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Ecologically Sustainable Development

Barangaroo Central Waterfront Promenade and Interim Public Domain Works

Barangaroo

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Interim Public Domain Works

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Executive Summary

INTRODUCTION

SLR Consulting Australia Pty Ltd has been engaged by Baulderstone Pty Ltd on behalf of the Barangaroo Delivery Authority (BDA) to develop a report which describes how the principles of *Ecologically Sustainable Development* (ESD) have been incorporated into the design for the Barangaroo Central Waterfront Promenade and Interim Public Domain Works (the Project) and how water demands and water resources are being managed on site, thereby addressing requirement number 14 (Ecologically Sustainable Development) of the Director General's Environmental Assessment Requirements (DG requirements) associated with application number SSD 5374:

- *Identify how the development will incorporate ESD principles in the design, construction and ongoing operation phases of the development*
- *Address water quality management for the site including an "integrated Water Management Plan" to include any proposed alternative water supply, proposed end uses of potable water, demonstration of water sensitive urban design and any water conservation measures*
- *Provide details of operational waste management and reduction measures*

Ecologically Sustainable Development (ESD) provides for long term social and economic sustainability by[1]:

- Enhancing individual and community well-being and welfare by following a path of economic development that safeguards the welfare of future generations;
- Providing for equity within and between generations; and
- Protecting biological diversity and maintaining essential ecological processes and life-support systems.

This report consolidates the documented ESD strategies and commitments (including operational waste management and reduction initiatives), and water management measures, as presented in existing drawings, previous impact assessment reports developed for the Barangaroo Headland Park, and scoping documents.

Ecologically Sustainable Development Conclusions

The Barangaroo Central development, and the general Barangaroo Precinct, will be a world leader in sustainability. The Project aims to provide environmental leadership to the community by incorporating Best Sustainability Practices and One Planet Living Principles –during delivery and throughout operation. The following overarching sustainability goals have been defined for the Barangaroo Precinct:

- Water Positive - more water recycled and exported from the site than is used within the site;
- Zero Waste – through prevention, minimisation, recycling and re-use;
- Carbon Neutral – by generating more new renewable energy the total net greenhouse gas emissions; and
- Socially Sustainable – through learning development programs, effective community infrastructure and a commitment to cultural and public arts facilities.

The high-level sustainability objectives of this Project are:

[1] Department of Sustainability, Environment, Water, Population and Communities (2002) *National Strategy for Ecologically Sustainable Development* Australian Government

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- provide next generation infrastructure of a scale that allows for an innovative precinct-wide network to support the twin challenges of reduced potable water demand and reduction in greenhouse gas emissions.
- provide a place to live and work, by seeking to be a liveable neighbourhood and lively work environment. Over time Barangaroo's range of cultural, educational and recreational amenities and programs will ensure its position as a great destination for Sydney-siders and visitors to the city.
- provide a comprehensive remediation outcome for Barangaroo and in doing so become a benchmark for the reuse of degraded post-industrial landscapes.
- work with government agencies, private sector and community to provide timely and co-ordinated delivery of social and community infrastructure and programs.
- co-ordinate transport and access outcomes to ensure, reduced dependency on car travel to the city supported by new and safe pedestrian and cycle links to a range of transport modes and ease of connectivity with the CBD.

To address and meet the above requirements a long list of sustainability initiatives and strategies have been included into the design of this Project. The below points show how the various initiatives link with and correspond to the four principles of ESD:

- The range of energy efficiency measures and carbon management initiatives in place to minimise impacts of the Project on climate change;
- The strong focus on resource efficiency, as well as the flexibility in design to allow the space to evolve and change over time, illustrates the consideration of intergenerational equity in the Project;
- Minimising the use of virgin materials, and a strict water management regime designed to minimise pollution and reduce potable water use are evidence of the way in which the conservation of biological diversity has been included as a principle in Project design; and
- A focus on precise estimating of materials, minimising the use of virgin materials, recycling wastes and water, and using local suppliers shows that the Project has considered the importance of improving the valuation and pricing of environmental resources.

Integrated Water Management Plan Conclusions

An integrated water cycle management plan has been prepared for the Project which includes initiatives that will deliver best practice management of potable water use, sewage reduction and sustainable stormwater management.

These initiatives will include:

- Use of water efficient hand basins, waterless urinals and by 3.1L/flush toilets in amenities blocks provided for events;
- Extension of the Headland Park stormwater harvesting and re-use system to irrigate the permanent public foreshore and temporary lawn during establishment only;
- Use of recycled water from the Blackwater Treatment Plant in Barangaroo South to supply all non-potable water demands associated with toilet flushing; and
- Connection provisions to the public domain to support future landscape and public art requirements and events.

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Integrated Water Management

The Integrated Water Cycle Management Plan that has been prepared for the Project establishes the following management hierarchy of water resources which will reduce the embodied energy of water used on site and substitute potable water on a fit for purpose basis:

1 Reduction of Interim Public Domain water demands through:

   a) use of water efficient hand basins, waterless urinals and 3.1L/flush toilets in portable amenities blocks during events; and

   b) use of turf and native tree species in the Interim Public Domain landscaping, provide irrigation only during plant establishment and cease irrigating after establishment.

