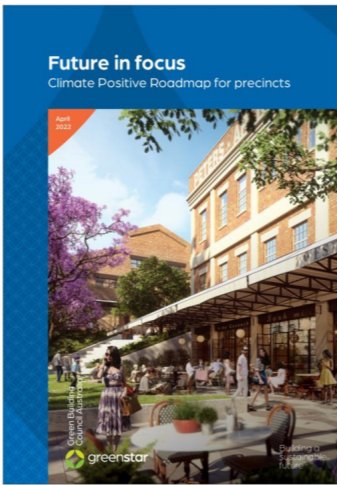


Figure 5.1 Future in Focus: Climate Positive Roadmap for precincts discussion paper (Source: GBCA)

The latest version of the Green Star Buildings rating tool is the first to be aligned with the new focus areas. Some key insights likely to translate to the newest version of the Green Star Communities tool:

- 10 **Minimum Expectations** that must be achieved by all projects
- 6 Star rated buildings must be designed to be **fossil fuel free**, **powered by renewables**, and built with **low carbon materials**
- rewards products that have lower environmental impact, are transparent, respect human rights, and are lower in carbon content
- creating a driver for low carbon products by introducing a requirement that must be met by all buildings to **reduce their embodied carbon** to achieve a rating
- increase in stringency over time



Figure 5.3 Green Star Buildings version 1 submission guidelines (Source: GBCA)

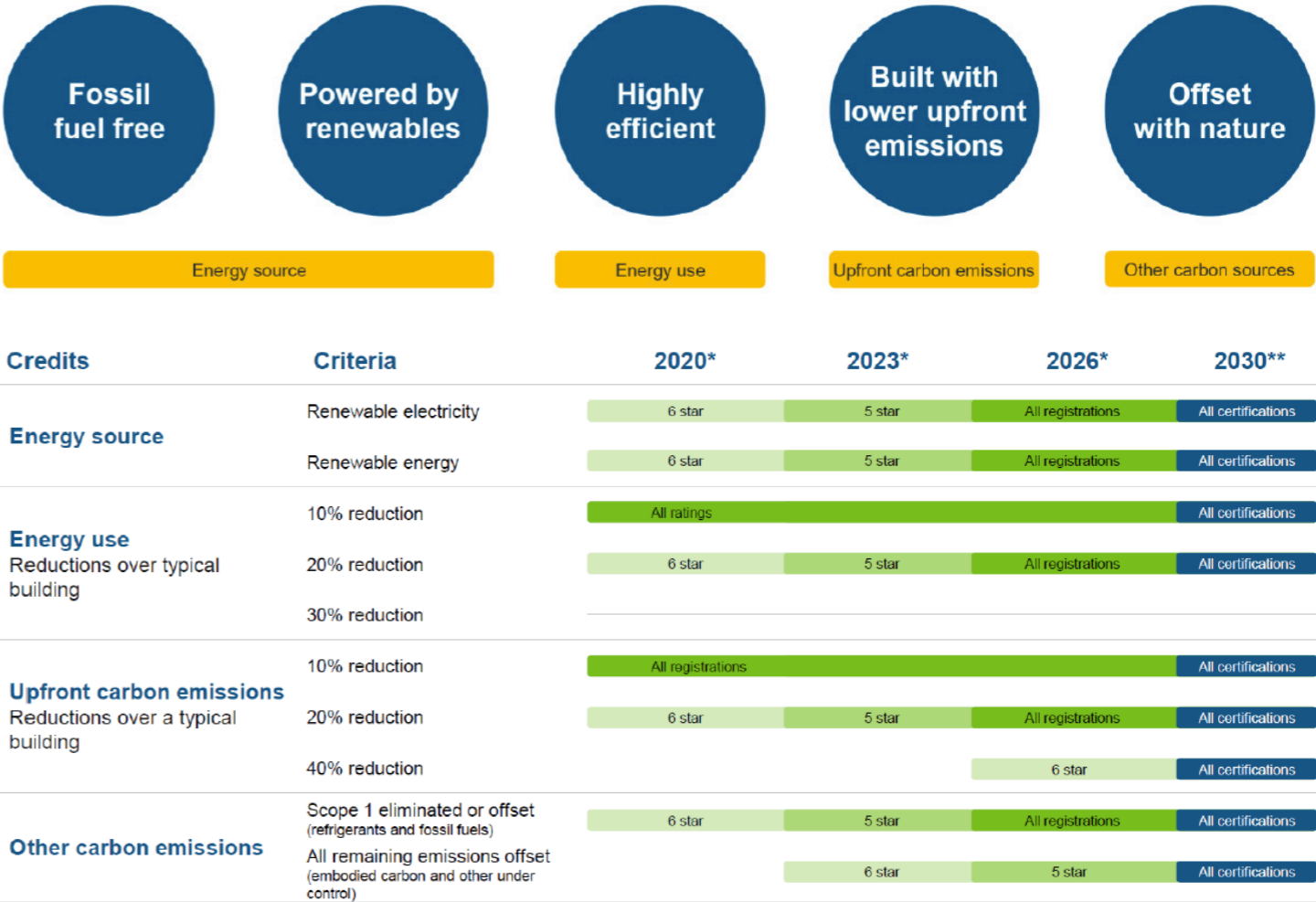


Figure 5.4 Graphic representation of how sustainability will ramp up over time (Source: GBCA)

Actions for developers

1. Commit your organisation to delivering zero carbon precincts by 2030 and develop partnerships with key stakeholders to deliver your vision
2. Develop project specific targets and plans for deep carbon reductions, and undertake modelling to inform decision making and progress tracking
3. Ensure your precincts are fossil fuel free right from the outset and facilitate the purchase of 100% renewable energy
4. Set standards for energy efficient, low carbon buildings in your developments
5. Explore ways to reduce upfront emissions of materials used in buildings, roads, open space structures and infrastructure
6. Deliver precincts that are highly walkable and promote active transport, provide local amenities and services, and utilise low carbon forms of transport.
7. Prioritise the adoption of electric vehicles and supporting charging infrastructure
8. Engage early with utility network planners and operators in precinct planning to ensure support for grid solutions
9. Embed renewable energy generation and batteries in your precincts, and explore innovative solutions such as embedded networks and neighbourhood batteries
10. Negate remaining emissions through on-site or offsite nature-based offsets

Figure 5.2 Actions for developers taken from Climate Positive Roadmap for precincts (Source: GBCA)

5.7 Implications for Sydney Olympic Park

Several changes to credits may potentially have implications for Sydney Olympic Park that they may not already be addressing in their progressive operations:

- Offsite restoration projects to offset construction
- Carbon reduction plan
- Low carbon materials
- Infrastructure dependency
- Passive survivability
- Annual reporting against progress

The implications for the majority of these relate to operations, however there may be some spatial considerations that can be implemented as part of the Master Plan 2050, including:

- Low Carbon Materials: Utilise materials with low carbon footprints in construction.
- Infrastructure Dependency: Address dependencies on existing infrastructure, considering sustainability.
- Passive Survivability: Ensure designs are resilient and adaptable to changing environmental conditions.
- Well-being and Active Lifestyle Encouragement: Design amenities that promote health and active transport.
- Connection with Nature: Incorporate natural elements into the urban environment for comfort and ecological value.
- Toxic Material Reduction: Focus on reducing or eliminating toxic materials in construction.
- Resilience to Climate Change and Disasters: Design for adaptability to climate change and resilience to disasters.
- Energy Efficient Design: Aim for lower energy consumption through smarter design practices.
- Renewable Energy Integration: Power buildings and infrastructure with renewable energy sources.
- Fossil Fuel Reduction: Move towards carbon neutrality and reduce fossil fuel dependency.
- Inclusive and Safe Design: Ensure designs are inclusive, safe, and provide high amenity.
- Cultural and Historical Respect: Incorporate designs that respect and celebrate local culture and history.
- Ecological Value Enhancement: Contribute to increasing biodiversity and ecological value.
- Energy Generation and Storage: Implement building and precinct scale energy generation and storage systems.
- Electric Vehicle and Solar Energy Optimisation: Optimise electric vehicle usage and solar energy capture.
- Intelligent Microgrids and Virtual Power Plants: Utilise intelligent microgrids for balanced energy supply and demand.
- Minimum Expectations for Sustainability: Adhere to minimum sustainability expectations for all projects.
- Embodied Carbon Reduction in Construction: Reduce embodied carbon in building materials and construction.



Responsible

Recognises activities that ensure the building is designed, procured, built, and handed over in a responsible manner.



Healthy

Promotes actions and solutions that improve the physical and mental health of occupants.



Resilient

Encourages solutions that address the capacity of the building to bounce back from short-term shocks and long-term stresses



Positive

Encourages a positive contribution to key environmental issues of carbon, water, and the impact of materials.



Places

Supports the creation of safe, enjoyable, integrated, and comfortable places.



People

Encourages solutions that address the social health of the community.



Nature

Encourages active connections between people and nature and rewards creating biodiverse green spaces in cities.



Leadership

Recognises projects that set a strategic direction, build a vision for industry, or enhance the industry's capacity to innovate.

06 RESOURCE USE MODELLING

6.1 Resource use model

The Resource Use Model for the SOP 2050 Master Plan is a critical element in addressing the study requirement to “understand resource consumption outcomes, including energy, water, waste, climate change resilience and greenhouse gas emissions.”

It focuses on the comparison of resource consumption in two distinct scenarios: Business as Usual (BAU) and Best Practice. The BAU scenario is grounded in standard development practices meeting basic regulatory requirements, whereas the Best Practice scenario aspires to achieve broader, more ambitious benchmarks in resource usage across key areas.

Through this analysis, the Master Plan 2050 not only justifies the necessity of setting higher sustainability standards but also quantifies their impact.

6.1.1 Resource use calculator

Atelier Ten have developed a Resource Use Calculator for estimating the total precinct resource usage from construction through to decommissioning and providing a breakdown of the resources associated with embodied carbon, electricity, water and waste. The calculator also enables an estimation of the resource savings associated with implementing sustainability measures at the precinct such as: building re-use, best practice embodied carbon, electricity, and water targets, on-site and off-site renewables. The implementation of these measures have been integrated into the ‘best practice’ scenario which is compared against the ‘business-as-usual’ scenario.

6.1.2 Methodology and Assumptions

To quantify the amount of resources exhausted for embodied carbon, electricity, water and waste across the project life two inputs are required:

- Area schedules - based on project masterplan
- Resource rates - based on industry benchmarks

Quantifying resource use and emissions over the project life at such an early stage requires a great deal of assumptions to be made due to the lack of information known at the masterplan stage. Therefore, the results shown represent a preliminary assessment and these assumptions should be reviewed by the project developer for greater accuracy.

Construction Assumptions

Resource use and emissions considered from construction through to end-of-life whereby the following was assumed:

- Construction commences 2025.
- The buildings have a service life of 60 years and a replacement frequency of 15 years.
- Project will take 25 years to construct all buildings and a linear

- construction rate of 4% has been assumed for each year.
- Decommissioning emissions are considered with a decommissioning period of 25 years (same as construction period). The project is completely disassembled by 2100.

The project scope considered during the resource model assessment is illustrated in Figure 6.2

Electricity, Water, Waste and Embodied Carbon Assumptions (BAU vs. Best Practice).

- A brief overview of how BAU and Best Practice have been defined is shown in “Table 6.1 Summary of BAU vs. best practice data sets”:
- NABERS Energy targets are taken from Section 3.5.4 of the MP 2050
 - NABERS Water targets represent reasonable outcomes associated with Green Star Buildings ratings required in Section 3.5.4 of the MP 2050
 - Waste and embodied carbon targets are aligned with the new version of Green Star Communities and will apply to SOPA during recertification

Table 6.1 Summary of BAU vs. best practice data sets

	BAU	Best Practice
Energy	NABERS 4 star	NABERS 5-5.5 star
Water	NABERS 4 star	NABERS 5 star
Waste	No waste reduction	20% reduction in Waste from circular economy initiatives expected to be implemented to achieve a 6 star Green Star Community rating
Embodied Carbon	No embodied carbon reduction	20% reduction in upfront embodied emissions, in line with the 6 star Green Star community requirement 20% reduction in embodied B and C emissions from circular economy initiatives expected to be implemented to achieve a 6 star Green Star Community rating
PV Generation	7 MW on-site PV system (as agreed by SOPA)	55MW on-site PV system considered (there is space available for an additional 25MW on SOPA assets and 23 MW or non-SOPA assets as recommended in the Sydney Olympic Park GHG Emissions Response Strategy)

Refer to “Appendix C | Resource and Emissions Assumptions” for a more detailed list of the energy, water, waste and embodied carbon resource rates and emission factors selected for each building end-use. These assumptions were justified the justification/sources for making these assumptions. Also included are emission factors chosen for each resource.

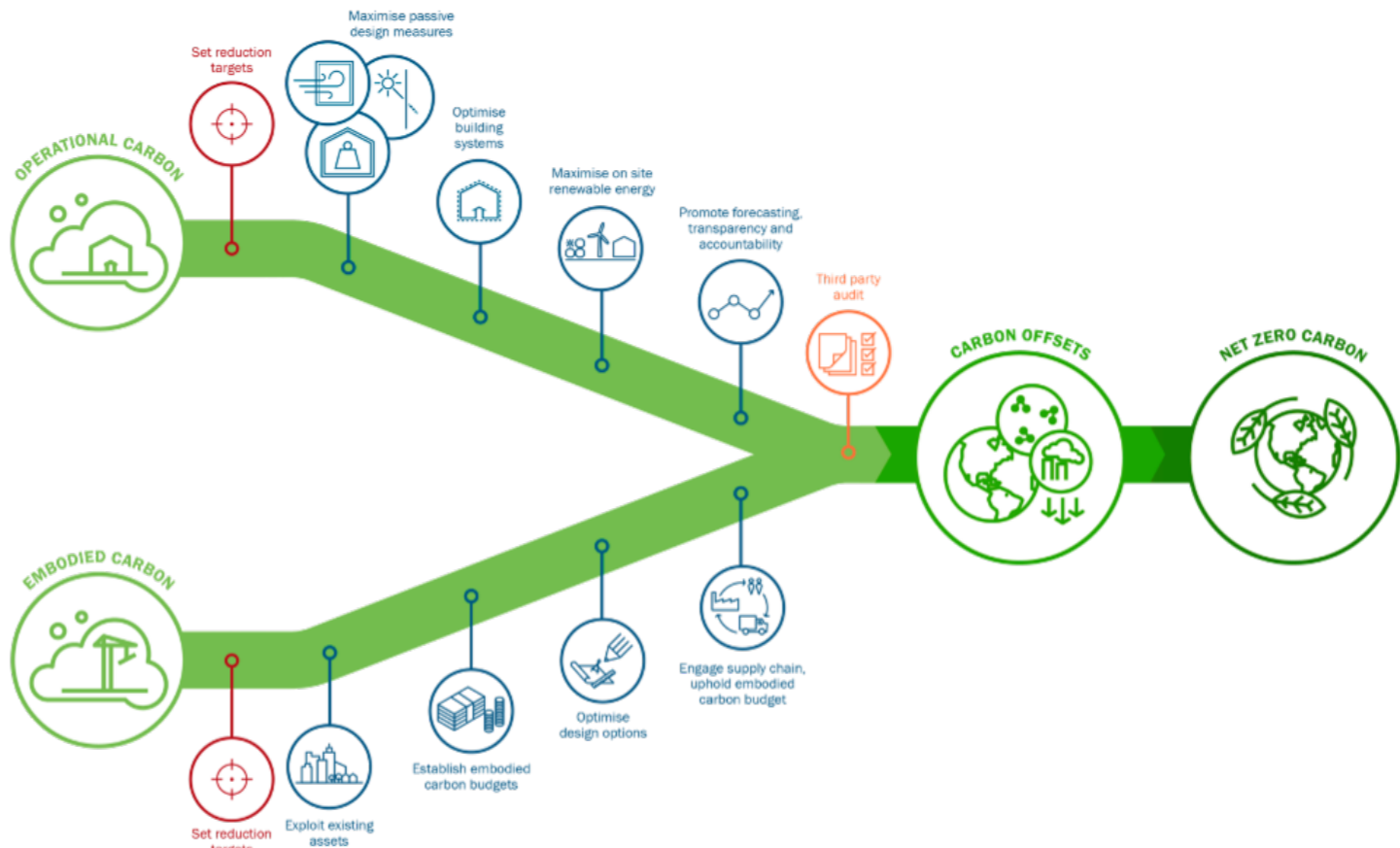


Figure 6.1 Pathway to Zero Carbon

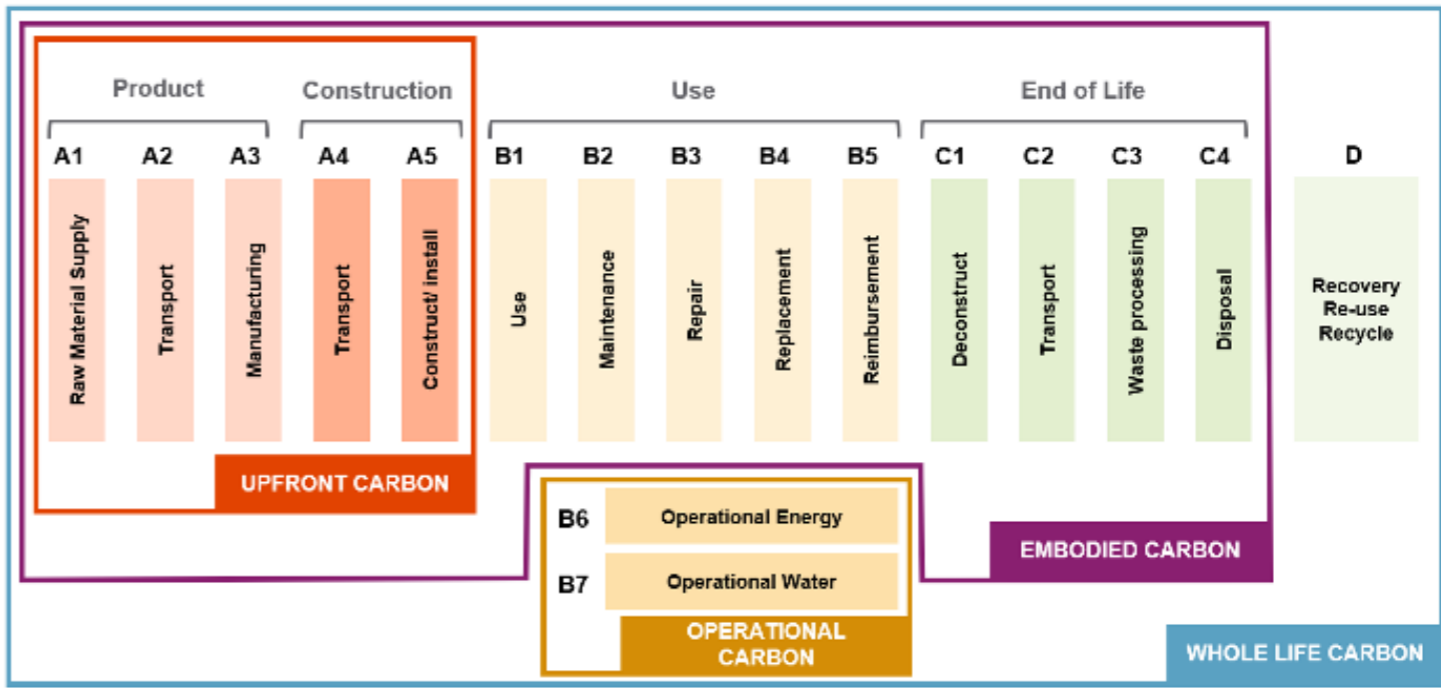


Figure 6.2 Project scope considered for resource use model and emissions

6.1.3 Resource Analysis - Electricity

Disclaimer: For electricity resource use the impacts of additional PV have been excluded.

The difference between BAU and Best Practice electricity is only caused by energy efficiency measures required to achieve a higher NABERS rating.

Insights

- Setting higher NABERS Energy targets reduces electricity use by 42%.
- Annual electricity increases linearly during construction, before flat-lining from 2050 as all buildings have been constructed.
- The maximum amount of annual electricity consumption projected once all buildings are constructed is approximately 260,000 MWh and 150,000 MWh for BAU and Best Practice scenarios respectively.
- Electricity consumption is highest from hotel and residential GFA's.

