



City & Southwest

Sustainability strategy

2017-2024

June 2019 update



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Cover: Artist's impression of Barangaroo Station
This page: Sydney Metro train at Kellyville Station

SUSTAINABILITY STRATEGY HIGHLIGHTS



Construction

During tunnelling activities, the **total excavated spoil** (2.4 million cubic metres) could fill **Darling Harbour twice**



100% clean spoil will be beneficially reused

90% of construction and demolition waste will be recycled



25% reduction in Portland cement in concrete, saving the equivalent carbon emissions of planting

784,000 trees

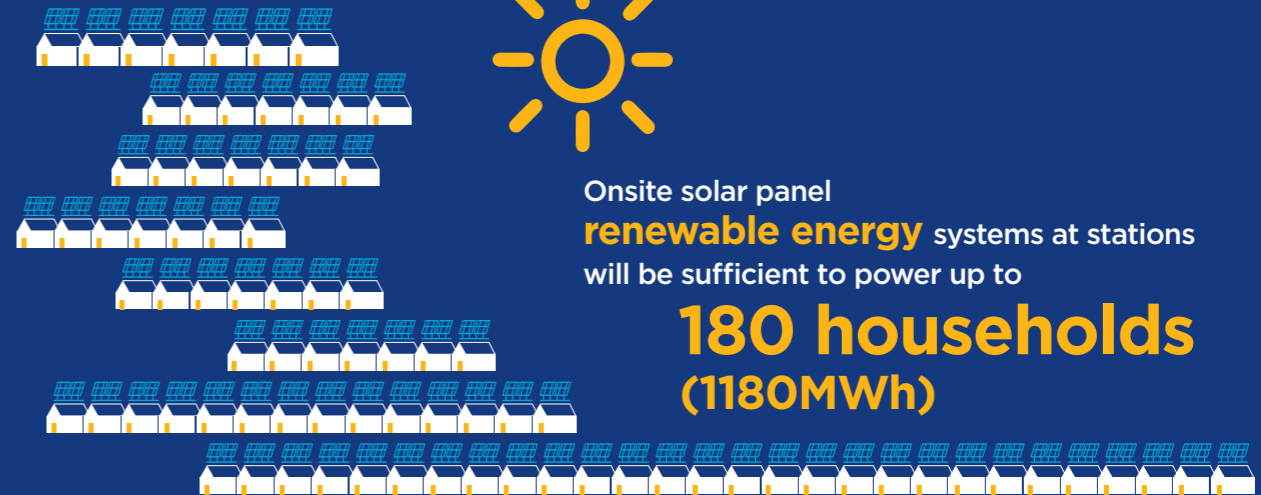
Offsetting 25% of construction electricity will reduce carbon emissions by the equivalent of planting



225,800 trees

Operations

100 households (20,000kL) of water usage per year will be saved through the Project's use of water efficient fixtures and rainwater harvesting



Onsite solar panel **renewable energy** systems at stations will be sufficient to power up to

180 households (1180MWh)

Improved pedestrian and cycling connections will make walking and cycling easier, resulting in health benefits to customers



Secure access and covered bicycle parking spaces will be provided



100% of **timber products** will be from reused, recycled or responsibly managed sources



100% of the **operational electricity** needs for the project will be offset (which is an estimated 221 Gigawatt hours a year). This will be the equivalent to the energy generated by 1.1 million solar panels (240 hectares solar plant) or 40 wind turbines



Station energy performance improvements (such as lighting systems and efficient glazing) will save the equivalent electricity consumption of approximately **610 households** a year



Accurate May 2017 (subject to change and pending confirmation in the detailed design process)

1 INTRODUCTION

Sydney Metro has a clear vision for the Sydney Metro City & Southwest project (the Project) to demonstrate best-practice environmental, social and economic outcomes in delivery and operation.

Sustainability underpins the core project objectives and is integrated across all project stages.

This Sustainability Strategy document and appendices outlines performance targets, initiatives and outcomes which will be adopted across key policy areas in the design, construction and operation stages of the Project.

The targets are benchmarked against world best practice on similar infrastructure projects. Targets within this document will be embedded into contract documents to drive improvements and innovation.

The strategy articulates how the project team will maximise the delivery and operation of the Project's sustainability requirements.

The approach to addressing sustainability for the Project is built on that adopted for Sydney Metro Northwest, incorporating lessons learned, and responding to intervening drivers and location-specific opportunities and constraints.

For Sydney Metro, 'sustainability' means optimising environmental and social outcomes, transport service quality, and cost effectiveness.



Artist's impression of Barangaroo Station

2 PROJECT OVERVIEW

2.1 Project scope

The Sydney Metro City & Southwest project extends metro rail from the north west, under Sydney Harbour, through the CBD and south west to Bankstown. It is due to open in 2024 with seven new metro stations and 11 upgraded stations.

Sydney Metro City & Southwest has two components:

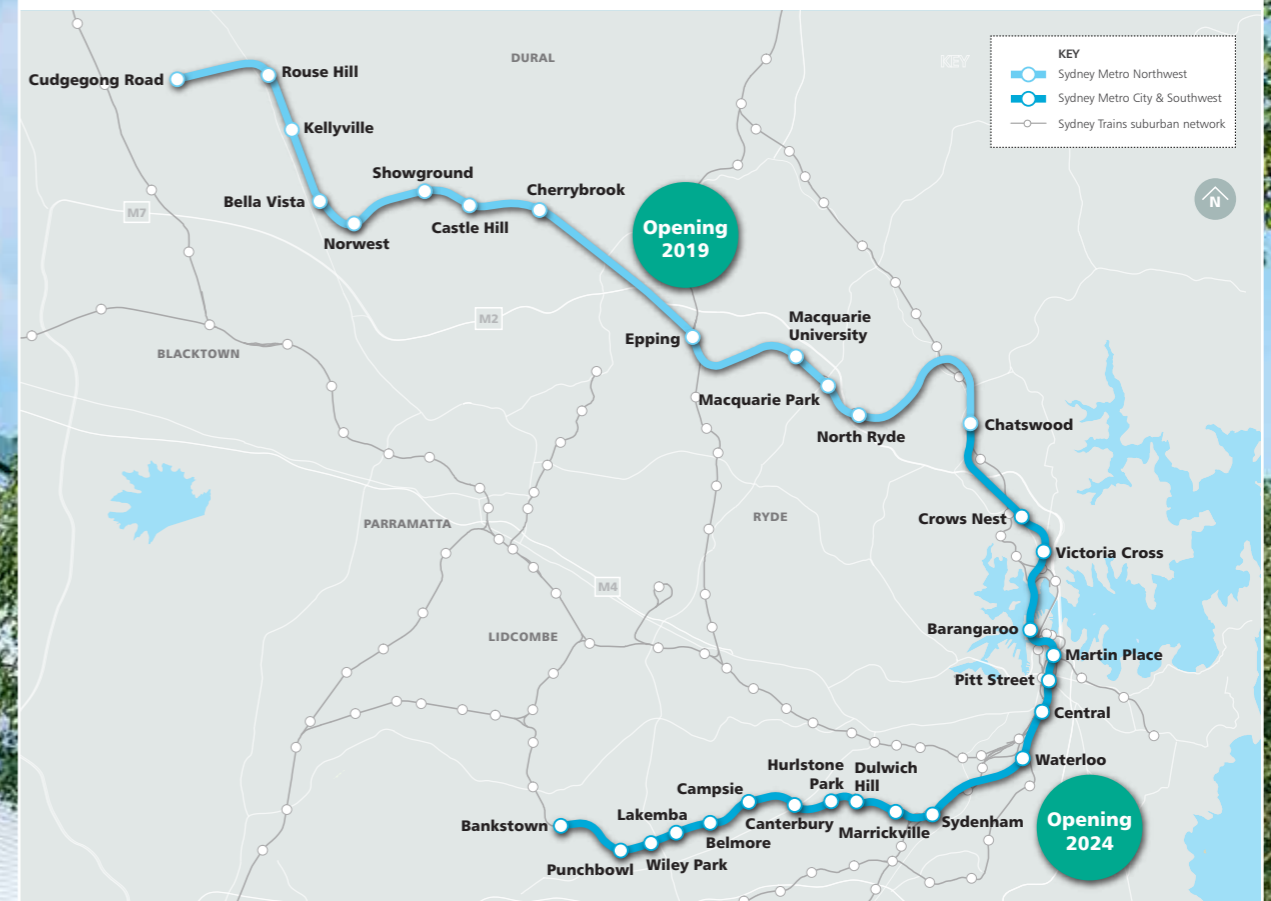
- › Chatswood to Sydenham - new 15-kilometre twin tunnels from Chatswood, under Sydney Harbour through Sydney's CBD to Sydenham
- › Sydenham to Bankstown upgrade - upgrade and conversion of the existing 13.5-kilometre railway from Sydenham Station to Bankstown Station to metro standards, including upgrading the 11 existing stations.

The Project will deliver seven new metro stations, at:

- › Crows Nest
- › Victoria Cross (North Sydney)
- › Barangaroo
- › Martin Place
- › Pitt Street
- › Central Station (new underground platforms)
- › Waterloo.

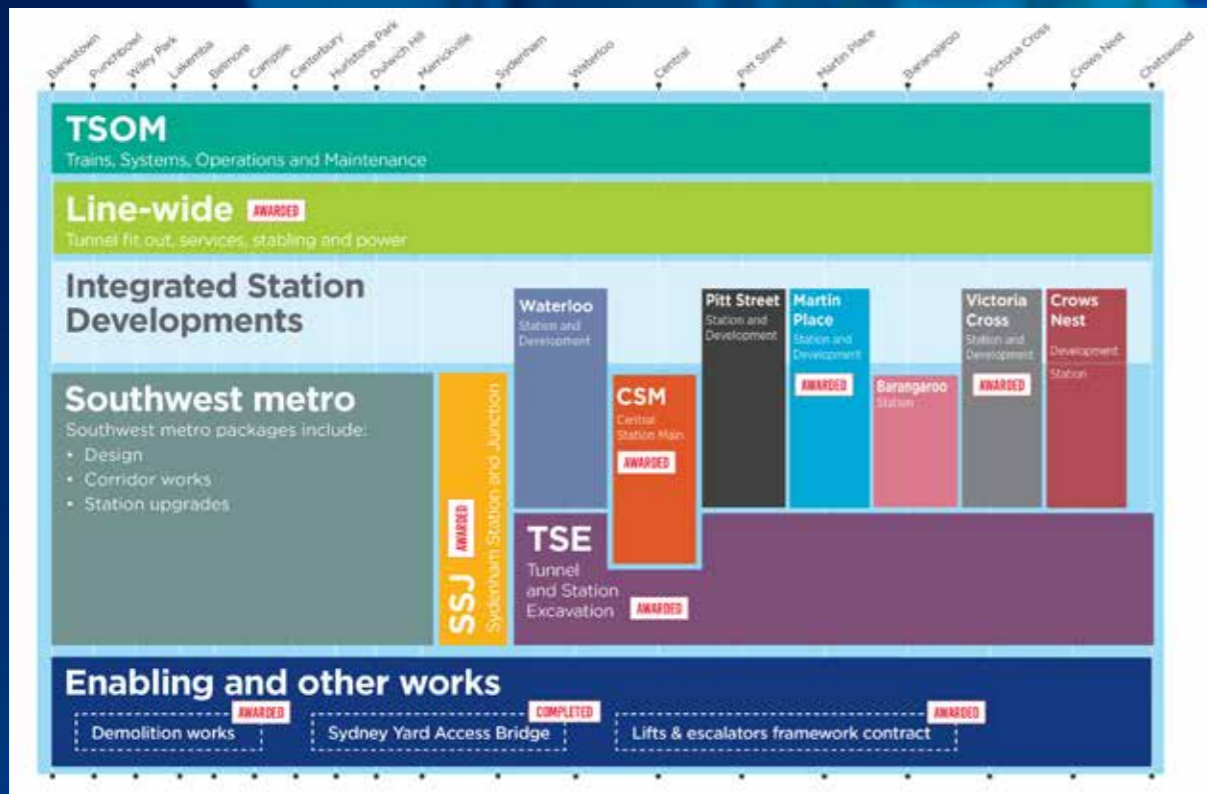
The Project will be delivered via a series of contract packages, as outlined in Figure 2.

Figure 1 The Sydney Metro network



Artist's impression of Crows Nest Station

Figure 2 Sydney Metro City & Southwest contract packages



2.2 Integrated Station Development and Rail Corridor Development

The Project also includes 'integrated station development' (ISD) at station locations between Chatswood and Sydenham. Being located in dense urban areas and above high-capacity stations, the ISDs will be significant contributors to the urban landscape.

The ISDs will comprise;

- › multi-storey residential and commercial buildings
- › development of integrated property developments in connection with metro stations
- › development of surplus land which is no longer required after the construction phase.

Sydney Metro is completing preliminary planning for the ISDs, securing planning approvals and developing concepts, for sale and development by others.

Transport for NSW (TfNSW) is also investigating the feasibility of rail corridor development (RCD), including the development of residual land in and adjacent to the rail corridor between Sydenham and Bankstown for a variety of uses.

Sydney Metro will be seeking best-practice sustainable design and governance outcomes for ISD and RCD (if included in the Project scope), including:

- › achieving high benchmarks using Green Star Design and As Built ratings and Green Star Communities ratings where appropriate
- › achieving high benchmarks using NABERS and BASIX ratings
- › site specific responses to the Project's sustainability objectives
- › investigation and inclusion of affordable housing where appropriate.



Above: Development at Barangaroo
Right: Artist's impression of Waterloo Station



Sydney Metro will be seeking **best practice** sustainable design and governance outcomes

2.3 Project benefits

Benefits of the Project include:

- › Transport benefits:
 - Enabling the long-term growth of the Sydney rail network.
 - Caters for growth in demand, from an estimated 168,400 to 288,000 trips in the one-hour AM peak by 2036¹.
 - Increased accessibility and trip diversity.
 - Increased rail network capacity.
 - Improved network resilience.
 - Improved transport integration.
 - Providing demand relief for Sydney Trains lines (T1 North Shore Line; T1 Western Line; T2 Airport, Inner West and South Line; and T3 Bankstown Line).
 - Improved conditions for bus passengers and road users through supporting and managing growth.
 - Increased rail network reach and use.
 - Provides customers with significant travel time savings and increased reliability and comfort.
 - Enhanced safety features.
 - Improved bus services and improved pedestrian and cyclists access¹.
- › Sustainability benefits:
 - The Project is an enabler which will encourage greater urban infill rather than greenfield housing developments which results in infrastructure savings for the taxpayer.
 - By attracting more people to the medium and higher density dwellings there would be household cost savings for the consumption of utilities (electricity, gas and water) and transport.
 - Health benefits from sustainable living – the Project has the potential to result in a reduction in public health care costs as it will be enabling more customers to access public transport by walking and cycling².
- › Broader city building benefits:
 - Peak additional employment during the construction period of 6200 workers³
 - approximately \$8.5 million per annum additional value-add in 2036, from increased co-location and productivity of businesses and workers in the corridor⁴.
 - Stimulating approximately 44,000 additional jobs in the Global Economic Corridor by 2036, providing greater access to and between employment opportunities, education and health precincts, retail and commercial centres and cultural and open spaces⁵.

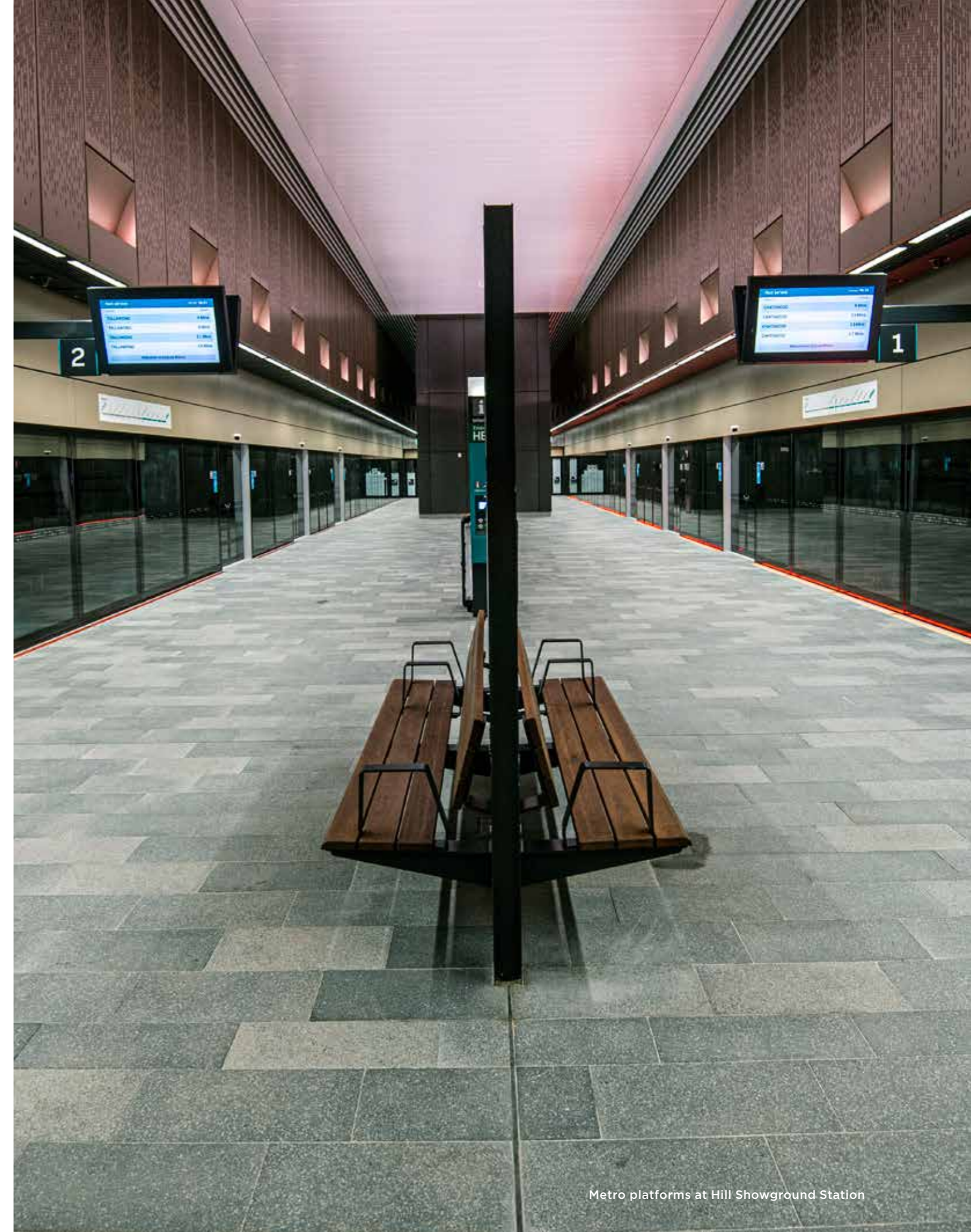
¹ Sydney Metro City & Southwest Business Case Summary, October 2016, page 26

² Sydney Rapid Transit Business Case, October 2014, page 7–41

³ Sydney Metro City & Southwest Business Case Summary, October 2016, page 26

⁴ Sydney Metro City & Southwest Business Case Summary, October 2016, page 26

⁵ Sydney Metro City & Southwest Business Case Summary, October 2016, page 26



Metro platforms at Hill Showground Station

3 DEVELOPMENT OF THE SUSTAINABILITY STRATEGY

3.1 Defining 'sustainability' for Sydney Metro

There are many definitions for 'sustainability' or 'sustainable development'. The most commonly referred to definition is in the Bruntland Report, which defined 'sustainability' as 'development which meets the needs of the present without compromising the ability of future generations to meet their own needs'⁶.

The NSW Government has defined 'sustainability' as 'Sustainability in the NSW public sector means addressing the needs of current and future generations through the integration of social justice, economic prosperity and environmental protection in ways that are transparent, accountable and fiscally responsible.'

TfNSW Environment and Sustainability Policy (August 2015) reflects a commitment to 'delivering transport services, projects, operations and programs in a manner that balances economic, environmental and social issues to ensure a sustainable transport system for NSW.'

For Sydney Metro, 'sustainability' means building a metro system for current and future generations, that optimises environmental and social sustainability outcomes, transport service quality and cost effectiveness.

⁶Bruntland, G. (ed.), 1987, Our Common Future: The World Commission on Environment and Development, Oxford University Press, Oxford



Artist's impression of Hurlstone Park Station

3.2 Purpose and scope of the strategy

The purpose of this Sustainability Strategy is to outline performance targets, initiatives and outcomes which will be adopted across key policy areas in the design, construction and operation stages of the Project. The intention is to review and update this strategy as required, as the Project progresses.