2 Prioritise stormwater for potable water substitution by extension of the Headland Park stormwater harvesting system to irrigate the permanent public foreshore; and

3 Use recycled water from the Blackwater Treatment Plant in Barangaroo South to supply all non-potable water demands associated with toilet flushing in portable amenity blocks during events.

4 Subject to the construction program, prioritise the establishment of turf between the months of April and September to greatly reduce the associated water demand and the reliance on irrigation. Establishing turf during this period will ensure that the Interim Public Domain does not impact on the reliability of the Headland Park harvesting strategy.

5 The proposed water sensitive urban design approach to stormwater management will ensure Interim Public Domain Works delivers stormwater pollution reduction.

Water Sensitive Urban Design

Stormwater management within the site will achieve City of Sydney and NSW State best practice stormwater pollution reduction targets. These targets are as follows:

- Litter and vegetation larger than 5mm: 90% reduction on the Baseline Annual Pollutant Load;
- Total Suspended Solids (TSS): 85% reduction on the Baseline Annual Pollutant Load;
- Total Phosphorus (TP): 65% reduction on the Baseline Annual Pollutant Load; and
- Total Nitrogen (TN): 45% reduction on the Baseline Annual Pollutant Load.

The proposed stormwater management strategy will prevent upstream or downstream flood impacts and will manage safe conveyance of flood waters across the site.

Groundwater and Soils

Provided that the same level of quality of imported fill is provided for the Headland Park, the Interim Public Domain Works will have no adverse impact on groundwater or discharges to Sydney Harbour.

Sea Level Rise

The majority of the permanent public foreshore promenade will be established above the 100 year wave heights accounting for sea level rise of 90cm of sea level rise by 2100 on top of the current high water level in Sydney Harbour. Some areas may be temporarily affected by elevated wave and water levels in an extreme storm event.

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This report consolidates the documented ESD strategies and commitments (including operational waste management and reduction initiatives), and water management measures, as presented in existing drawings, previous impact assessment reports developed for the Barangaroo Headland Park, and scoping documents.

[2] Department of Sustainability, Environment, Water, Population and Communities (2002) *National Strategy for Ecologically Sustainable Development* Australian Government

2 BACKGROUND

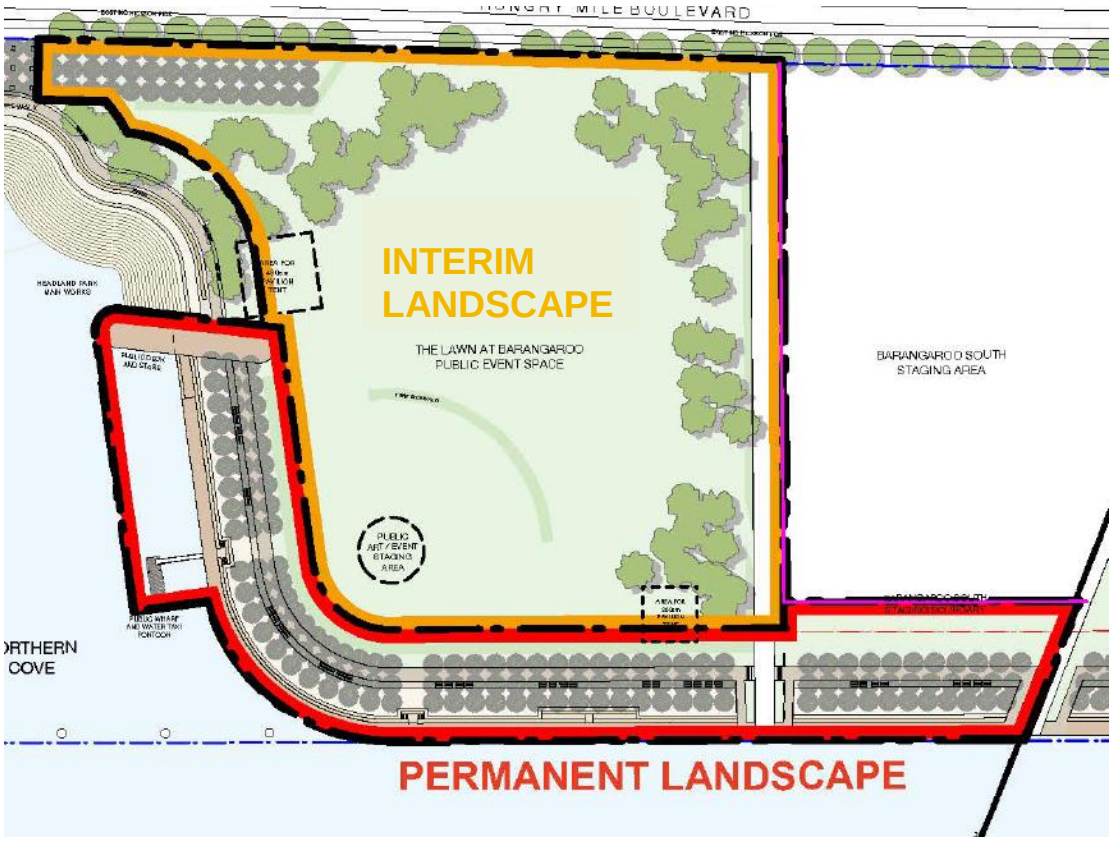
The public domain in Barangaroo Central will be the connector between Headland Park and the urban precinct of Barangaroo South, and will contain elements common to both of these areas. It will extend the Headland Park Promenade along the harbour to Barangaroo South as well as providing significant spaces for public recreation and leisure, and for major events.