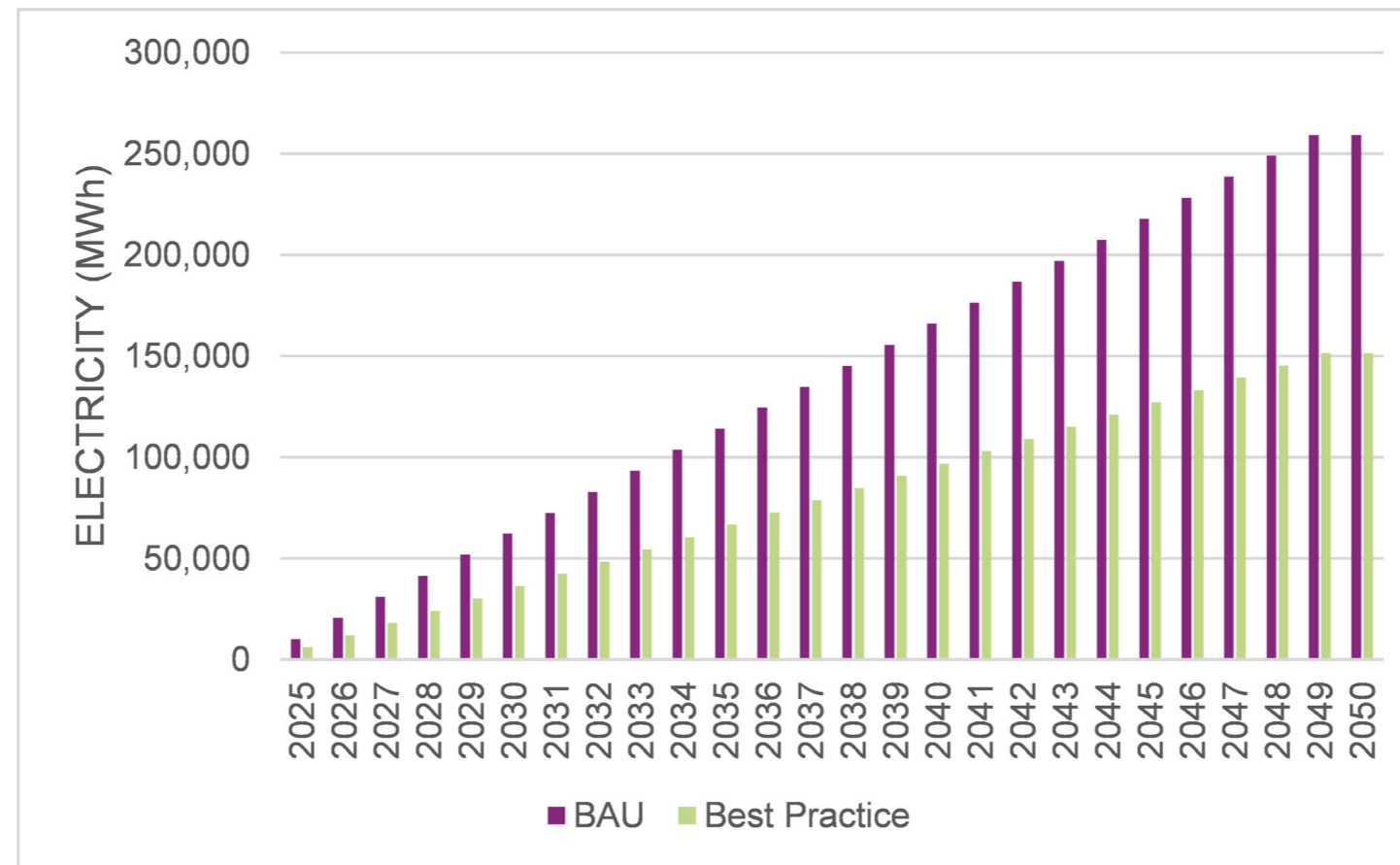


Figure 6.3 SOPA projected annual electricity use for BAU vs Best Practice

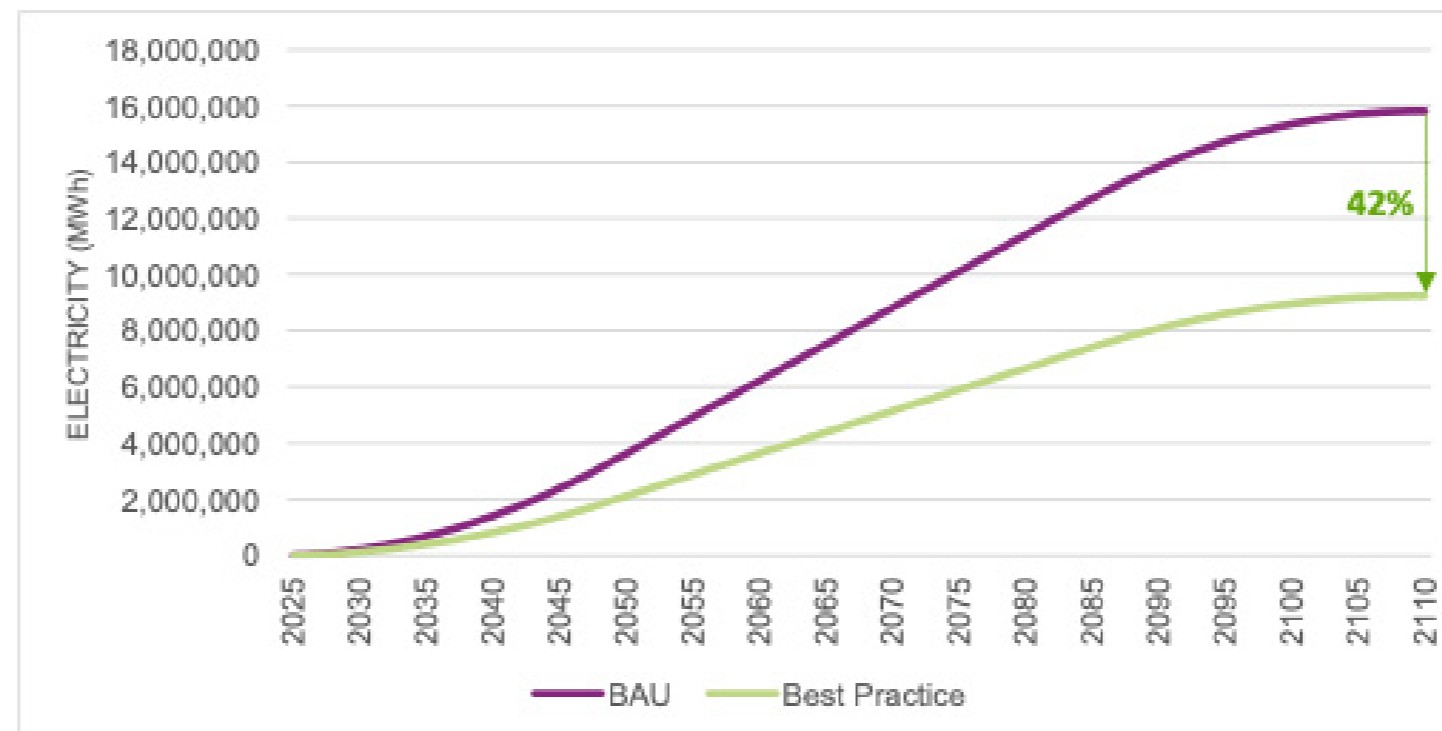


Figure 6.4 SOPA projected cumulative electricity use for BAU vs Best Practice

6.1.4 Resource Analysis - Water

Disclaimer: Both potable and non-potable water have been considered with a 49%, 51% split respectively.

Insights

- Setting a 5* NABERS Water as the benchmark across all buildings reduces water use by 42%.
- Annual water increases linearly during construction, before flat-lining from 2050 as all buildings have been constructed.
- The maximum amount of annual water consumption projected once all buildings are constructed is approximately 2,160,000 kL and 1,255,000 kL for BAU and Best Practice scenarios respectively.
- High water use associated with the hotel and residential GFA's.

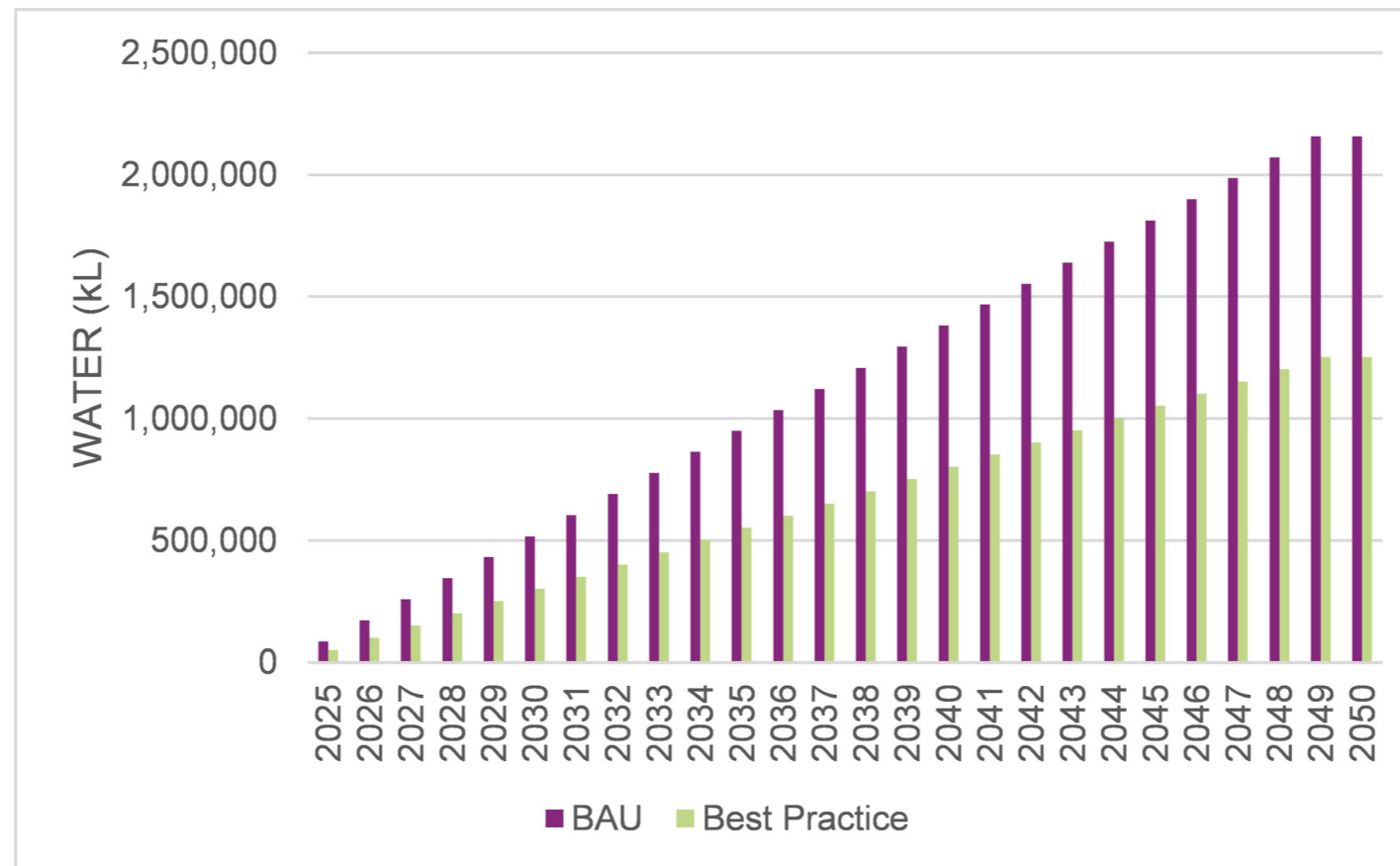


Figure 6.5 SOPA projected annual water use for BAU vs Best Practice

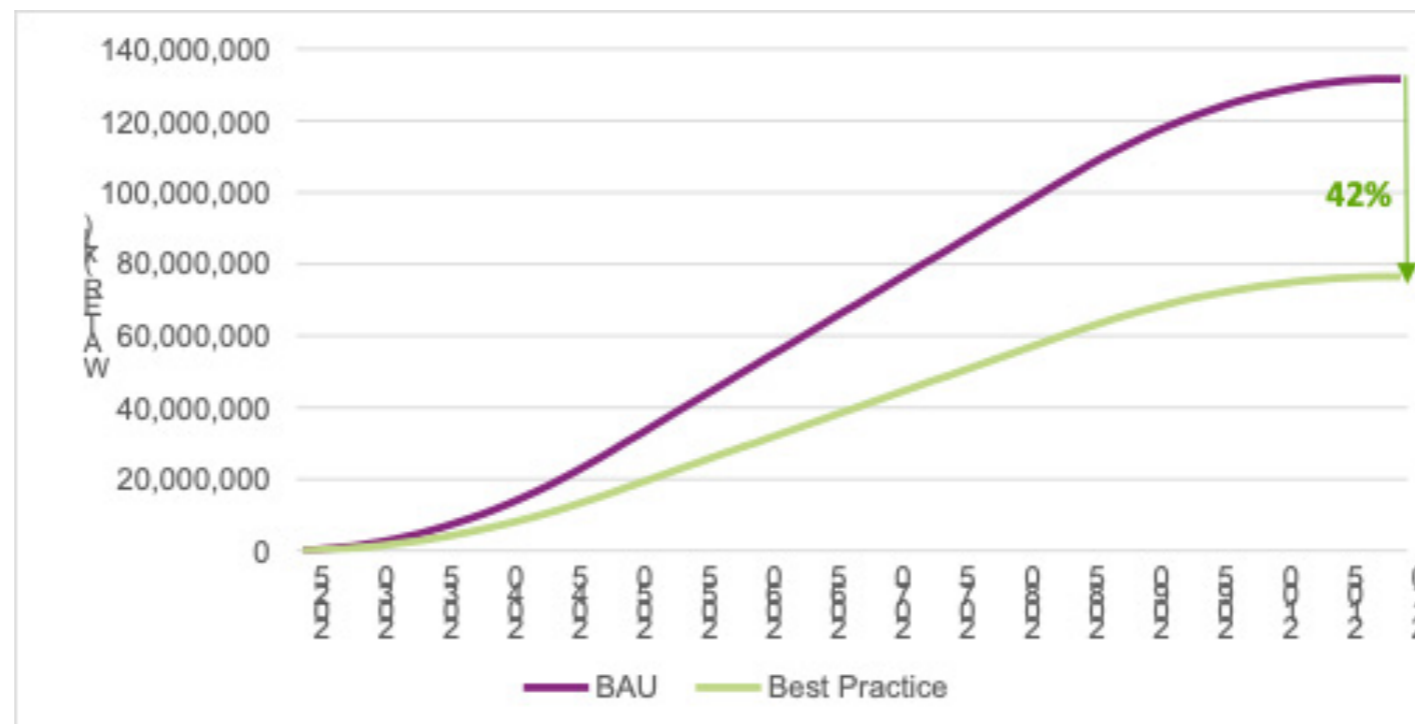


Figure 6.6 SOPA projected cumulative water use for BAU vs Best Practice

6.1.5 Resource Analysis - Waste

Insights

- Recyclables contribute the highest amount of waste approximately 3.5 times the amount of landfill and 26 times the amount of waste produced across the project life.
- Annual waste increases linearly during construction, before flat-lining from 2050 as all buildings have been constructed.
- The maximum amount of annual waste production projected once all buildings are constructed is approximately 6,000 tonnes, 22,000 tonnes and 815 tonnes for landfill, recycling, and organics respectively.
- Reducing emissions from waste will help deliver NSW's goal of net zero emissions by 2050.
- National Waste Policy Action Plan targets:
 - Reduce waste by 10% per person
 - Halving food waste to landfill by 2030
 - Achieving an 80% resource recovery rate

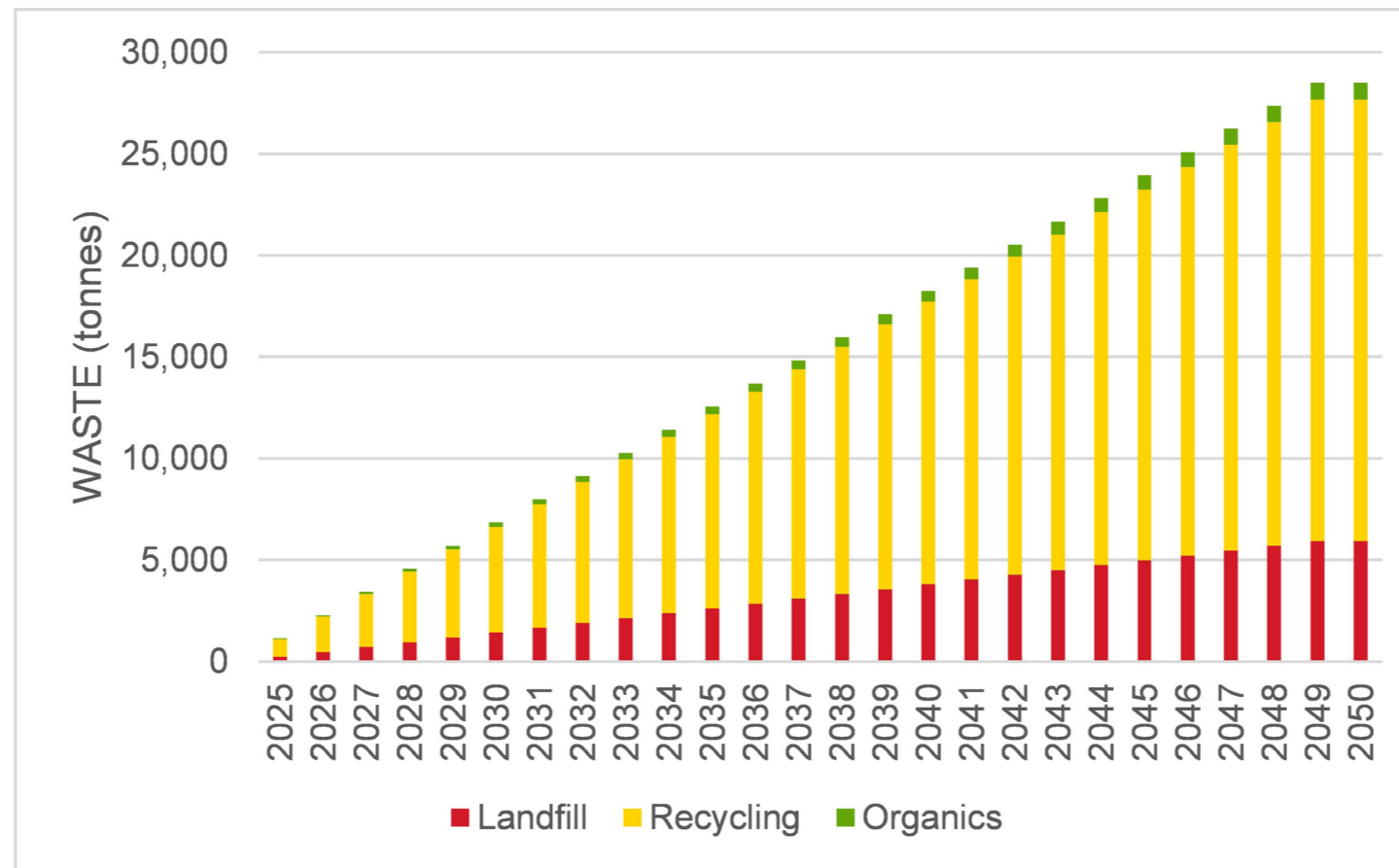


Figure 6.7 SOPA projected annual waste supplied to landfill, recycling and organics

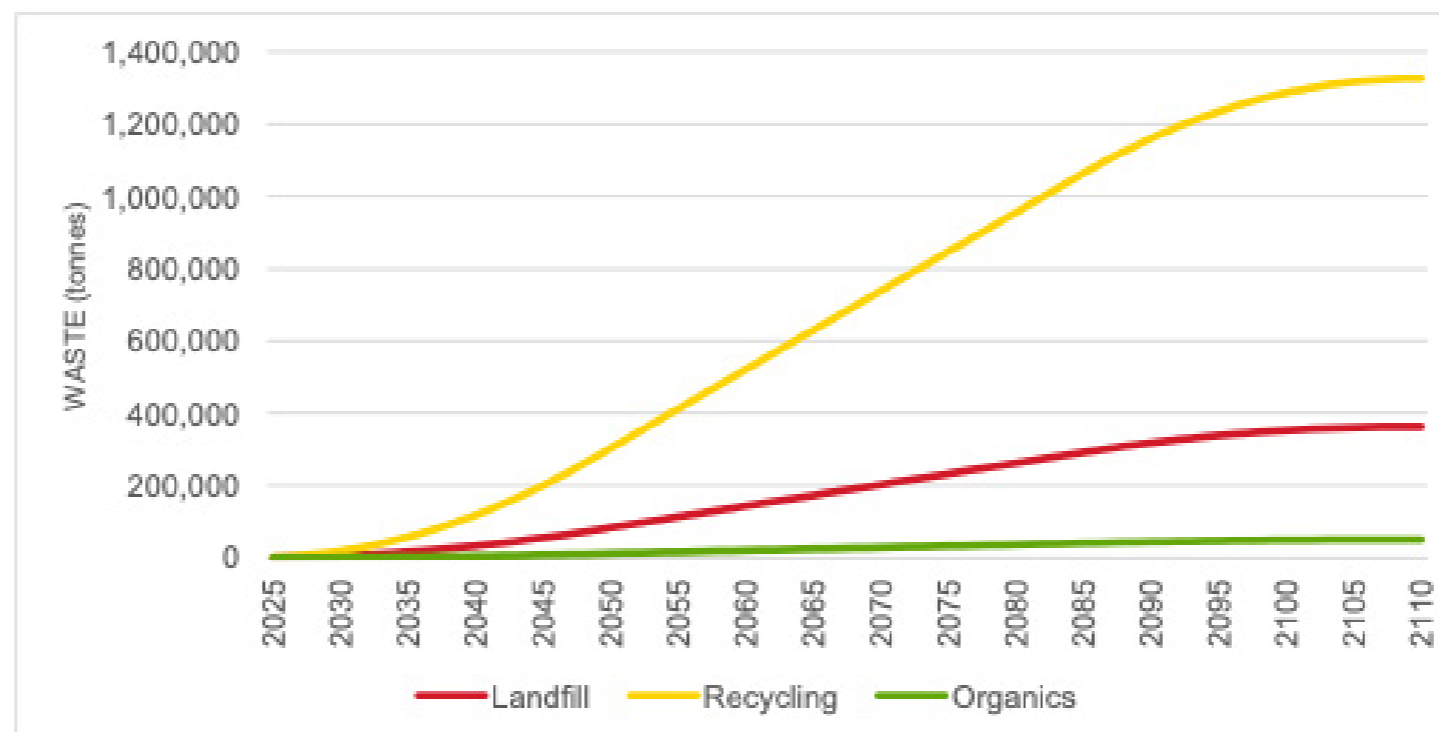


Figure 6.8 SOPA projected cumulative waste sent to landfill, recycling and organics

6.1.6 Resource Analysis - Operational and Embodied Emissions

To convert from resource use to emissions,emissions factors in Table 6.2 were applied.

Table 6.2 Electricity, water, waste and embodied carbon emission intensities

	Emission Intensity	Source
Electricity ¹	0.65 kgCO ₂ /kWh for 2025. An annual improvement of 3% assumed due to grid decarbonisation.	2019 and 2022 NGA Factors workbook, DCCEEW, Table 1 ²
Water	0.00022 kgCO ₂ /L	Sydney Water 2021-2022 Annual Report ³
Waste	0.59 kgCO ₂ /kg	DCCEEW GHG inventories NSW EPA
Embodied Carbon	Refer to Appendix C for embodied carbon intensities. A 4% annual improvement assumed.	LETI

Insights

- Operation emissions are significantly reduced for the Best Practice scenario. This is driven by the higher NABERS target and on-site PV generation.
- The majority of embodied emissions occur within the first 25 years during construction. Embodied emissions continue to increase annually at a slower rate from 2050, which includes the emissions associated with replacement/maintenance and disassembly.
- More advanced measures of reducing upfront embodied carbon should be considered. These include:
 - Increasing building re-use (building re-use has not been considered for the best practice scenario in this preliminary assessment)
 - Sourcing materials locally and using low embodied carbon materials (i.e. timber, low carbon concrete)

1 Disclaimer: Both BAU and Best Practice emissions include a 7MW and 55MW PV system respectively. These have been accounted for by reducing the electrical consumption needs. It's also been assumed that all the PV electricity generated will be consumed on-site.
2 3% grid decarbonisation rate calculated by comparing 2019 and 2022 grid emission intensities. 2025 emission intensity forecasted using this rate.
3 Emission intensity calculated by dividing total emissions by water supply for the year recorded by Sydney Water in this report.