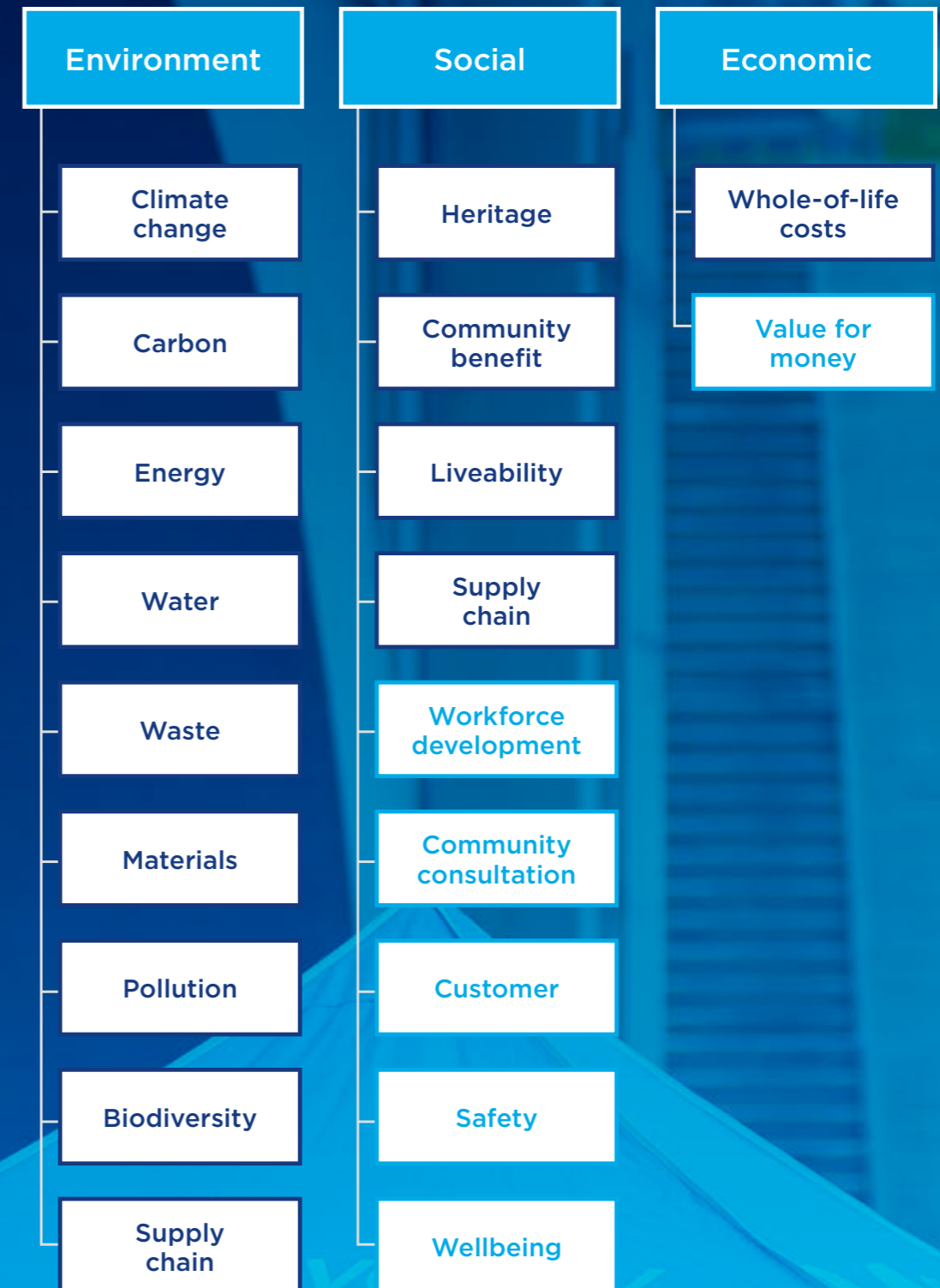
This strategy supersedes the Sustainability Strategy which was issued in July 2017, taking into account the updated scope of the Sydenham to Bankstown section of the Project and associated planning approval requirements.

There are many elements to the broader definition of sustainability. This Sustainability Strategy focuses on those areas identified in Figure 3.

Appendix A outlines the Conditions of Approval (CoA), revised mitigation measures and revised environmental outcomes relating to sustainability for the Project, and where each item is addressed within this strategy to demonstrate compliance.

A separate sustainability approach is being developed for the Integrated Station Development and Rail Corridor Development as described in Section 2.2.

Figure 3 Sydney Metro sustainability elements



Addressed in other Sydney Metro strategy documents.



This strategy outlines **performance targets, initiatives and outcomes** which will be adopted by the Project.



Above: Landscaping initiatives
Right: Public exhibition and community consultation, Sydney, May 2016

3.3 Development of this strategy

This strategy has been developed by:

- › using the Sydney Metro Northwest sustainability strategy, policy and objectives as a starting point
- › incorporating lessons learned in the implementation of the Sydney Metro Northwest strategy and early outputs of a review of the strategy which was completed in 2016 by Ernst & Young (see below)
- › considering project-specific opportunities and constraints as environmental studies have been completed as part of ongoing assessments
- › formulating an appropriate response to regulatory and other drivers
- › benchmarking the sustainability performance and approaches taken on other recent large infrastructure projects in Australia and internationally.

The sustainability framework illustrated in Figure 4 outlines how the above components provide input (outlined in further detail in Appendix B) into the development of the Project's sustainability policy objectives, targets and initiatives that are detailed in Sections 3.4-3.7 and Appendices C-N of this Strategy.



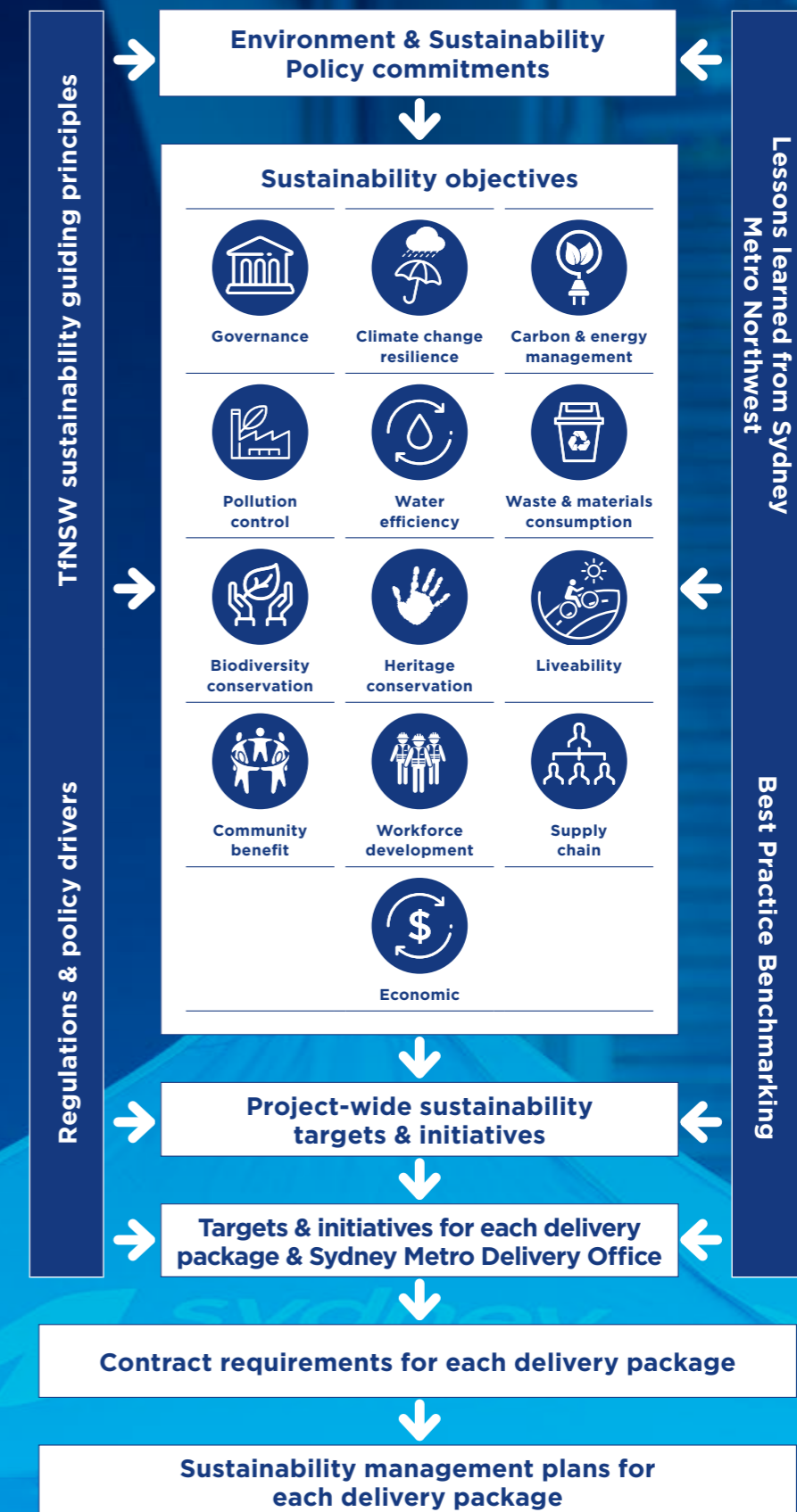
Ernst & Young (EY) has completed a review of the **Sydney Metro Northwest Sustainability Strategy** and performance to date against the objectives and targets set out in the strategy. Findings indicate that, of the 43 performance targets established for the Project:

- › 85 per cent of the targets are either being met or on track to being met.
- › 10 per cent of the targets are not being met, but the overall intent of the target is being met.
- › 5 per cent of the targets are no longer applicable to the Project.

Based on the assessment, EY is of the view that 'the scope of the Sustainability Strategy... and the performance to date of the Sydney Metro Northwest project... are in keeping with international best practice for similar project.'

Above top: Workers in a tunnel on Sydney Metro Northwest
Above: Water-sensitive urban design, Victoria Park, Sydney


Figure 4 Sustainability framework




3.4 Sustainability policy

An Environment & Sustainability policy has been developed to articulate Sydney Metro's commitment to sustainable outcomes on the Project, and is included in Figure 5. The policy is based on that which was adopted for Sydney Metro Northwest, with some updates to capture the workforce development agenda for the Project. This policy will be reviewed by the project team every two years to ensure any new initiatives and developments are captured.

Figure 5 Transport for NSW Sydney Metro Environment & Sustainability Policy (April 2016)



Environment
& Sustainability
Policy



This Policy reflects a commitment in our delivery of the Sydney Metro program to:

- Align with, and support, Transport for NSW (TfNSW) Environment & Sustainability Policy.
- Optimise sustainability outcomes, transport service quality, and cost effectiveness.
- Develop effective and appropriate responses to the challenges of climate change, carbon management, resource and waste management, land use integration, customer and community expectation, and heritage and biodiversity conservation.
- Be environmentally responsible, by avoiding pollution, enhancing the natural environment and reducing the project ecological footprint, while complying with all applicable environmental laws, regulations and statutory obligations.
- Be socially responsible by delivering a workforce legacy which benefits individuals, communities, the project and industry, and is achieved through collaboration and partnerships.

To deliver on these commitments, the Sydney Metro team will:

Industry leadership

- Implement coordinated and transparent decision making, by engaging with stakeholders and suppliers, encouraging innovation and demonstrating sustainability leadership.
- Explore new benchmarks for the transport infrastructure sector by requiring high standards from our designers, contractors and suppliers, building on experience gained through development of Sydney Metro Northwest.

Community and customer

- Provide accessible, safe, pleasurable, and convenient access and transport service for all customers.
- Establish positive relationships with community and stakeholders to maximise opportunities to add value to local communities.

Land use integration and place making


- Create desirable places, promote liveability and cultural heritage, and optimise both community and economic benefit.
- Balance transit oriented development opportunities with stakeholder expectations.

Embedding environmental and social sustainability

- Establish robust sustainability objectives and targets.
- Maintain an environmental management system that is integrated into all our project activities.
- Ensure thorough and open environmental assessment processes are developed and maintained.
- Develop and maintain an environmental management framework to embed best practice pollution management and sustainable outcomes during construction.
- Apply effective assurance processes to monitor performance against the project environment and sustainability objectives and identify appropriate reward or corrective action, as required.
- Apply environment and sustainability specific processes to the procurement of delivery activities.

Accountability

- Undertake public sustainability reporting.
- Hold employees and contractors accountable for proactively meeting their environmental and social sustainability responsibilities.
- Provide appropriate training and resources necessary to meet our responsibilities.



Rodd Staples
Program Director, Sydney Metro

© Sydney Metro 2016
SM ES-ST-209 Sydney Metro Environment and Sustainability Policy



Sydney Metro City & Southwest community consultation

3.5 Sustainability objectives

Sustainability objectives have been developed to incorporate the outcomes of a critical review of the sustainability objectives for Sydney Metro Northwest, consideration of the inputs detailed in Appendix B and consultation across Sydney Metro work streams. These objectives have been endorsed by the Sydney Metro Program Executive.

Table 1 Sustainability objectives

SUSTAINABILITY THEMES & OBJECTIVES	 <p>Governance</p>	<ul style="list-style-type: none"> › Demonstrate leadership by embedding sustainability objectives into decision making. › Demonstrate a high level of performance against objectives and appropriate benchmarks. › Be accountable and report publicly on performance.
	 <p>Carbon & energy management</p>	<ul style="list-style-type: none"> › Improve the shift toward lower carbon transport. › Reduce energy use and carbon emissions during construction. › Reduce energy use and carbon emissions during operations. › Support innovative and cost effective approaches to energy efficiency, low-carbon / renewable energy sources and energy procurement.
	 <p>Environmental performance</p>	<ul style="list-style-type: none"> › Reduce sources of pollution and optimise control at source to avoid environmental harm. › Comply with environmental obligations outlined in applicable project planning approvals.
	 <p>Climate change resilience</p>	<ul style="list-style-type: none"> › Infrastructure and operations will be resilient to the impacts of climate change.
	 <p>Resources - water efficiency</p>	<ul style="list-style-type: none"> › Minimise use of potable water. › Maximise opportunities for reuse of rainwater, stormwater, wastewater and groundwater.
	 <p>Resources - waste & materials</p>	<ul style="list-style-type: none"> › Minimise waste through the Project lifecycle. › Reduce materials consumption. › Consider embodied impacts in materials selection. › Maximise beneficial reuse of spoil.
	 <p>Biodiversity conservation</p>	<ul style="list-style-type: none"> › Protect and create biodiversity through appropriate planning, management and financial controls.

SUSTAINABILITY THEMES & OBJECTIVES	 <p>Heritage conservation</p>	<ul style="list-style-type: none"> › Protect and promote heritage through appropriate design, planning, and management controls.
	 <p>Liveability</p>	<ul style="list-style-type: none"> › Promote improved public transport patronage by maximising connectivity and interchange capabilities. › Provide well-designed stations and precincts that are comfortable, accessible, safe and attractive.
	 <p>Community benefit</p>	<ul style="list-style-type: none"> › Make a positive contribution to community health and well-being. › Ensure community and local stakeholder engagement and involvement in the development of the Project. › Contribute to the delivery of legacy projects to benefit local communities. › Create opportunities for local business involvement during the delivery and operations phases. › Optimise community benefit of residual land development. › Minimise negative impacts on the community and local businesses during construction and operation.
	 <p>Supply chain</p>	<ul style="list-style-type: none"> › Influence contractors, subcontractors and materials suppliers to adopt sustainability objectives in their works and procurement.
	 <p>Workforce development</p>	<ul style="list-style-type: none"> › Increase opportunities for employment of local people, participation of local businesses, and participation of SME's. › Enable targeted and transferable skills development which resolves local and national skills shortages, supports industry to compete in home and global markets, and embeds a health and safety culture within all induction and training activities, promoting continuous improvement. › Increase workforce diversity and inclusion, targeting indigenous workers and businesses, female representation in non-traditional trades, and long term unemployed. › Inspire future talent and develop capacity in the sector, engaging young people via education and work experience, collaborating with higher education institutions to provide programs responding to rapid transit and other infrastructure requirement, and supporting vocational career development through apprenticeships and traineeships.
	 <p>Economic</p>	<ul style="list-style-type: none"> › Consider adopting a whole-of-life costing model to maximise sustainability benefits. › Optimise development opportunities for residual land. › Capture sustainability benefits in the business case for the project.




3.6 Sustainability targets and initiatives

Targets and initiatives have been developed to support the above sustainability objectives for the Project. Sustainability targets represent performance aspirations across the Project. It is acknowledged that future developments in the design or other changes to the Project may affect our ability to meet all targets. Performance against targets will be monitored and reported on a regular basis.

Sustainability initiatives are detailed in Appendices C–N for each theme respectively and will be further refined as part of the design process and included in the contract documents for all detailed design, construction and operations contracts.

Project contractors will be required to clearly identify how they will ensure that specific sustainability objectives, initiatives and targets are met. This approach will encourage industry to develop innovative value-for-money sustainability solutions.

Table 2 Sydney Metro City & Southwest sustainability targets

SUSTAINABILITY THEMES & TARGETS	 <p>Governance</p>	<ul style="list-style-type: none"> › A high level of attainment (minimum ISCA IS Rating of 65 'Excellent') for relevant infrastructure. › 5 Star Green Star ratings for relevant buildings. › Align with a high rating using the TfNSW Sustainable Design Guidelines.
	 <p>Carbon & energy management</p>	<ul style="list-style-type: none"> › Achieve at least a 20 per cent reduction in carbon emissions associated with construction, when compared to business as usual.* › Offset 25 per cent of the electricity needs for the construction phase of the project. › Achieve at least a 20 per cent reduction in carbon emissions associated with operations, when compared to business as usual.* › Maximise the capture and reuse of energy generated from braking trains. › Design buildings (stations and stabling buildings) to achieve at least a 15 per cent improvement over performance requirements set out in Section J of the National Construction Code. › Source 5-20 per cent of the low voltage electricity required at above ground stations from onsite renewable energy sources where feasible. › Offset 100 per cent of the electricity needs for the operational phase of the project.
	 <p>Environmental performance</p>	<ul style="list-style-type: none"> › Zero major pollution incidents. › New emission standards will be identified and applied to diesel equipment and vehicles during construction.
	 <p>Climate change resilience</p>	<ul style="list-style-type: none"> › Mitigate all extreme and high level risks. › Mitigate a minimum of 25 per cent of medium level risks (examples include increased flooding, increased temperatures, sea level rise, and increased storm events).
	 <p>Resources - water efficiency</p>	<ul style="list-style-type: none"> › Reduce water use by at least 10 per cent compared to business as usual.* › Source at least 33 per cent of the water used in construction from non-potable sources. › Source at least 33 per cent of the water used in operations from non-potable sources. › Implement rainwater harvesting and reuse systems at construction sites and feasible above ground stations.

SUSTAINABILITY THEMES & TARGETS	 <p>Resources - waste & materials</p>	<ul style="list-style-type: none"> › Reduce the environmental footprint of materials used on the project by at least 15 per cent compared to business as usual.* › Use concrete which has an average Portland cement replacement level of more than 25 per cent. › 100 per cent beneficial reuse of usable spoil. › Recycle or reuse 90 per cent of recyclable construction and demolition waste. › Recycle or reuse 60 per cent of office waste during the construction phase. › Recycle or reuse 80 per cent of the waste generated during operations. › Recycle or reuse 65 per cent of office waste during operations. › 60 per cent of reinforcing steel is produced using energy-reducing processes in its manufacture. › Source 100 per cent reused, recycled timber or responsibly sourced timber.
	 <p>Biodiversity conservation</p>	<ul style="list-style-type: none"> › Minimise vegetation clearing. › Native landscaping targets to be established.
	 <p>Heritage conservation</p>	<ul style="list-style-type: none"> › Prepare a Heritage Strategy, including stakeholder engagement with relevant stakeholders. › Implement the Heritage Strategy during design and delivery, to conserve and activate. › Maximise opportunities for archaeological research and future interpretation of archaeological finds. › Opportunities for heritage interpretation identified and implemented at appropriate station precincts.
	 <p>Liveability</p>	<ul style="list-style-type: none"> › Station interchanges designed in accordance with the Interchange Access Plans and modal hierarchy. › Stations and precincts designed in accordance with the Sydney Metro Design Guidelines. › Promote access by cycling, through provision of bicycle parking, and safeguard for future expansion of bicycle facilities.
	 <p>Community benefit</p>	<ul style="list-style-type: none"> › Implement initiatives which will provide tangible benefits to local community groups during the construction period. › Implement initiatives which will provide tangible benefits to the broader local community beyond the construction period. › Identify key drivers for affordable housing and work with other lead agencies to identify opportunities and develop an appropriate response.
	 <p>Supply chain</p>	<ul style="list-style-type: none"> › All principal contractors develop and implement sustainable procurement strategies.
	 <p>Workforce development</p>	<ul style="list-style-type: none"> › Refer to the Sydney Metro City & Southwest Workforce Development and Industry Participation Strategy, which is a separate document to be read in conjunction with this strategy and outlines priorities, objectives and targets to address workforce development.

* Note: 'Business as usual' (BAU) is defined as that which is used in the applicable rating scheme for the respective target (e.g. ISCA Rating Tool, Green Star and TfNSW CERT).

Examples of design initiatives

Examples of sustainable design initiatives which are being considered for inclusion at new underground stations are illustrated in Figures 6, 7, and 8. These initiatives will continue to be evaluated throughout the detailed design process, and included where feasible.

Figure 6 Cross section highlighting sustainability opportunities

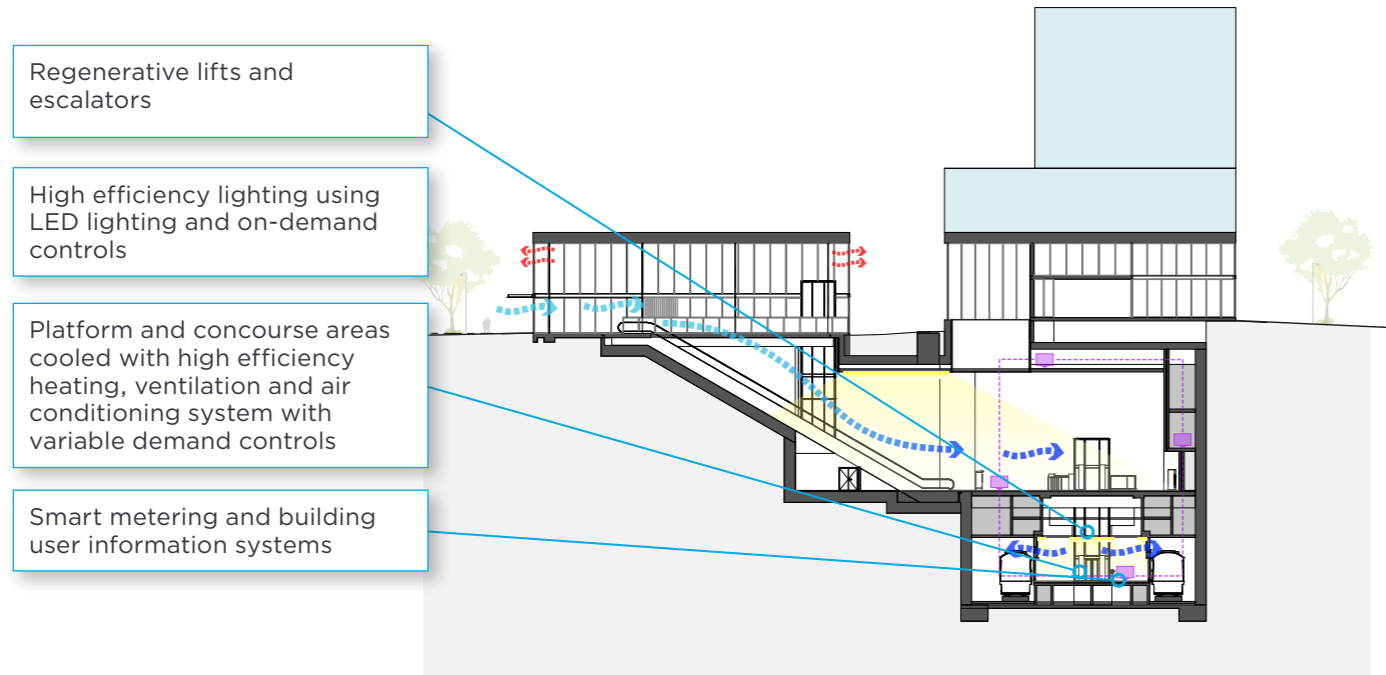


Figure 7 Long section highlighting sustainability opportunities

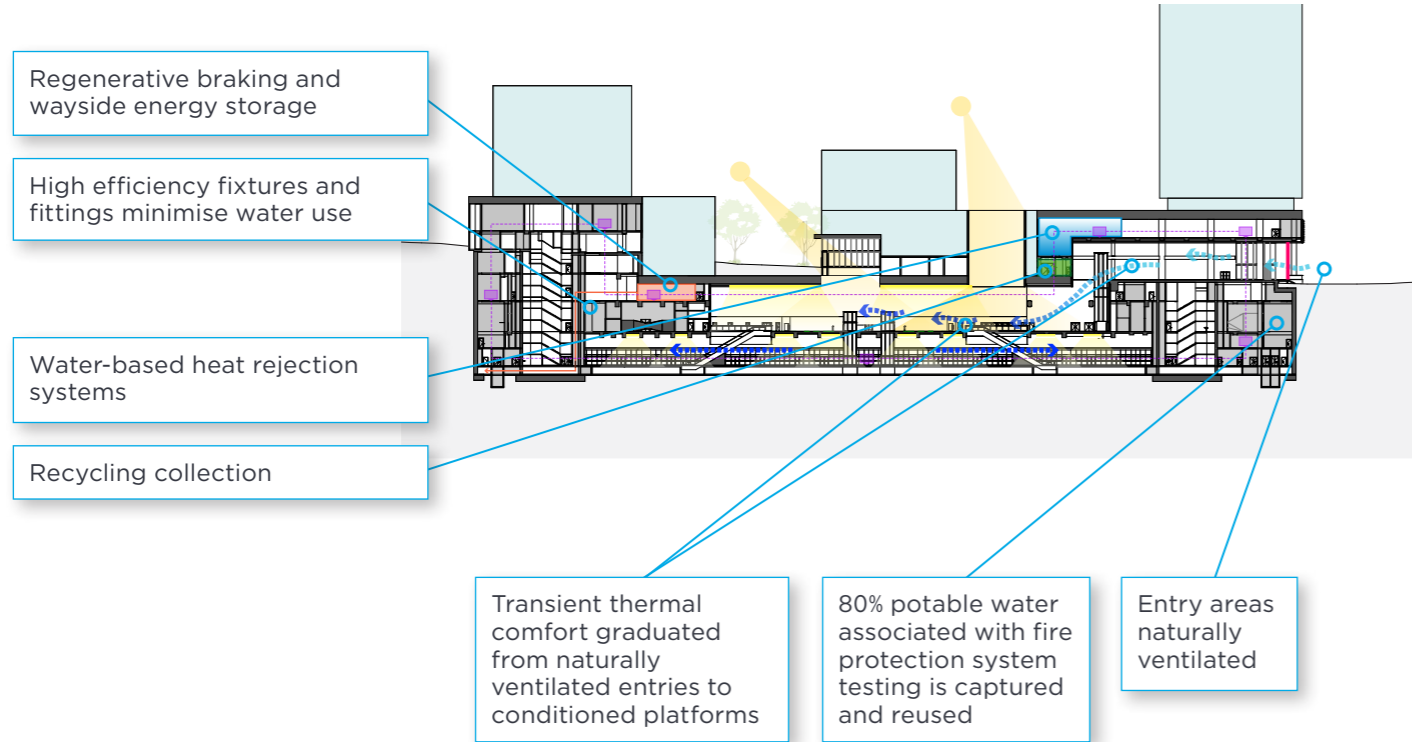
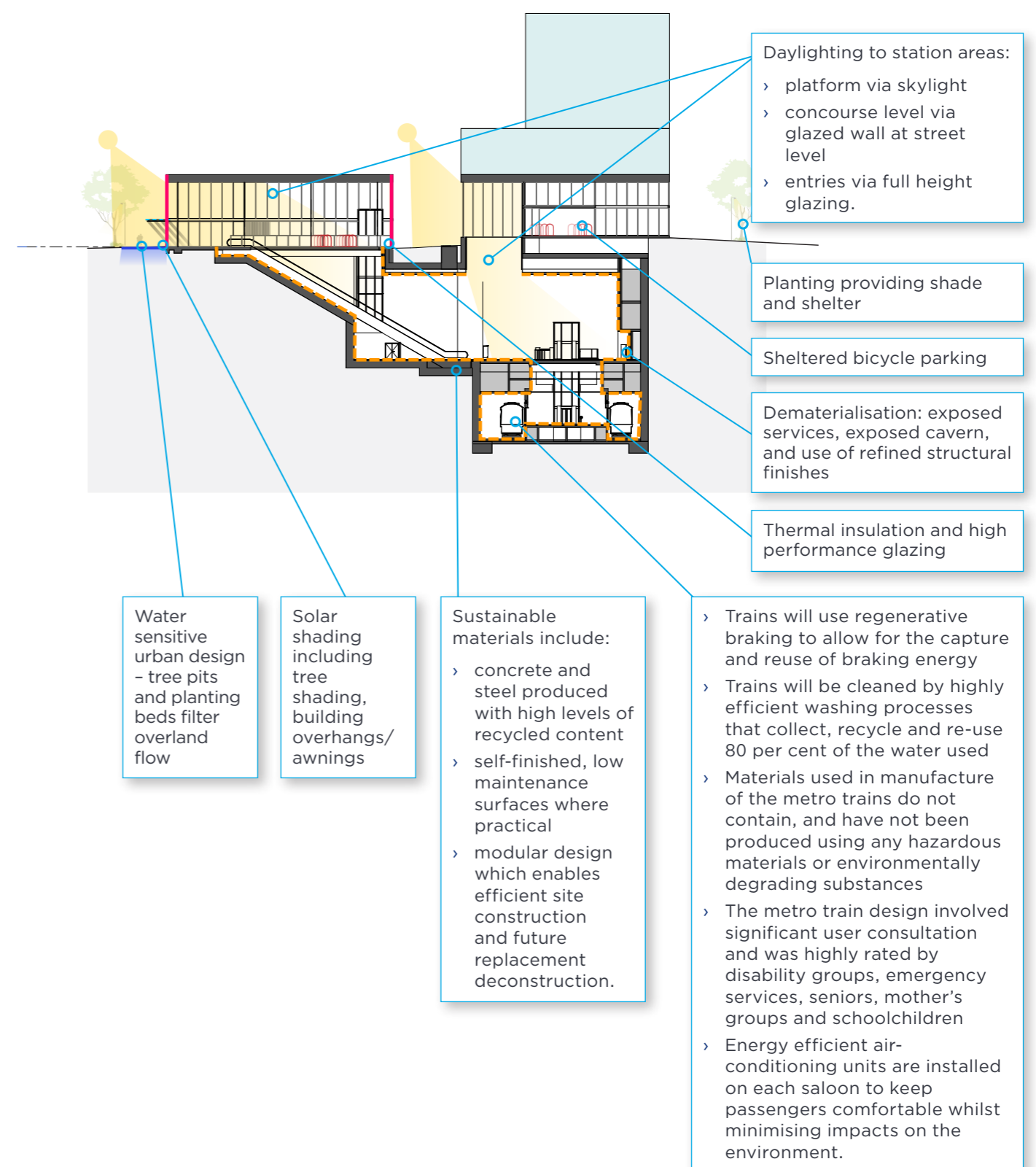


Figure 8 Cross section highlighting sustainability opportunities

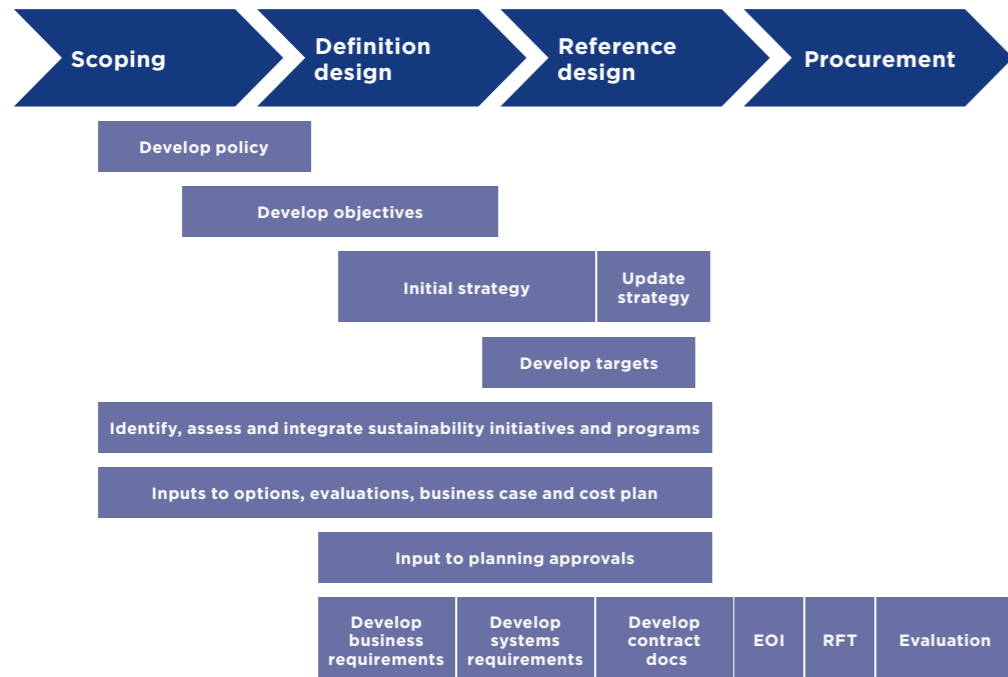


3.7 Strategy process and key activities

The overall process and key activities which have been undertaken to achieve the sustainability objectives, targets and initiatives for the Project components, through to the early procurement stage, are illustrated in Figure 9.

The next steps in implementation are described in Section 4.

Figure 9 Early implementation activities for individual project components of the City & Southwest Project



3.8 Relationships with other strategies and frameworks

The Sydney Metro Integrated Performance Framework sets out a range of strategic program objectives for Sydney Metro. This Sustainability Strategy aligns with the strategic program objectives, as described in Appendix B

As previously outlined in Section 3.2 and Figure 3, there are some elements that while they form part of the broader definition of sustainability, are not the focus of this strategy. These elements are being delivered by other Sydney Metro teams and their respective objectives and initiatives are addressed in other strategies and plans, including:

- › Sydney Metro Heritage Strategy
- › Sydney Metro Overarching Community and Communications Strategy
- › Sydney Metro City & Southwest Construction Noise and Vibration Strategy
- › Sydney Metro Construction and Environmental Management Framework
- › Sydney Metro Product Strategy
- › Sydney Metro Program Safety Assurance Plan.

Workforce development has traditionally formed part of Sydney Metro’s overall sustainability strategy’s objectives and targets. These are now reflected in the Sydney Metro City & Southwest Workforce Development and Industry Participation Strategy (a separate document). The strategy sets a vision, objectives and initiatives relating to workforce development to reflect industry skills requirements, local demographics, regulatory drivers and wider government priorities around skill, employment, diversity and business growth.

Benefits from the implementation of the Sydney Metro City & Southwest Workforce Development and Industry Participation Strategy include:

- › increased availability of skills and capacity, supporting Project delivery within a value-for-money approach
- › socio-economic benefits for local communities and individuals
- › development of intellectual capital through skilling, reskilling and upskilling local workers
- › providing better employment options for local under-represented groups including Aboriginal people, young people and women
- › increased collaboration with industry partners
- › increased global competitiveness of Australia’s enterprises
- › management of risks around providing local jobs as part of the project.

Further information on the Sydney Metro City & Southwest Workforce Development and Industry Participation Strategy is provided in Appendix O.



National Aborigines and Islanders Day Observance Committee (NAIDOC) Week celebrations at Sydney Metro Community Information Centre, Castle Hill, July 2016

4 IMPLEMENTATION

4.1 Roles and responsibilities

The responsibility for ensuring sustainability outcomes extends well beyond the Sydney Metro sustainability team to other work streams, functional groups, the Project Executive and contractors. Whether it is ownership of targets, or promotion of benefits and outcomes, sustainability is integrated across the team and is a shared responsibility.

4.2 Ensuring compliance - overarching management systems

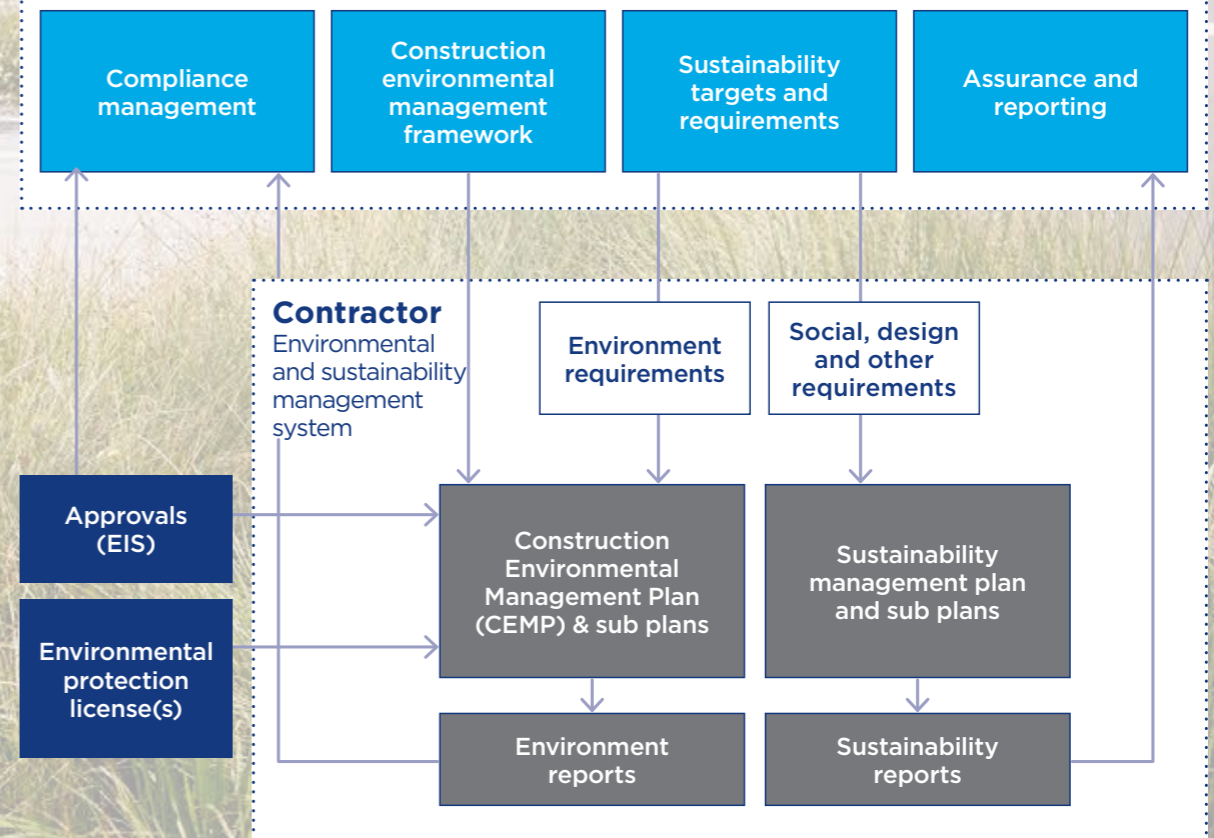
The Environment & Sustainability Policy and Strategy has been integrated into the Environmental and Sustainability Management System (E&SMS), outlined in Figure 10. This figure also shows relationship between key documents within the Sydney Metro E&SMS and the Principal Contractor's E&SMS. Notably:

- › the Construction Environment Management Plan (CEMP) and sub plans will capture the construction environmental requirements emerging from the EISs and subsequent planning approvals and this strategy
- › the Sustainability Management Plans will capture governance and design requirements as well as social sustainability initiatives required by this strategy and contract requirements. These plans will vary in scope across different delivery packages
- › progress against sustainability objectives and targets will be tracked through regular sustainability reporting over the delivery period. Future design changes may affect our ability to meet all targets. If a target has not been met, commentary will be provided.

Figure 10 Sydney Metro City & Southwest Environment and Sustainability Management System

Sydney Metro City & Southwest

Environmental and sustainability management system



Bioretention basin in commuter car park at Edmondson Park



Riding the Sydney Metro on its opening day

APPENDIX A CONSISTENCY WITH RELEVANT PLANNING APPROVALS

The Project Conditions of Approval (CoA), revised mitigation measures and revised environmental outcomes relating to sustainability and where they are addressed to demonstrate compliance are outlined in Tables A1 to A4.