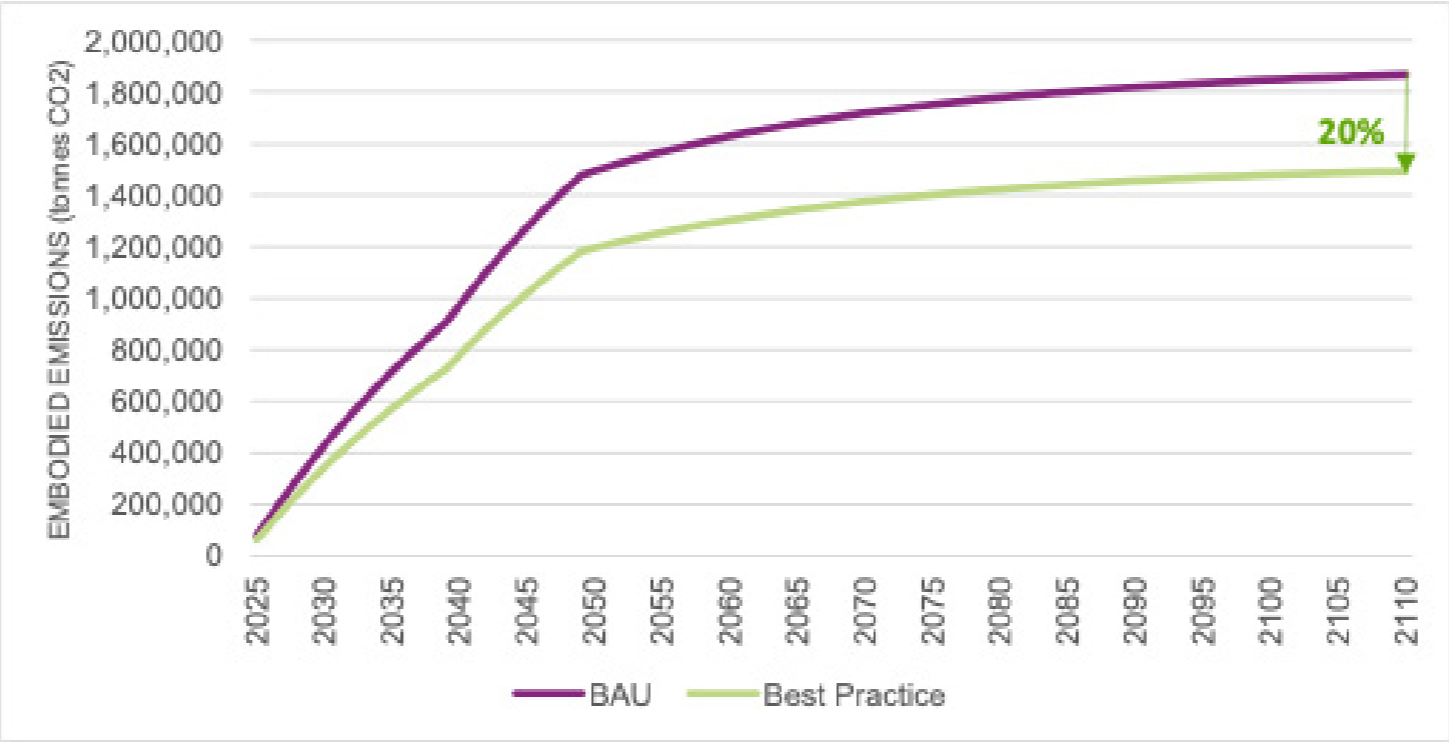


Figure 6.9 SOPA cumulative operating GHG emissions for BAU vs Best Practice

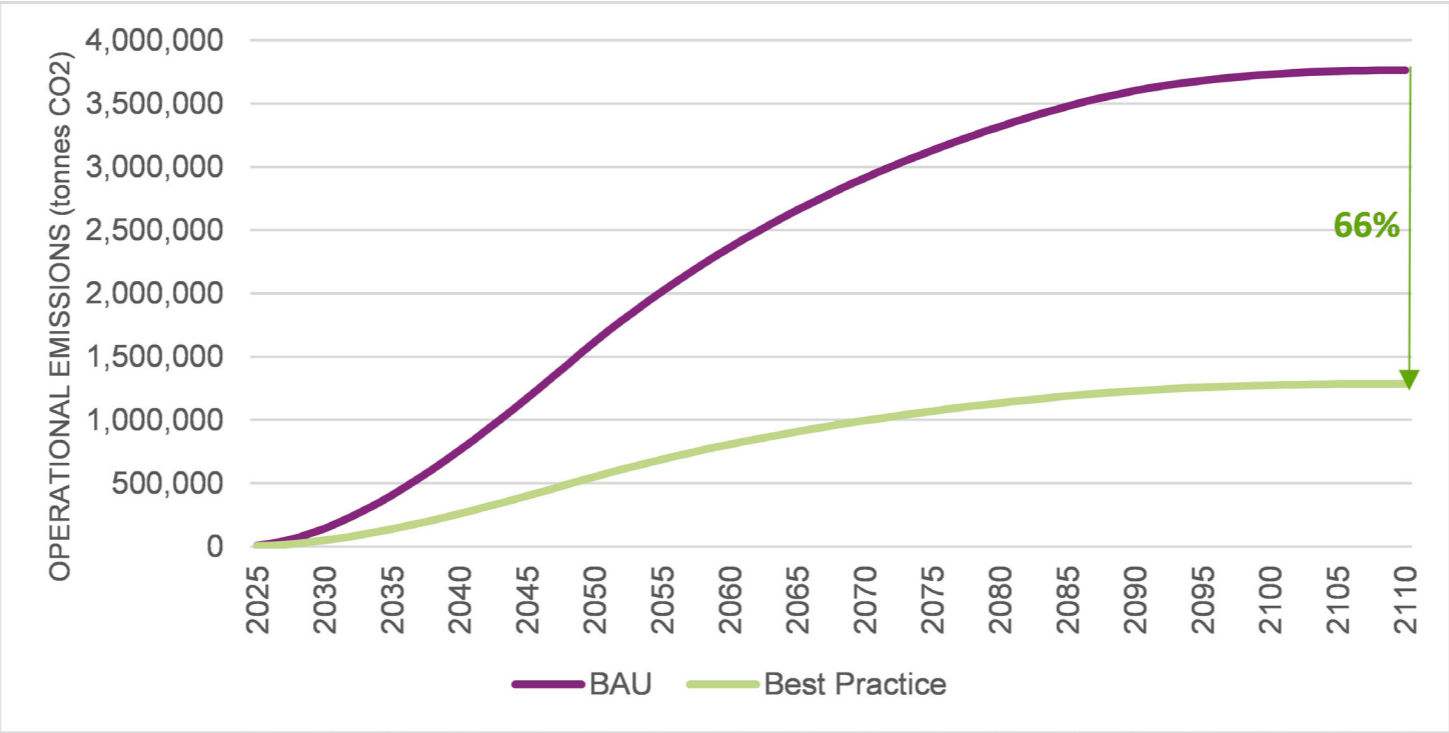


Figure 6.10 SOPA cumulative embodied GHG emissions for BAU vs Best Practice

6.1.7 Resource Analysis - Whole of Life Emissions

The results for the emissions associated with the project from construction through to end of life are shown in Figure 6.11. This accounts for both the operating and embodied emissions.

Insights

- A 51% saving in GHG emissions is projected across the project life if the Best Practice sustainability targets are implemented:
 - 55MW PV system installed across both SOPA and non-SOPA assets.
- The dominant source of emissions is electricity for BAU and embodied emissions for the Best Practice scenario.
- Both electricity and embodied emissions are high for both scenarios.
- Emissions for the best practice scenario can be further reduced by implementing more advanced sustainability measures. These additional measures will reduce the amount carbon off-sets required to achieve net zero targets:
 - Setting a more ambitious embodied emissions reduction target of 40%. This 40% target is forward looking and in line with 2030 requirement for a 6 star rated community.
 - Setting higher NABERS rating (i.e. 6 stars).
 - Off-site purchasing of renewables can be utilised to offset the remainder of the electricity emissions for the Best Practice scenario.

Disclaimer: no off-site purchasing has been considered in this preliminary assessment). Discussions with the client are needed to understand the extent of off-site purchasing being pursued.
- Emissions associated with Water and Waste remain a small component (<15%) for both scenarios.

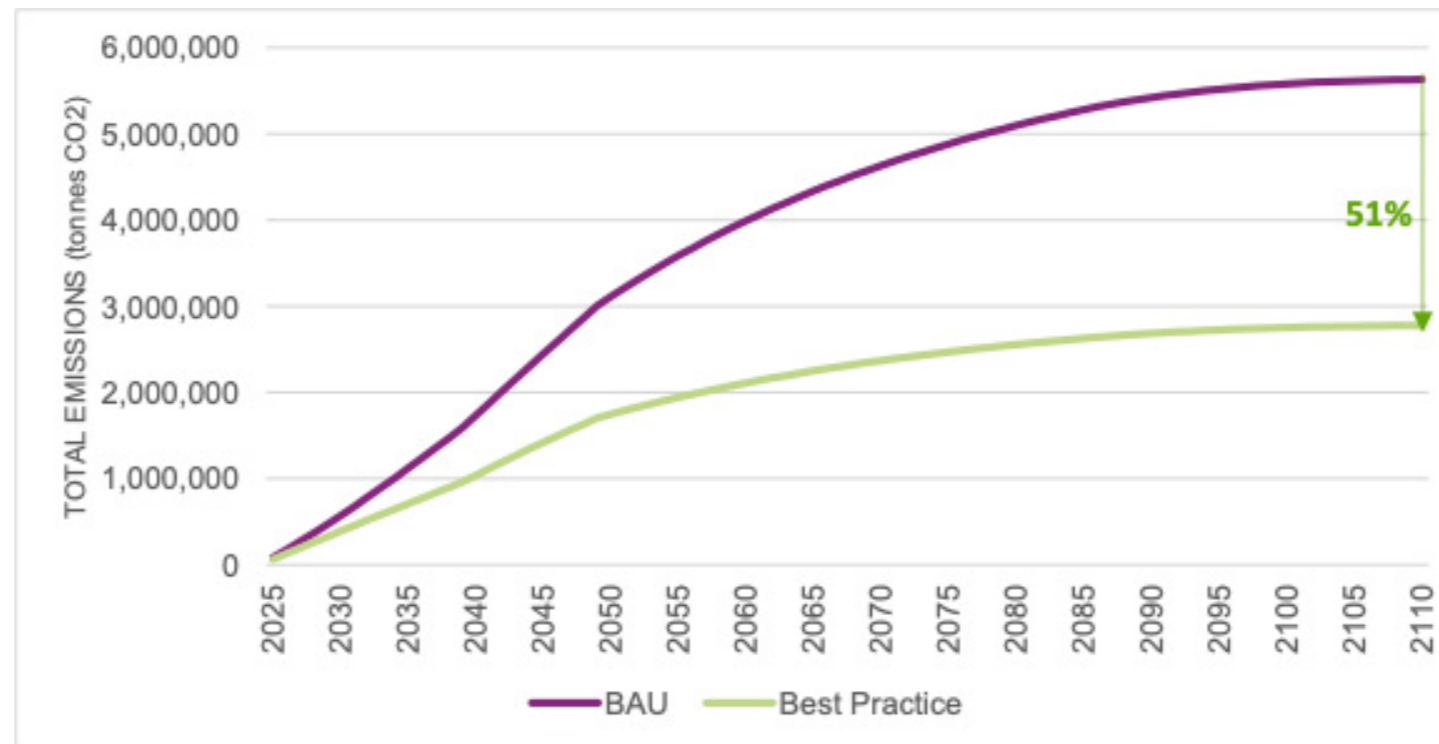


Figure 6.11 SOPA cumulative whole-of-life GHG emissions for BAU vs Best Practice

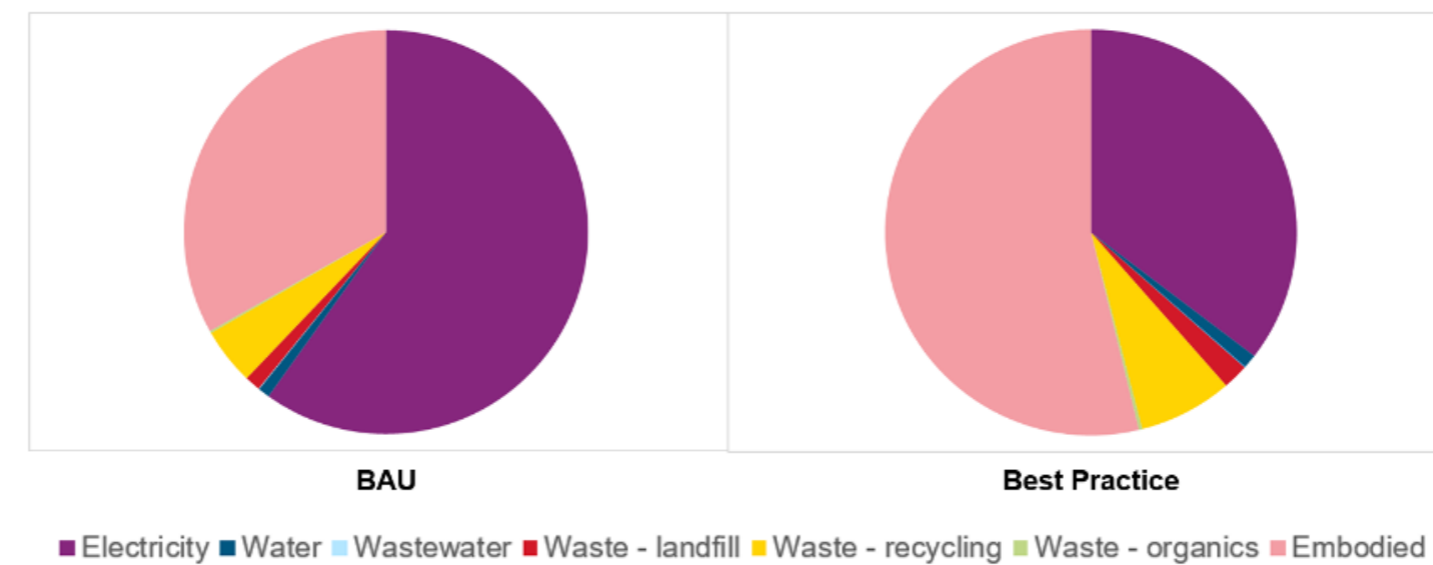


Figure 6.12 SOPA project GHG emission breakdown by resource for BAU vs Best Practice

City of Sydney. (2012). *Decentralised Water Master Plan 2012-2030*. City of Sydney.

City of Sydney. (2018). *Guidelines for Waste Management in New Development*. City of Sydney.

Department of Climate Change, Energy, the Environment and Water. (2022). *Australian National Greenhouse Accounts Factors*. Canberra: Commonwealth of Australia.

Department of Climate Change, Energy, the Environment and Water. (2022). *Strategy. Policy. Research*. Canberra: Commercial Building Baseline Study 2022.

London Energy Transformation Initiative. (2017). *LETI Embodied Carbon Primer*. London: LETI.

NSW EPA. (2020-21). *Annual Report 2020-21*. NSW EPA.

Sydney Water. (2021-2022). *Annual Environmental Performance Report*. Sydney Water.

07 IMPLEMENTATION

7.1 Recommendations

The recommendations which represent the outcome of master plan development process take four forms:

- Performance targets - certified ratings for development type from a series of rating tools;
- Spatial design recommendations for inclusion in the MP 2050; and
- Recommended objectives and development controls relating to ecology and environmental sustainability to be included in the Master Plan.
- Strategic initiatives

7.1.1 Performance targets

Performance targets are based on the outcome of the assessment of global peer precincts, all of which seek to attract world-class developers and tenants, and the ambition for world’s best practice.

All of these performance targets will result in significantly better sustainability outcomes in comparison to statutory requirements, like BASIX. Embedding the requirement for certification with third party sustainability rating tools also ensures outcomes which would otherwise be impossible for SOPA to deliver with statutory requirements only.

Table 7.1 Sustainability targets

Development type	Rating tool	Rating type	Target rating
Public domain	Green Star	Communities	6 Star
Commercial office	Green Star	Buildings	5 Star
	Green Star	Interiors	5 Star
	NABERS	Energy	5.5 Star with commitment agreement
Commercial office (design competition site)	Green Star	Buildings	6 Star
	Green Star	Interiors	5 Star
	NABERS	Energy	5.5 Star with commitment agreement
Retail centre	Green Star	Buildings	4 Star
	NABERS	Energy	5 Star with commitment agreement
Retail centre (design competition site)	Green Star	Buildings	5 Star
	NABERS	Energy	5 Star with commitment agreement
Public buildings	Green Star	Buildings	5 Star
Healthcare	Green Star	Buildings	5 Star
Educational	Green Star	Buildings	5 Star

Development type	Rating tool	Rating type	Target rating
Mixed use developments	Green Star	Buildings	5 Star
Hotels	Green Star	Buildings	4 Star
	NABERS	Energy	5 Star with commitment agreement
Hotels (design competition site)	Green Star	Buildings	5 Star
	NABERS	Energy	5 Star with commitment agreement
Residential	Green Star	Buildings	4 Star
Residential (design competition site)	Green Star	Buildings	5 Star

7.1.2 Design considerations for the master plan

The Master Plan 2050 incorporates key sustainability initiatives into its physical design, directly addressing the “Master Plan Potential Initiatives” outlined in Section 3 ‘Sustainability Strategy.’ This approach ensures that the design of the Park is not only aesthetically pleasing but also functionally sustainable.

Implementing Master Plan Potential Initiatives

The Master Plan 2050 is structured to include practical design elements that reflect the sustainability values and themes. These elements are not just ideas; they are actionable measures integrated into the physical layout and infrastructure of the suburb. By embedding these initiatives into the design, we ensure that Sydney Olympic Park’s development is in harmony with our sustainability goals.

Collaboration with Technical Reports

These design considerations are supported and reinforced by insights from other technical reports. These reports provide the necessary data and guidance to ensure that the implementation of sustainability initiatives is both feasible and effective. By aligning our design approach with these technical insights, we ensure a cohesive and comprehensive development strategy.

7.1.3 Development Control Provisions

In this section, we translate our sustainability goals into clear Development Control Provisions. These provisions, which include both Objectives and Controls, are our way of turning sustainability values, themes, principles, objectives, and selected opportunities into actionable guidelines. These guidelines are to be integrated into key

sections of the Master Plan 2050, specifically in areas concerning water systems, environmental conservation, landscape, and overall environmental performance.

The development of these provisions has been a collaborative effort. Some have been led by Atelier Ten, drawing on our expertise in sustainability. Others, particularly those related to broader environmental, social, or economic sustainability issues, have been crafted in partnership with SJB Planning and other consultants.

Our recommendation is for these provisions to be formally incorporated into the 2050 Master Plan. This integration ensures that all future developments within Sydney Olympic Park adhere to these sustainability guidelines, making them a standard part of the planning and development process.

Water systems

Objectives

- Celebrate water as a precious resource and defining element of Sydney Olympic Park, where water is conserved, demand for potable water is minimised and aquatic ecosystems are protected.
- Promote the sustainable use of water across Sydney Olympic Park through water harvesting and reuse and water conservation practices.
- Continue to implement Water Sensitive Urban Design (WSUD) across Sydney Olympic Park to improve water quality, reduce stormwater runoff and regenerate the waterways and sensitive ecosystems of Sydney Olympic Park.
- Protect sensitive and functional riparian ecosystems within the Badu Mangroves, Powells Creek and Haslams Creek.
- Promote the ongoing restoration of waterways and estuarine areas across Sydney Olympic Park, including the Parramatta River, Haslams Creek, Powells Creek and Boundary Creek.
- Plan for sea level rise, ensuring resilience against flooding and accommodating the migration of estuarine species.
- Create opportunities for people to interact with and enjoy water at scales and locations compatible with conservation objectives.
- Protect and manage existing wetlands and water bodies for ongoing storage, harvesting, water quality management, aquatic habitat and amenity functions values.

Controls

- Development must be planned and designed in accordance with:
 - Sydney Olympic Park Authority’s Stormwater Management and WSUD Policy and accompanying Guidelines;
 - The Environmental Guidelines; and
 - The Parklands Plan of Management (where applicable).
- Implement integrated precinct scale stormwater treatment systems as identified in Figure 3.5.1 of the Master Plan.
- Contribute towards upgrade and rectification works of the applicable downstream receiving water bodies (in accordance with the ICF 2050).
- Incorporate WSUD elements, such as raingardens and passive irrigation, in the design of new streets and upgrades of existing

streets, as identified in Figure 3.5.1 of the Master Plan.

- Have dual-reticulation with an alternative water supply to all approved uses. Developments are to connect to a recycled water network wherever it is available.
- Incorporate water fittings and fixtures of the highest Water Efficiency Labelling Scheme (WELS) star rating available at the time of development and meet the requirements of State Environmental Planning Policy (Sustainable Buildings) 2022.
- Provide an integrated water cycle management plan with development applications for new buildings, substantial alterations and additions to existing buildings and public spaces, in accordance with the WSUD policy.
- Manage groundwater in accordance with regulatory requirements and best practices for protection of receiving waters, including addressing any contamination/leachate.
- Provide appropriate sediment and erosion control measures and ensure that downstream waterbodies and waterways are not impacted during construction.
- Demonstrate arrangements for effective ongoing operation and maintenance of any private water management systems.
- Development must contribute to the relevant water catchment in accordance with Table 3.5.1 of the Master Plan.

Environmental conservation and protected areas

Objectives

- Promote land use and development which protects, nurtures and values nature.
- Protect and enhance ecological communities on lands zoned for conservation.
- Avoid habitat loss, degradation, fragmentation or increased edge effects.
- Maximise opportunities to implement First Nations land management practices, including re-vegetation, clearing and food production and harvesting.
- Provide environmental education, interpretive and experiential activities in natural areas at scales and locations compatible with conservation objectives.
- Enhance the ecological values of the Boundary Creek Corridor.
- Enhance ecological connectivity between Newington Nature Reserve and the bushland habitats south of Haslams Creek.
- Respond to future environmental changes and promote climate-sensitive and resilient ecosystems.

Controls

- Development and use of Sydney Olympic Park must be consistent with the Sydney Olympic Park Environmental Guidelines and the Parklands Plan of Management.
- The development and use of the ecological conservation areas must be consistent with Figure 3.5.2 of the Master Plan and the Parklands Character Areas at Chapter 4 of the Master Plan.
- Land adjacent to Newington Nature Reserve must be managed to enhance and complement the ecological conditions of the Nature Reserve.
- Promote the introduction of urban ecologies and ecological connectivity consistent with Figure 3.5.2 of the Master Plan.
- Prioritise species-rich, locally endemic and structurally diverse

planting palettes on private and public lands across urban areas to promote native pollinator species in accordance with the Design Manual (DM).

Landscape and urban canopy

Objectives

- a. Protect, maintain and increase the landscaped area across Sydney Olympic Park to:
 - i. reduce the urban heat island effect and maximise natural cooling of public spaces and surrounding development;
 - ii. increase urban green infrastructure to support the Sydney Green Grid;
 - iii. improve air quality by capturing airborne pollution;
 - iv. enhance urban ecology by supporting habitats;
 - v. manage water; and
 - vi. improve the well-being of people and ecosystems.
- b. Showcase locally endemic flora in the landscaping of civic spaces as an educational and interpretive resource.
- c. Establish a biophilic environment that provides regular immersion in and contact with nature and natural systems.
- d. Create an interconnected urban tree canopy to assist in climate change mitigation and adaptation, provide for ecological movements, reduce urban heat load and improve health and wellbeing of people and ecosystems.
- e. Restore riparian corridors across Sydney Olympic Park, including Parramatta River and Boundary Creek, to provide more opportunities for tree canopy and habitat.
- f. Increase urban tree canopy to:
 - i. 40-70% within streets; and
 - ii. 30-40% within public open space.

Controls

- 1. Retain all trees in the public domain as illustrated on Figure 3.5.3 of the Master Plan.
- 2. Provide additional street tree and understorey planting in public open spaces in the Urban Centre as shown in the concept plans and street sections provided at Chapter 4 of the Master Plan.
- 3. 3. Focus tree canopy cover within public open spaces and streets in the Urban Centre in accordance with the crosssection diagrams provided at Chapter 4 of the Master Plan.
- 4. 4. In accordance with SOPA's Urban Greening Policy, tree removal must be kept to a minimum. Where tree removal cannot be avoided, a tree replacement strategy within the Neighbourhoods and Precincts Boundary shown at Figure 3.5.3 of the Master Plan must be implemented requiring:
 - a. tree replacement at a ratio varying between 1:2 and 1:16 depending on the size of the tree to be removed, in accordance with SOPA's Urban Greening Policy.
 - b. mature replacement trees with a minimum pot size of 400 litres (L).
- 5. Replacement trees are to be in accordance with SOPA's Urban Greening Policy. Contributions made to the tree intensification fund will provide funding for tree planting into the specified tree canopy intensification zones around the stadiums as illustrated in Figure 3.5.3 of the Master Plan, so long as it aligns with the strategic direction for the Stadia Precinct.