Table A1 Consistency with the Chatswood to Sydenham CoAs and revised mitigation measures and environmental outcomes

Ref	Condition/commitment	Where addressed in this Strategy
Condition of Approval – Infrastructure approval SSI 15_7400 (9 January 2017)		
E71	The proponent must seek to achieve a best practice level of performance for the CSSI using market leading sustainability ratings tools (including a minimum 'Design' and 'As built' rating score of 65 using the Infrastructure Sustainability Council of Australia infrastructure rating tool, or an equivalent level of performance using a demonstrated equivalent rating tool).	Table 2 – Governance theme and Appendix C
E72	The Proponent must prepare a Sustainability Strategy to be submitted to the Secretary within six (6) months of the date of this approval, or within another timeframe agreed with the Secretary, which must be implemented throughout design, construction and operation of the CSSI. The Sustainability Strategy must include:	This Strategy & Appendices
	(a) details of the sustainability objectives and targets for the design, delivery and operation of the CSSI	Section 3 and Appendices C–N
	(b) details of the sustainability initiatives which will be investigated and / or implemented (c) a description of how the strategy will be implemented for the CSSI.	Section 6 and Appendices C–N
E73	Opportunities to reduce operational greenhouse gas emissions must be investigated during detailed design. The sustainability initiatives identified must be implemented, reviewed and updated regularly throughout design development and construction, and annually during operation.	Table 2 – Carbon & Energy Management theme and Appendix D
E74	The Proponent must fully offset the greenhouse gas emissions associated with consumption of electricity during operation of the CSSI.	Table 2 – Carbon & Energy Management theme and Appendix D
E101	Before commencement of permanent built surface works and/or landscaping, the Proponent must prepare Station Design and Precinct Plans (SDPP) for each station.....Each SDPP must include, but not be limited to: (a) identification of specific design objectives, principles and standards based on – ...v. sustainable design and maintenance...	This Strategy & Appendices outline applicable objectives, principles and standards, and will inform the SDPPs

Ref	Condition/commitment	Where addressed in this Strategy
Revised environmental mitigation measures – Sydney Metro Chatswood to Sydenham Submission and Preferred Infrastructure Report (October, 2016)		
Construction		
SUS1	Sustainability initiatives would be incorporated into the detailed design and construction of the project to support the achievement of the project sustainability objectives.	Appendix C
SUS2	A best-practice level of performance would be achieved using market leading sustainability rating tools during design and construction.	Table 2 – Governance theme and Appendix C
SUS3	A workforce development and industry participation strategy would be developed and implemented during construction.	Section 4
SUS4	Climate change risk treatments would be incorporated into the detailed design of the project including:	Table 2 – Climate change resilience theme and Appendix F
	› ensuring that adequate flood modelling is carried out and integrated with design.	
	› testing the sensitivity of air-conditioning systems to increased temperatures, and identify potential additional capacity of air-conditioning systems that may be required within the life of the project, with a view to safeguarding space if required. › testing the sensitivity of ventilation systems to increased temperatures and provide adequate capacity.	
SUS5	An iterative process of greenhouse gas assessments and design refinements would be carried out during detailed design and construction to identify opportunities to minimise greenhouse gas emissions. Performance would be measured in terms of a percentage reduction in greenhouse gas emissions from a defined reference footprint.	Table 2 – Carbon & Energy theme and Appendix D
SUS6	25 per cent of the greenhouse gas emissions associated with consumption of electricity during construction would be offset.	Table 2 – Carbon & Energy Management theme and Appendix D
WM2	100 per cent of spoil that can be reused would be beneficially reused in accordance with the project spoil reuse hierarchy.	Table 2 – Resources – Waste & Materials theme
WM3	A recycling target of at least 90 per cent would be adopted for the Project.	Table 2 – Resources – Waste & Materials theme and Appendix H
Operation		
SUS7	Sustainability initiatives would be incorporated into the operation of the Project to support the achievement of the project sustainability objectives.	Appendix C
SUS8	Periodic review of climate change risks would be carried out to ensure ongoing resilience to the impacts of climate change.	Appendix F
SUS9	A workforce development and industry participation strategy would be developed and implemented during operation.	Section 4
SUS10	100 per cent of the greenhouse gas emissions associated with consumption of electricity during operation would be offset.	Table 2 – Carbon & Energy Management theme and Appendix D

Table A2 Consistency with the Chatswood to Sydenham EIS environmental performance outcomes

Relevant Secretary's environmental assessment requirements desired performance outcomes	Environmental performance outcome	Where addressed in this Strategy
Sustainability		
Sustainability The project reduces the NSW Government's operating costs and ensures the effective and efficient use of resources. Conservation of natural resources is maximised.	The project would be carried out in accordance with the Sydney Metro City & Southwest Environment and Sustainability Policy.	Section 3
	25 per cent of the greenhouse gas emissions associated with consumption of electricity during construction would be offset.	Table 2 - Carbon & Energy Management theme and Appendix D
	100 per cent of the greenhouse gas emissions associated with consumption of electricity during operation would be offset.	Table 2 - Carbon Energy Management theme and Appendix D
Non-Aboriginal heritage		
Heritage The design, construction and operation of the project facilitates, to the greatest extent possible, the long term protection, conservation and management of the heritage significance of items of environmental heritage and Aboriginal objects and places. The design, construction and operation of the project avoids or minimises impacts, to the greatest extent possible, on the heritage significance of environmental heritage and Aboriginal objects and places.	The project would be sympathetic to heritage items and, where feasible and reasonable, avoid and minimise impacts to non-Aboriginal heritage items and archaeology.	Table 2 - Heritage Conservation theme and Appendix J
	The design of the project would reflect the input of an independent heritage architect, relevant stakeholders and the design review panel.	Appendix J
Aboriginal heritage		
Heritage The design, construction and operation of the project facilitates, to the greatest extent possible, the long term protection, conservation and management of the heritage significance of items of environmental heritage and Aboriginal objects and places. The design, construction and operation of the project avoids or minimises impacts, to the greatest extent possible, on the heritage significance of environmental heritage and Aboriginal objects and places.	The project would be sympathetic to heritage items and, where feasible and reasonable, avoid and minimise impacts to Aboriginal heritage items and archaeology.	Table 2 - Heritage Conservation theme and Appendix J
	The design of the project would reflect the input of an independent heritage architect, relevant stakeholders and the design review panel.	Appendix J

Relevant Secretary's environmental assessment requirements desired performance outcomes	Environmental performance outcome	Where addressed in this Strategy
Social impacts and community facilities		
Socio-economic, land use and property The project minimises adverse social and economic impacts and capitalises on opportunities potentially available to affected communities. The project minimises impacts to property and business and achieves appropriate integration with adjoining land uses, including maintenance of appropriate access to properties and community facilities, and minimisation of displacement of existing land use activities, dwellings and infrastructure.	The project would avoid long-term impacts (during operation) on the availability and quality of public open space and community facilities.	Appendix L
	The project, during operation, would help to improve access to local facilities, services and destinations, supporting opportunities for community interaction.	Table 2 - Community Benefit theme and Appendix L
Biodiversity		
Biodiversity The project design considers all feasible measures to avoid and minimise impacts on terrestrial and aquatic biodiversity. Offsets and/or supplementary measures are assured which are equivalent to any remaining impacts of project construction and operation.	The biodiversity outcome would be consistent with the Framework for Biodiversity Assessment.	Appendix I
	The project would minimise impacts to biodiversity.	Table 2 - Biodiversity theme and Appendix I
Waste management		
All wastes generated during the construction and operation of the project are effectively stored, handled, treated, reused, recycled and/or disposed of lawfully and in a manner that protects environmental values.	All waste would be assessed, classified, managed and disposed of in accordance with the NSW Waste Classification Guidelines.	Appendix H
	100 per cent of spoil that can be reused would be beneficially reused in accordance with the Project spoil reuse hierarchy.	Table 2 - Resources - Waste & Materials theme and Appendix H
	A recycling target of at least 90 per cent would be adopted for the construction of the project.	Table 2 - Resources - Waste & Materials theme and Appendix H

Table A3 Consistency with the Sydenham to Bankstown CoAs and revised mitigation measures and environmental outcomes

Ref	Condition/commitment	Where addressed in this Strategy
Condition of Approval – Infrastructure approval SSI 15_8256 (12 December 2018)		
E42	The Proponent must seek to achieve a best practice level of performance for the CSSI using market leading sustainability ratings tools (including a minimum 'Design' and 'As built' rating score of 65 using the Infrastructure Sustainability Council of Australia infrastructure rating tool [version 1.2], or an equivalent level of performance using a demonstrated equivalent rating tool).	Table 2 – Governance theme and Appendix C
E43	The Sustainability Strategy must be submitted to the Planning Secretary within six (6) months of the date of this approval and must be implemented throughout Construction and Operation.	This Strategy & Appendices
E44	Opportunities to reduce Operational greenhouse gas emissions must be investigated during detailed design. The sustainability initiatives identified must be regularly reviewed, updated and implemented throughout the design development and construction, and annually during Operation.	Table 2 – Carbon & Energy Management theme and Appendix
E45	The Proponent must fully offset the greenhouse gas emissions associated with consumption of electricity during Operation of the CSSI.	Table 2 – Carbon & Energy Management theme and Appendix D
Revised environmental mitigation measures – Sydney Metro Chatswood to Sydenham Submission and Preferred Infrastructure Report (October, 2016)		
Construction		
SCC1	Sustainability initiatives and targets would be reviewed and incorporated into the detailed design to support the achievement of the project's sustainability objectives. A best practice level of performance would be targeted using relevant sustainability rating tools e.g. ISCA as built 'excellent' level rating.	Appendix C
SCC2	A sustainable procurement strategy would be developed and implemented to apply to Principal Contractors, their subcontractors and their suppliers.	Appendix M
SCC3	A workforce development and industry participation strategy would be developed covering both construction and operation.	Section 4
SCC4	The need for climate change risk treatments would be assessed and incorporated into the detailed design, where required.	Table 2 – Climate change resilience theme and Appendix F
SCC5	An iterative process of greenhouse gas assessments and design refinements would be carried out during detailed design and construction to identify opportunities to minimise greenhouse gas emissions. Performance would be measured in terms of a percentage reduction in greenhouse gas emissions from a defined reference footprint.	Table 2 – Carbon & Energy theme and Appendix D

Ref	Condition/commitment	Where addressed in this Strategy
SCC6	Sustainability reporting (and corrective action where required) would be undertaken during construction.	Section 4, Appendix C
SCC7	The construction workforce development plan would be implemented.	Section 4
SCC8	25 per cent of the greenhouse gas emissions associated with consumption of electricity during construction would be offset.	Table 2 – Carbon & Energy Management theme and Appendix D
WM2	A recycling target of at least 90 per cent would be adopted.	Table 2 – Resources – Waste & Materials theme
WM4	Target 100 per cent reuse of reusable spoil.	Table 2 – Resources – Waste & Materials theme and Appendix H
Operation		
SCC9	Prior to operation commencing, sustainability initiatives would be reviewed and updated, and relevant initiatives would be implemented to support the achievement of the project's sustainability objectives.	Appendix C
SCC10	The operation workforce development plan would be implemented.	Section 4
SCC11	Periodic review of climate change risks would be carried out to ensure ongoing resilience to the impacts of climate change.	Appendix F
SCC12	100 per cent of the greenhouse gas emissions associated with consumption of electricity during operation would be offset.	Table 2 – Carbon & Energy Management theme and Appendix D

Table A4 Consistency with the Sydenham to Bankstown EIS environmental performance outcomes

Relevant Secretary's environmental assessment requirements desired performance outcomes	Environmental performance outcomes	Where addressed in this Strategy
<p>Biodiversity</p> <p>The project design considers all feasible measures to avoid and minimise impacts on terrestrial and aquatic biodiversity.</p> <p>Offsets and/or supplementary measures are assured which are equivalent to any remaining impacts of project construction and operation</p>	<p>The project is designed to minimise impacts on biodiversity. Where practicable, the design minimises the need to clear vegetation.</p> <p>Potential impacts on biodiversity are managed in accordance with relevant legislation, including the EP&A Act, TSC Act, EPBC Act, and the <i>Noxious Weeds Act 1993</i>.</p> <p>The biodiversity outcome is consistent with the Framework for Biodiversity Assessment.</p> <p>Offsets are provided in accordance with the <i>NSW Biodiversity Offsets Policy for Major Projects</i>.</p>	Table 2 – Biodiversity theme and Appendix I
<p>Flooding and hydrology.</p> <p>Sustainable use of water resources.</p>	<p>Opportunities to reuse water resources are considered during the design process.</p> <p>The use of water during construction is minimised.</p>	Appendix G
<p>Heritage</p> <p>The design, construction and operation of the project facilitates, to the greatest extent possible, the long term protection, conservation and management of the heritage significance of items of environmental heritage and Aboriginal objects and places.</p> <p>The design, construction and operation of the project avoids or minimises impacts, to the greatest extent possible, on the heritage significance of environmental heritage and Aboriginal objects and places.</p>	<p>The design is sympathetic to the historic significance of existing stations and the heritage significance of surrounding listed heritage items, and where practicable, avoids and minimises impacts to heritage.</p> <p>The design and mitigation strategies are reviewed by the Sydney Metro Design Review Panel.</p> <p>Impacts on heritage are managed in accordance with relevant legislation, including the EP&A Act, the <i>Heritage Act 1977</i>, and relevant guidelines.</p> <p>The potential impacts identified are mitigated by the mitigation measures provided.</p>	Appendix J
<p>Socio-economic, land use and property</p> <p>The project minimises adverse social and economic impacts and capitalises on opportunities potentially available to affected communities.</p> <p>The project minimises impacts to property and business and achieves appropriate integration with adjoining land uses, including maintenance of appropriate access to properties and community facilities, and minimisation of displacement of existing land use activities, dwellings and infrastructure.</p>	<p>The project minimises impacts to the local community, community infrastructure, and businesses.</p> <p>Impacts to existing land use and properties are minimised.</p> <p>The project is appropriately integrated with adjoining land uses, and access to private properties is maintained.</p> <p>The project is appropriately integrated with local and regional land use planning strategies, including the <i>Sydenham to Bankstown Corridor Urban Renewal Strategy</i>.</p> <p>During operation, the project would improve access to local facilities, services and destinations, supporting opportunities for community interaction.</p>	Appendix L

Relevant Secretary's environmental assessment requirements desired performance outcomes	Environmental performance outcomes	Where addressed in this Strategy
<p>Sustainability</p> <p>The project reduces the NSW Government's operating costs and ensures the effective and efficient use of resources.</p> <p>Conservation of natural resources is maximised.</p>	<p>Sustainability considerations are integrated throughout design, construction, and operation.</p> <p>The project would be carried out in accordance with the Sydney Metro City & Southwest Sustainability Policy.</p>	This Strategy Section 3
<p>Traffic, transport and access</p> <p>Network connectivity, safety and efficiency of the transport system in the vicinity of the project are managed to minimise impacts.</p> <p>The safety of transport system customers is maintained.</p> <p>Impacts on network capacity and the level of service are effectively managed.</p> <p>Works are compatible with existing infrastructure and future transport corridors.</p>	<p>The project would reduce station crowding, increase rail network reach and use, improve network resilience, and improve travel times within the global economic corridor.</p> <p>Impacts to traffic and transport are minimised.</p> <p>Motorist, pedestrian and cyclist safety will be maintained or improved.</p> <p>Safe access to properties is maintained.</p> <p>The project is integrated with existing and future local and regional transport infrastructure and planning strategies.</p> <p>Metro customers would be provided with a safe and secure service.</p>	Appendix K
<p>Place making and urban design</p> <p>The project capitalises on opportunities to improve place, character and quality of the surrounding build and natural environment (including adjoining public spaces).</p> <p>The project contributes to the accessibility and connectivity of communities.</p>	<p>The project is designed to have regard to the surrounding landscape and visual environment and to minimise the potential for visual impacts.</p> <p>The project is visually integrated with its surroundings.</p> <p>The stations provide a sense of place, and contribute positively to the surrounding urban environment.</p> <p>The design takes into account future planning for the <i>Sydenham to Bankstown Corridor Urban Renewal Strategy</i>.</p> <p>Vegetation providing screening to the rail corridor is retained where practicable.</p>	Appendix K

APPENDIX B INPUTS TO THE SUSTAINABILITY FRAMEWORK

Regulations and policy drivers

The City & Southwest sustainability strategy responds to, and aligns with, a number of regulatory and project drivers, outlined in Table B1.

Table B1 Regulatory and Project drivers for the City & Southwest Sustainability Strategy

Driver	Description
Regulatory drivers	
Environmental Planning and Assessment Act 1979 (NSW)	The EP&A Act objectives encourage Ecological Sustainable Development (ESD). The EP&A Act recognises that ESD requires the effective integration of economic and environmental considerations into decision making processes. There are four main principles supporting the achievement of ESD: <ul style="list-style-type: none"> › precautionary principle › intergenerational equity › conservation of biological diversity and ecological integrity › improved valuation and pricing of environmental resources.
Transport Administration Act 1988 (NSW)	A common objective and service delivery priority of public transport agencies is 'To promote the delivery of transport services in an environmentally sustainable manner'.
The National Greenhouse and Energy Reporting Act 2007 (NGER)	The NGER Act outlines a mandatory national system for reporting greenhouse emissions, abatement actions and energy consumption. Under the NGER Act, the Project will have reporting obligations due to the anticipated energy demand.
Aboriginal Participation in Construction Guidelines (2007)	The Aboriginal Participation in Construction Guidelines (2007) (Guidelines) are 'aimed at supporting and encouraging more employment and business opportunities for Aboriginal people on government construction projects'. Under the Guidelines project specific Aboriginal participation targets and KPIs are set by Contractors. A plan must be prepared and progress monitored and reported on.
NSW 2021 - State Plan (2011)	NSW 2021 includes a number of targets to protect and restore priority land, vegetation and water habitats, protect local environments from pollution, increase renewable energy, minimise waste, encourage recycling and minimise impacts of climate change on local communities.
NSW Long Term Transport Master Plan (2012)	The Plan states that 'promoting sustainability and protecting the environment in our transport planning, decisions and projects' is a state-wide challenge that must be addressed. The Plan focuses on achieving the following environmental and sustainability objectives: <ul style="list-style-type: none"> › enhancing environmental and sustainability outcomes › minimising damage to our environment › adapting our transport infrastructure to be resilient (to climate change and natural disasters) › maintaining Sydney's air quality › reducing emissions and managing energy use.

Driver	Description
Australia Jobs Act 2013	Industry to supply goods and services to the Project.
NSW Government Resource Efficiency Policy (2014 and 2019)	The NSW Government Resource Efficiency Policy (2014) (Policy) aims to drive resource efficiency, with a focus on energy, water and waste, and reducing harmful air emissions. The Policy aims to ensure NSW Government agencies: <ul style="list-style-type: none"> › meet the challenge of rising costs for energy, water, clean air and waste management › use purchasing power to drive down the cost of resource-efficient technologies and services › show leadership by incorporating resource efficiency in decision-making. The policy includes specific measures, targets and minimum standards to drive resource efficiency.
NSW Waste Avoidance and Resource Recovery Strategy 2014-21 (2014)	The NSW Waste Avoidance and Resource Recovery Strategy 2014-21 (2014) (Strategy) provides a framework for waste management and aligns with the NSW Government's waste reforms in NSW 2021. The Strategy includes the following six key result areas: avoid and reduce waste generation, increase recycling, divert more waste from landfill, manage problem wastes better (including asbestos), reduce litter, and reduce illegal dumping.
Aboriginal Participation in Construction Policy (2015)	The Policy aims to 'increase the employment and education opportunities for Aboriginal people within the construction industry'. Under the Policy a percentage of the total estimated value of the contract (termed 'targeted project spend') must be directed to Aboriginal related employment and education activities, procurement of goods or services from recognised Aboriginal businesses or other programs. An Aboriginal Participation Plan must be prepared and published shortly after contract award. A Participation Report must be prepared and published (once construction is 90 per cent complete) describing how the Plan was implemented.
NSW Strategic Business Case Gateway	Sustainability indicators form a key component of the Gateway Review System. The Gateway Review is a NSW Government process that assesses the progress of projects against the following seven criteria service (including sustainability) to inform the procurement process.
Transport Administration Amendment (Sydney Metro) Act 2018	The Transport Administration Act 1988 (the Principal Act) was amended to facilitate the development, implementation and operation of a metro in Sydney by constituting Sydney Metro as a NSW Government Agency, and as a corporation and sets out its objectives, functions and management. The principal objectives of Sydney Metro are: <ul style="list-style-type: none"> (a) to deliver safe and reliable metro passenger services in an efficient, effective and financially responsible manner, (b) to facilitate and carry out the orderly and efficient development of land in the locality of metro stations, depots and stabling yards, and proposed metro stations, depots and stabling yards. Another objective is; where its activities affect the environment, to conduct its operations in compliance with the principles of ecologically sustainable development contained in section 6 (2) of the Protection of the Environment Administration Act 1991.
NSW Future Transport Strategy 2056 (2018)	Future Transport 2056 is the NSW Government's overarching 40 year integrated transport strategy. It outlines six state-wide outcomes to guide investment, policy and service provision; customer focused successful places, a strong economy, safety and performance, accessible services, and sustainability. The sustainability outcome specifies that the transport system is economically and environmentally sustainable, affordable for customers and supports emissions reductions. It recognises that transport accounts for over 42 percent of the state's energy consumption and has a role in operating in a more sustainable way to contribute to NSW Government's aspirational net-zero emission target.

Driver	Description
NSW State Infrastructure Strategy 2018-2038 (2018)	Vision of delivering the right infrastructure, in the right place, that is well managed and put to good use, boosting productivity, global competitiveness, and improving the quality of people's lives.
Other frameworks and policies	
Transport Environment and Sustainability Policy Framework (2013)	The Framework was developed to establish a collective and coordinated approach to deliver the NSW Government's environmental and sustainability agenda across the transport sector. The Framework includes objectives, targets, measures and action plans to deliver positive environmental outcomes. The Framework has been developed to align with the State Plan 2021 and Transport Master Plan. The TfNSW sustainability aspiration is 'to provide a world class sustainable transport system that meets customer expectations and optimises economic development for NSW' (TfNSW Framework, 2013). A number of TfNSW sustainability guiding principles are outlined and have been used to guide the development of the sustainability objectives for The Project.
Sydney's Cycling Future, Cycling for everyday transport (2013)	Outlines how the NSW Government will 'improve the bicycle network and make sure that the needs of bike riders are built into the planning of new transport and infrastructure projects.' Sydney's Cycling Future provides the strategic and policy context, articulating: <ul style="list-style-type: none"> › [ensuring] that the needs of bike riders are built into the planning of new transport and infrastructure projects › Deliver bicycle infrastructure through major transport and development projects.'
Sydney's Walking Future, Connecting people and places (2013)	The goal of Sydney's Walking Future, Connecting people and places (2013) is to 'get people in Sydney walking more through actions that make it a more convenient, better connected and safer mode of transport.'
Sydney's Bus Future, Simpler, faster, better bus services (2013)	Sets out how essential improvements to the bus network will be implemented to meet changing customer needs, including being able to access major centres outside the Sydney CBD.
NSW Renewable Energy Action Plan (2013)	The REAP intends to position NSW as the clean energy State of Australia - attracting investment, building a clean energy knowledge industry and creating jobs, whilst reducing the State's contribution to greenhouse gas (GHG) emission.
NSW Procurement Policy Framework 2014	Sets out mandatory requirements and guidance on sustainable procurement practices for NSW government agencies.
TfNSW Environment & Sustainability Policy (2015)	TfNSW's commitment to delivering transport services, projects, operations and programs in a manner that balances economic, environmental and social issues to ensure a sustainable transport system for NSW.
NSW Premier's 12 Priorities (2018)	The Premier's 12 Priorities is a whole-of-government approach to tackling important issues for the people of NSW. The project supports key priorities including delivering infrastructure, ensuring on-time running for public transport, increasing housing supply, improving road travel reliability, creating jobs, and potentially tackling childhood obesity through indirect interventions of increased active transport uptake.
TfNSW Diversity and Inclusion Policy	The policy embraces equal employment opportunity which is pivotal to addressing employment disadvantage for diverse groups including but not limited to: women, Aboriginal people, people with a disability and people from culturally and linguistically diverse backgrounds.
Infrastructure Skills Legacy Program & Demonstration pilot	The Program will support the Premier's state priority to create jobs, together with a focussed commitment to grow skills and jobs through infrastructure investment. Sydney Metro is in the final stages of signing a MoU with NSW Department of Industry, Skills and Regional Development to become a demonstration pilot project as part of the program. This will secure funding for accredited training across the Project.

Driver	Description
NSW Procurement - PBD-2016-02 Construction apprenticeships	The Procurement directive ensures skills development goals are established for all relevant government construction projects. The NSW Procurement Board requires all NSW projects identify a target for the engagement of apprentices or trainees for every construction contract valued over \$10 million.
NSW Greater Sydney - Green Grids and Blue Grids (2016)	Green Grids acknowledges that green space is a key hallmark of liveability and proposes a network of high-quality green space that connects town centres, public transport hubs and major residential areas. This is an integral part of the Greater Sydney Region and District Plans and promotes sustainable development while maximising quality of life and wellbeing. The Green Grids utilises the natural Blue Grid of waterways and watercourses that thread throughout Greater Sydney, and calls for the restoration of these. It includes an extensive range of open spaces: from national, regional and local parks, through the harbour, wetlands, rivers, beaches and creeks to playgrounds, playing fields, golf courses and cemeteries. Further links will be made through enhancements to creek corridors, transport routes, footpaths and cycle ways to encourage walking, help promote healthy living patterns and reduce extremes of urban heat that can be expected to increase with climate change.
NSW Five million trees for a greener Sydney by 2030 (2018)	Aiming to increase Greater Sydney's tree canopy to 40 percent by 2030 by planting more trees in streets, parks, bushland areas and yards.
Smart Cities Plan (2017), Australian Government	The Smart Cities Plan sets out the Australian Government's urban policy priorities, including improving connectivity and reducing congestion in our cities, increasing housing supply in the right locations, and prioritising projects that meet broader economic and city objectives such as accessibility, jobs, affordable housing and healthy environment. It supports the '30-minute city' concept, where residents can access employment, schools, shopping, services and recreational facilities within 30 minutes travel time from home
PBD-2017-05 Construction training and skills development	NSW Government agencies must set targets for the engagement of apprentices and trainees on construction projects over \$10 million and must report outcomes to the Department of Industry.
Project drivers	
City & Southwest Environment & Sustainability Policy (April 2016)	Project commitment to sustainable outcomes.
NWRL Sustainability Strategy (2012)	Benchmark for Sydney Metro's approach to sustainability.
City & Southwest Business Requirements	Reflect the sustainability objectives for the Project.
Endorsed approach to workforce development	The workforce development objectives and approach to implementation, including investigating specific programs, was endorsed by the People and Teams Executive Subcommittee.

TfNSW sustainability guiding principles

TfNSW's Transport Environment and Sustainability Policy Framework (June 2013) outlines six guiding principles guide and support TfNSW's decision making to deliver improved sustainability performance. These were considered in the development of this Strategy and the Project's sustainability objectives and include:

- › **Consider whole-of-life costing:** When comparing investment decisions, TfNSW will consider the potential future costs such as operating costs, environmental and social costs as well as the initial capital expenditure in the assessment of the best option. This will ensure the true cost of the asset over its life time is fully considered.
- › **Integrated planning:** Transport will work with its partners to develop integrated transport services and infrastructure that meet the existing and future requirements of its customers.
- › **Encourage innovation:** Transport will work with its partners to drive continual improvement in the environmental performance of transport infrastructure and services during the planning, design, building and operating. This will help to ensure we maintain best practice and deliver value for money.
- › **Customer focus:** Transport will consider the needs and expectations of its customers in the planning, design, building and operation of transport services and infrastructure. The customer is at the centre of our decision making.
- › **Engage our partners:** The successful delivery of transport services and infrastructure is dependent on the performance of TfNSW's partners. TfNSW aims to develop strong and trusted relationships with its partners to ensure transport services and infrastructure meets the expectations of its stakeholders – value for money, innovation and environmental performance.
- › **Measure and report on performance:** To drive continual improve in transport services and infrastructure, Transport will measure and report its progress against the sustainability indicators and targets. It will report internally and to its external stakeholders on a regular basis.

Lessons learnt from Sydney Metro Northwest

Recommendations and lessons learnt from the implementation of the Sydney Metro Northwest sustainability strategy, targets and requirements which are relevant to strategic sustainability considerations are as follows:

- › the sustainability targets and contract requirements established for Sydney Metro Northwest are achievable and to date have been successfully delivered by Sydney Metro Northwest contractors
- › rating tools have been useful in focussing contractor teams, and communicating performance to broader stakeholders
- › dedicated contractor sustainability resources with appropriate qualifications and experience (rather than shared environmental management resources) will provide the best opportunity to achieve good outcomes
- › adequate sustainability resourcing on the client side (within Sydney Metro, implementation groups, contract managers) and within the independent certifier, is an important consideration
- › best outcomes are achieved when the contractor executive team is active in, and responsible for, getting results
- › incentive payments can be a useful tools for achieving outcomes
- › requiring contractors to comply with layers of ratings and contract requirements can lead to ambiguity and conflicts, and should be streamlined and simplified where possible
- › contractors will not deliver against requirements or targets which are not measurable (e.g. 'enhance' community benefits)
- › construction and operational targets should be separated for clarity
- › additional focus is required in the procurement area. Sustainable outcomes will not be achieved if requirements are not passed down the supply chain
- › human rights / ethical sourcing issues should be considered where equipment and materials are sourced from developing countries.

Additional lessons learned in the workforce development and industry participation area have been documented in that Strategy the Workforce Development and Industry Participation Strategy.

Best practice benchmarking

A Sustainability Benchmarking Report (February 2015) was developed to review recent and current best practice in the sustainable design of national and international rail and infrastructure projects. The following case studies were reviewed to inform the project team of industry best practice sustainability initiatives and performance targets:

- › North West Rail Link – Sydney, Australia
- › Sydney Port Botany Expansion, Habitat Restoration
- › Sydney Inner West Light Rail – Greenway
- › Sydney South West Rail Link Leppington Station – Green Walls
- › Barangaroo South, Seawater Cooling
- › Goulburn Valley Highway, Aboriginal Heritage
- › Goulburn Valley Highway, Aboriginal Heritage
- › Qld Northern Busway Alliance, Aboriginal Heritage
- › Gold Coast Light Rail – Queensland, Australia
- › Gateway WA – Perth, Australia
- › Westgate Freeway, E-Crete (Geopolymer Concrete)
- › South Morang Rail Extension Project, bike and pedestrian connectivity
- › TriMet Portland – USA
- › New York Metropolitan Transit Agency – USA
- › Tarrant Regional Water District Line J – Texas, USA
- › LA Metro, Trackside Energy Storage
- › Hong Kong Metro, Trackside Energy Storage
- › Leeds Northern Rail – Cyclepoint
- › London Heathrow Airport, ‘Pavegen’ Footfall Energy Generation
- › London Farringdon Station Redevelopment, Green Roof
- › London Olympics 2012 Development – UK
- › Network Rail – UK.



Artist's impression of the cable-stayed bridge over Windsor Road



APPENDIX C GOVERNANCE

OBJECTIVES:

- Demonstrate leadership by embedding sustainability objectives into decision making.
- Demonstrate a high level of performance against objectives and appropriate benchmarks.
- Be accountable and report publicly on performance.

C1.1 Current position

Sydney Metro is committed to embedding good governance in all processes for the Project and providing the resources required to ensure effective implementation of those practices.

Sustainability governance activities include ensuring there are appropriate levels of resources and budget for key personnel to champion sustainability throughout the project team, embedding sustainability within decision-making frameworks and project management systems, engaging internal and external stakeholders, aligning the Project to achieve best-practice sustainability outcomes, implementing an assurance process to track and report against sustainability targets, and capturing and applying lessons learned from the Sydney Metro Northwest project to ensure continual improvement.

The main components of the sustainability governance framework are:

- › **This strategy** lays the foundation for addressing social and environmental issues for City & Southwest by clearly articulating the objectives and targets for the Project.
- › **The Environment & Sustainability policy** (April 2016) articulates Sydney Metro's position on sustainability and the environment of the Project and provides a point of reference for internal and external stakeholders.
- › **Rating tools** applicable to the Project have been adopted where considered to drive best practice sustainability outcomes, whilst providing clarity to the project team, market recognition, and third party verified assurance. The priority has been to develop a streamlined outcomes-focussed approach to applying sustainability rating tools on the Project which minimises duplication and is tailored to the scope of each of the delivery contracts.
- › Sydney Metro will develop an **assurance framework** and process to track and report against targets for the Project. The Sydney Metro Environment & Sustainability Management Manual, (which is part of the Integrated Management System for Sydney Metro), sets out roles and responsibilities, processes and procedures for driving sustainable outcomes, monitoring and reporting performance, and continual improvement.

C1.2 Future expectations

Sydney Metro will require delivery contractors to achieve ratings and/or adopt initiatives outlined in the following available sustainability rating tools:

- › Infrastructure Sustainability Council of Australia (ISCA) Infrastructure Sustainability (IS) rating scheme
- › Green Building Council of Australia (GBCA) Green Star design and as built rating scheme
- › TfNSW's Sustainable Design Guidelines (SDGs).

The application of rating tools to specific contracts is dependent on the scope and dollar value of each of the contract packages.

The IS rating scheme is most applicable to the infrastructure portions of the Project. Sydney Metro will register the Project under the 'Program' ratings system, and then have contractors seek ratings for their individual delivery packages (where specified in contracts). Sydney Metro Northwest civil works contractors were required to achieve an IS 65 ('Excellent') score. The tunnelling contractors achieved a score of 92, and the viaduct contractors are on track to also exceed the 65 benchmark.

The GBCA Green Star rating scheme is applicable to buildings. Sydney Metro will be using Green Star to drive sustainable design outcomes for new underground stations.

The TfNSW SDGs comprise a scoring system for sustainable design and construction of rail projects. The SDGs are currently being reviewed and updated by the TfNSW Infrastructure and Services Division, with a new version (Version 4) scheduled for release in mid-2017. To streamline ratings requirements, Sydney Metro will not require all contractors to achieve SDGs ratings. Instead, relevant elements of the emerging updated SDGs will be embedded into contracts where appropriate.

Where ratings are specified, contractors will be required to achieve a high level of attainment. The specific level has been tested by the Sydney Metro design team and reflects the optimum level of performance which maximises both sustainability outcomes and value for money.

Sydney Metro will establish appropriate resources, funding and systems within the project team to monitor and track achievement against sustainability performance targets, and review performance on a regular basis (annually at a minimum).

TARGETS:

- **A high level of attainment (minimum ISCA IS Rating of 65 'Excellent') for relevant infrastructure.**
- **5 Star Green Star ratings for relevant buildings.**
- **Align with a high rating using the TfNSW Sustainable Design Guidelines.**

Objective	Key example initiatives
Demonstrate a high level of performance against objectives and appropriate benchmarks	<ul style="list-style-type: none"> › Develop performance targets across all sustainability themes. › Achieve a best practice level of performance using market leading sustainability rating tools (ISCA, Green Star, SDGs or equivalent) during design, construction and operation.
Demonstrate leadership by embedding sustainability objectives into decision making	<ul style="list-style-type: none"> › Ensure the project decision making framework includes sustainability criteria (environment and community). › Implement incentives such as Key Performance Indicators and tender assessment criteria. › Develop industry partnering to promote sustainable development (e.g. with industry bodies, educational institutions and the community). › Promote innovation.
Be accountable and report publicly on performance	<ul style="list-style-type: none"> › Use an assurance framework and reporting system to assist Sydney Metro and contractors in reliably reporting against sustainability targets. › Monitor sustainability performance, and provide public sustainability reports.



Artist's impression of an underground station at Central Station



APPENDIX D CARBON AND ENERGY MANAGEMENT

OBJECTIVES:

- Improve the shift toward lower carbon transport.
- Reduce energy use and carbon emissions during construction.
- Reduce energy use and carbon emissions during operations.
- Support innovative and cost effective approaches to energy efficiency, low-carbon/renewable energy sources and energy procurement.

D1.1 Current position

Construction and operation of a new metro system is energy intensive and has the potential to result in the emission of significant quantities of greenhouse gases (GHG) associated with fuel and electricity use, and contribute to climate change. Sydney Metro will identify and implement best practice approaches to minimising and managing energy use and carbon emissions, which are economically feasible and environmentally responsible, including sourcing renewable energy for both construction and operational purposes.

The main contributors to construction-related emissions are:

- › combustion of fuel in construction plant, equipment and vehicles and at construction sites – Scope 1 emissions¹
- › electricity consumption for the tunnel boring machines – Scope 2 emissions²
- › embodied emissions in key construction materials, principally cement and steel – Scope 3 emissions³.

The operations phase estimate includes GHG emissions associated with operational and maintenance activities over the life cycle of the Project including:

- › metro trains
- › station facilities
- › signalling and communications
- › tunnel ventilation
- › water treatment plants.

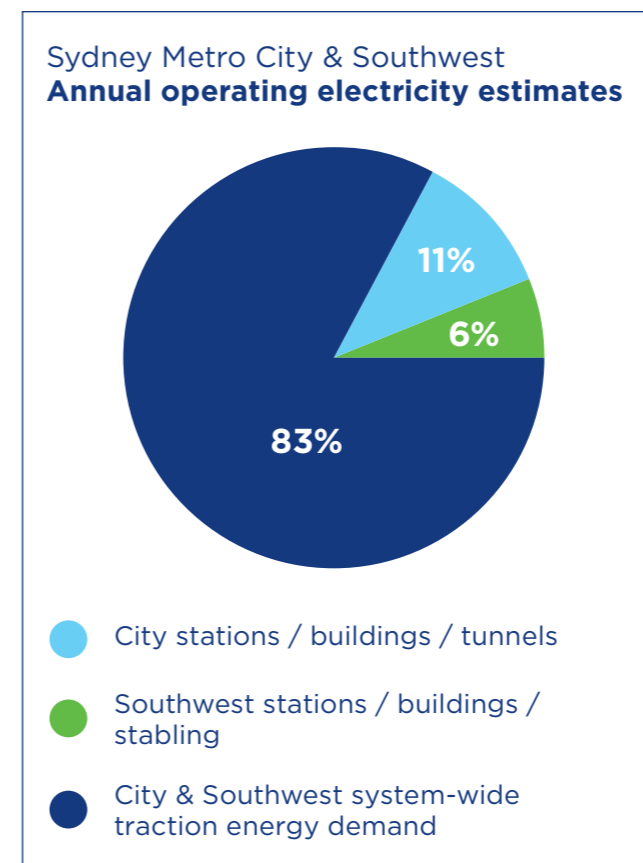
The most significant contributor to operational GHG emissions is electricity consumption. At the initial feasibility stage, traction energy was estimated to represent approximately 83 per cent of the operational electricity consumption (refer to Figure D1).

¹ Scope 1 emissions, also called 'direct emissions' are emissions generated directly by a project.

² Scope 2 emissions, also referred to as "indirect emissions" are generated outside of a project's boundaries to provide energy to the project.

³ Scope 3 emissions include all indirect emissions (not included in Scope 2) due to upstream or downstream activities.

Figure D1 Sydney Metro City & Southwest operational electricity consumption estimates



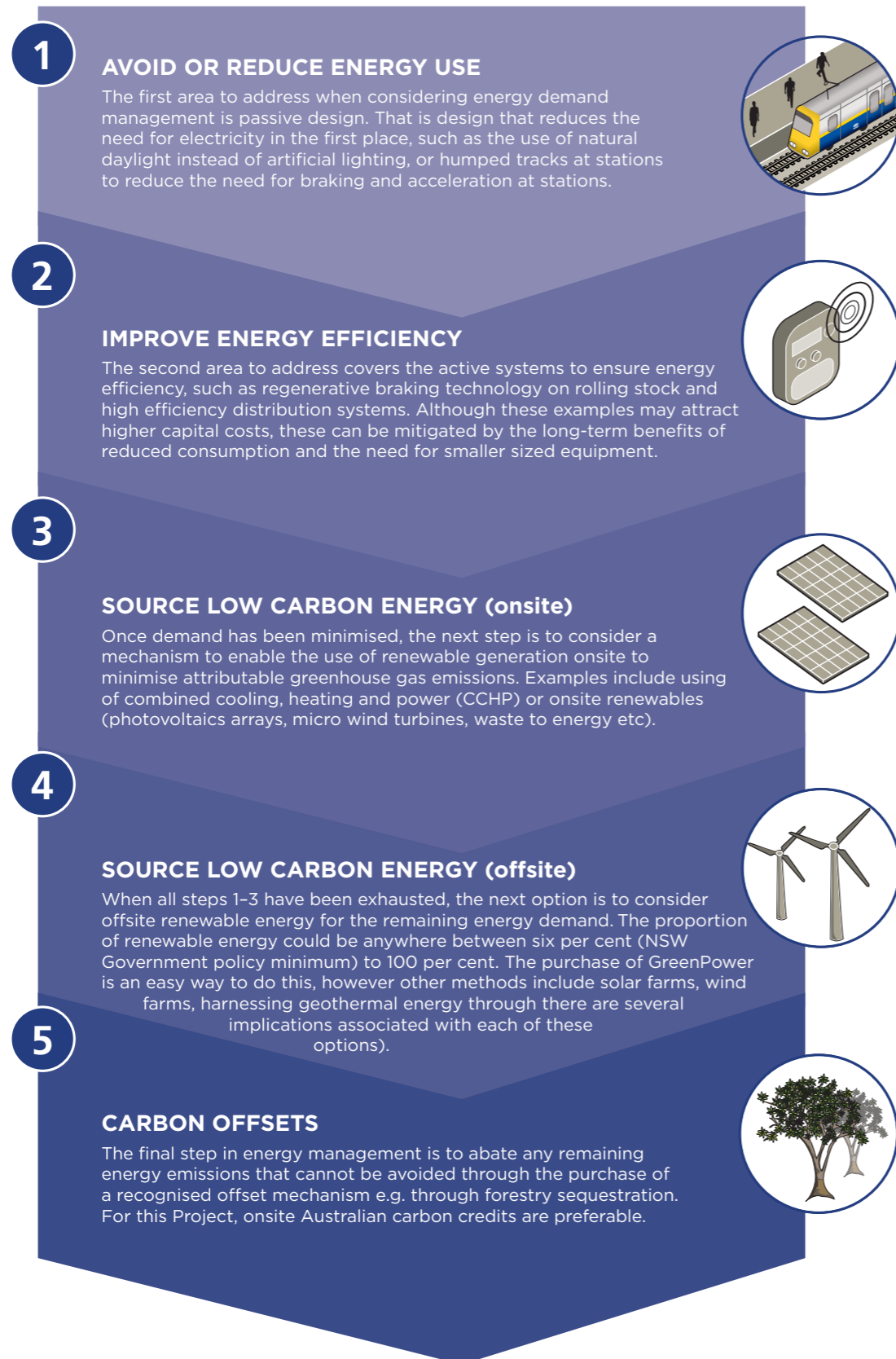
The Beryl solar farm is generating carbon offsets for Sydney Metro Northwest.



Sydney Metro Trains Facility at Tallawong Road from above, showcasing the 1.1 MW solar array

In identifying and implementing energy efficiency and GHG reduction opportunities, Sydney Metro adopts the energy management hierarchy illustrated in Figure D2.

Figure D2 Energy management hierarchy



Design

Key energy efficiency and GHG reduction measures adopted at the initial feasibility stage of the Project include:

- › Receptivity of the traction power system has been maximised – a minimum of 32 per cent of the net traction energy consumption per round trip can be reduced through regenerative braking.
- › Space for wayside energy storage safeguarded.
- › Energy efficient vertical transport, high performance thermal insulation and glazing, energy efficient heating, ventilation and air conditioning systems, LED lighting, smart metering and building user information systems at all stations.
- › At city stations, transient thermal comfort is provided for in-line with station function, graduating from naturally ventilated entries to fully conditioned platforms. City stations maximise daylight penetration to concourse levels, complementing energy efficient lighting systems.
- › Initial feasibility assessments indicate that a 15 per cent improvement on National Construction Code BCA Section J minimum energy performance requirements can be achieved for new stations.
- › Solar shading provided where possible including tree shading, building overhangs/awnings, and external shading devices.
- › Photovoltaics (PV) at Central Station, the Southwest stabling facility, and feasible buildings in the Southwest, to meet approximately 5 to 20 per cent of the annual electrical energy demand for those buildings.
- › Safeguarding for connection of the Sydney Metro Barangaroo Station to an alternative cooling system at Barangaroo.

Technical and cost benefit analysis completed by the Project technical advisers has supported the development of energy and GHG reduction targets

Design phase initiatives will translate to energy savings during the operations phase.