- 6. Provide green cover for all new buildings incorporating biophilic design principles, and tree planting on development sites is to be in accordance with the ADG, at a minimum. This is to be equivalent to 80% of the site area and include a combination of the following:
 - a. deep soil;
 - b. landscaped area;
 - c. layered planting on structure;
 - d. green roofs;
 - e. permanent plants on balconies / podiums; and
 - f. green awnings.
- 7. Where a front setback is specified (and not an active frontage), 50% of the setback is to be planted.
- 8. Incorporate planting strategies which maximise the use of native, endemic tree, shrubs and ground cover species, and includes a diversity of species and genus within each strata.
- 9. Incorporate an appropriate tree selection strategy which considers the full growth of the tree including tree pit dimensions and proximity to buildings and awnings.

Environmental building performance and sustainability

Objectives

- a. Sydney Olympic Park is recognised, nationally and internationally, for excellence and innovation in building design and sustainability.
- b. Promote development that embodies a world leading approach to environmental sustainability principles.
- c. Sydney Olympic Park will strive to become a carbon positive precinct, and will be a net-zero carbon precinct by 2050.
- d. Provide high performance new buildings which are net zero carbon in design, construction and operation at time of occupation.
- e. Improve the energy efficiency of existing buildings.
- f. Maximise resource efficiency, minimise new resource and new product use, and protect natural resources that would otherwise be damaged through resource extraction or deposition.
- g. Maximise opportunities for development to connect with nature through biophilic design principles.
- h. Provide a fossil-fuel free precinct that prioritises energy efficiency and affordability while ensuring reliable energy supply.
- i. Achieve circularity in the construction, operational, and end-of-life stages of all buildings and other constructions throughout the precinct.
- j. Enable future electrification of all road mobility.
- k. Avoid and mitigate development impacts to nature including overshadowing, birdstrike, artificial night lighting, disturbance, noise, biosecurity risk and stormwater pollution.
- l. By 2050, 100% of energy will be renewably supplied.

Controls

- 1. Development involving new buildings and substantial alterations to existing buildings must achieve the targets provided at Table 7.1.
- 2. Development sites greater than 10,000m² in area must incorporate an on-site waste and recycling facility.
- 3. Development must include suitably sized waste management

areas for the sorting, storage and recycling of waste.

- 4. Sustainable building materials must be selected for new development, including materials sourced from certified sustainably managed suppliers.
- 5. Materials and finishes are not to include banned or highly toxic materials (including asbestos, mercury, lead, polychlorinated biphenyls (PCBs) etc.), and must eliminate or significantly reduce toxins harmful to human and environmental health (including volatile organic compounds (VOCs), formaldehyde, chlorine-based products etc.).
- 6. New development must ensure diversion of 90% construction and demolition waste from landfill in line with Green Star Credit Achievement.
- 7. Building roofs must contribute to sustainability outcomes by being either green, usable open space, solar photovoltaic (PV), or a combination of these, and not contribute to urban heat island (UHI) by incorporating materials with a low solar reflectance index (SRI).
- 8. New developments must incorporate electric vehicle charging in line with best practice expectations for quantity, speed and management, and provide future proofing should there be an increased need for electric vehicle charging.
- 9. Where possible, unoccupied buildings should not be illuminated at night time.
- 10. 85% of all reflective glazing must incorporate bird safe glass to prevent bird strike. Bird safe glass should incorporate leading technologies and be applied to the exterior (first) surface of the glass.

7.1.4 Strategic initiatives

Having thoroughly explored a range of strategic initiatives in Section 4, this section concludes by strongly recommending their implementation as a key component of the Master Plan 2050. These initiatives represent significant steps forward in the sustainability journey and are pivotal in shaping the future of the suburb. To effectively bring these initiatives to life, we propose the following implementation strategies:

Implementation of Planned Initiatives

The strategic initiatives, including the Sharing Economy Hub and Circular Repair Hub, which have been detailed earlier, should now be actively pursued. Their integration into the suburb's development is crucial for reinforcing our commitment to sustainability and enhancing its overall sustainability profile.

Structured Framework for Implementation

A comprehensive and structured framework is essential for the successful implementation of these initiatives. This framework should detail the processes, assign roles and responsibilities, and set clear milestones. Key initiatives such as the Living Lab, Sustainability-as-a-Service Strategy, and NSW Centre of Resilience Excellence require this organised approach to ensure their seamless integration into the Park's operations.

Business Case Analysis and Detailed Planning

For transformative projects like the Microgrid or District Thermal Energy System, conducting a robust business case analysis is critical to ascertain their viability and potential benefits. Alongside this, a detailed implementation plan should be developed, laying out the technical aspects, timeline, and performance indicators necessary for precise and effective execution.

By implementing these strategic initiatives, Sydney Olympic Park will not only continue its legacy as a leader in sustainable development but also set new benchmarks for urban sustainability, demonstrating a forward-thinking and proactive approach to environmental stewardship.

Appendices

[Appendix A | Policy and Planning documents](#)

[Appendix B | Development Context](#)

[Appendix C | Sustainability Research](#)

Appendix A | Policy and Planning Documents

1.A.1 SEPP (Precincts - Central River City) 2021, NSW Government

The State Environmental Planning Policy (Precincts—Central River City) 2021 is a planning policy issued by the NSW government to guide development and growth in the central river city precinct, including the Sydney Olympic Park.

The policy aims to promote sustainable and resilient development that supports economic growth, social well-being, and environmental protection. Key points related to Sydney Olympic Park include:

- The policy designates Sydney Olympic Park as a “Principal Centre” within the Central River City precinct.
- The policy sets out objectives and strategies for the development of Sydney Olympic Park, including promoting employment growth, supporting cultural and recreational activities, improving public transport, and enhancing the natural and built environment.
- The policy requires any development within Sydney Olympic Park to comply with relevant environmental and sustainability standards, including water and energy efficiency, waste management, and biodiversity conservation.
- The policy also requires the preparation of a new master plan for Sydney Olympic Park that aligns with the policy’s objectives and strategies.

Implications for Master Plan 2050

- Opportunities to enhance the social, cultural, and recreational amenities of Sydney Olympic Park.
- Opportunities to improve the sustainability and environmental performance of the precinct through better design, planning, and management.
- Potential for increased employment and economic growth through new development and infrastructure projects.
- Potential challenges related to managing growth and development in a way that balances economic, social, and environmental concerns.
- Need for consultation and engagement with stakeholders, including local communities, businesses, and government agencies.

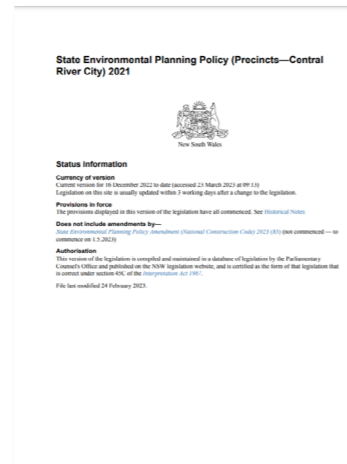


Figure 1.1 Central River City Precinct SEPP (Source: NSW)

1.A.2 Six Cities Region Discussion Paper, Greater Cities Commission

The Six Cities Region Discussion Paper is a report produced by the Greater Cities Commission, which outlines a framework for the development of six cities in the greater Sydney region.

While the report does not specifically focus on Sydney Olympic Park, it does provide some broader context and implications for the development of the precinct:

- The report identifies the six cities of Liverpool, Parramatta, Penrith, Campbelltown-Macarthur, Wollondilly, and Hawkesbury as key growth areas for the region.
- The report emphasises the need for integrated planning, infrastructure, and services to support the growth of these cities, including better transport links, affordable housing, and employment opportunities.
- The report also highlights the importance of environmental sustainability and resilience in the development of these cities, including protecting green spaces and waterways, reducing carbon emissions, and adapting to climate change impacts.
- While the report does not specifically mention Sydney Olympic Park, it does suggest that the development of regional hubs and economic corridors could provide opportunities for job creation and innovation.

Implications for Master Plan 2050

- The need to align the master plan with broader regional planning objectives and priorities, including promoting sustainable growth, improving connectivity, and enhancing environmental outcomes.
- Opportunities to position Sydney Olympic Park as a hub for innovation, research, and development, particularly in emerging industries such as clean energy, technology, and advanced manufacturing.
- The need to enhance public transport and connectivity to surrounding areas to support employment, education, and recreational activities.
- The importance of preserving and enhancing green spaces and waterways within and around the precinct, including improving biodiversity and mitigating the urban heat island effect.
- The need for close collaboration and consultation with stakeholders, including the local community, businesses, and government agencies, to ensure that the master plan reflects their needs and aspirations.

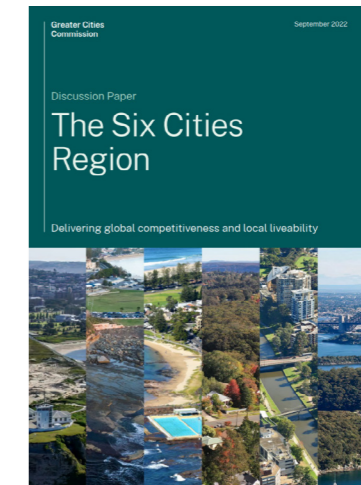


Figure 1.2 The Six Cities Region (Source: GSC)

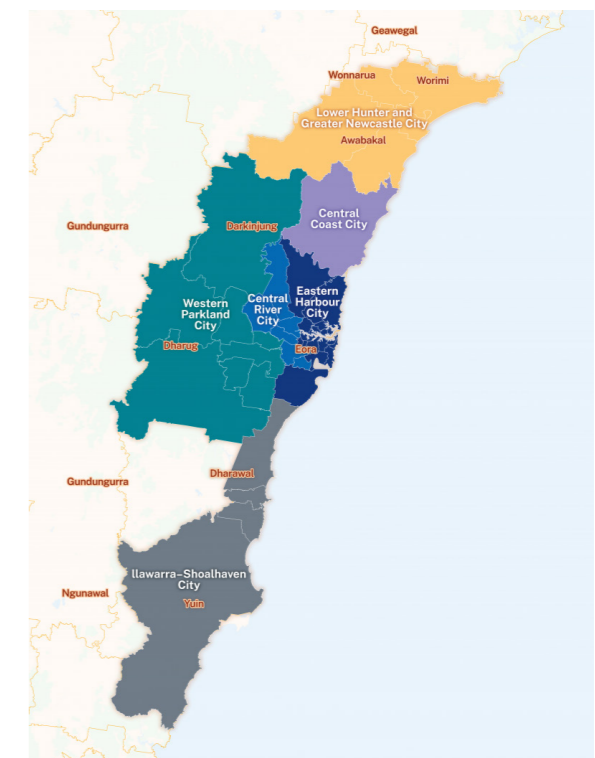


Figure 1.3 Map showing the six cities regions (Source: Six Cities Discussion Paper)

1.A.3 NSW Circular Economy Policy Statement, NSW Government

The NSW Circular Economy Policy Statement aims to revolutionise resource management, production, and consumption to reduce waste and environmental impact while fostering economic growth. This transition towards a circular economy entails a paradigm shift in product lifecycle management and resource use.

By embracing circular economy principles, the NSW Government aspires to stimulate innovation, job creation, and sustainable practices across various sectors. Key components of the policy include:

- **Circular Economy Definition and Principles:** The policy outlines seven fundamental principles for achieving a circular economy, emphasising sustainable resource management, waste reduction, innovative solutions, job creation, and behavior change.
- **Implementation and Impact:** The NSW Government will drive circular economy adoption through policy integration, sustainable procurement, waste management, and fostering collaborations. Initiatives will span manufacturing, design, re-use, repair, and recycling, leading to improved resource efficiency and environmental outcomes.
- **Focus Areas for Government Action:** Eight focus areas guide the implementation of circular economy principles, including innovation support, sustainable procurement practices, high-quality recycling, organic resource utilisation, product stewardship, responsible packaging, re-use and repair promotion, and circular design incentives.

Implications for Master Plan 2050

- **Engage in Circular Economy Innovation:** Foster collaboration
- **Circular Design:** Integrate circular design principles into the master plan to create durable, re-usable structures.
- **Sustainable Procurement:** Embrace eco-friendly procurement practices for materials and services.
- **Re-use and Repair:** Establish on-site re-use and repair hubs to extend product lifecycles.
- **Advanced Recycling:** Implement advanced recycling systems for high-quality material recovery.
- **Responsible Packaging:** Encourage businesses to adopt sustainable packaging practices.
- **Innovation Collaboration:** Partner with local entities to drive circular economy innovation.
- **Community Engagement:** Educate and involve the community in waste reduction efforts.



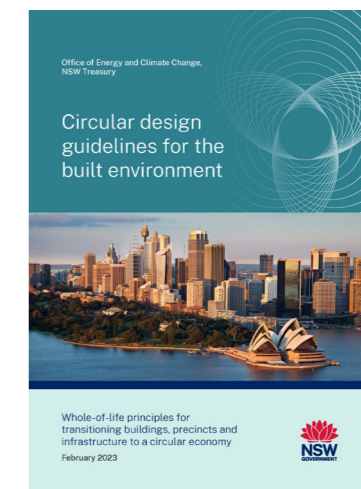
1.A.4 Circular design guidelines for the built environment, NSW Government

The Circular Design Guidelines for the Built Environment by the Office of Energy and Climate Change, NSW Treasury, emphasises adopting circular economy principles in building, precinct, and infrastructure projects.

These guidelines support NSW's transition to a circular economy, aiming to reduce waste, promote efficient resource use, and cut emissions.

Implications for Master Plan 2050

- **Longevity in Design:** Prioritise designs that extend the useful life of structures and infrastructure, reducing material consumption and costs.
- **Flexibility and Adaptability:** Design for change, enabling components and spaces to be easily reconfigured or repurposed.
- **Materials Circularity and Disassembly:** Opt for materials, products, and connection systems that facilitate re-use and recycling at end-of-life.
- **Materials Efficiency:** Incorporate design and construction methods that minimise material use and waste generation.
- **Operational Waste Management:** Design waste storage and collection systems that maximise re-use and recycling while minimising landfill waste.
- **Re-use Existing Assets:** Incorporate and refurbish existing structures, materials, and components to reduce waste and resource consumption.
- **Recycled Content:** Choose products with recycled content to reduce extraction of virgin materials and embodied energy.
- **Designed for Disassembly:** Specify products and connection systems that enable easy disassembly for re-use and recycling.
- **End-of-Life Recovery Pathway:** Select materials and products with identified re-use or recycling options.
- **Low-Impact Materials:** Prioritise materials with minimal environmental impact and human health effects.
- **Green Infrastructure:** Integrate natural systems and green spaces to reduce environmental impact and enhance urban landscapes.
- **Materials Database:** Maintain a digital inventory of building materials and components to support re-use and recycling efforts.
- **Products as a Service:** Procure products or systems through a service-based model to support asset longevity and reduce waste.



1.A.5 Greater Parramatta and the Olympic Peninsula, Greater Sydney Commission

The Greater Parramatta and Olympic Peninsula (GPOP) is a key growth area in the Greater Sydney region, identified by the Greater Sydney Commission as a priority for integrated planning and development.

The GPOP vision seeks to leverage the area's strategic location and existing assets to create a dynamic and sustainable urban centre. Key points from the GPOP vision document include:

- Sydney Olympic Park is identified as a major asset within the GPOP area, with its existing infrastructure, sporting facilities, and entertainment venues providing a platform for further development and investment.
- The GPOP vision seeks to integrate Sydney Olympic Park with surrounding areas, including Parramatta, Rydalmere, and Camellia, to create a cohesive and connected urban centre.
- The vision emphasises the need for sustainable and resilient development, including reducing carbon emissions, enhancing green spaces and waterways, and adapting to climate change impacts.
- The vision also highlights the importance of economic diversity and job creation, with a focus on high-value industries such as knowledge-based services, advanced manufacturing, and creative industries.
- The vision calls for a collaborative and consultative approach to planning and development, involving stakeholders from across the community, government, and private sectors.
- The GPOP vision stresses the need for integrated transport and mobility solutions, including better public transport connections and active transport options such as walking and cycling.

Implications for Master Plan 2050

- The need to align the master plan with broader regional planning objectives and priorities, particularly in terms of sustainability, economic diversity, and connectivity.
- Opportunities to leverage Sydney Olympic Park's existing assets and infrastructure to attract new businesses and industries to the precinct.
- The need to enhance transport connections and mobility options, particularly through better integration with surrounding areas and public transport networks.
- The importance of preserving and enhancing green spaces and waterways within and around the precinct, as well as mitigating the urban heat island effect.
- The need for close collaboration and consultation with stakeholders, including the local community, businesses, and government agencies, to ensure that the master plan reflects their needs and aspirations.

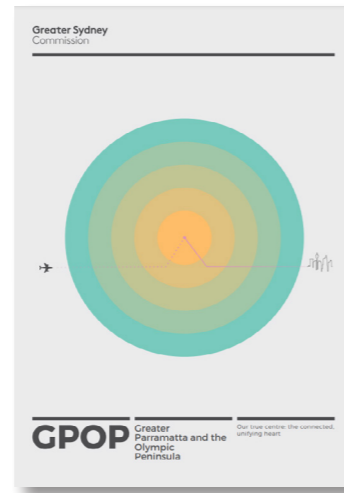


Figure 1.5 Four quarters of GPOP (Source: GSC)

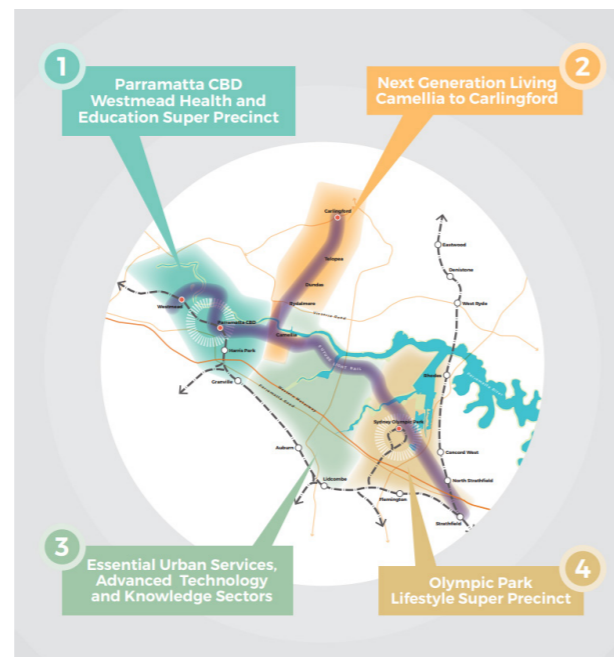


Figure 1.4 Four quarters of GPOP (Source: GPOP)

1.A.6 Sydney Olympic Park Master Plan 2030 (2018 Review), Sydney Olympic Park Authority

The Sydney Olympic Park Master Plan 2030 (2018 Review) is a planning document that outlines the vision and strategies for the ongoing development of Sydney Olympic Park over the next decade.

Key points from the document include:

- The master plan seeks to build on the strengths and assets of the precinct, including its world-class sporting facilities, parklands, and transport connections, to create a vibrant and sustainable urban centre.
- The vision for Sydney Olympic Park is to be a leading example of a sustainable and connected city, with a focus on innovation, liveability, and inclusivity.
- The master plan identifies six strategic themes to guide the development of the precinct, including creating a diverse mix of uses, enhancing public spaces and open areas, and promoting sustainable transport and mobility options.
- Key projects identified in the master plan include the development of new residential, commercial, and cultural facilities, as well as the enhancement of public transport connections and active transport options such as cycling and walking.
- The master plan also emphasises the importance of engaging with the community and stakeholders to ensure that the ongoing development of the precinct reflects their needs and aspirations.

Implications for Master Plan 2050

- The need to build on the strategic themes and priorities identified in the 2030 master plan, including promoting sustainability, enhancing public spaces, and creating a diverse mix of uses.
- Opportunities to identify new projects and initiatives that align with the vision and strategies of the 2030 master plan, such as the development of new cultural or community facilities, or the enhancement of transport connections.
- The importance of engaging with the community and stakeholders to ensure that the new master plan reflects their needs and aspirations, and to build support and ownership for the ongoing development of the precinct.
- The need to consider new trends and developments that may have emerged since the 2030 master plan was developed, such as the increasing focus on climate resilience and the role of technology in urban development.



Figure 1.6 Four quarters of GPOP (Source: SOPA)



Figure 1.7 Artist's impression of SOP and surrounds 2030 (Source: SOP Masterplan 2030)

1.A.7 Sydney Olympic Park Masterplan 2030 (Interim Metro Review), Sydney Olympic Park Authority

The Sydney Olympic Park Masterplan 2030 (Interim Metro Review) is a planning document developed by the Sydney Olympic Park Authority that outlines a vision for the development of Sydney Olympic Park over the next decade.

Sustainability is a key focus of the Sydney Olympic Park Masterplan 2030, with the aim of creating a sustainable community that balances economic, environmental, and social considerations. The plan seeks to achieve this by integrating sustainability principles into all aspects of the development process.

Implications for Master Plan 2050

- Incorporating sustainable design principles into all new buildings and infrastructure, such as passive solar design and water-efficient fixtures.
- Increasing the use of renewable energy sources, such as solar and wind power, to reduce reliance on fossil fuels.
- Encouraging sustainable modes of transport, such as walking, cycling, and public transport, by improving infrastructure and reducing car dependence.
- Protecting and enhancing the natural environment, including biodiversity and waterways, through the use of green infrastructure and conservation measures.
- Reducing waste generation and promoting recycling and reuse of materials.
- Engaging with the community and stakeholders to ensure that sustainability considerations are incorporated into decision-making processes.
- Monitoring and reporting on sustainability performance to ensure that targets are being met and that the master plan remains on track to achieve its sustainability goals.



Figure 1.8 Artist's impression of SOP and surrounds 2030 (Source: SOPA))

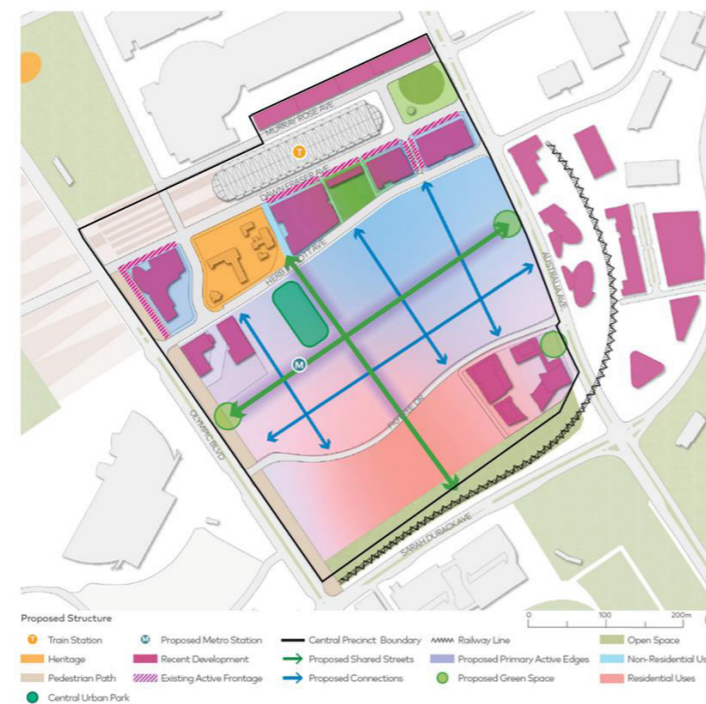


Figure 1.9 Proposed Structure Plan (Source: SOP Masterplan 2030))

1.A.8 Newington Nature Reserve Plan of Management 2003, Sydney Olympic Park Authority

The Newington Nature Reserve Plan of Management 2003 is a document developed by the Sydney Olympic Park Authority to guide the management of the Newington Nature Reserve, which is located within Sydney Olympic Park.

The plan outlines a vision for the Reserve that balances conservation, recreational use, and cultural heritage considerations.

Sustainability is a key focus of the Newington Nature Reserve Plan of Management, with the aim of protecting and enhancing the natural environment for the benefit of current and future generations. The plan seeks to achieve this by incorporating sustainability principles into all aspects of the management of the Reserve.

Implications for Master Plan 2050

- Protecting and enhancing biodiversity within the Reserve, through measures such as weed and pest control, habitat restoration, and monitoring of wildlife populations.
- Conserving and managing the cultural heritage values of the Reserve, including Aboriginal sites and relics from the site's industrial history.
- Providing opportunities for environmental education and interpretation, to increase public awareness and understanding of the natural and cultural values of the Reserve.
- Promoting sustainable recreational use of the Reserve, through measures such as the development of walking and cycling trails and the provision of visitor facilities that minimise environmental impact.
- Incorporating sustainable design principles into any new infrastructure development, such as the use of recycled materials, water-saving features, and renewable energy sources.
- Monitoring and reporting on sustainability performance, to ensure that the management of the Reserve is achieving its sustainability goals and targets.

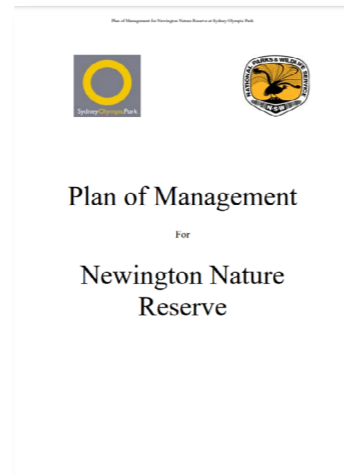


Figure 1.12 Plan of Management for Newington Nature Reserve (Source: SOP Authority)

1.A.9 Parklands Plan of Management 2010, Sydney Olympic Park Authority

The Parklands Plan of Management 2010 is a document developed by the Sydney Olympic Park Authority to guide the management of the Parklands, which is a significant green space within Sydney Olympic Park.

Sustainability is a key focus of the Parklands Plan of Management, with the aim of creating a sustainable green space that benefits the local community and the environment. The plan seeks to achieve this by incorporating sustainability principles into all aspects of the management of the Parklands.

Implications for Master Plan 2050

- Protecting and enhancing the natural environment within the Parklands, through measures such as the restoration of waterways and wetlands, and the preservation of biodiversity.
- Encouraging sustainable modes of transport to and within the Parklands, such as walking, cycling, and public transport, by improving infrastructure and reducing car dependence.
- Providing opportunities for environmental education and interpretation, to increase public awareness and understanding of the natural and cultural values of the Parklands.
- Promoting sustainable recreational use of the Parklands, through measures such as the development of walking and cycling trails and the provision of visitor facilities that minimise environmental impact.
- Incorporating sustainable design principles into any new infrastructure development, such as the use of recycled materials, water-saving features, and renewable energy sources.
- Engaging with the community and stakeholders to ensure that sustainability considerations are incorporated into decision-making processes.
- Monitoring and reporting on sustainability performance, to ensure that the management of the Parklands is achieving its sustainability goals and targets.



Figure 1.11 Parklands Plan of Management 2010 (Source: NSW)



Figure 1.10 Variety of parklands at SOP (Source: Parklands Plan of Management 2010)

1.A.10 Reconciliation Action Plan (RAP), Sydney Olympic Park Authority

The Reconciliation Action Plan (RAP) of the Sydney Olympic Park Authority is a strategic framework that outlines the organisation's commitment to reconciliation between Aboriginal and Torres Strait Islander peoples and the wider Australian community.

The plan seeks to promote social, economic, and environmental sustainability through building respectful relationships, increasing awareness and understanding of Indigenous cultures, and promoting equal opportunities for all.

Sustainability is one of the key themes in the RAP, with a focus on embedding sustainable practices into the operations of the Sydney Olympic Park Authority. The plan recognises that reconciliation and sustainability are interconnected and mutually reinforcing, and that by working towards reconciliation, the organisation can also promote sustainable development.

Implications for Master Plan 2050

- Acknowledging and respecting the cultural heritage of the land and its traditional custodians, and incorporating Indigenous perspectives into the development of the master plan.
- Engaging with local Aboriginal and Torres Strait Islander communities and organisations to build partnerships and promote cultural awareness.
- Embedding sustainable practices into the operations of the Sydney Olympic Park Authority, such as reducing waste, conserving water and energy, and promoting sustainable transport options.
- Encouraging sustainable development within Sydney Olympic Park, such as the use of renewable energy, sustainable building materials, and green infrastructure.
- Providing opportunities for Indigenous people to participate in the development and management of the master plan, and promoting Indigenous employment and training opportunities.
- Monitoring and reporting on sustainability performance, and integrating sustainability considerations into decision-making processes.
- Promoting public education and awareness of Indigenous cultures and reconciliation, and providing opportunities for visitors to learn about the cultural and environmental heritage of the area.



Figure 1.13 RAP (Source: SOPA)

1.A.11 Local Strategic Planning Statement, City of Parramatta

The Local Strategic Planning Statement (LSPS) for the City of Parramatta is a strategic document that guides land use planning and development within the local government area.

The LSPS outlines the vision, priorities, and objectives for the City of Parramatta over the next 20 years, and sets out strategies for achieving sustainable and resilient communities.

Sydney Olympic Park is specifically mentioned in the LSPS as an important economic and cultural hub within the City of Parramatta. The LSPS acknowledges the need to balance economic development with environmental and social sustainability, and identifies opportunities for sustainable growth within Sydney Olympic Park.

Implications for Master Plan 2050

- Encouraging the use of renewable energy and reducing carbon emissions within Sydney Olympic Park, in line with the City of Parramatta's target of net-zero emissions by 2030.
- Ensuring that new development within Sydney Olympic Park is designed to be resilient to the impacts of climate change, such as heatwaves and flooding.
- Incorporating green infrastructure and urban greening initiatives into the design of new development, to improve the local environment and promote biodiversity.
- Promoting sustainable transport options within and around Sydney Olympic Park, such as walking, cycling, and public transport, to reduce reliance on private cars and promote active lifestyles.
- Encouraging sustainable business practices within Sydney Olympic Park, such as waste reduction, water conservation, and sustainable procurement.
- Protecting and enhancing the cultural heritage and natural assets of Sydney Olympic Park, such as the Brickpit Ring Walk and the wetlands, and incorporating these features into the design of new development.
- Engaging with local communities and stakeholders in the development of the new master plan, and ensuring that their needs and aspirations are taken into account.

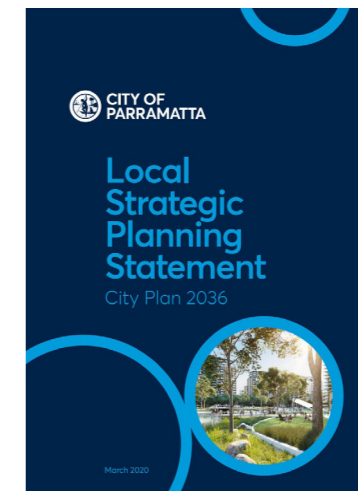


Figure 1.14 Parramatta LSPS (Source: CoP)



Figure 1.15 The Greater Parramatta and Olympic Peninsula (Source: Parramatta LSPS)

1.A.12 Community Strategic Plan, City of Parramatta

The Community Strategic Plan (CSP) for the City of Parramatta is a long-term plan that sets out the community's vision, goals, and priorities for the future.

The CSP is based on extensive community consultation and engagement, and is designed to guide decision-making and resource allocation over the next 10 years.

Sydney Olympic Park is specifically mentioned in the CSP as an important economic and cultural hub within the City of Parramatta. The CSP recognises the need for sustainable and resilient development in Sydney Olympic Park, and identifies opportunities for improving sustainability in the area.

Implications for Master Plan 2050

- Ensuring that new development in Sydney Olympic Park is sustainable and resilient to the impacts of climate change, and contributes to the City of Parramatta's target of net-zero emissions by 2030.
- Promoting sustainable transport options within and around Sydney Olympic Park, such as cycling, walking, and public transport, to reduce reliance on private cars and promote active lifestyles.
- Encouraging the use of renewable energy and promoting energy efficiency in buildings within Sydney Olympic Park.
- Incorporating green infrastructure and urban greening initiatives into the design of new development, to improve the local environment and promote biodiversity.
- Supporting sustainable businesses and encouraging sustainable practices within Sydney Olympic Park, such as waste reduction, water conservation, and sustainable procurement.
- Protecting and enhancing the cultural heritage and natural assets of Sydney Olympic Park, such as the Brickpit Ring Walk and the wetlands, and incorporating these features into the design of new development.
- Engaging with local communities and stakeholders in the development of the new master plan, and ensuring that their needs and aspirations are taken into account.
- Ensuring that the development of Sydney Olympic Park contributes to social sustainability, including improving access to affordable housing and promoting social inclusion.



Figure 1.16 Community Strategic Plan (Source: CoP)

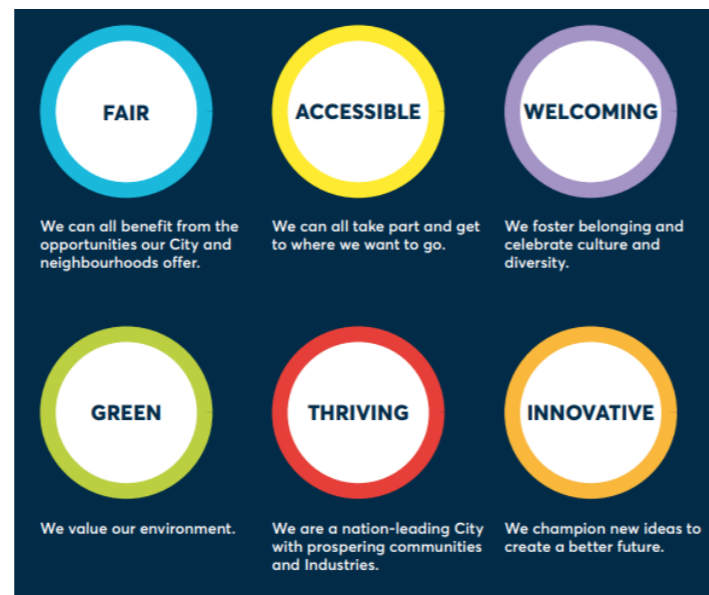


Figure 1.17 Community Strategic Plan Goals (Source: CSP)

1.A.13 Environmental Sustainability Strategy, City of Parramatta

The Environmental Sustainability Strategy of the City of Parramatta outlines the council's commitment to environmental sustainability and its goals, strategies, and actions to achieve them.

With regards to Sydney Olympic Park, the strategy notes that the area has a unique ecological landscape and provides significant opportunities for sustainable development.

The Environmental Sustainability Strategy highlights the importance of protecting and enhancing the natural environment of Sydney Olympic Park while promoting sustainable development and reducing environmental impacts.

Implications for Master Plan 2050

- The need to protect and enhance the natural environment of Sydney Olympic Park, including its wetlands, woodlands, and wildlife corridors.
- The importance of reducing greenhouse gas emissions from buildings, transport, and waste in the area.
- The potential for renewable energy generation and energy efficiency improvements in the area, such as through solar PV installations and smart building technologies.
- The need for water conservation measures and stormwater management strategies to protect the natural environment and reduce the impact of floods.
- The importance of promoting sustainable transport options, such as cycling and public transport, to reduce car use and associated emissions.
- The need to incorporate sustainable design principles into new developments in the area, such as green roofs and walls, and passive solar design.

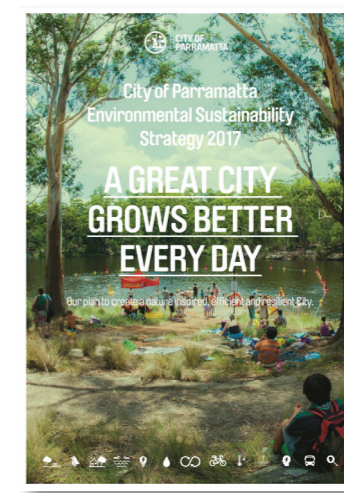


Figure 1.18 Environmental Sustainability Strategy 2017 (Source: CoP)



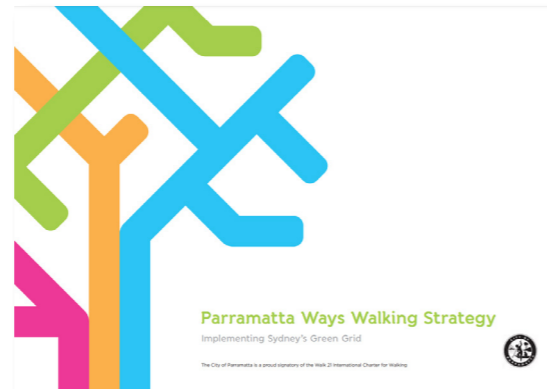
1.A.14 Ways Walking Strategy, City of Parramatta

The Parramatta Ways Walking Strategy aims to encourage walking as a sustainable mode of transport, improve walkability and accessibility, and promote active lifestyles.

Although Sydney Olympic Park is not specifically mentioned in the strategy, there are a number of recommendations which could be applied to the new master plan.

Implications for Master Plan 2050

- Improving walkability and accessibility in the park through the provision of safe, accessible and connected pedestrian paths and walkways.
- Enhancing the park's natural environment and biodiversity by preserving and restoring natural habitats and providing green open spaces for recreation and relaxation.
- Reducing carbon emissions by promoting walking as a sustainable mode of transport and encouraging the use of public transport and active transport options such as cycling.
- Promoting healthy lifestyles by encouraging regular physical activity through walking, and providing facilities such as walking tracks and trails that cater to all ages and abilities.
- Engaging with the community to encourage walking and active lifestyles through education and awareness campaigns, and involving them in the planning and design of walking infrastructure in the park.



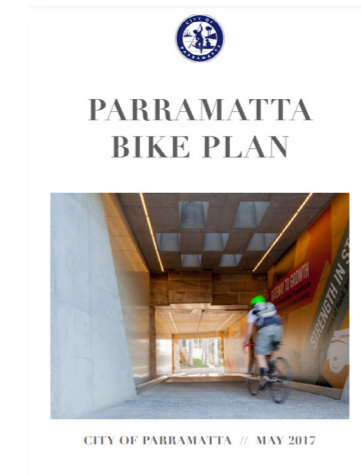
1.A.15 Bike Plan, City of Parramatta

The Bike Plan, City of Parramatta provides a comprehensive plan for improving cycling infrastructure and encouraging cycling as a sustainable mode of transport across the City of Parramatta.

While the plan does not specifically mention Sydney Olympic Park, it does provide an overarching strategy that could be applied to the park.

Implications for Master Plan 2050

- Development of a comprehensive network of cycling infrastructure within the park, including dedicated bike lanes and shared paths.
- Improved cycling connections between Sydney Olympic Park and neighbouring suburbs, including Parramatta and Rhodes.
- Implementation of bike share schemes within the park to encourage visitors to cycle instead of driving.
- Provision of secure bike parking facilities and end-of-trip facilities within the park to make cycling a more convenient and attractive option.
- Promotion of cycling as a sustainable and healthy mode of transport through marketing and educational campaigns.



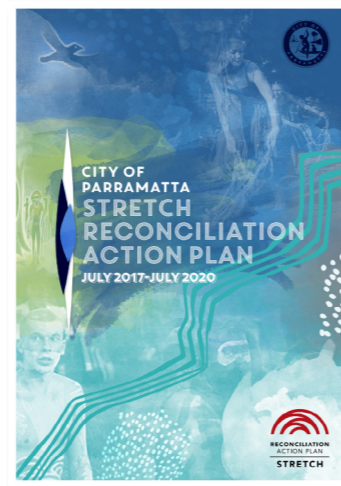
1.A.16 Stretch Reconciliation Action Plan (RAP), City of Parramatta

The Stretch Reconciliation Action Plan (RAP) of City of Parramatta aims to build relationships, create opportunities, and enhance respect between Aboriginal and Torres Strait Islander peoples and the broader community.

The plan focuses on four key areas: Respect, Relationships, Opportunities, and Governance.

Implications for Master Plan 2050

- Acknowledge and pay respect to the traditional owners of the land and their cultural heritage within the Sydney Olympic Park Master Plan.
- Develop an Aboriginal and Torres Strait Islander Cultural Heritage Management Plan that aligns with the Sydney Olympic Park Master Plan.
- Work with the Aboriginal and Torres Strait Islander community to increase access and participation in education, training, and employment opportunities, including sustainable tourism and cultural activities within Sydney Olympic Park.
- Promote and celebrate Aboriginal and Torres Strait Islander culture and heritage through events, arts, and cultural programs at Sydney Olympic Park.
- Collaborate with the Aboriginal and Torres Strait Islander community to identify and protect sites of cultural significance within Sydney Olympic Park.
- Provide opportunities for Aboriginal and Torres Strait Islander peoples to participate in the development of environmental and sustainability policies and strategies related to Sydney Olympic Park.
- Ensure that the design, construction, and operation of buildings and infrastructure within Sydney Olympic Park aligns with sustainable principles and minimises environmental impact.



1.A.17 Waste Avoidance and Resource Recovery Strategy 2019-2023, City of Parramatta

The Waste Avoidance and Resource Recovery Strategy 2019-2023 of the City of Parramatta aims to reduce waste generation and increase recycling and resource recovery.

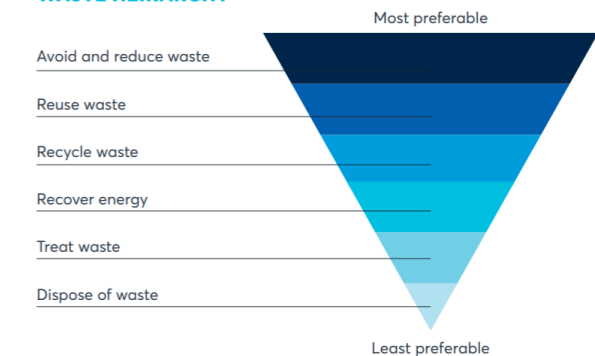
The strategy includes actions to reduce waste, increase recycling and composting, and improve education and awareness about waste reduction and recycling.

Implications for Master Plan 2050

- Implementation of a food waste collection system for commercial and industrial premises.
- Encouragement of waste reduction and recycling in the Sydney Olympic Park Authority's procurement processes.
- Collaboration with the Sydney Olympic Park Authority to improve waste management practices and facilities.
- Implementation of a waste education and awareness program for residents, businesses, and visitors of Sydney Olympic Park.
- Development of a resource recovery facility in the Parramatta LGA to process organics and other materials.
- The need to integrate waste management and resource recovery principles into the new master plan for Sydney Olympic Park.



WASTE HEIRARCHY



Appendix B | Development Context

1.B.1 Creating Great Australian Cities, Property Council of Australia

The Property Council has commissioned this project to stimulate debate about the future of our cities, to improve public understanding of the issues at stake, and to help governments make good decisions for the future.

This report examines what is required to create great Australian cities. It provides an 'outside in' perspective based on our analysis of city megatrends, new research into global benchmarks, international case studies and the distinctive underlying issues present in Australian cities.

This research identified ten megatrends that will shape Australia's cities for decades to come:

- Urbanisation and metropolitan growth
- Aging population
- Exponential technology change
- Globalisation of trade, supply and value chains
- Intensifying climate change
- Re-urbanisation of jobs and capital
- Economic transition and the rise of the innovation economy
- The rise of Asia
- Resource scarcity and energy convergence
- Rising infrastructure and governance gaps

Implications for Master Plan 2050

- A consistent high rate of infrastructure investment and infrastructure finance innovation
- Use of public land, anchors and assets to strategic goals allows cities to unlock new areas of opportunity, catalyse new development processes, and adjust to new economic and social trends.
- A high quality of placemaking, place management and tactical urbanism
- Master-planning and pooled public budgets for neighbourhoods and areas
- Growing political divides between educated 'anywheres' and rooted 'somewheres'.
- Spiralling climate, pollution and health threats result in much more frequent extreme weather.
- Governments, companies and societies will be forced to create more capacity to combat challenges, but stronger planetary pushback may exacerbate existing concerns and create new ones.
- More cities become exposed by failures to integrate climate change with public health, co-ordinate among local governments, and support the most vulnerable groups.
- New weather patterns and extreme events incur immediate costs and long-term effects on productivity, tourism and reputation associated with damaged natural assets.
- Reduced investor appeal if resilience against unexpected events is not improved.
- Spikes of migration from other climate-affected regions.



Figure 1.19 Creating Great Australian Cities (Source: Property Council of Australia)

FIGURE 5 Collective performance of Australia's big five cities versus aggregate scores of benchmark countries

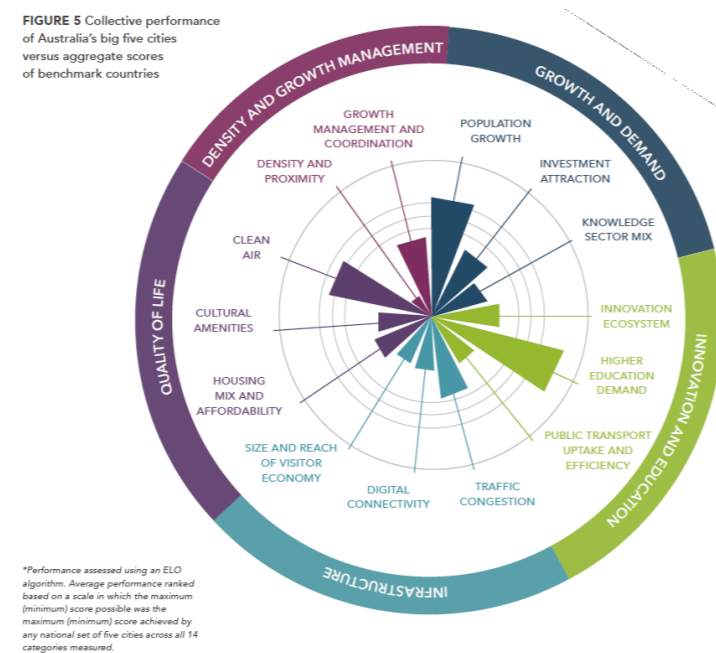


Figure 1.20 t

1.B.2 Creating Great Australian Cities: Insights for Sydney, Property Council of Australia

The report sets out a further 12 broad recommendations designed to equip Australian cities for the future. The Property Council has distilled these into 3 key actions for Sydney.

When evaluated against more than 300 benchmarks to assess relative performance, Sydney is an established member of the second tier of 'contender' cities, in a peer group with cities such as San Francisco, Boston, Toronto and Madrid. Sydney's success, as evidenced by global benchmarks and the mix of its global functions, means it is now a 'contender' among the established group of global cities.

For Sydney, the 'outside-in' analysis against the comparable cities revealed that:

- Sydney's industry profile is globally facing, comparable to Toronto and Stockholm, but there is room to grow and diversify the knowledge economy to the likes for San Francisco
- Sydney is very prominent in global benchmarks relative to its size and economic role
- Sydney is ranked in the bottom third of cities globally for peak period congestion
- Sydney is one of the most unaffordable metropolitan markets in the world, substantially more expensive than nearly all North American and European metros.