Construction

Construction phase initiatives identified to be adopted during delivery include:

- › using the TfNSW Carbon Estimate Reporting Tool (CERT) and relevant ISCA credits to set energy use and emission reduction targets
- › using energy efficient construction practices, and temporary facilities
- › offsetting 25 per cent of the electricity used during construction
- › ensuring that major equipment is selected and operated for optimum energy efficiency, especially large equipment such as tunnel boring machines and road headers
- › using modern vehicles, plant and equipment utilising technology that minimises carbon emissions, including hybrid technology where available
- › encouraging workers to travel to and from construction sites using public transport
- › prioritising local sourcing of materials where feasible.

Offset

During operation, Sydney Metro Northwest is committed to offset 100 per cent of the GHG emissions associated with operational electricity (approximately 134 GWh/year). This commitment is being progressed via the procurement of electricity from a new renewable energy project in NSW. Aside from significant GHG offsetting, this approach has the additional benefits of driving investment in renewable energy in NSW and delivering economic benefits to the local and state economies.

A similar commitment will be implemented for the Project.

D1.2 Future expectations

Sydney Metro will require delivery contractors to implement energy efficiency and carbon reduction initiatives in design and construction.

Further investigation of the following initiatives will be conducted in the next stage of the Project:

- › wayside energy storage of energy generated from braking trains
- › potential funding opportunities which may be available to facilitate energy efficiency upgrades (lighting, air conditioning, ventilation, lifts/escalators, power factor correction etc.) of southwest and Central stations which will be retained
- › further analysis of costs and benefits of offsetting 100 per cent of carbon emissions associated with operation of the Project
- › design development to fully integrate photovoltaics into feasible buildings in the Southwest and new canopies at Central Station
- › refinement of the incentive scheme to minimise electricity consumption during the operations phase
- › opportunities for connection by Sydney Metro Barangaroo Station to the alternative cooling system at Barangaroo.

TARGETS:

- **Achieve at least a 20 per cent reduction in carbon emissions associated with construction, when compared to business as usual.**
- **Offset 25 per cent of the electricity needs for the construction phase of the project.**
- **Achieve at least a 20 per cent reduction in carbon emissions associated with operations, when compared to business as usual.**
- **Maximise the capture and reuse of energy generated from braking trains.**
- **Design new buildings (stations and stabling buildings) to achieve at least a 15 per cent improvement over performance requirements set out in Section J of the National Construction Code.**
- **Source 5–20 per cent of the low voltage electricity required at above ground stations from onsite renewable energy sources where feasible.**
- **Offset 100 per cent of the electricity needs for the operational phase of the project.**

Objective	Key example initiatives
Improve the shift toward lower carbon transport	› Optimise integration of the Project with the most sustainable access modes including walking, cycling and bus.
Reduce energy use and carbon emissions during construction	› Incorporate energy efficient construction equipment, methods, and practices. › Local sourcing of materials where feasible. › Use biodiesel and ethanol fuel. › Implement green travel plans. › Energy efficient site construction compounds. › Investigate and implement opportunities to use renewable energy (including small scale photovoltaics) during the construction phase. › Offset 25 per cent of the greenhouse gas emissions associated with consumption of electricity during construction.
Reduce energy use and carbon emissions during operations	› Maximise reuse of energy recovered from the train braking system (regenerative braking). › Maximise passive design features including daylight, natural ventilation, and passive cooling. › Energy efficient ventilation, air conditioning, pumps, escalators, lifts and appliances. › Efficient lighting and lighting control systems. › Target energy consumption at least 15 per cent lower than minimum compliance with the National Construction Code. › Integrate renewable energy (photovoltaics) into new canopies and buildings where feasible. › Continual improvements using metering, monitoring and reporting to drive efficiency. › Ongoing investigation and implementation of energy efficiency initiatives in line with evolving technology.
Support innovative and cost effective approaches to energy efficiency, low-carbon / renewable energy sources and energy procurement	› Utilise wayside energy storage, renewable energy, and district cooling systems where feasible. › Offset 100 per cent of the greenhouse gas emissions associated with consumption of electricity during operation. › Explore funding opportunities for energy efficiency upgrades of Central and southwest stations.



Pedestrian and bicycle connections



APPENDIX E ENVIRONMENTAL PERFORMANCE

OBJECTIVES:

- Reduce sources of pollution and optimise control at source to avoid environmental harm.
- Comply with environmental obligations outlined in applicable project planning approvals.

E1.1 Current position

As with any large infrastructure project, without appropriate management, the construction and operation of the Project has the potential to cause pollution impacts related to noise and vibration, air quality and water quality. Potential impacts include:

- › noise and vibration impacts during construction
- › noise and vibration impacts during operation
- › dust and diesel emissions during construction
- › internal air quality in buildings and stations during operation
- › quality of discharge or stormwater runoff during construction and operation
- › groundwater impacts during tunnelling
- › accidental spills or incidents potentially impacting receiving waters, including Sydney Harbour
- › light pollution impacts during construction and operations.

The Project's impacts are the subject of environmental impact statements as part of seeking planning approval for the Project. Measures required to prevent and mitigate impacts will be included as conditions of approval, and will be implemented on the Project.

Opportunities will be taken to improve stormwater quality and minimise runoff through the implementation of water sensitive urban design (WSUD). WSUD features have been integrated in design to date, and include allowance for planting of the onsite detention basin at the Northern Dive, and tree pits and planting beds to filter overland flow at stations. Water quality objectives have been established for WSUD features.

E1.2 Future expectations

Sydney Metro will proactively work with its contractors to maximise environmental protection and to minimise both environmental harm and disturbance to local communities and businesses. Contractors will be required to adhere to a Construction Environmental Management Framework and develop environmental management plans for the construction phase. Many of the contract packages will work under an Environmental Protection Licence regulated by the EPA, depending on the activities which are being conducted by the contractors.

Further opportunities will be explored to incorporate elements of WSUD into the design of the stations, their immediate environs and the above ground sections of the Project's alignment. Opportunities may include the implementation of grass or vegetated swales to capture stormwater drainage at all paved areas such as at-grade car parks and the stabling facility.

Sydney Metro will work with contractors to explore feasible methods of minimising emissions from diesel-fuelled construction equipment. In the first instance this will involve:

- › contractors reporting on mobile non-road diesel plant and equipment engine conformity with relevant United States Environmental Protection Agency, European Union or equivalent emission standards and the fitting of any exhaust after-treatment devices
- › encouraging contractors to identify new emission standards and apply these to diesel equipment and vehicles during construction

Contractors will also be required to minimise harmful emissions associated with finishes and fittings emissions, it is expected that all internal applications will have Volatile Organic Compounds (VOC) limits for paints, finishes, adhesives and sealants, and formaldehyde limits for all composite wood products.

TARGETS:

- **Zero major pollution incidents.**
- **New emission standards will be identified and applied to diesel equipment and vehicles during construction.**

Objective	Key example initiatives
Reduce sources of pollution and optimise control at source to avoid environmental harm	<ul style="list-style-type: none"> › Environmental Management Plans and Environmental Management Systems are in place prior to commencement of construction. › Early identification and management of existing soil and groundwater contamination which may be impacted by the Project. › Integrating water sensitive urban design solutions for storm water treatment. › Encouraging contractors to utilise equipment with pollution control devices to reduce emissions from mobile non-road diesel plant and equipment at source. › Including noise and air quality mitigation measures where appropriate. › Designing stations and temporary facilities to minimise light spill in accordance with standards. › VOC and formaldehyde limits for fittings and finishes.
Comply with environmental obligations outlined in applicable project planning approvals	<ul style="list-style-type: none"> › Compliance with planning approval conditions will be managed through the City & Southwest Compliance Tracking Program.



APPENDIX F CLIMATE CHANGE RESILIENCE

OBJECTIVE:

- Infrastructure and operations will be resilient to the impacts of climate change.

F1.1 Current position

There is widespread scientific consensus that the effects of climate change will be significant. The CSIRO and NSW Office of Environment & Heritage (OEH) have undertaken considerable research into the predicted effects of climate change across Australia.

In order to reduce the vulnerability of the Project to climate change, a climate change risk assessment for the Project has been developed at the initial feasibility stage (August, 2016) and provides climate change projections, a climate change risk assessment and risk treatment measures (adaptation).

Climate change projections

Climate change projections used for the Project are presented in Table F1 and summarised below:

- Short term (2030) – project stages for this scenario include construction, operations and routine maintenance. By 2030 there will be approximately a 1.1°C increase in temperature, with increasing frequency of hot days over 35°C. Average rainfall may range from a 10 per cent decrease in spring to a 0.7 per cent increase in summer, with increased likelihood and intensity of extreme rainfall.
- Medium term (2060) – project stages for this scenario include operations, routine maintenance, major maintenance and replacement of assets and systems. By 2060, it is projected for there to be up to a 2.4 °C increase in temperature, with average rainfall ranging from an 11.3 per cent decrease in winter to 0.4 per cent decrease in summer.
- Long term (2090) – project stages for this scenario include operations, major maintenance and replacement of assets and systems. By 2090 up to 3.9°C increase in temperature, with increasing frequency of hot days over 35°C. Winter and spring rainfall patterns to vary widely, with increased likelihood and intensity of extreme rainfall.

Table F1 Summary of climate change projections

	Sydney Metro – City baseline (1986-2005)	Sydney Metro – Southwest baseline (1986-2005)	2030 (RCP8.5)	2060 (RCP8.5)	2090 (RPC8.5)
Temperature					
Annual	22.3	23.2	+1.2	+2.4	+3.9
Mean maximum temperatures (°C) – summer	26.1	27.8	+1.1	+2.0	+3.8
Mean minimum temperature (°C) – annual	14.4	12.0	+1.1	+2.4	+3.8
Days over 35°C – annual	3.5	8.9	+4	+11	Unknown
Rainfall					
Mean precipitation change (per cent) – annual	1335mm	1723mm	-6.1	-6.6	-7.9
Mean precipitation change (per cent) – spring	258mm	370mm	-9.7	-10.7	-18.5
Mean precipitation change (per cent) – summer	389mm	525mm	0.0	-0.4	3.6
Mean precipitation change (per cent) – autumn	387mm	507mm	-6.8	-7.1	-7.4
Mean precipitation change (per cent) – winter	301mm	320mm	-9.9	-11.3	-15.1
Extreme rainfall events	Maximum 1 day rainfall – Projected to increase 2-22 per cent				
	20-year return level of maximum 1 day rainfall – Projected to increase 5-42 per cent				
Fire regimes					
Change in number of severe fire danger days per year	0.9	0.9	1.3	Not available	2.1
Severe wind					
Maximum daily wind speed	Not available	Not available	Not available	Not available	-6 per cent to 2.5 per cent
Sea conditions					
Sea level rise (m)	0	0	0.14	Not available	0.66
Sea surface temperature (°C)	Not available	Not available	1.0	Not available	3.1
Evapotranspiration[1]			2030 increase on baseline	2070 increase on baseline	2090 increase on baseline
Evapotranspiration	Not available	Not available	+3 per cent	+9 per cent	Not available

	Sydney Metro – City baseline (1986-2005)	Sydney Metro – Southwest baseline (1986-2005)	2030 (RCP8.5)	2060 (RCP8.5)	2090 (RCP8.5)
Extreme Events¹					
Hail	2050 medium emissions scenario – Average recurrence intervals of hail storm events 40mm hail or greater: Increase to 1.2 years from 1.4 years 60mm hail or greater: Increase to 5 years from 8 years 80mm hail or greater: Increase to 19 years from 28 years 100mm hail or greater: Increase to 28 years from 51 years				
Lightning	For every 1°C of temperature increase: Lightning strikes in the USA will increase by about 12 per cent (+/- 5 per cent), resulting in about 50 per cent more strikes by 2100.				

[1] Sydney Trains 2015

Note 1: Modelling for the Intergovernmental Panel on Climate Change's Fifth Assessment Report (AR5) used Representative Concentration Pathways (RCPs) to define different projections. The RCPs are labelled according to the radiative forcing values (relative to pre-industrial levels) which could be experienced in 2100 based on different atmospheric concentrations of greenhouse gases

Note 2: Climate modelling does not typically model extreme storm projections directly – instead these events are inferred from other results.

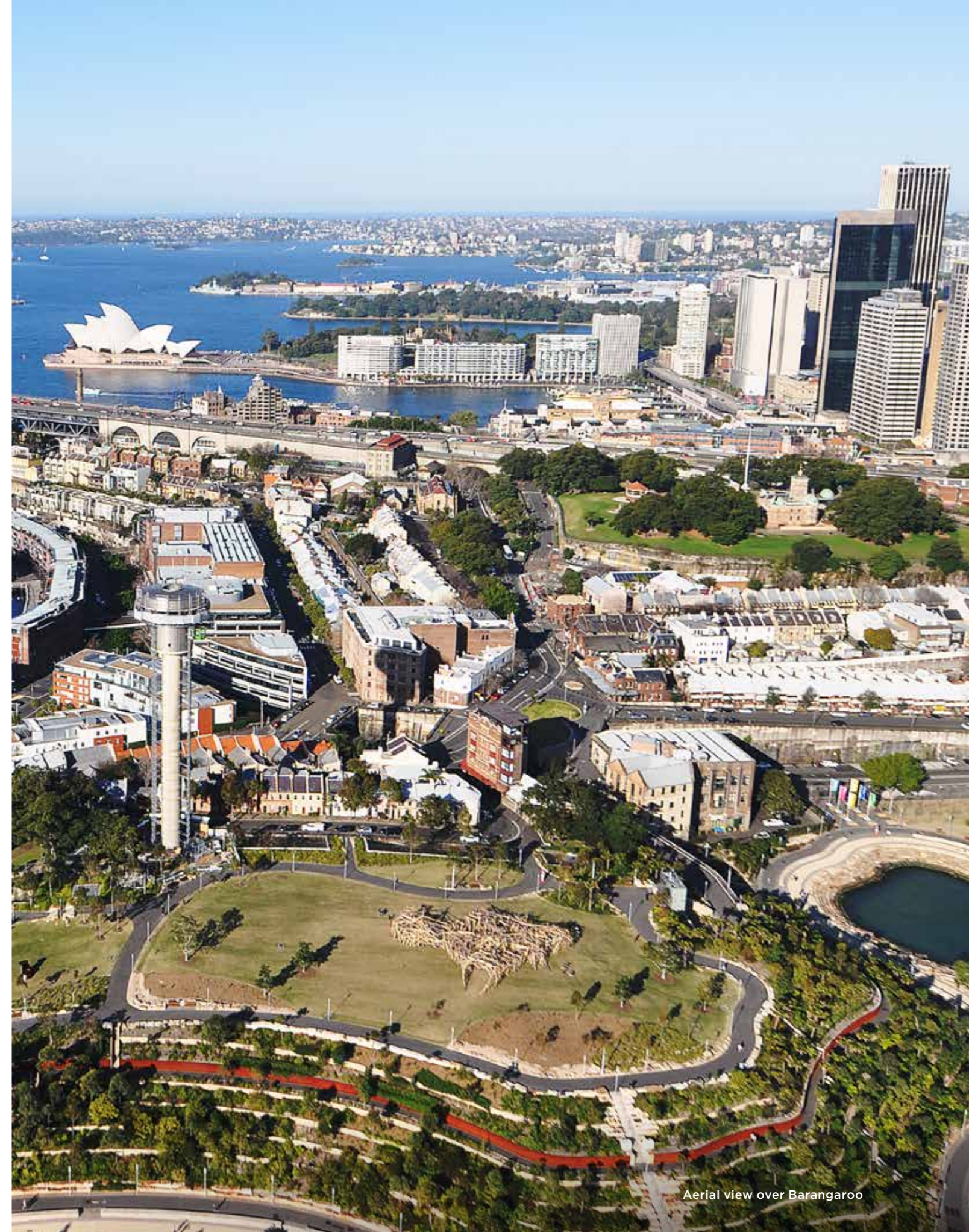
Source: Sydney Metro – City & Southwest – Technical Services Climate Resilience Report – Reference Design, Rev B, 19 August 2016 (NWRLSRP-PBA-SRT-SU-REP-000013).

Climate change risk assessment during design

Sydney Metro have used the above projections and undertaken a climate change risk assessment. The purpose of the risk assessment is to identify risks which could be addressed in the early design phase, as well as identify initiatives that can be developed in subsequent design and delivery phases of the Project and captured through contract requirements.

Overall, the results of the climate change risk assessment to date can be summarised as follows:

- › No extreme, unacceptable level risks, or high, undesirable level risks identified.
- › Medium level risks identified relating to:
 - increased rainfall, extreme events and flooding affecting station entries, interchange, precincts, station surrounds, tunnel drainage, canopies and track drainage
 - increasing daily and annual temperatures, resulting in equipment (such as tunnel ventilation and air conditioning equipment) being unable to meet the design criteria
 - sea level rise and increase in extreme events including high tides and wind waves.
 - changed rainfall patterns and groundwater levels, impacting portals, dives and embankments
 - storm events including hail storms.
- › The results of the climate change risk assessment indicate that at the early design stage, the Project is largely resilient to the impacts of climate change, but highlights the need to identify adaptation opportunities during subsequent design phases.
- › All risks have been integrated into the project-wide risk register.



Key activities which have been undertaken to enhance resilience to climate change at this stage include:

- › testing the sensitivity of air-conditioning systems for increased temperatures, identifying potential additional capacity that may be required within the life of the Project, and safeguarding space within the stations if required
- › testing the sensitivity of ventilation systems for increased temperatures, to ensure they provide adequate capacity
- › utilising flood modelling which includes an allowance to cater for predicted changes in rainfall intensity with climate change.

Climate change risk assessment during construction

At this stage, short term climate change risks identified during the construction phase of the Project relate to increased intensity and frequency of extreme rainfall events and increased temperatures, including:

- › increases in the number of days where personnel are unable to work due to stop work thresholds resulting in delays in program and lost days
- › an inundation of any excavations during construction
- › flooding roads, congestion, and increased risk of road incidents during construction, affecting workers and/or equipment accessing sites resulting in delays in program and lost days
- › increases in the number of precautionary shut down periods during extreme storm events
- › increases in damage and delays to equipment
- › an increasing load on temporary water treatment devices, and erosion control devices, increasing flooding events and affecting water quality treatment levels achieved
- › increases in dust issues
- › Increase in peak energy demand across the network and causing brownouts or power failure in temporary power supply and mains power supply.

F1.2 Future expectations

Sydney Metro will:

- › Ensure key climate change resilience initiatives are included as requirements in contracts, relating to:
 - adopting conservatively high flood levels for station entries, portals, underground access points, precincts, interchanges and critical equipment and infrastructure
 - adopting a 10 per cent uplift in rainfall intensity in drainage design
 - raising station entries and fire stairs entries at Barangaroo Station to account for projected sea level rise estimates
 - designing for higher ambient temperatures for tunnel ventilation and air conditioning equipment
 - requiring sensitivity testing for climate change scenarios during detailed design stages.

- › Include contractual requirements for contractors to identify climate change risks and implement climate change initiatives to ensure detailed design and construction activities are resilient to climate change, based on the latest climate change projections.
- › Ensure contractors implement all necessary adaptation measures that comprehensively address risks and implement reassures to mitigate all extreme and high climate change risks medium level risks where feasible.
- › Ensure contractors conduct an ongoing review of projections and update of the risk assessment and risk mitigation actions during the operations phase.
- › Maintain a watching brief on future predictions including the NSW OEH's ongoing work and the Engineers Australia Australian Rainfall & Runoff review.

TARGETS:

- **Mitigate all extreme and high level risks.**
- **Mitigate a minimum of 25 per cent of medium level risks (examples include increased flooding, increased temperatures, sea level rise, and increased storm events).**

Objective	Key example initiatives
Infrastructure and operations will be resilient to the impacts of climate change	<ul style="list-style-type: none"> › Contractors and operators will be required to undertake updated climate risk assessments. › Identify and implement adaptation measures to mitigate extreme and high level climate change risks, and address medium level climate change risks on the Project. › Identify sites vulnerable to flooding, mitigate impacts where feasible. › Sensitivity testing of ventilation and air conditioning equipment. › Reviewing emergency procedures (severe weather plan), to address climate change impacts. › Protecting sensitive construction equipment from the effects of extreme climate and weather.



APPENDIX G RESOURCES – WATER EFFICIENCY

OBJECTIVES:

- Minimise use of potable water.
- Maximise opportunities for reuse of rainwater, stormwater, wastewater and groundwater.
-

Potable (drinking water quality) and non-potable water will be required for the construction and operation of the Project.

G1.1 Current position

A preliminary water balance study has been completed to estimate the quantities, types and potential sources of water that will be required for the Project and identify the best opportunities to:

- › Use non-potable water (where available) instead of potable water.
- › Minimise the quantities of both potable and non-potable water which will be consumed.

Non-potable water can potentially be used at stations for flushing, cooling, irrigation and cleaning.

The following design features have been included to source and use non-potable water during operations:

- › Provision of rainwater harvesting and reuse systems at the stabling yard and aboveground stations where feasible.
- › Connection to the rainwater reuse system at Central Station.

Initiatives to reduce the quantity of water used include the specification of water efficiency standards for equipment, fittings and fixtures, water metering to track water use, use of landscape species which do not require significant quantities of water beyond the establishment phase, and water sensitive urban design features.