Implications for Master Plan 2050

- Higher than average congestion
- Lower than average public transport coverage
- Growing commute distances
- Lengthening commute times and journey times
- Low digital/internet speeds
- High carbon intensity of infrastructure systems
- Relatively low density urban forms leading to lower public transport suitability.



Figure 1.21 Creating Great Australian Cities: Insights for Sydney (Source: Property Council of Australia)

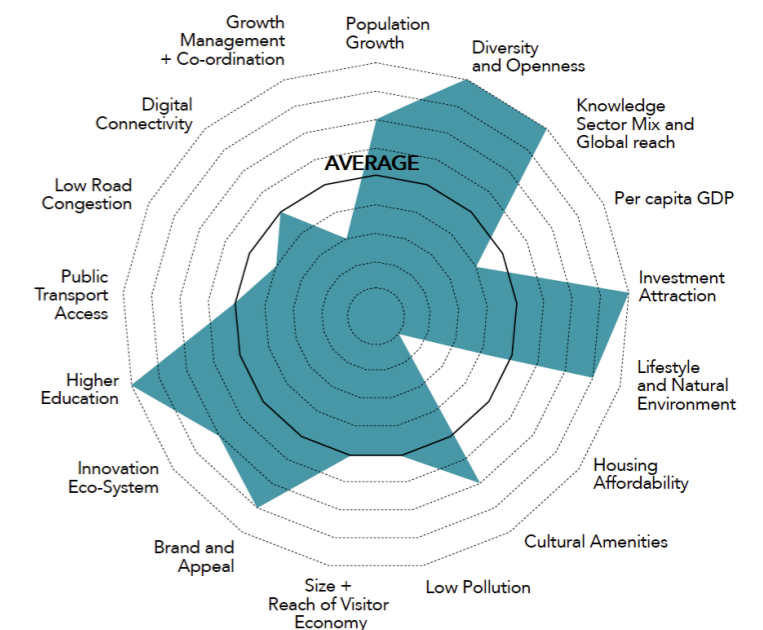


Figure 1.22 Performance of Sydney versus aggregate scores of benchmark countries (Source: Property Council of Australia)

1.B.3 A Common Language for Social Sustainability, Property Council of Australia

A common language for social sustainability, launched by the Property Council in 2018, sparked a new industry conversation about the S in environmental, social and governance.

The handbook, A common language for social sustainability, provides definitions and context of social sustainability and the 17 Sustainable Development Goals.

The handbook covers five key areas and uses examples to explain how social sustainability applies to:

- Culture and community
- Health and wellbeing
- Mobility and access
- Equity and fair trade
- Economic outcomes

Implications for Master Plan 2050

- Contributing to ‘closing the gap,’ reconciliation, and Indigenous inclusion are critical success factors.
- Community engagement, investment, and partnership is key to generating buy in, shared value, and long-term success.
- Diversity of race, ethnicity, gender, sexual orientation, socio-economic status, work experience, educational background, marital or parental status, income, age, physical abilities, geographical location, religious beliefs, political beliefs or other ideologies throughout operations is necessary.
- Placemaking reveals and responds to the location, culture and people that gives each place its unique value and authentic qualities.
- The capacity of communities and their members to survive, adapt and grow, regardless of the chronic stresses and acute shocks imposed by the economy or natural environment needs more focus.
- Health and wellbeing needs to be viewed as a state of “complete physical, mental and social wellbeing and not merely the absence of disease of infirmity”, as defined by the World Health Organisation.
- The key components that influence the health, comfort and wellbeing of building occupants. IEQ is determined by many factors, including air quality, lighting and views, acoustic and thermal comfort, radiation, décor, amenity, layout and ergonomics.
- Liveability is important and broad, encompassing: the built and natural environments; economic prosperity and affordability; social diversity, stability and equity; educational opportunity; cultural, entertainment and recreation. Other factors influencing community liveability include: amenities; connection or sense of belonging; sense of safety; education provision; support for personal health; resilience and citizenship.
- The goal of accessibility is to create an inclusive society for all people, regardless of their physical, mobility, visual, auditory or cognitive abilities.
- Equal access to community resources and opportunities. No individuals or groups of people should be asked to carry a greater social or environmental burden than the rest of the community.



Figure 1.23 A Common Language for Social Sustainability (Source: Property Council of Australia)

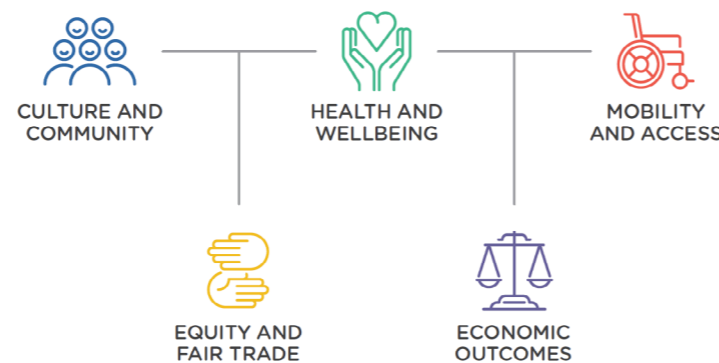


Figure 1.24 Social sustainability themes (Source: Property Council of Australia)

1.B.4 Health & Well-being in Real Estate, Green Health Partnership and GRESB

This report summarises outcomes from a multi-year collaboration between the Green Health Partnership and GRESB to provide real estate companies and investors with actionable information on health and well-being within ESG (environment, social, governance) reporting.

Health and well-being are emerging as a global leadership and market differentiation opportunity for property companies and funds around the world. Forward-looking real estate companies and investors incorporate environmental, social and governance (ESG) considerations into business operations. While human health and wellbeing is an implicit component of ESG, it is now becoming an intentional and increasingly institutionalised focus across the entire real estate industry.

Implications for Master Plan 2050

- High performing employees – present, healthy, engaged – are prepared to support high performing companies.
- An explicit focus on health and well-being helps fund managers maximise the potential value of real estate assets and services and mitigate associated risks.
- Engaged investors ask about efforts to promote health through real estate fund management and development.
- Top performing companies implement holistic processes that influence asset design, construction and operation to promote health and well-being among employees, tenants and communities. Engaged investors ask about the purpose and scope of an organisation’s health efforts.
- Engaged investors ask organisations about the quality of health strategies management and request information about results.
- Engaged investors ask organisations about the presence or state of development of fundamental health promotion processes, including leadership, policy, needs assessment, business strategy and performance measurement.
- Companies should ensure that health and well-being are explicit components of business strategies.
- Increase utilisation of secondary data while working to increase the availability of primary data.
- Leading companies are implementing a variety of actions, simultaneously including those related to asset design, operation and programming as well as actions to benefit the communities surrounding assets.
- Many GRESB participants use third party building certifications to take action to promote health and well-being for tenants and customers (WELL or Fitwel).



Figure 1.25 Health & Well-being in Real Estate (Source: Green Health Partnership and GRESB)

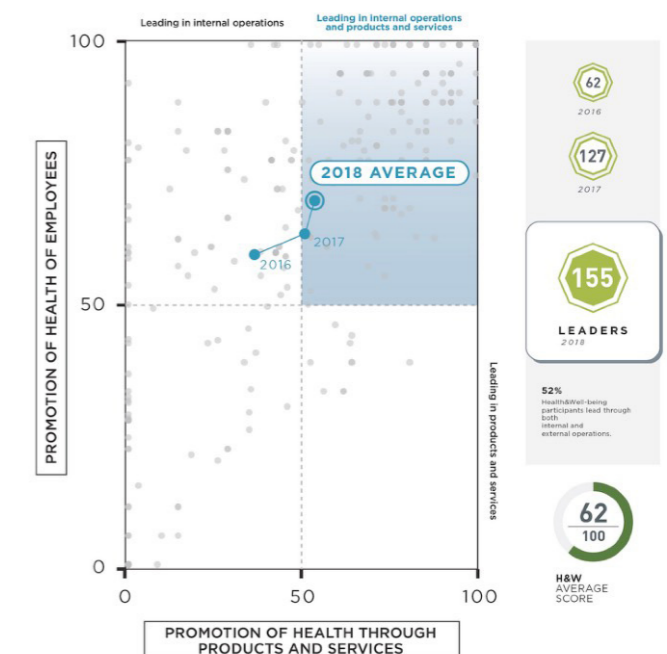


Figure 1.26 Average GRESB Health & Well-being score (Source: Green Health Partnership; and GRESB)

1.B.5 Unleashing Sydney’s Innovation Economy, Committee for Sydney

Sydney currently faces an opportunity to drive innovation to emerge economically strong with world-changing ideas.

- The recommendations in the report are summarised into five ideas:
- Invest government dollars in important R&D efforts.
 - Make it easy to start new companies and create good jobs.
 - Make Sydney’s underlying economic systems more efficient.
 - Make it easy for talented people to come and stay in Sydney.
 - Give Sydneysiders the skills they need to be successful

Implications for Master Plan 2050

- A shared goal to actually drive collaboration is required
- Support a strong governance model that supports collaboration
- Encourage collaboration from major anchor tenants – a major, established international firm and a university with research expertise in the relevant area,
- Support University-led research tethered to the hub
- Implement shared-use facilities to support local firms and researchers
- Create an ecosystem of start-ups and SMEs operating within the precinct, supported by incubators/hubs
- Link a precinct with a specific problem and goal, aligned with a CSIRO National Mission – with government funding to drive research
- Provide affordable and non-market housing
- Make Sydney a vibrant, cultural city by: improving the night-time economy; funding the cultural sector to improve Sydney’s
- Global cultural standing; promoting the existing diverse, multicultural culture across Sydney.
- Encouraging high-density, well-connected communities;
- Mitigate and adapt to climate change to protect Sydney from heat, sea-level rises and natural disasters



Figure 1.27 Unleashing Sydney’s Innovation Economy (Source: Committee for Sydney)

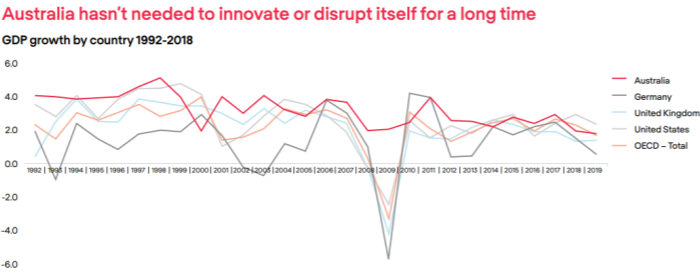


Figure 1.28 GDP growth by country compared to Australia 1992-2018 (Source: Committee for Sydney)

1.B.6 Decarbonising Sydney, Committee for Sydney

This report considers further actions to prepare Sydney for a decarbonised economy, building on the expected successful delivery of emissions reductions in the NSW Electricity Infrastructure Roadmap.

It identified five key moves to put Sydney on track for net zero:

1. Electrify Sydney’s road transport with 40% sustainable transport by 2030; fuel emissions standards for cars and trucks; and a date to shift all car sales to electric, and all truck sales to battery or hydrogen
2. More sustainable buildings with electric space heating, water heating and cooking, gas phased out in new buildings, and residential energy performance disclosure
3. Increase distributed energy with incentives for rooftop solar, battery storage and smart meters, and better access for low-income groups, renters and others
4. Prepare the energy grid with innovative tariffs and demand management measures to reward customer behaviour, and vehicle to grid technology
5. Work collaboratively across Greater Sydney to track and manage progress to emissions goals, and accelerate coal closures to make up the deficit if needed.

Implications for Master Plan 2050

- Increase EV charging infrastructure in the public domain and in private developments of all types.
- Supporting retrofitting of EV infrastructure in existing buildings.
- Ban on new residential and commercial gas connections.
- Strengthen building codes and guidelines for focus on passive heating and cooling – and reduce reliance on electricity where possible.
- Update planning instruments (e.g. Exempt and Complying Development, DCP and LEP) to encourage electrification of buildings including provision of incentives.
- Use incentives to accelerate the uptake of rooftop solar and distributed battery storage,
- Support access to community-scale batteries for lowrise commercial or public buildings, which would also help lower income households access solar

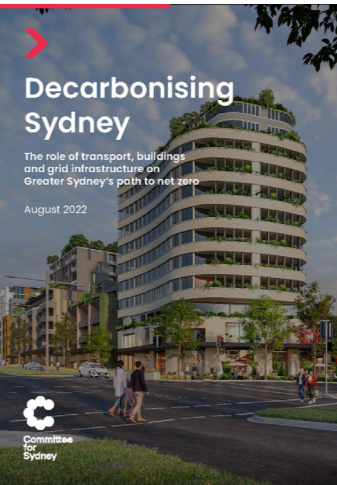


Figure 1.29 Decarbonising Sydney (Source: Committee for Sydney)

Chart 8: Electrification of household energy use could reduce household energy costs ~\$1900 per year by 2050, a 45% reduction from 2020

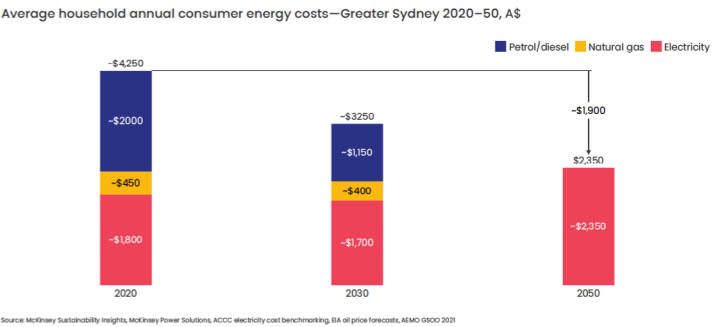


Figure 1.30 Average household annual consumer energy costs—Greater Sydney 2020–50, A\$ (Source: Committee for Sydney)

Chart 9: Decarbonisation technologies could reduce consumer energy costs by ~80% to <\$1,000, from ~\$4,250 today

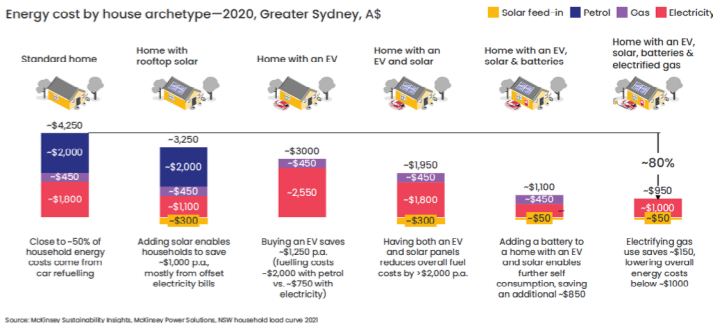


Figure 1.31 Energy cost by house archetype—2020, Greater Sydney, A\$ (Source: Committee for Sydney)

1.B.7 Nature Positive Sydney, Committee for Sydney

The report discusses the importance of increasing living infrastructure in Greater Sydney, highlighting the benefits of nature in urban environments.

It emphasises the need for a strategic approach to incorporate living infrastructure, such as trees, green roofs, and waterways, into the city's planning and development. The report focuses on various strategies and actions to achieve this goal, including community education, setting clear targets, driving structural investment, and aligning asset management and procurement processes.

Implications for Master Plan 2050

- Prioritise living infrastructure like trees, green spaces, and water features.
- Involve locals in living infrastructure initiatives, like the “Cool Streets Pilot Project.”
- Set specific goals for tree canopy, green roofs, and water-sensitive design.
- Secure funding for sustainable living infrastructure through funds or partnerships.
- Require landscape architects in design; consider living infrastructure alternatives.
- Use a Green Factor Tool to incentivise living infrastructure in new developments.
- Regularly assess biodiversity, air quality, temperature reductions, and community engagement.
- Incorporate Indigenous perspectives on nature and design.
- Use living infrastructure to adapt to climate change and reduce urban heat.

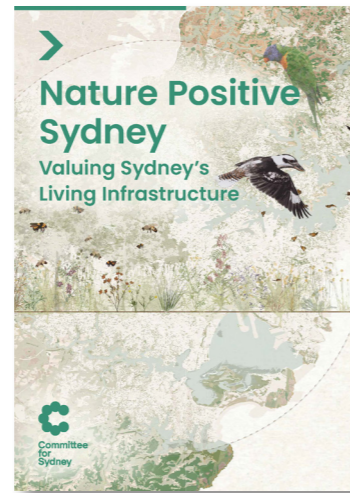


Figure 1.32 Nature Positive Sydney - Valuing Sydney's Living Infrastructure
(Source: Committee for Sydney)

1.B.8 Rethinking Station Precincts, Committee for Sydney

The network of Sydney Metro and Sydney Trains will support a polycentric growth model for Sydney.

The network of Sydney Metro and Trains will grow to 338 stations when the current projects are complete.

The Strategy outlines the following objectives:

1. Allow more of Sydney's growth in walking distance of rail and Metro stations
2. Ensure growth is high quality, supports community life and helps make areas more liveable.

Implications for Master Plan 2050

- Establish clear growth targets around stations – set a goal to accommodate at least 40-45% of Sydney's population growth in walking distance of train and Metro stations
- Establish effective governance for station precincts – set up a delivery authority for each Major Station Precinct with significant government landholdings, and establish collaborative governance structures to work with councils on other locations
- Selectively retain strategic sites in public ownership around stations – where government owns land around strategic station precincts, government should retain a long term leasehold interest (99 years) to enable the land to revert to government for re-leasing, value capture and precinct redevelopment
- Ensure infrastructure contributions are communicated in advance and effectively applied – to help fund local improvements and transport operations, as well as generalised public services
- Encourage sustainable transit – put parking in the right locations so it does not disrupt the walkability and amenity of station precincts
- Require more affordable rental housing in station precincts – make it a condition of rezoning that a minimum commitment of 5% affordable housing is delivered on private sites, and 10% on government sites.

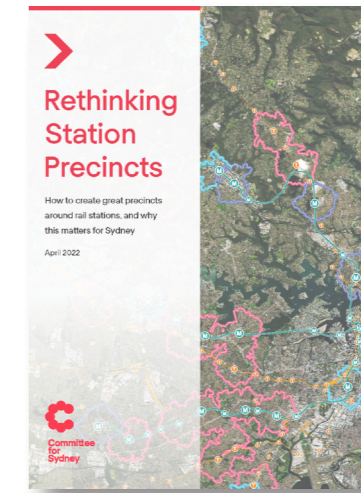


Figure 1.33 Rethinking Station Precincts (Source: Committee for Sydney)

1.B.9 Unlocking the pathway: Why electrification is the key to net zero building, Australian Sustainable Built Environment Council (ASBEC)

A report from the Australian Sustainable Built Environment Council (ASBEC) confirms 100% electrification is the lowest cost, fastest emissions reduction pathway for Australia’s built environment.

SPR modelled three ‘plausible but divergent’ decarbonisation scenarios: 100% electrification; a combination of electrification and green hydrogen; and a ‘base case’, representing ‘business as usual’ of electrification, fossil gas, green hydrogen and carbon offsets.

This report finds 100% electrification is the lowest cost option to decarbonise our built environment – but lowest cost does not mean no cost. Our detailed analysis by building type, geography and lifecycle reveals that electrification, while necessary, is not always cost-beneficial. Failing to acknowledge and address these costs will significantly impede the transition to net zero building operations.

Implications for Master Plan 2050

- Energy efficiency matters to the electrification agenda. A wealth of literature supports a “fabric first” approach to energy efficiency, in which the building does the hard work rather than bolt on energy devices.
- Improvements to energy efficiency can decrease the space requirements and size of equipment, minimise the need for purchased energy, and enable a higher share of operational costs to be covered by rooftop photovoltaics.
- The building sector cannot rely on offsets in the future, as these will need to be allocated to sectors that are harder to abate in other words, those industries that don’t have the decarbonisation solutions readily available.



Figure 1.34 Unlocking the pathway: Why electrification is the key to net zero building (Source: ASBEC)

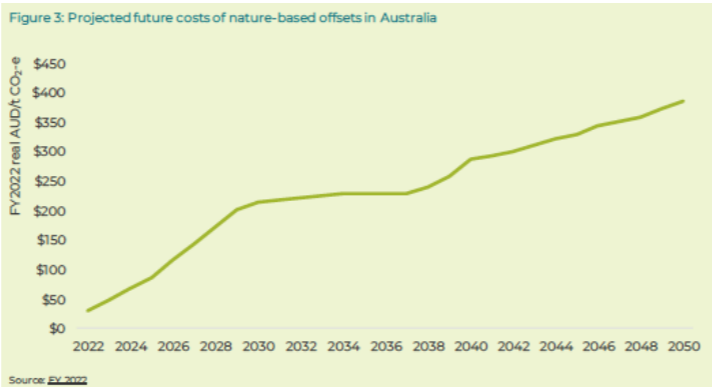


Figure 1.35 Projected future costs of nature-based offsets in Australia (Source: ASBEC)

1.B.10 Rapid and Least Cost Decarbonisation of Building Operations, Australian Sustainable Built Environment Council (ASBEC)

The “Rapid and Least Cost Decarbonisation of Building Operations” project which encompasses new and existing, commercial and residential buildings examines the lowest cost pathways to decarbonise building operations aligned with a net zero by 2050 target.

Specifically, the final report is intended to provide:

- A detailed inventory of operational emissions (scope 1 and scope 2) in residential and commercial buildings
- A detailed characterisation of decarbonisation options available to building owners, and the internal costs, benefits and barriers associated with each option
- Modelling which considers the likely take up of decarbonisation options in at least three divergent scenarios for decarbonisation of fuel sources (including electricity, gas, biofuels and hydrogen)
- Analysis of implications for industry and government.

Implications for Master Plan 2050

- Solar and battery storage technologies, and the new business models that they enable, are disrupting traditional energy supply models but also creating significant value for consumers.
- Power Purchase Agreements (PPAs) allow customers to hedge electricity price risks at the same time as ensuring their consumption is fully supplied by renewable energy sources. They also enable building owners to choose a fully electric solution while achieving zero operational emissions immediately, ahead of full grid decarbonisation.
- Solar energy systems, batteries, and demand management require long term investments, but returns are highly susceptible to short term changes in tariffs and regulatory settings.
- The electrification of the transport sector, now underway around the world albeit more slowly in Australia will shift much of the transport energy demand to the built environment, with many electric vehicle (EV) drivers and fleets recharging their vehicles at home or at work, adding to building loads.
- EVs offer the facility of being ‘batteries on wheels’, with vehicle to load (VTL) possibilities, along with smart chargers, enhancing grid stability.



Figure 1.36 Rapid and Least Cost Decarbonisation of Building Operations (Source: ASBEC)

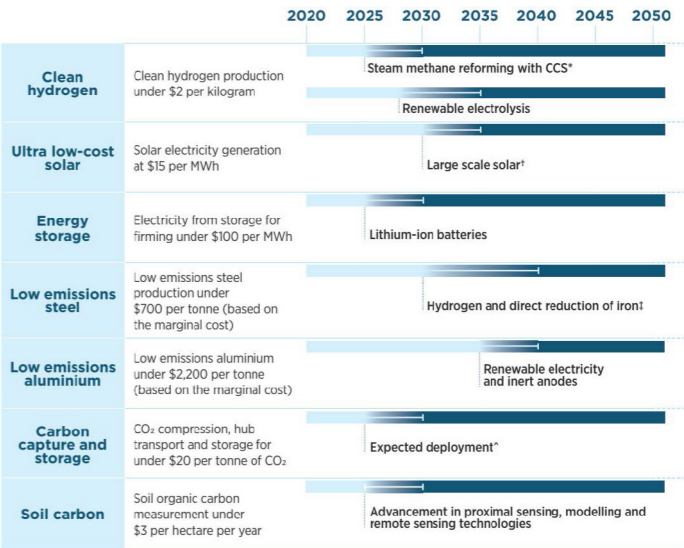


Figure 1.37 The Australian Government's Long Term Emissions Reductions Plan (Source: ASBEC)

1.B.11 Five ways the built environment can help Australia transition to a net zero future, Australian Sustainable Built Environment Council (ASBEC)

The Australian Sustainable Built Environment Council (ASBEC), as the peak body of key organisations committed to a sustainable, productive, resilient built environment in Australia, urges the federal government to seize the unique opportunity the built environment offers to dramatically reduce carbon emissions in highly cost-effective ways that will also stimulate the economy.