In the construction phase, the main opportunities to minimise potable water use will relate to:

- › use of recycled water (e.g. water from concrete production operations) which meets water quality requirements in the concrete
- › treatment and reuse of water used in some construction processes (e.g. spoil conveyors, equipment wash-down)
- › specifying water efficiency requirements for equipment in temporary site facilities.

Technical analysis completed by designers has highlighted potential additional water savings opportunities associated with eliminating the need to steam-cure concrete, and connecting construction sites and tunnel segment production facilities to reliable sources of recycled water, where these are available.

Water conservation and recycling targets have been established based on technical analysis completed by designers, benchmarking, and experience on the Sydney Metro Northwest project.

G1.2 Future expectations

As the Project progresses, Sydney Metro will:

- › Complete technical and feasibility analysis of connections to district systems, and the use of non-potable water in concrete.
- › Embed water efficiency and water harvesting and reuse requirements in contracts.
- › Include water reduction targets and recycled water targets in contracts.

TARGETS:

- Reduce water use by at least 10 per cent compared to business as usual.
- Source at least 33 per cent of the water used in construction from non-potable sources.
- Source at least 33 per cent of the water used in operations from non-potable sources.
- Implement rainwater harvesting and reuse systems at construction sites and feasible above ground stations.

Objective	Key example initiatives
Minimise use of potable water	<ul style="list-style-type: none"> › Estimate and monitor potable water usage, and implement design and construction initiatives to minimise water use. › Include water-efficient features, equipment and appliances in the design of stations and at construction sites. › Avoid use of potable water for non-potable purposes if non-potable water is available.
Maximise opportunities for reuse of rainwater, stormwater, wastewater and groundwater	<ul style="list-style-type: none"> › Prior to the commencement of construction undertake a water balance to inform feasibility for reuse initiatives. › Identify opportunities for treatment of water for reuse on the Project, including water from tunnelling works, concrete batching, casting facilities. › Connect to district recycled water networks where available › Use non-potable water in concrete › Harvest and reuse rainwater at permanent and temporary facilities where feasible.



APPENDIX H RESOURCES – MATERIALS AND WASTE

OBJECTIVES:

- Minimise waste through the project lifecycle.
- Reduce materials consumption.
- Consider embodied impacts in materials selection.
- Maximise beneficial reuse of spoil.

H1.1 Current position

The Project is aiming to minimise the environmental footprint of materials consumed through minimising the quantity of material required, selecting materials with lower embodied impacts, using recycled materials or materials sourced from environmentally accredited bodies where possible and recovering materials from waste throughout its construction and operation.

Materials

The main materials used on the Project are concrete and steel. Technical analysis has been completed by designers to identify materials and construction methods that could be applied to reduce the environmental impacts of the Project, improve durability and improve construction efficiencies. The following opportunities were identified as feasible for implementation and/or further consideration:

- › reducing embodied energy and carbon through optimisation of concrete mix designs and replacing Portland cement with supplementary cementitious materials
- › energy reduction and improved durability through appropriate concrete technology to eliminate the requirement for steam curing of concrete segments
- › reducing impact on increasingly scarce virgin sand supplies by the reuse of tunnel spoil and the use of crushed rock fines for concrete production
- › use of ultra-high performance concrete
- › use of geopolymer concrete
- › sourcing of steel and steel products suppliers and fabricators which are registered under certification schemes.

Initiatives which have been considered during the initial feasibility stage include:

- › refining materials volumes through design
- › integrating modular and prefabricated design and construction techniques
- › specifying self-finished, low maintenance surfaces where practical
- › reducing materiality and use of refined structural finishes
- › proposing use of high performance concrete at stations, particularly for columns where minimal spatial impact is required
- › developing recommended maximum Portland cement content for different concrete strengths, and recommended supplementary cementitious materials ratios in concrete for various concrete thicknesses.

Responsible materials sourcing opportunities, similar to those required for Sydney Metro Northwest have been identified in consultation with TfNSW counterparts.

Waste recycling/reuse

General solid waste and construction and demolition waste will make up the majority of the wastes generated during the delivery phase of the Project. Sydney Metro has established waste recycling/reuse targets for recyclable construction and demolition waste and construction site office waste.

Contractors will be encouraged to look into opportunities to recycle or reuse some general solid waste streams, and maximise recycling/reuse of building fit out waste.

Operational waste recycling targets have also been established based on feedback obtained on the Sydney Metro Northwest project.

Spoil reuse

Approximately 2.4 million cubic metres of spoil, comprising mainly sandstone and shale will be generated by the Project. As was the case for the Northwest project, contractors will be required to divert all clean reusable spoil from landfill, and reuse 100 per cent of usable spoil from excavated tunnels and station caverns, in accordance with the spoil management hierarchy outlined in Table H1.

Table H1 Spoil hierarchy for the Project

Preference		Reuse option
Highest	Within the Project	› Reuse in Project fill embankments and mounds within short haulage distance of source. › Restoration of any pre-existing contaminated sites within the Project boundaries. › Reuse as a feed product in construction materials (e.g. concrete).
	Environmental works	› Reuse in coastal protection works such as beach nourishment and land raising. › Reuse in flood mitigation works and other restoration works
Lowest	Other development projects	› Reuse for fill embankments and mounds on projects within an economic transport distance from site. › Reuse for land reclamation or remediation works. › Manufacturing with sand in concrete or shale in bricks/tiles.
	Land restoration	› Reuse to fill dis-used facilities, e.g. mines and quarries, to enable either future development or ecological rehabilitation.
	Landfill management	› Reuse to cap completed landfill cells. › Reuse in daily covering of landfill waste.

H1.2 Future expectations

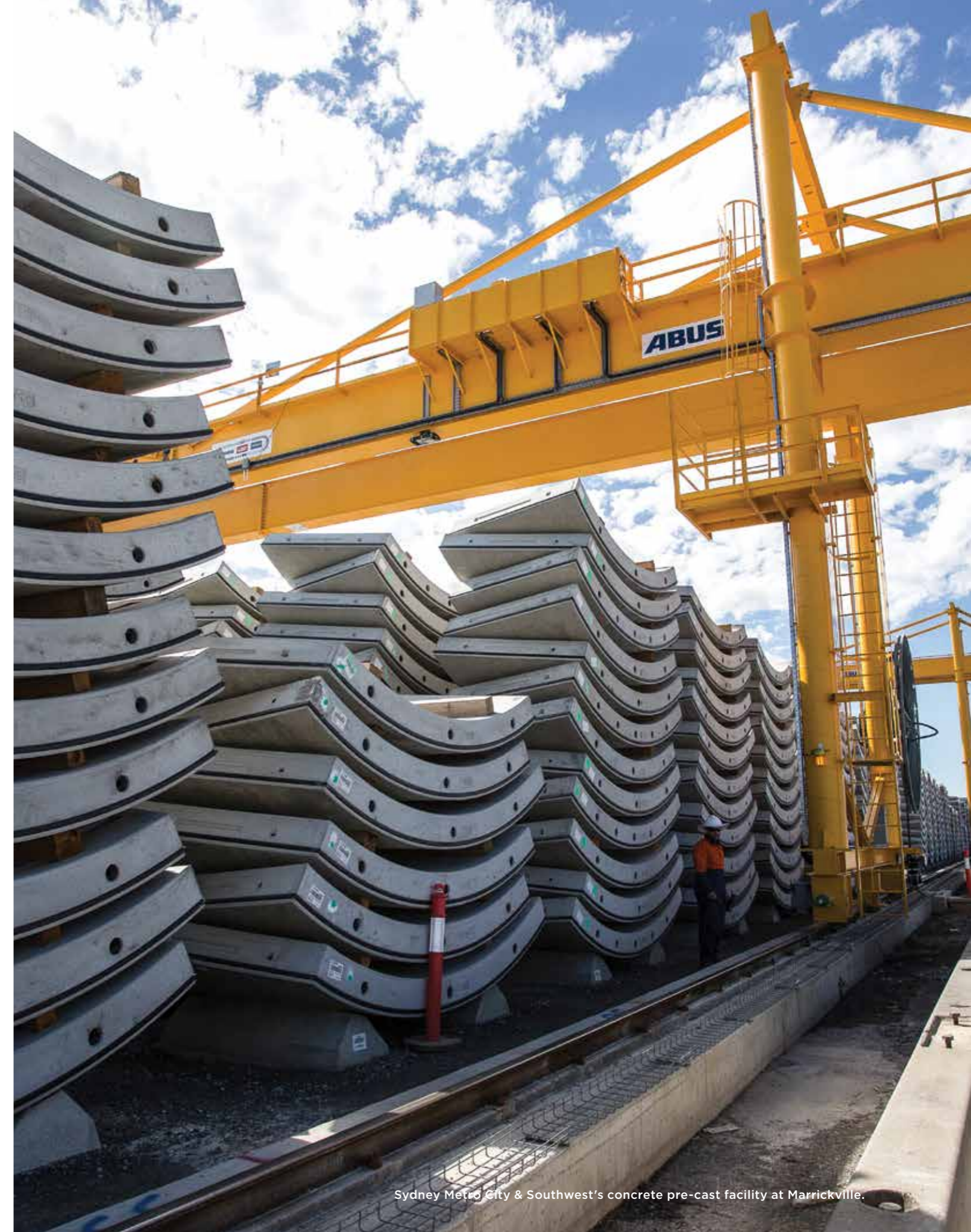
Sydney Metro will:

- › Require contractors to consider environmental impact of materials in design and procurement by undertaking life cycle impact assessments.
- › Require contractors to meet the concrete and steel sourcing targets, water recycling targets and spoil reuse targets, which have been tested through design and best practice benchmarking, and market sounding.
- › Continue to work with TfNSW counterparts to investigate opportunities to minimise truck movements associated with spoil transportation by exploring rail and barging options.

TARGETS:

- Reduce the environmental footprint of materials used on the project by at least 15 per cent compared to business as usual.
- Use concrete which has an average Portland cement replacement level of more than 25 per cent.
- 100 per cent beneficial reuse of usable spoil.
- Recycle or reuse 90 per cent of recyclable construction and demolition waste.
- Recycle or reuse 60 per cent of office waste during the construction phase.
- Recycle or reuse 80 per cent of the waste generated during operations.
- Recycle or reuse 65 per cent of office waste during operations.
- 60 per cent of reinforcing steel is produced using energy-reducing processes in its manufacture.
- Source 100 per cent reused, recycled or responsibly sourced timber.

Objective	Key example initiatives
Minimise waste through the project lifecycle	<ul style="list-style-type: none"> › Maximise recycling of construction and demolition waste by adopting waste recycling targets (90 per cent). › Enable recycling of waste materials from office facilities and customers. › Use modular, refabricated and precast structural and finishing materials to minimise waste during construction and maintenance.
Reduce materials consumption	<ul style="list-style-type: none"> › Design optimisation to minimise volumes of excavation, concrete and steel. › Dematerialisation of components and finishes. › Maximise reuse of existing materials, buildings, facades, and structures.
Consider embodied impacts in materials selection	<ul style="list-style-type: none"> › Minimise the embodied impacts of materials, including high impact materials such as steel and concrete used in the Project, through the selection of low carbon alternatives and considering durability and local sourcing.
Maximise beneficial reuse of spoil	<ul style="list-style-type: none"> › Beneficial reuse of 100 per cent of usable spoil from excavated tunnels and station caverns, in accordance with a spoil management hierarchy.



Sydney Metro City & Southwest's concrete pre-cast facility at Marrickville.



APPENDIX I BIODIVERSITY CONSERVATION

OBJECTIVE:

- Protect and create biodiversity through appropriate planning, management and financial controls.

11.1 Current position

The Project has the potential for a negative impact on biodiversity through:

- › the clearing of native and non-native vegetation and habitat (including potential microbat and grey-headed flying fox habitat)
- › unintended impacts on marine ecosystems in Sydney Harbour via the introduction of marine pests.

Mitigation measures have been identified through the EIS process, and will be implemented in accordance with planning approval conditions. Mitigation measures include redesigning elements of the project to avoid and minimise impacts, and the development and implementation of a biodiversity offset strategy where required. Biodiversity impacts are not anticipated to be significant.

The Project presents opportunities for biodiversity enhancement, such as prioritising the selection of native species when proposing landscaping options in the vicinity of stations.

11.2 Future expectations

Sydney Metro will:

- › Ensure contractors comply with mitigation measures detailed in planning approvals to minimise biodiversity impacts.
- › Develop and implement a biodiversity offset strategy as required.
- › Develop and implement a landscaping strategy to enhance biodiversity through the use of native species where possible. Targets for inclusion of native species will be established as part of the strategy.

TARGETS:

- **Minimise vegetation clearing.**
- **Native landscaping targets to be established.**

Objective	Key example initiatives
Protect and create biodiversity through appropriate planning and management	<ul style="list-style-type: none"> › Contract documents will contain biodiversity conservation compliance requirements. › Minimise vegetation removal. › Select native species for landscaping. › Contractors to implement clearing protocols where required. › Marine pest prevention and management completed in accordance with planning approvals.



Flowering gum tree



APPENDIX J HERITAGE CONSERVATION

OBJECTIVE:

- Project and promote heritage through appropriate design, planning, and management controls.

J1.1 Current position

The Project has the potential to impact on Aboriginal and non-Aboriginal heritage values as a result of extensive excavation works, demolition of buildings, and modifications to stations. Heritage conservation is a key consideration throughout the design and construction of the Project and ongoing measures are being considered to ensure the historical knowledge captured can be shared with the community through various interpretation strategies.

Design development

Heritage conservation is a key objective influencing the Project's progressive design development, and the design team has considered the heritage value of sites when determining the alignment, station designs and other surface features.

The delivery phase

Some key heritage items identified along the Project route includes:

- › St Leonards Centre
- › MLC Building
- › Blues Point
- › Millers Point Conservation Area (including the Hickson Road wall)
- › Martin Place Railway Station
- › Bennelong stormwater channel
- › properties along Pitt Street
- › Central Station
- › Various State and locally significant station buildings along the Bankstown line

Heritage assessment work is ongoing for the portion between Sydenham and Bankstown; the assessment will consider how upgrades to stations will minimise adverse impacts to station heritage features.

During the delivery phase of the project, the project team will be focussed on ensuring those heritage items adjacent to the Project (that will not be directly impacted) are protected through construction measures and initiatives.

Archaeological Assessment Research Design (AARD) reports for non-Aboriginal heritage and Aboriginal Cultural Heritage Assessment Report's (ACHAR) for Aboriginal heritage have been developed for the Project to ensure the archaeological aspect has been appropriately addressed.

Interpretive initiatives

An important aspect the project team has considered in relation to heritage conservation is acknowledging the heritage and appropriate interpretation during the Project's development. A Heritage Interpretation Strategy (HIS) has been prepared for the Project and outlines a range of interpretive initiatives that considers key historic themes prominent along the Project's route, and aims to effectively communicate the history and heritage values associated with the Sydney Metro. Possible initiatives include signs and historic images in station concourses, large scale graphics and text on station platforms and passageways, design elements in interface areas, online exhibition and digital publication.

Consultation

A cross-government Heritage Working Group has been established and comprises representatives from the Sydney Metro Delivery Office, NSW Department of Planning & Environment, Heritage Division and Sydney Trains. The purpose of the Heritage Working Group is to discuss and hold sessions on key heritage issues for the Project such as the process for consideration of heritage during the design and design responses, constraints and opportunities that have influenced station locations, ongoing design development in relation to heritage and archaeology.

J1.2 Future expectations

Sydney Metro's team of heritage specialists will continue the development of a Heritage Strategy and heritage assessments for the Central and southwest stations, to inform heritage investigations, station and precinct design, and heritage interpretation plans as the Project progresses.

Interpretive material describing heritage values will be implemented and maintained. Interpretive material will convey the history, themes and stories in an engaging and interesting way so that significant previous layers of each station precinct's development are able to be appreciated.

Ongoing consultation with key heritage stakeholders and advice from the Heritage Working Group and the Design Review Panel for the Project will be central to the success of the heritage protection and interpretation program.

TARGETS:

- **Prepare a Heritage Strategy, including stakeholder engagement with relevant stakeholders.**
- **Implement the Heritage Strategy during design and delivery, to conserve and activate.**
- **Maximise opportunities for archaeological research and future interpretation of archaeological finds.**
- **Opportunities for heritage interpretation identified and implemented at appropriate station precincts.**

Objective	Key example initiatives
Protect and promote local heritage through appropriate design, planning, and management controls	<ul style="list-style-type: none"> › Engage a well-resourced team of heritage specialists. › Tender documents will contain heritage conservation compliance requirements. › Identify opportunities to enhance heritage values via education, design and implementation of heritage interpretation at those locations. › Develop partnerships with relevant stakeholders to identify and utilise heritage places to promote heritage values.



APPENDIX K LIVEABILITY

OBJECTIVES:

- Promote improved public transport patronage by maximising connectivity and interchange capabilities.
- Provide well designed stations and precincts that are comfortable, accessible, safe and attractive.
-

K1.1 Current position

The Project will increase the rail network catchment through the provision of:

- › new stations at Crows Nest, Victoria Cross, Barangaroo, Martin Place, Pitt Street, and Waterloo as well as new underground platforms at Central Station
- › more direct connections to high-capacity Sydney CBD stations at Martin Place and Pitt Street
- › additional interchange capacity at Chatswood, Central, Martin Place, Sydenham and Bankstown, improving network connectivity and increasing demand of rail services.

By increasing the catchment of the rail network, frequency of services, interchange with other modes and connections to key destinations, the Project is expected to increase accessibility, trip diversity and utilisation of the network during both peak and non-peak periods. This would facilitate a greater mode shift to rail from car, particularly during non-peak periods where travel service consumers will have greater choice.

The Project will facilitate a diverse range of trips, providing not only a fast journey to work but also encouraging trips for other purposes such as access within the Sydney CBD, local or business trips, access to universities and educational institutions, service and recreational uses.

Connectivity and interchange capabilities for the Project are being driven through the development and implementation of integrated multi-modal Interchange Access Plans for each station. The plans will outline principles and requirements for access and interchange at the Project's stations to help customers access the stations and improve their door-to-door journey. The plans will fold in key elements of modal access including walking and cycling, bus, taxis, kiss-and-ride, park-and-ride, and station access and interchange requirements, with reference to the following modal interchange hierarchy (refer to Figure K1).

The NSW Government Architect's Office is working to establish a 'Green Grid' of open space across Sydney and has identified the Bankstown rail corridor as providing an opportunity to connect green spaces and provide active transport linkages. As a first step, Sydney Metro is preparing a Walking and Cycling Strategy which will inform and enable the future development of active transport connections.

Figure K1 Modal hierarchy



Specific requirements to offer safe and weather-protected bicycle parking have been identified for each station. Work is ongoing to maximise the provision of bicycle parking spaces, and conduct space-proofing to safeguard for future additional spaces across the project.

The Project is retaining existing commuter car parking provision outside of centres at the Southwest stations.

Sydney Metro has developed preliminary design guidelines in order to guide the design development process, and articulate expectations in terms of customer-focused design, design quality, accessibility and safety. The development of the design guidelines has taken into consideration considered relevant local councils' urban design strategies and initiatives.

The preliminary design guidelines cover:

- › the interface between stations and their surrounding locality including:
 - station entries
 - transport interchange facilities (bicycle facilities, bus stops, kiss and ride, taxi ranks and connections to existing rail, ferry and light rail transport)
 - landscaping and other public domain elements.
- › rail corridor works including the tunnel dive structures, rail cuttings and embankments
- › station and service buildings, including underground stations.

Design principles include:

- › achieving an enjoyable customer experience
- › being part of a fully integrated transport system
- › being a catalyst for positive change
- › being responsive to distinct contexts and communities
- › delivering an enduring and sustainable legacy for Sydney.

The design guidelines include sustainable design aspirations.

K1.2 Future expectations

As the Project progresses, Sydney Metro will:

- › Develop updated design guidelines to inform the detailed design of stations, interchanges and precincts, expanding on existing guidance and addressing issues such as shade and shelter and minimising urban heat island effects.
- › Finalise Interchange Access Plans for all stations.
- › Ensure that design and delivery of the Project is conducted in accordance with the design guidelines and supports service integration, access, and transfer between travel modes.

TARGETS:

- Station interchanges designed in accordance with the Interchange Access Plans and modal hierarchy.
- Stations and precincts designed in accordance with the Sydney Metro Design Guidelines.
- Promote access by cycling, through provision of bicycle parking, and safeguard for future expansion of bicycle facilities.

Objective	Key example initiatives
Promote improved public transport patronage by leveraging connectivity and interchange capabilities	<ul style="list-style-type: none"> › Ensure efficient transfer of customers accessing Sydney Metro from bicycle, bus, rail and passenger drop off. › Integrating the surrounding active transport network into the interchange environment and working with stakeholders to fill in missing links in the active transport network. › Provide bicycle parking spaces at station interchanges that offer weather protection and security improvements.
Provide comfortable accessible, safe and attractive stations and precincts	<ul style="list-style-type: none"> › Design in accordance with best practice urban design principles. › Incorporate Crime Prevention Through Environmental Design principles in design to deter crime. › Design to minimise urban heat island.



Example of a bicycle parking hub, Woy Woy



APPENDIX L COMMUNITY BENEFIT

OBJECTIVES:

- Make a positive contribution to community health and well-being.
- Ensure community and local stakeholder engagement and involvement in the development of the project.
- Contribute to the delivery of legacy projects to benefit local communities.
- Create opportunities for local business involvement during the delivery and operations phases.
- Optimise community benefit of residual land development.
- Minimise negative impacts on the community and local businesses during construction and operation.