In this policy platform for COP26, ASBEC recommends five practical policies across residential, commercial and public buildings that should be implemented by federal government to drive emissions reduction:

1. Give households the energy performance information they need to achieve healthy, affordable, comfortable homes
2. Demonstrate government leadership through high performing government buildings
3. Position Australia as a global leader in high performance building products and technologies
4. Provide economic stimulus by incentivising building upgrades
5. Deliver a Net Zero Carbon Ready building code and pathways to decarbonise building operations

Implications for Master Plan 2050

- Support beyond code energy efficiency standards.
- Publicise consistent, easily-understood information about home energy performance.
- Prioritise passive design strategies to maximise energy efficiency.
- Implement a best practice governance model based on NABERS that brings governments together with industry to collectively manage energy performance benchmarks for homes.
- Assertive action is needed to raise the energy performance of new buildings and incentivise investment in existing building upgrades.
- Measures could include strong minimum standards for new buildings and fit-outs, targets for onsite energy efficiency and requirements around renewable energy, offsite renewable energy and offsets.
- Promote the adoption of building sustainability rating systems such as Green Star and NABERS to drive sustainable outcomes.
- Review of existing accommodation and leasing policy presents an opportunity for leadership in the transition towards net zero buildings.
- High performance glazing and heat recovery ventilation systems.
- Building and precinct level batteries.
- Thermal or battery energy storage at the building level to support local energy generation.
- Using electric vehicles and building and precinct level batteries to provide distributed energy storage, flatten energy demand and reduce the impact of peak events.
- 10% reduction in embodied emissions in new commercial and residential buildings.
- Incentivise deep retrofits to improve performance.



1.B.12 Issues Paper: Reshaping Infrastructure for a net zero emissions future, Infrastructure Sustainability Council of Australia (ISCA), ClimateWorks Australia, and the Australian Sustainable Built Environment Council (ASBEC)

The Issues Paper: Reshaping Infrastructure for a net zero emissions future is designed to progress a new conversation to better understand the challenges and opportunities in reshaping transport, energy, water, communications and waste infrastructure for a net zero emissions world.

It is the first step in a broader effort to reshape Australia's infrastructure agenda and makes the case for why emissions reductions should be prioritised in infrastructure advice and decisions today.

Implications for Master Plan 2050

- Planning for sector transitions to net zero emissions (e.g. in electricity and transport), and identifying strategic infrastructure needs and priorities to enable these transitions.
- Examining proposed needs, issues and opportunities for compatibility with a broad set of scenarios achieving net zero emissions by 2050.
- Designing adaptive strategies, where required, to ensure solutions are resilient to future changes.
- Drawing on existing standards to guide design and lifecycle decisions, such as Green Building Council of Australia's Green Star tool, and ISCA's Infrastructure Sustainability Planning Rating Tool. Upgrading or developing new tools where relevant.
- Prioritising and investing in infrastructure projects critical to enabling a net zero emissions future.
- Testing the performance of project options against a broad set of scenarios achieving net zero emissions by 2050, with only those that perform well in such scenarios progressing to business case development.
- Drawing on existing standards to guide investment decisions at the portfolio and asset level, such asGRESB's Infrastructure Assessment tool. Upgrading or developing new tools where relevant.
- Undertaking detailed cost-benefit analysis (and sensitivity tests of demand and cost modelling) of chosen project design, testing for robustness across a variety of future climate change scenarios, including multiple net zero emissions by 2050 scenarios.
- Setting emissions performance standards for infrastructure, including caps for emissions embodied in construction materials, produced during construction and operation.
- Seeking opportunities to reduce operating emissions (e.g. through retrofitting infrastructure, or through renewable power, energy efficiency, electrification, and offsets)
- Reviewing projects post-completion to evaluate whether a project achieved its emissions performance objectives, along with its strategic objectives and economic performance.



Figure 1.38 Issues Paper: Reshaping Infrastructure for a net zero emissions future (Source: ISCA, ClimateWorks Australia, and ASBEC)

FIGURE 3: Carbon reduction potential of strategic infrastructure choices²⁸

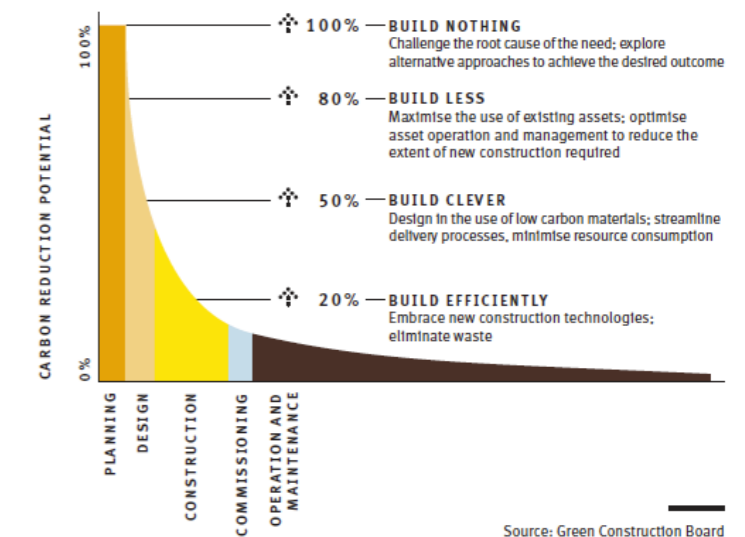


Figure 1.39 Carbon reduction potential of strategic infrastructure choices (Source: ISCA, ClimateWorks Australia, and ASBEC)

1.B.13 Green Star Future Focus, Green Building Council of Australia (GBCA)

In March 2018, Green Building Council of Australia (GBCA) embarked on an ambitious journey to reshape the Green Star rating system and create the next evolution of the tools.

Green Star Future Focus will see the rating system evolve and adapt to ensure the sustainable built environment delivers what it needs to, whilst also responding to global megatrends and emerging challenges.

Implications for Master Plan 2050

- Amenities that enhance a person’s well-being, encourage healthy and active transport and lifestyle decisions.
- Mimic or connect with nature and provide a comfortable environment.
- Conceived, built and operated to reduce or eliminate toxic materials, are well ventilated and lit.
- Ready to address the future impacts of climate change and to respond positively to other changes and shocks.
- Resilient to natural disasters and man-made impacts including changing technology and demographics.
- Resilient to long-term risks to its value.
- Minimise exposure to risks negatively impacting people’s health and human rights.
- Continue working in the face of adversity.
- Make the community and surroundings more resilient too.
- Highly efficient with the use of our limited natural resources.
- Lower energy consumption thanks to smarter design.
- Renewable energy powers the buildings and infrastructure (on-site or off-site).
- Mostly fossil-fuel free and is carbon neutral by offsetting all its emissions.
- Reducing and offsetting its embodied carbon.
- Smart, well-designed, managed and governed.
- Safe, comfortable, inclusive and of high amenity.
- Improve the urban fabric, enhance the local infrastructure, and provide value to the community.
- Designed for everyone, beyond accessibility compliance laws.
- Designed to respect and celebrate our culture and our history.
- Built with consideration of the rights of future occupants, the workers involved, those involved in the supply chain, and those in the surrounding community.
- considerate of the current and historic impacts to our natural environment.
- Reduce any impact on the site and enhance it as much as possible.
- Contribute to increasing the ecological value and biodiversity of the site and beyond.
- Connect green corridors in the city and work to enhance a city’s biodiversity.



Figure 1.40 Green Star Future Focus (Source: GBCA)

1.B.14 Green Star for Communities: A Future Focus Discussion Paper, Green Building Council of Australia (GBCA)

Green Star Communities aims to continue the success of Green Star on a precinct scale.

It aims to provide a clearer definition of a sustainable precinct, as well as set a pathway for net zero precincts to be delivered over the next decade. Green Star Communities:

- Introduces a new set of categories and credits reflecting issues relevant to the market now and in the future
- Prioritises the elimination of carbon emissions from the built environment
- Considers impacts at a precinct and building level
- Establishes a clear, well-defined entry point for best practice precincts
- Caters to distinct sectors through the introduction of sector specific credit

Implications for Master Plan 2050

- A new definition of a community
- A broader scope of issues with a clearer and more accessible language.
- All projects to deliver carbon reductions.
- Exploring the goal of net zero emissions precincts by 2030.
- Including a focus on buildings.
- The rating tool will place greater weight on the sustainability of built form, whilst acknowledging diverse levels of control across precinct types.
- Ensuring that all projects deliver a minimum set of clearly defined outcomes that align with what stakeholders are wanting in a sustainable precinct, in the short and long term.
- Higher levels of sustainability leadership, with the recalibration of requirements for 4,5 and 6 star.
- More consistent categories and language across all rating tools -to maximise how tools may work together, reduce documentation, and increase understanding of the benefits.



Figure 1.41 Green Star for Communities: A Future Focus Discussion Paper (Source: GBCA)

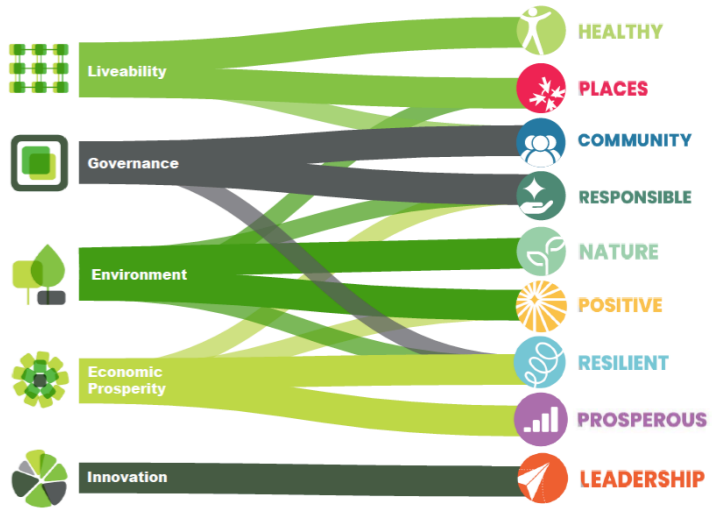


Figure 1.42 Alignment of old to new categories (Source: GBCA)

1.B.15 Climate Positive Roadmap for Precincts, Green Building Council of Australia (GBCA) 1.B.16 Green Star Buildings v1, Green Building Council of Australia (GBCA)

The Climate Positive Roadmap for Precincts contains a set of principles to guide precinct carbon reductions and ambitious targets for all new precincts to be climate positive by 2030 and existing precincts by 2050.

It spells out the five key actions to achieve climate positive precincts:

1. Embed climate positive pathways into all stages of planning.
2. Commit to fossil fuel-free precincts, and ensure policy and planning processes support this ambition.
3. Remove the barriers to low carbon precinct energy solutions.
4. Drive lower upfront carbon in materials and construction activity.
5. Commit to delivering low carbon buildings in all precincts.

Implications for Master Plan 2050

- Building & precinct scale energy generation and storage.
- Electric vehicle optimisation for transport, solar energy capture and building consumption.
- Intelligent microgrids and virtual power plants balancing energy supply and demand.
- Precinct scale energy trading supported by networked metering and retail platforms.
- Offsite power purchase agreements for renewable energy.
- Capture of waste heat and coolth for re-use.

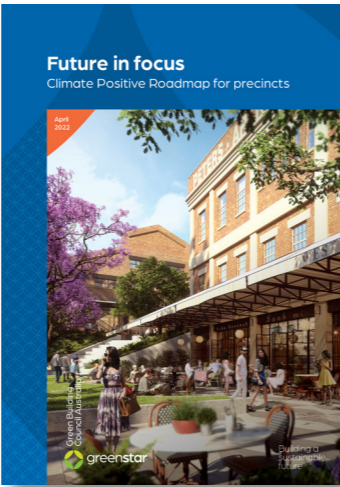


Figure 1.43 Climate Positive Roadmap for Precincts (Source: GBCA)

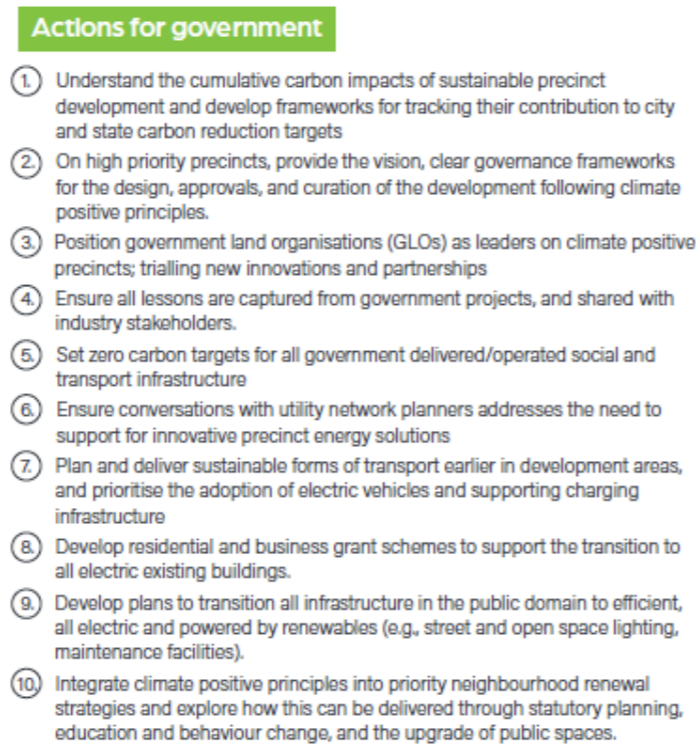


Figure 1.44 Actions for government to deliver climate positive precincts (Source: GBCA)

The latest version of the Green Star Buildings rating tool is the first to be aligned with the new focus areas aligned with megatrends.

Some key insights we think will translate over to the newest version of the Green Star Communities tool:

Implications for Master Plan 2050

- 10 Minimum Expectations that must be achieved by all projects
- 6 Star rated projects must be designed to be fossil fuel free, powered by renewables, and built with low carbon materials
- Rewards products that have lower environmental impact, are transparent, respect human rights, and are lower in carbon content
- Creating a driver for low carbon products by introducing a requirement that must be met by all buildings to reduce their embodied carbon to achieve a rating
- Climate Positive Pathway will increase in stringency over time.



Figure 1.45 Green Star Buildings v1 (Source: GBCA)



Figure 1.46 Green Star Buildings v1 categories (Source: GBCA)

Credits	Criteria	2020*	2023*	2026*	2030**
Energy source	Renewable electricity	6 star	5 star	All registrations	All certifications
	Renewable energy	6 star	5 star	All registrations	All certifications
Energy use Reductions over typical building	10% reduction	All ratings			All certifications
	20% reduction	6 star	5 star	All registrations	All certifications
	30% reduction				
Upfront carbon emissions Reductions over a typical building	10% reduction	All registrations			All certifications
	20% reduction	6 star	5 star	All registrations	All certifications
	40% reduction			5 star	All certifications
Other carbon emissions	Scope 1 eliminated or offset (refrigerants and fossil fuels)	6 star	5 star	All registrations	All certifications
	All remaining emissions offset (embodied carbon and other under control)		6 star	5 star	All certifications***

* Denotes year of registration
** Denotes year of completion
*** under consideration

Figure 1.47 Increasing stringency of Climate Positive Pathway over time (Source: GBCA)

1.B.17 Future of NABERS Energy (FoNE) Consultation Paper, NSW Government

Over the past decade, the property and energy markets have gone through several transformations, such as the decarbonisation of the grid and the rise in net zero emissions targets.

The Future of NABERS Energy project seeks to adapt NABERS Energy to these trends. NABERS has developed proposals in consultation with a Technical Working Group and the NABERS National Steering Committee, and is now inviting stakeholders to provide feedback.

Key topics in this consultation paper include:

- Update to the emissions factors used in NABERS
- Recognition for net zero emissions
- Enhanced recognition for renewable energy purchases
- Aligning to the Greenhouse Gas Protocol's market-based carbon accounting method
- Renewable energy purchasing

Implications for Master Plan 2050

- Current average NABERS Energy ratings for 100% electric buildings in NSW is ~4 Star.
- Average NABERS Energy rating for 100% electric building in NSW based on predicted future National Greenhouse Accounts (NGA) emissions factors will be ~4 Star.
- Lower emissions fuel choices will continue to be rewarded in ratings.
- Over the past year, various Property Council Australia (PCA) members and Technical Working Group (TWG) members have requested that NABERS consider introducing a net zero emissions recognition for existing buildings, that could be conducted alongside a NABERS Energy rating.
- NABERS proposes to recognise buildings that are energy efficient and run on 100 % renewable energy with a NABERS Net Zero Emissions certification.
- The proposed NABERS Net Zero Emissions certification would be equivalent to the 7th star of NABERS Energy with GreenPower.
- The NABERS Net Zero Emissions certification would be different to Carbon Neutral in two ways:
 - The scope of NABERS Energy rating tools only includes energy consumed for the operation of the buildings: electricity and onsite fuels (typically gas and diesel). Therefore, the NABERS Net Zero Emissions certification would only include stationary energy.
 - Renewable energy would be the only method to achieve the NABERS Net Zero Emissions certification (as NABERS does not allow the use of carbon offsets).
- NABERS proposes to update the NABERS Energy with GreenPower tool to align with the market-based carbon accounting method.

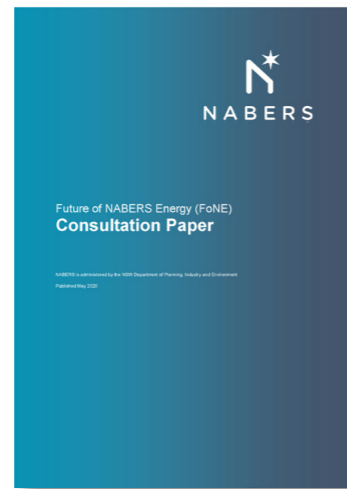


Figure 1.48 Future of NABERS Energy (FoNE) Consultation Paper (Source: NSW Government)

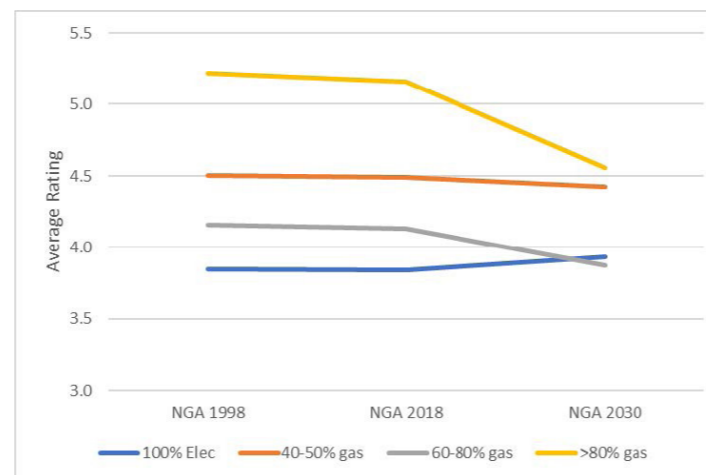


Figure 1.49 Average NABERS Energy for office base building ratings with updated NGA factor NSW/ACT (Source: NSW Government)

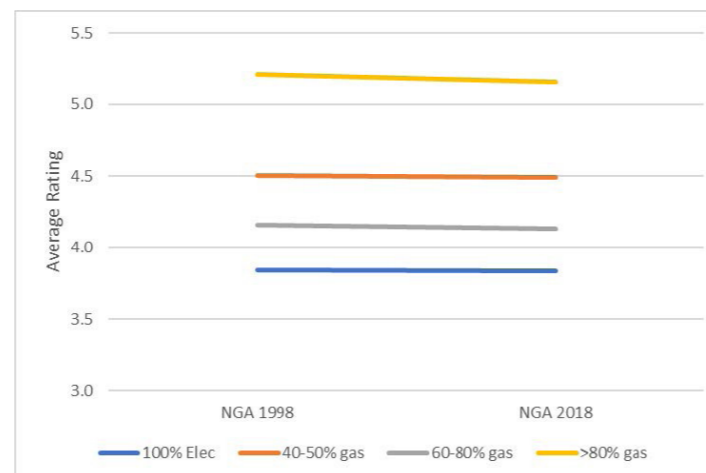


Figure 1.50 Average NABERS Energy for office base building ratings with predicted 2030 NGA factor NSW/ACT (Source: NSW Government)

1.B.18 Embodied Emissions Consultation Paper, NSW Government

Australia currently has no consistent method of measurement for embodied emissions. Over 12 months, NABERS has worked in partnership with the GBCA and collaborated with industry and governments across Australia to understand the appetite for a standard for embodied emissions and the role of NABERS in administering that standard.

In developing this consultation paper NABERS has engaged with 207 individuals from 139 organisations across 38 workshops. The feedback from industry told us that NABERS has a clear role to play in accelerating efforts to reduce embodied emissions in Australia's commercial building stock.

NABERS has published a consultation paper containing 10 proposals for feedback covering five topic areas:

- Scope of the tool
- Calculation method
- Benchmarking
- Certification Process
- Future Development

The 10 proposals outline how a rating tool, which we are tentatively calling the NABERS Embodied Emissions tool, would measure, verify and compare embodied emissions in new buildings and major refurbishments.

Implications for Master Plan 2050

- Embodied emissions are an emerging focus for the property sector.
- There is no single accepted approach to calculating embodied emissions from buildings in Australia or globally.
- NABERS will provide an industry standard method for measuring embodied carbon.
- This will be tied to existing NABERS tools which are well understood by industry, and used by Government.
- It will provide consent authorities and developers a method for assuring and certifying true whole of life net zero.
- GBCA will recognise the NABERS Embodied Emissions tool as a verification pathway in the current 'Upfront carbon emissions' credit of future versions of the Green Star Buildings rating tool.
- Stakeholders recognised that, as the grid becomes less reliant on fossil fuels, operational emissions will fall and this will elevate the issue of embodied emissions.
- Stakeholders acknowledged that interest in measuring and reducing embodied emissions is increasing across all segments of the property sector, driven by influencers such as investors, developers, builders, suppliers and policy makers.

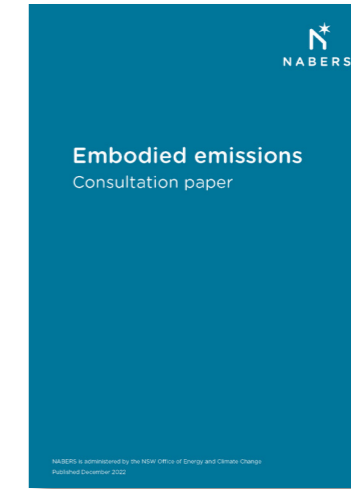


Figure 1.51 Embodied Emissions Consultation Paper (Source: NSW Government)

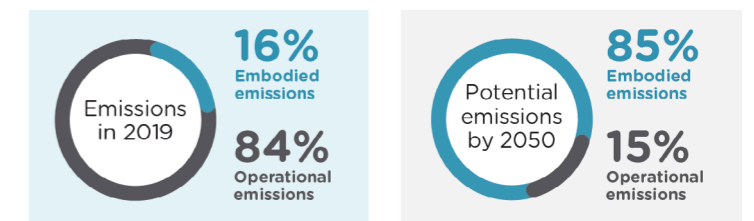


Figure 1.52 Comparison of embodied emissions and operational emissions in 2019 and forecast for 2050 (Source: NSW Government)

1.B.19 Climate Active, Australian Government

The Climate Active Carbon Neutral Standard is a voluntary standard to manage greenhouse gas emissions and to achieve carbon neutrality, and is the only government accredited carbon neutral certification scheme in Australia.