L1.1 Current position

The Project undertook early consultation along the Project corridor in June 2015. The aim was to collect stakeholder and community feedback on the Project with a focus on preferred station locations, tunnel versus track work and information about the rail line route.

Meetings were held with key stakeholders, including local government, New South Wales and Australian Government departments, peak bodies and industry associations.

Community and stakeholder engagement for the Project is the responsibility of the Stakeholder and Community functional group, which implements a program of consultation and other activities to:

- › ensure community and local stakeholder engagement and involvement in the development of the Project
- › represent the community's interests within Sydney Metro
- › ensure the community is well informed of potential impacts during construction and operation.

The Project will facilitate new commercial and/or residential development opportunities above four new underground metro stations at Crows Nest, North Sydney, Martin Place, Pitt Street and Waterloo; and at two sites which will have been utilised for construction (Chatswood and Sydenham).

There is a potential opportunity to make a provision within new developments for affordable housing and/or affordable commercial premises which would benefit the local community. Relevant policy drivers for affordable housing include, but are not limited to: A Plan for Growing Sydney; State Infrastructure Strategy (2014 and 2018); City of Sydney Sustainable Sydney targets for housing (2013); SEPP Affordable Rental Housing, and the North Sydney Affordable Housing Strategy, A Metropolis of Three Cities (2018) and Greater Sydney Commission District Plans (2018).

L1.2 Future expectations

The Sydney Metro sustainability team will consult and collaborate with the Stakeholder and Community and the Workforce Development teams to scope and develop an appropriate community benefit program. Key activities will include:

- › reviewing the outcomes of early community consultation
- › reviewing research programs which have been implemented on other similar projects (for example, Crossrail developed community improvement plans at key locations)
- › understanding community priorities and needs around each station and construction site
- › determining whether any of these needs could be met or facilitated by the Project
- › identifying potential sources of additional funding which may be available
- › identifying opportunities for involvement of local businesses and social enterprises in the delivery of the Project
- › assessing the feasibility of opportunities
- › developing a strategy to minimise impacts on the homeless community which may be affected by Project works.

It is expected that contractors working in and around local communities will play their part in working with those communities to minimise impacts and build good will. Contractors will be required to implement initiatives in the local areas which benefit the local community. Example of initiatives could include fundraising, projects benefiting community groups, education, and public projects.

The affordable housing feasibility analysis will be progressed, and local community and stakeholder consultation activities will be ongoing. Feasibility investigations for the proposed Bankstown line active transport corridor will also be progressed.

TARGETS:

- **Implement initiatives which will provide tangible benefits to local community groups during the construction period.**
- **Implement initiatives which will provide tangible benefits to the broader local community beyond the construction period.**
- **Identify key drivers for affordable housing and work with other lead agencies to identify opportunities and develop an appropriate response.**

Objective	Key example initiatives
Make a positive contribution to community health and well-being	<ul style="list-style-type: none"> › Establish and achieve targets for identifying and completing projects which benefit local communities and make a positive contribution to community health and well-being. › Integrate station entries into public spaces and facilitate uses which benefit local communities.
Engage and involve the community and local stakeholders in the development of the project	<ul style="list-style-type: none"> › Seek input from the community and stakeholders throughout the planning, design and delivery stages of the Project.
Contribute to the delivery of legacy projects to benefit local communities	<ul style="list-style-type: none"> › Investigate and implement feasible opportunities to use residual land to benefit local communities.
Create opportunities for local business involvement during construction and operation	<ul style="list-style-type: none"> › Opportunities for local business involvement will be investigated.



APPENDIX M SUPPLY CHAIN

OBJECTIVE:

- Influence contractors, subcontractors and materials suppliers to adopt sustainability objectives in their works and procurement.

M1.1 Current position

A sustainable procurement strategy has been developed and implemented on Sydney Metro Northwest. The procurement strategy is based on best practice policy and frameworks including BS8903 Sustainable Procurement Best Practice Guidance and Code, and informed by benchmarking on availability and costs of sustainably-sourced materials. The strategy is designed to apply to principal contractors, their sub-contractors and their suppliers.

The strategy comprises five main elements:

- › Policy
 - Objectives clearly articulated and documented with tenderers and project team
 - Strategy includes targets.
 - Sustainability knowledge building and training.
- › People
 - Sustainability skill sets required in integrated teams during tender process.
 - Tenderers to demonstrate sustainability resources in organisation charts.
- › Procurement process
 - Build in procedures and penalties into the contract.
 - Embed sustainability in assessment criteria and provide rationale.
 - Embed sustainability objectives into every aspect of the process from planning through the tender process to measurement of results.
- › Engaging suppliers
 - Ethical sourcing.
 - Suppliers to demonstrate supply chain and diversity policies.
 - Demonstrated continual improvement of sustainability profile.
- › Measurement and results
 - Encourage innovation and invite tenderers to set new benchmarks.
 - Award system to recognise excellence in sustainability.
 - Contract monitoring.
 - Independent auditing.

These same sustainable procurement principles are being applied to the Project. To improve supply chain outcomes, Sydney Metro is also:

- › Aligning procurement requirements for contractors with ISCA IS Rating Tool “Pro” credits which set out performance requirements standards for demonstrating commitment to sustainable procurement, identifying suppliers, evaluation and contract award, and managing supplier performance.
- › Requiring contractors to ensure high impact suppliers are provided with sustainability training.
- › Ensuring contractors undertake due diligence when sourcing materials or equipment from developing countries to ensure environmental and human rights standards are not contravened in the manufacture and supply of those materials.
- › Requiring relevant contractors to develop procurement processes which align to the new ISO20400 Standard: Sustainable Procurement – guidance.

Initiatives aimed at improving participation of local businesses and SME’s in the Project supply chain are addressed in the Workforce Development and Industry Participation Strategy.

M1.2 Future expectations

Sydney Metro will:

- › Require contractors to develop and implement sustainable procurement policies and strategies based on BS BS8903, ISO 20400 and ISCA guidance undertake supplier training and due diligence when sourcing from developing countries.

TARGET:

- All principal contractors develop and implement sustainable procurement strategies.

Objective	Key example initiatives
Influence contractors, subcontractors and materials suppliers to adopt these objectives in their works and procurement	<ul style="list-style-type: none"> › Principal contractors, develop and implement sustainable procurement strategies. › Sustainability requirements passed down to subcontractors and their suppliers. › Sustainability training provided to high impact suppliers. › Due diligence conducted to ensure supply of materials and equipment from developing countries has not contravened environmental or human rights standards.



APPENDIX N ECONOMIC

OBJECTIVES:

- Consider adopting a whole-of-life costing model to maximise sustainability benefits.
- Optimise development opportunities for residual land.
- Capture sustainability benefits in the business case for the project.
-

N1.1 Current position

An economic appraisal was completed for the Project to understand the economic benefits and costs of the Project. The economic appraisal considered a range of potential benefits, including benefits to:

- › continuing rail customers – comprising travel time, reliability, train de-crowding, station de-crowding and amenity
- › new and lost rail users – same as continuing rail users but the ‘rule-of-half’ was applied to benefits
- › continuing bus users and road users – road decongestion due to higher rail mode share
- › residual value – the remaining asset life at the end of the appraisal period
- › wider economic impacts – productivity impacts from agglomeration and worker accessibility
- › land use change impacts – productivity impacts and externalities from higher density land use.

The Project would provide a substantial increase in capacity for the Sydney rail network and enable the future development of a broader metro network.

Whole-of-life costs for a project include the costs of construction, operation, maintenance, renewal, disposal and replacement; plus where relevant non-construction costs (such as land), asset income (but not revenue) and externalities, such as the cost of carbon emissions.

Whole-of-life costing is being adopted:

- › at a project-wide level, where the business case for the Project takes into account whole-of-life costs
- › in assessing project options, where evaluations consider capital and operating costs
- › in cost-benefit analysis for sustainability/energy efficiency initiatives, where the environmental cost of carbon emissions (an effective carbon price) is accounted for.

N1.2. Future expectations

As the Project progresses, Sydney Metro will:

- › Continue to make decisions based on whole-of-life considerations.
- › Continue to consider environmental and social costs and benefits of sustainability initiatives, where appropriate.
- › Consider environmental and social costs and benefits in the detailed analysis which will be completed as part of investigating the commitment to obtain 100 per cent of operational energy from a renewable energy project, where savings in health costs associated with improved air quality will be taken into account.

Objective	Key example initiatives
Consider adopting a ‘whole of life’ costing model to maximise sustainability benefits.	› Include consideration of whole-of-life costs and benefits in optioneering and decision making.
Optimise development opportunities for residual land.	› Optimise integrated station development.
Capture sustainability benefits in the business case for the project.	› Ensure social and environmental benefits of improved access to transport and employment are documented in the business case, and ongoing benefits realisation work.



APPENDIX O WORKFORCE DEVELOPMENT AND INDUSTRY PARTICIPATION STRATEGY – OVERVIEW

O1.1 Scope of Workforce Development and Industry Participation

Workforce development forms part of Sydney Metro social sustainability commitments and encompasses Aboriginal and Industry Participation. While workforce development has traditionally formed part of the overall sustainability strategy's objectives and targets, these are now reflected in the Sydney Metro City & Southwest Workforce Development and Industry Participation Strategy (a separate document). The strategy sets a vision, objectives and initiatives relating to workforce development to reflect industry skills requirements, local demographics, regulatory drivers and wider government priorities around skill, employment, diversity and business growth.

The delivery of Sydney Metro City and Southwest provides a significant opportunity to support jobs and skills for a more diverse and inclusive workforce and supply chain whilst also addressing key issues currently experienced across industry. Sydney Metro has a Workforce Development and Industry Participation Plan which sets out the approach to support these outcomes whilst addressing key state and federal policies. Key priorities of this plan include:

- › **Industry and jobs participation** – increase opportunities for employment of local people, participation of small and medium enterprises including Recognised Aboriginal Businesses, and support industry to compete in home and global markets through targeted programs and initiatives
- › **Workforce skills development** – enable targeted and transferable skills development in areas with local and national skills shortages, support changing job roles and increased skill requirements, and embed transferable skills in the workforce
- › **Diversity and inclusion** – increase diversity and inclusion within the workforce and supply chain through collaborative partnerships, initiatives and programs
- › **Inspiring future talent and developing capacity** – engage young people via education and work experience including apprenticeships and traineeships

Collaboration is essential to the successful delivery of Sydney Metro workforce development and industry participation objectives. The Skills and Employment Advisory Group (SEAG), a strategic stakeholder forum, was established in 2014 to support the delivery of the WFDIP strategy, associated programs and initiatives. Members include both state and Commonwealth government, Sydney Metro and our delivery partners.

These priorities and objectives have been translated into contractual requirements across all of the Project's contract packages. Sydney Metro also has a number of Workforce and Industry Participation programs to respond and drive key priorities and objectives. Contractor participation varies dependant on the program:

- › Sydney Metro Apprentice and Trainee program
- › Sydney Metro Industry Curriculum
- › Sydney Metro Pre-employment program
- › Sydney Metro Job Brokerage pilot

In 2017 Sydney Metro in collaboration with TAFE NSW and Department of Jobs and Small Business established the NSW Infrastructure Skills Centre (at Annandale) with satellite centres at Nirimba (Quakers Hill) and Ingleburn. These centres have already seen over 3,500 workers go through the Sydney Metro Industry Curriculum (SMIC) program as well as supporting Sydney Metro apprenticeship and pre-employment programs

Please refer to the Sydney Metro City & Southwest Workforce Development and Industry Participation Strategy for further information.

O1.2 Project and regulation drivers

The Workforce Development and Industry Participation strategy is driven by project and regulatory drivers, and associated regional and skills issues. NSW is delivering a record Infrastructure Program. The pipeline of infrastructure investment planned for the next decade provides an opportunity to grow and develop the industry as a whole and its workforce however, it will also include the simultaneous delivery of major projects competing for the same skills. A skills capability study by BIS Oxford Economics for the Australasian Railway Association (ARS) made it clear that, "The overwhelming evidence is that there is a fast developing skills crisis in the Australasian rail industry".¹ This is a result of massive investment and growth as well as an ageing current workforce and the impacts of new digital technologies. The development of infrastructure skills capacity and capability is critical to wider Australian growth.

The Workforce Development and Industry Participation strategy aligns and contributes to state and federal priorities, policies and associated procurement directives. Through the delivery of this plan will support wider objectives to support jobs, skills and education in the region. Contractors will be expected to be across the key objectives detailed in these policies and plans:

- › **INSW – NSW Government Action Plan** – A ten point commitment to the construction sector: The NSW Government Construction Leadership Group (CLG), led by Infrastructure NSW has developed the NSW Government Action Plan: A ten point commitment to the construction sector. Part of the focus of this action looks for cross infrastructure collaboration to develop skills, capability, capacity and greater diversity in the construction workforce and its supply chain. Sydney Metro continues to commit and deliver wider outcomes which support skills development, employment, small business participation and inspiring future talent in the industry. Sydney Metro actively participates in strategic advisory groups which support the commitment of this plan.

¹ Australasian Railway Association, Skills Capability Study: skills crisis: a call to action. BIS Oxford Economics for ARA, 2018, p.2

› **Infrastructure Skills Legacy Program and Demonstration pilot –**

The Infrastructure Skills Legacy Program (ISLP) will capitalise on the NSW Government’s record levels of infrastructure investment to boost the number of skilled construction workers and create fresh pathways to employment across the state. Sydney Metro City and Southwest has been a demonstration pilot for the program since 2016.

› **NSW State Priorities: Boosting apprenticeships** – Sydney Metro mandates minimum percentages or numbers of apprentices and trainees across the project. As part of these targets apprentices and trainees must be working for a minimum length of time ensuring high quality work experience and encouraging successful completions. Sydney Metro also has a Sydney Metro Apprentice and Trainee program to support increased diversity and completion rates across the project.

› **Australian Jobs Act 2013**

› **NSW Aboriginal Participation in Construction Policy (APIC)** – Sydney Metro has incorporated this policy into our Workforce Development and Industry Participation requirements since 2016. Sydney Metro also has an City and Southwest Aboriginal Participation strategy to drive the policy outcomes.

› **PBD-2017-05 Construction training and skills development.**



Sydney Metro Pre-employment Program Graduates

APPENDIX P – ACCESSIBILITY DETAILS

The below is provided to satisfy accessibility requirements.

Sustainability Strategy Highlights

CONSTRUCTION

- During tunnelling activities, the total excavated spoil (2.4 million cubic metres) could fill Darling Harbour twice, 100 per cent clean spoil will be beneficially reused
- 90 per cent of construction and demolition waste will be recycled
- 25 per cent reduction in Portland cement in concrete, saving the equivalent carbon emissions of planting 784,000 trees
- Offsetting 25 per cent of construction electricity will reduce carbon emissions by the equivalent of planting 225,800 trees

OPERATIONS

- 100 households (20,000kL) of water usage per year will be saved through the Project's use of water efficient fixtures and rainwater harvesting
- Onsite solar panel renewable energy systems at stations will be sufficient to power up to 180 households (1180MWh)
- Improved pedestrian and cycling connections will make walking and cycling easier, resulting in health benefits to customers
- Secure access and covered bicycle parking spaces will be provided
- 100 per cent of timber products will be from reused, recycled or responsibly managed sources
- 100 per cent of the operational electricity needs for the project will be offset (which is an estimated 221 Gigawatt hours a year). This will be the equivalent to the energy generated by 1.1 million solar panels (240 hectares solar plant) or 40 wind turbines
- Station energy performance improvements (such as lighting systems and efficient glazing) will save the equivalent electricity consumption of approximately 610 households a year

Figure 1 The Sydney Metro network

Stage 1 of Sydney Metro is under construction. There are thirteen stations including:

- | | |
|------------------|------------------------|
| - Cudgegong Road | - Cherrybrook |
| - Rouse Hill | - Epping |
| - Kellyville | - Macquarie University |
| - Bella Vista | - Macquarie Park |
| - Norwest | - North Ryde |
| - Showground | - Chatswood |
| - Castle Hill | |

Stage 2 of Sydney Metro will run from Chatswood to Bankstown including the following stations:

- | | |
|------------------|------------------|
| - Chatswood | - Dulwich Hill |
| - Crows Nest | - Hurlstone Park |
| - Victoria Cross | - Canterbury |
| - Barangaroo | - Campsie |
| - Martin Place | - Belmore |
| - Pitt Street | - Lakemba |
| - Central | - Wiley Park |
| - Waterloo | - Punchbowl |
| - Sydenham | - Bankstown |
| - Marrickville | |

Figure 2 Sydney Metro City & Southwest contract packages

Shows the contract packages which form the City & Southwest project. These include:

- Enabling works (Demolition works, Sydney Yard Access Bridge, Lifts and escalators framework contract)
- Tunnels and station excavation works (TSE)
- Central Station main works (CSM)
- Sydenham Station and Junction works (SSJ)
- Southwest metro
- Integrated Station Developments at Waterloo, Pitt St, Martin Place, Victoria Cross and Crows Nest
- Barangaroo Station
- Line-wide (tunnel fit out, services, stabling and power)
- Trains, systems, operations and maintenance (TSOM).

Figure 3 Sydney Metro sustainability elements

Shows the sustainability elements of the project which have been considered, categorised as environmental, social, or economic. In the "Environmental" category, the elements listed include climate change, carbon, energy, water, waste, materials, pollution, biodiversity and supply chain. In the "Social" category, the elements listed include heritage, community benefit, liveability, supply chain, workforce development, community consultation, customer, safety and wellbeing. In the "Economic" category, the elements listed include whole-of-life costs and value for money. Figure 3 notes that workforce development, community consultation,

customer, safety, wellbeing and value for money elements are addressed in other Sydney Metro documents. The remaining elements are addressed in this Sustainability Strategy.

Figure 4 Sustainability framework

Outlines the sustainability framework for the project. Key inputs to the sustainability policy, objectives and targets for the project have included regulations and policy drivers, TfNSW sustainability guiding principles, lessons learned from the Sydney Metro Northwest project, and the results of best—practice benchmarking. Sustainability initiatives have been developed to support achievement of the sustainability targets and initiatives, and translated to contract requirements within each of the contract packages. Sustainability performance is managed through the development and implementation of sustainability management plans for each contract package.

Figure 6, 7 and 8

Figures 6, 7 and 8 show cross sections through a typical underground station, and illustrate opportunities for key sustainability initiatives. Key initiatives include:

- High efficiency LED lighting
- Efficient cooling
- Smart metering
- Regenerative braking and wayside energy storage
- Recycling collection
- Water sensitive urban design
- Sustainable materials
- Thermal insulation and high performance glazing
- Daylighting and natural ventilation
- Sheltered bicycle parking

Figure 9 Early implementation activities for individual project components of the City & Southwest Project

Shows the activities which were undertaken in the early stages of the City & Southwest project toward development of the sustainability strategy. Key activities include:

- Developing policy and objectives
- Developing an initial strategy and progressively updating the strategy
- Developing performance targets
- Identify, assess and integrate sustainability initiatives and programs
- Inputs to options, business case and cost plans
- Input to planning approvals
- Developing business requirements, system requirements, and contract documents, and participation in Expression of Interest (EOI), Request for Tender (RFT) and evaluation processes.

Figure 10 Sydney Metro City & Southwest Environment and Sustainability Management System

Illustrates the Sydney Metro City & Southwest Environment & Sustainability Management System. The Figure shows the key components of the Sydney Metro system and how these are interrelated to the Contractor environmental and sustainability management system, environmental approvals and environmental protection licences. Components of the Sydney Metro system include compliance management, construction environmental management framework, sustainability targets and requirements and assurance and reporting).

Components of the Contractor system include Construction Environmental Management Plans and sub-plans, environmental reports, Sustainability Management Plans and sub-plans, and sustainability reports.

Figure D2 Energy management hierarchy

1. **AVOID OR REDUCE ENERGY USE**
The first area to address when considering energy demand management is passive design. That is design that reduces the need for electricity in the first place, such as the use of natural daylight instead of artificial lighting, or humped tracks at stations to reduce the need for braking and acceleration at stations.
2. **IMPROVE ENERGY EFFICIENCY**
The second area to address covers the active systems to ensure energy efficiency, such as regenerative braking technology on rolling stock and high efficiency distribution systems. Although these examples may attract higher capital costs, these can be mitigated by the long-term benefits of reduced consumption and the need for smaller sized equipment.
3. **SOURCE LOW CARBON ENERGY (onsite)**
Once demand has been minimised, the next step is to consider a mechanism to enable the use of renewable generation onsite to minimise attributable greenhouse gas emissions. Examples include using of combined cooling, heating and power (CCHP) or onsite renewables (photovoltaics arrays, micro wind turbines, waste to energy etc).
4. **SOURCE LOW CARBON ENERGY (offsite)**
When all steps 1-3 have been exhausted, the next option is to consider offsite renewable energy for the remaining energy demand. The proportion of renewable energy could be anywhere between six per cent (NSW Government policy minimum) to 100 per cent. The purchase of GreenPower is an easy way to do this, however other methods include solar farms, wind farms, harnessing geothermal energy through there are several implications associated with each of these options).
5. **CARBON OFFSETS**
The final step in energy management is to abate any remaining energy emissions that cannot be avoided through the purchase of a recognised offset mechanism e.g. through forestry sequestration. For this Project, onsite Australian carbon credits are preferable.

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