Climate Active is a world-leading, government-backed certification that is aligned to national and international greenhouse gas accounting protocols. Focused on operational carbon emissions at present, with a probable future focus on upfront carbon as well.

It provides best-practice guidance on how to measure, reduce, offset, validate and report emissions that occur as a result of the operations of a precinct.

Climate Active certification is available for :

- Organisations (Certification that the business operations of an organisation have resulted in a state of carbon neutrality)
- Products (Certification that a product being created, used and disposed has resulted in a state of carbon neutrality)
- Services (Certification that the provision of a service has resulted in a state of carbon neutrality)
- Events (Certification that the activities associated with running an event have resulted in a state of carbon neutrality)
- Buildings (Certification that the operations of a building have resulted in a state of carbon neutrality)
- Precincts (Certification that the operations of a precinct have resulted in a state of carbon neutrality)

Implications for Master Plan 2050

- Climate Active certification represents the Gold Standard for carbon neutral certification in Australia.
- Building certification is available through the National Australian Built Environment Rating System (NABERS) or the Green Building Council of Australia (GBCA).
- Climate Active certification sends a clear signal that organisations are serious about addressing climate change and committed to sustainability, innovation, and industry leadership.
- It provides an edge over competitors and taps into an increasing number of consumers driving the market for sustainable and ethical products and services.



Figure 1.53 Climate Active Carbon Neutral Standards for Precincts and Buildings (Source: Australia Government)

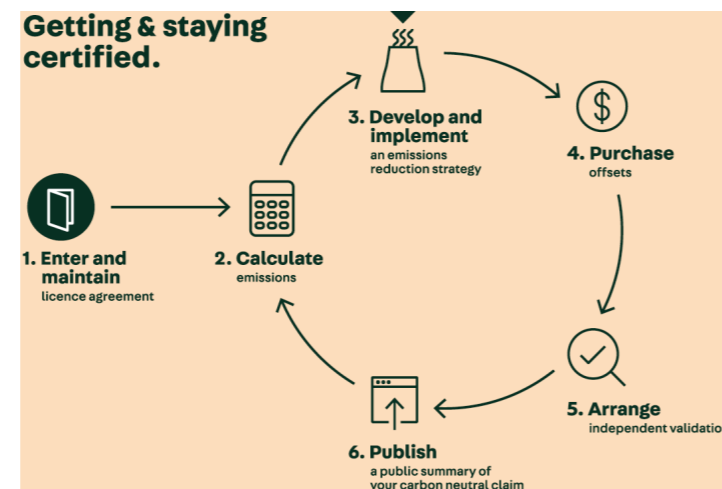


Figure 1.54 Applying for and maintaining carbon neutral certification (Source: Australian Government)

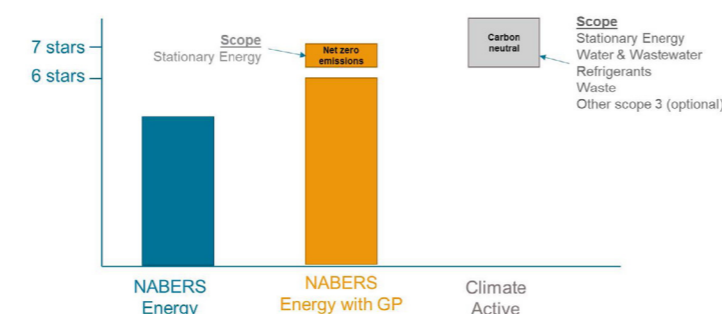


Figure 1.55 Difference between the NABERS Energy ratings tools and Climate Active Carbon Neutral certification for buildings (Source: NSW Government)

1.B.20 WELL Standard, International WELL Building Institute (IWBI)

The WELL rating system follows performance-based criteria that measure, monitor and certify parts of the built environment that have an innate impact on wellbeing and health of humans.

Its aim is to help prevent chronic diseases by using the built environment through the improvement of nutrition, mood, fitness, sleep patterns and performance of its occupants. It assesses how “healthy” a building is across 10 categories: air, water, nourishment, light, movement, thermal comfort, sound, materials, mind and community.

Implications for Master Plan 2050

- The COVID-19 pandemic had led to a rapid uptake of health, safety and well-being considerations in buildings, communities and organisations.
- Australia leads the market with about 25 per cent of commercial office space now WELL-enrolled, largely spurred by workplaces wanting to support a return to the workplace.
- The biggest momentum has come from the large real estate owners, which then influences the rest of the market.
- There is growing global awareness that by creating healthier buildings and a culture that prioritises human well-being, employers will benefit from a healthier, more productive workforce and building owners and property investors gain a higher-valued asset.
- There is growing demand from tenants for health-focused buildings.
- The existence and popularity of a health and wellbeing focused third party rating system in the marketplace demonstrates the enthusiasm from investors, tenants, and the public for places that contribute positive health outcomes.
- The rate of adoption both locally and globally demonstrates recognition that the Standard, its evidence-base, and its future pathway represents an authoritative exemplar of healthy places.



Figure 1.56 WELL Building Standard (Source: IWBI)



Figure 1.57 WELL Community Standard (Source: IWBI)



Figure 1.58 10 WELL concepts (Source: IWBI)

Appendix C | Resource and Emissions Assumptions

1.C.1 Asset Mapping

- The following assumptions were applied to the area schedules and assets types to facilitate resource use and emission modelling.
- Assets have been categorised into 6 categories according to buildings with similar resource usage.
 - Residential
 - Office - commercial space
 - Retail
 - Community - inc. Civic, Events/Tourism/Sports, Arts/ Industry
 - Education
 - Hotel
 - A 4% annual marginal increase in GFA is assumed across all categories.
 - Assumed no resource use or carbon emissions associated with parking.
 - Assumed no building re-use. Further information is required regarding a breakdown of the percentage re-used vs. newly built for each category.

Table 1.1 Asset area breakdown

Residential (m²)	Office (m²)	Retail (m²)	Community (m2)	Education (m²)	Hotel (m²)
1,242,768	338,363	96,575	298,765	68,696	182,876

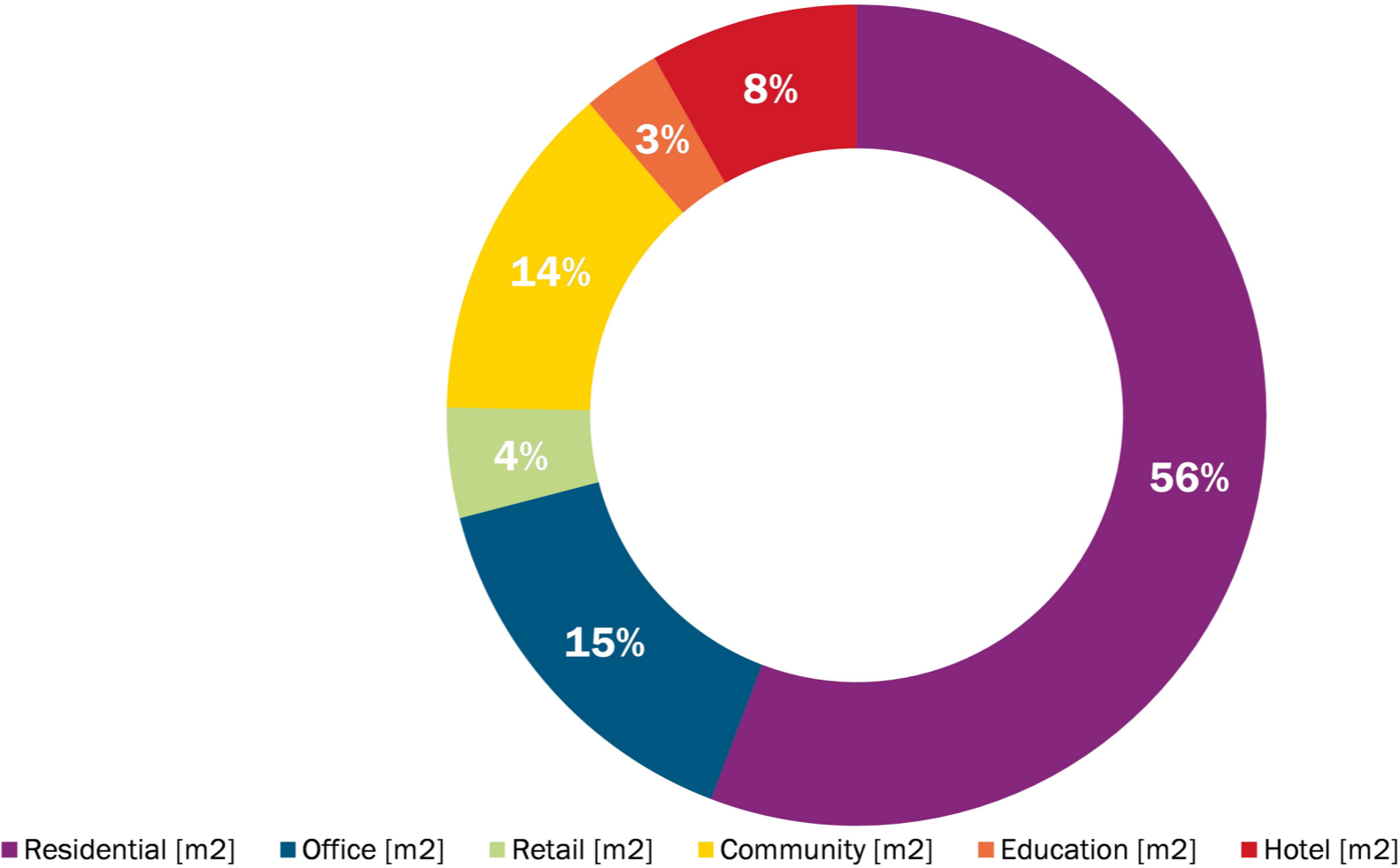


Figure 1.59 Asset area percentage breakdown

1.C.2 Embodied Carbon assumptions

The following assumptions were made in estimating the embodied carbon of the asset types to facilitate net zero modelling.

Benchmark data

Embodied Carbon Benchmarks taken against 'Business as usual' benchmarks for Office, Residential and School Buildings and extrapolated based on LETI 'rules of thumb' for breakdown of scope (London Energy Transformation Initiative, 2017). For the other buildings the following assumptions were made:

- Retail embodied carbon assumed to be representative of Office LETI benchmarks.
- Recreation embodied carbon assumed to be representative of Office LETI benchmarks.
- Hotel embodied carbon assumed to be representative of Office LETI benchmarks.

Table 1.2 LETI embodied carbon primer extrapolated benchmarks

Life Cycle stage	GWP [kgCO ₂ -e/m ² GFA]		
	Office	Residential (Medium scale)	School
Products/ materials (A1-A3)	895	727	936
Transport (A4)	53	58	43
Construction (A5)	53	15	21
Maintenance and replacement (B1-B5)	842	291	426
End of life (C1-C4)	53	29	43
Total Embodied	1,895	1,120	1,468

These assumptions are simplifications and able to updated pending additional insight. For this early stage modelling, these estimates are deemed sufficient for high level insights.

Time variables

- Assumed a 60 year service life, construction and decommissioning period of 25 years and replacement frequency of 15 years for the project.
- Accounted for embodied carbon annual improvement of 4% based on extrapolation of LETI targets

Embodied Carbon Reduction Targets

Green Star

Currently, reporting and reduction of embodied carbon is voluntary, led by Green Star. That said, with developers, and occupiers all

calling for improved Green Star ratings, responding to the Green Star framework is important for maximising value at development scale.

Green Star Buildings v1 is in the process of progressively increasing the stringency of the mandatory requirement for Upfront Embodied Carbon reduction. The table below summarises the minimum requirements of the tool based on star rating and registration date.

Table 1.3 Green Star upfront embodied carbon target reductions

	4 star	5 star	6 star
2020	10% reduction	10% reduction	20% reduction
2023	10% reduction	20% reduction	20% reduction
2026	20% reduction	20% reduction	40% reduction
2030	40% reduction	40% reduction	40% reduction

NABERS

Disclosure of a NABERS Operational energy rating is mandatory at point of sale or lease of commercial offices: NABERS are currently developing an Embodied Carbon tool that will sit alongside the operational energy tool.

Though the NABERS Embodied carbon tool is still likely to be a few years away it is likely to affect the later stages of the master plan development.

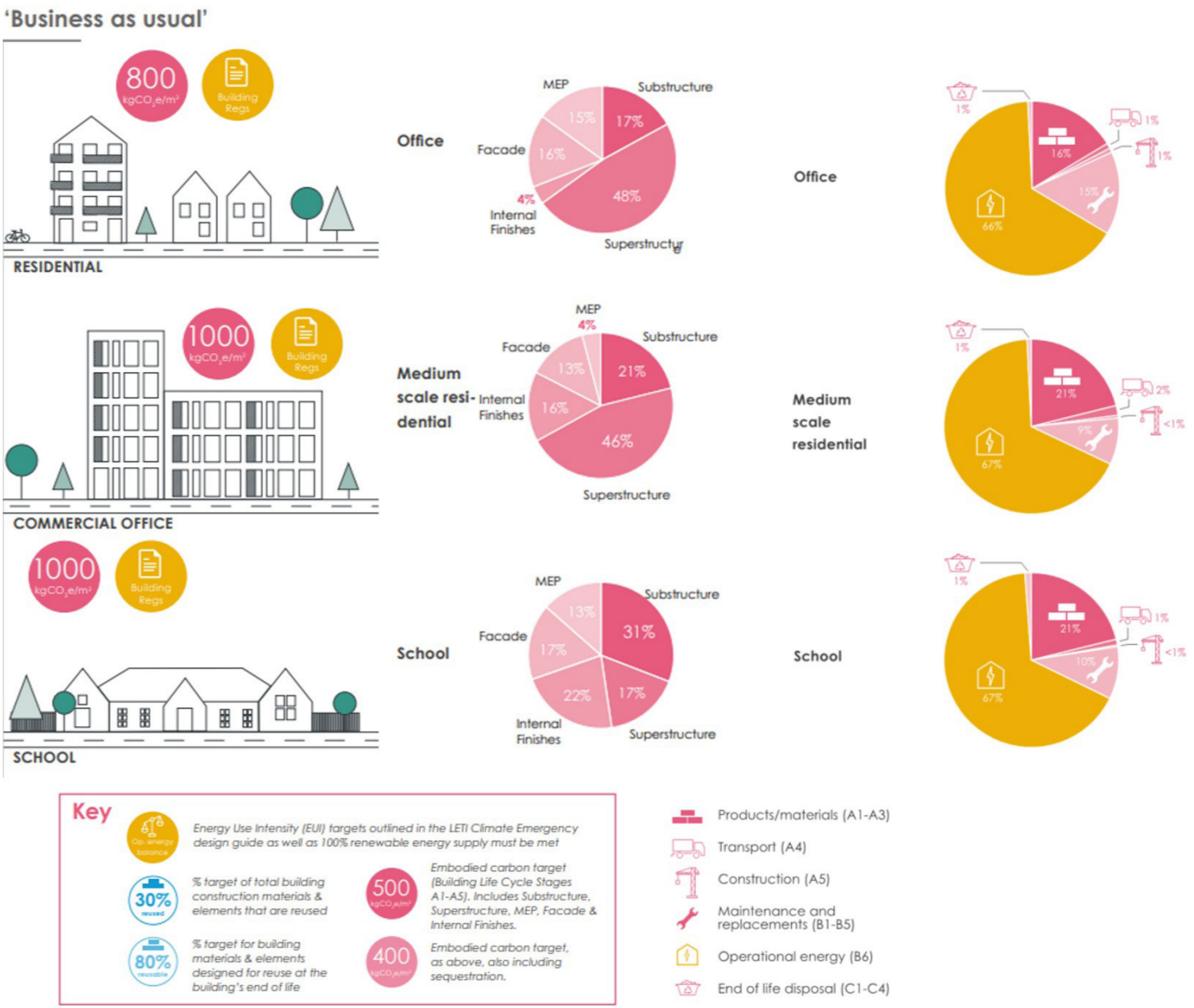


Figure 1.60 Extract from LETI Embodied Carbon Primer

1.C.3 Electricity and water assumptions

The following assumptions were made in estimating the electricity usage of the asset types to facilitate resource use modelling.

NABERS Reverse Calculator

The Reverse Calculator was performed for SOP (postcode: 2127) and the following assumptions were made.

Table 1.4 NABERS Reverse Calculator Assumptions

Building end-use	Assumptions
Office	<ul style="list-style-type: none">- Energy Rating: BAU 4*, Best practice = 5.5*- Water Rating: BAU 4*, Best practice = 5*- Operational hours/week: 50- NLA = 338,363 m²- 100% electricity (Green Star requirement)
Hotel	<ul style="list-style-type: none">- Energy Rating: BAU = 4*, Best practice = 5*- Water Rating: BAU 4*, Best practice = 5*- 4.5 star hotel rating (assume range from 4-5, midpoint taken)- 9,143 rooms at 20m²- laundering done off-site- 0 function room seats- 0 pools- 100% electricity
Residential	<ul style="list-style-type: none">- Used NABERS Apartment Reverse Calculator assuming multi-storey resi- Energy Rating: BAU = 4*, Best practice = 5*- Water Rating: BAU 4*, Best practice = 5*- Dwelling size 100m² = 12,427 dwellings- No centrally air-conditioned (all apartments individually conditioned)- No condenser water servicing- All apartments have their own cold water meter and not supplied with central domestic hot water- All lift serviced- No pool or gym facilities- No parking spaces- 100% electricity
Shopping Centre	<ul style="list-style-type: none">- Energy Rating: BAU = 4*, Best practice = 5*- Water Rating: BAU 4*, Best practice = 5*- Total Shopping Centre Area GLAR 96,575m²- Entire shopping centre GLAR is centrally serviced (conditioned)- 0 car spaces- Annual trading days 365- Weekly hours of service 72- Multi Storey- Number of food court seats 580 (0.6 per every 100m²)- 0 cinema seats- 0 gymnasium area- 100% electricity

These assumptions will need to be reviewed as more details are provided regarding the building operation and design. The Reverse Calculator will then be updated to ensure EUI benchmarks are reflective of SOP.

Note: the same assumptions were made when using the NABERS Reverse calculator to estimate water-use intensity benchmarks.

Electricity Use Intensity

NABERS Reverse Calculator was used for estimating annual energy (kWh/m²) benchmarks for Office, Hotel (Commercial), Residential, Shopping Centre (Retail) where BAU is benchmarked against 5-5.5 star NABERS Energy.

Where NABERS energy is not applicable for building end-uses (i.e. Community buildings) benchmarks were used from Australian Government survey data (Department of Climate Change, Energy, the Environment and Water, 2022).

Table 1.5 Summary of BAU and Best Practice annual EUI

Building end-use	BAU EUI (kWh/m²)	Best Practice EUI (kWh/m²)	Notes
Office	119	62	
Hotel	480	296	
Residential	54	36	
Retail	135	90	
Civic	119	62	NABERS office benchmark used for both BAU (4 star) and Best Practice (5.5 star) due to lack of benchmark information for Civic buildings.
Events/ Tourism/ Sports & Arts/ Industry	144	62	BAU Based on the 'Commercial Buildings Energy Consumption Baseline Study 2022' conducted by Australian DCCEEW, table 53 p131 for medium case Recreation EUI. NABERS office benchmark used for Best Practice (5.5 star) due to lack of benchmark information
Education	119	62	NABERS office benchmark used for both BAU (4 star) and Best Practice (5.5 star) due to lack of benchmark information for Education buildings.

There are limitations in these assumptions, while climate is reflected in the benchmarks, building scale, form and program will influence the electricity demands. Further architectural information could refine these assumptions.

Water Use Intensity

NABERS Reverse Calculator was used for estimating water use where BAU is considered 4 star and Best Practice is considered 5 star.

- Under this rating tool benchmarks are only available for Office, Hotel, Residential and Shopping Centre Buildings. For the other buildings the following assumptions were made due to the lack of reliable water benchmarks:
 - Civic, Events/Tourism/Sports & Arts/Industry (Community) water consumption assumed to be representative of NABERS Office

- Education water consumption assumed to be representative of NABERS Office

Table 1.6 Summary of BAU and Best Practice annual water use intensity

Building end-use	BAU (kL/m²)	Best Practice (kL/m²)	Note
Office	0.682	0.342	
Hotel	3.800	2.000	
Residential	0.730	0.480	
Retail	0.770	0.514	
Civic, Events/ Tourism/ Sports & Arts/ Industry (Community)	0.682	0.342	NABERS office benchmark used due to lack of benchmark information
Education	0.682	0.342	NABERS office benchmark used due to lack of benchmark information

Emission Factors

Electricity

Annual reporting of state grid emission factors (scope 2) was used to convert the annual electricity use of the precinct to greenhouse gas emissions (Department of Climate Change, Energy, the Environment and Water, 2022).

Grid Decarbonisation at a rate of 3% annual was assumed by extrapolating grid decarbonisation between 2019 and 2022 from annual reporting of state grid emission factors (Department of Climate Change, Energy, the Environment and Water, 2022)

Table 1.7 Grid emission factors and extrapolated decarbonisation

	2019	2022
NSW grid emissions [kgCO ₂ -kWh]	0.81	0.73
		3%

Water

Greenhouse gas emission intensity associated with water use water was taken at 0.0012kgCO₂-e/L.

- Estimated by considering total water delivered and estimated emissions by Sydney Water (Sydney Water, 2021-2022)

Greenhouse gas emission intensity associated with wastewater production was taken at 0.0003kgCO₂-e/L.

- Estimate by considered wastewater processed and estimated emissions by Sydney Water (Sydney Water, 2021-2022). This

- data is not localised due to limitations in data availability.
- Assumed total water demand to blackwater production is 21% of total water consumption for all building types (City of Sydney, 2012). Although this production data is not localised it is deemed sufficient for high level early estimates as it reflects community behaviour rather than regional infrastructure.

1.C.4 Waste assumptions

Waste production intensity

The following assumptions were made in estimating the waste usage of the asset types to facilitate resource use and net zero modelling.

- Waste production benchmarks (landfill ,recycling, garden and food) are based on 'City of Sydney Guidelines for Waste Management in New Development' (City of Sydney, 2018) for Office, Hotel, Residential, Retail and Recreation buildings. For the other buildings the following assumptions were made:
 - Education waste assumed to be representative of Community Waste benchmark.
 - Although this data is not localised to City of Parramatta guidelines (lack of information from City of Parramatta the waste behaviour of residents in SOP is expected to be similar to that of broader City of Sydney.

Emission Factors

- CO₂ emission intensity associated with waste (all streams) was averaged at 0.590 kgCO₂-e/kg.
- Estimated by considering total waste produced in NSW during the 2020-2021 period (NSW EPA, 2020-21) and GHG Inventory data (Department of Climate Change, Energy, the Environment and Water, 2022).
 - This is a simplified intensity but sufficient for this early-stage estimates.

Appendix D | Climate Adaptation Plan



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