The Project is the first stage in the development of the Barangaroo Central site and is scheduled to be completed in 2015.

2.1 Location and Layout

The Project is located on the Barangaroo Central site, and is bounded by the Northern Cove and Headland Park to the north, the harbour to the west, Hickson Road to the east, and the Lend Lease Temporary Construction Staging Area to the south. This is illustrated as below.

Figure 1 Location of Barangaroo Central Waterfront Promenade and Interim Public Domain



The Project comprises two areas, the Barangaroo Central Waterfront Promenade (the “Promenade”) and the Barangaroo Central Interim Public Domain.

2.2 Intended Use

The Project is the first stage in the development of the Barangaroo Central site and is scheduled for completion in 2015. The Project seeks to deliver an active and connected waterfront that is in place at the time of completion of the Headland Park and partial completion of Barangaroo South.

The Barangaroo Central Waterfront Promenade will include a tree lined public promenade and a lower level boardwalk. The Promenade will provide public access along the harbour edge for pedestrians and cyclists. The lower level boardwalk will provide water edge access for pedestrians. A portion of the Promenade will accommodate deep water berthing and infrastructure for special events but not for long term stopping. A pontoon in the Northern Cove will provide small boat, drop-off access.

The Barangaroo Central Interim Public Domain comprises an interim lawn area that will accommodate major public gatherings, casual sports use and picnicking for example, as well as space for major and minor public and special events. The interim lawn includes two locations for temporary pavilions and a public art / event staging area.

2.3 Project Description

The Barangaroo Central Waterfront Promenade covers the zone from the harbour edge approximately 30m into the site, and extends along the full length of the Barangaroo Central site from the eastern side of the public deck in the Northern Cove to the Barangaroo South boundary

The Barangaroo Central Waterfront Promenade will integrate with and continue the foreshore Promenade from Headland Park to Barangaroo South, whilst acknowledging the character of each precinct.

Key landscaping elements of the Promenade design will include:

- Planting including shade trees along the Promenade;
- Paving and walls including pavements for pedestrians, cyclists and vehicular (emergency and maintenance) traffic, and sandstone block walls adjacent to the boardwalk;
- Timber boardwalk along the lower level waterfront edge;
- Furniture including seats, rubbish bins, drinking fountains, bike racks and life buoys along the Promenade and at key locations;
- Signage; and
- Lighting.

Where applicable, these elements will generally be based on the Headland Park design unless otherwise stated and will be permanent in nature.

The key structural elements include:

- Western Edge Treatment:
  - Ongoing use of the existing caissons as a seawall;
  - New retaining walls inside the western edge to raise the levels of the western Promenade;
  - Retain existing bollards and fenders for large vessel mooring; and
  - Timber boardwalk along the Promenade founded on the existing caissons, and associated stairs and ramps.
- Northern Edge Treatment:
  - Structural concrete slab beneath boardwalk;
  - Timber boardwalk along the Promenade founded on the new reinforced concrete retaining wall and adjacent fill, and associated stairs and ramps;
- Water taxi pontoon and access ramp; and
- Public Pier.

Note: the structural works required to form the Northern Cove are included in the Headland Park Main works and were included in planning approvals for the Headland Park.

The Barangaroo Central Interim Public Domain covers the remainder of the site

The Barangaroo Central Interim Public Domain will provide a flexible public space to address the various intended end uses.

Key landscaping elements of the Barangaroo Central Interim Public Domain designs will include:

- Planting including an interim lawn of a suitable quality to support the expected leisure and recreation activities such as touch football, and occasional major events;
- Furniture including seats and rubbish bins;
- Signage; and
- Provision of infrastructure for two future Pavilions and a Public Art / Event Staging Area including all necessary services to support the intended end use of these facilities.

These elements may differ from the Promenade unless otherwise stated due to the interim nature of this area.

The **civil works** comprises predominantly earthworks, pavements and roadworks. These works are located in both the permanent Barangaroo Central Waterfront Promenade and the Barangaroo Central Interim Public Domain, and should be designed to support the intended use and achieve the required design life in each area in the most cost effective manner.

The earthworks operation should seek to maximise the reuse of fill material from other areas of the Barangaroo development to reduce off-site disposal and fill importation. However all fill used on the Barangaroo Central site must be suitable for use and not contain unacceptable levels of contaminants.

The key civil elements include:

- Earthworks to re-profile the temporary lawn area;
- Filling to raise the levels along the Promenade by approximately 1m to 1.5m;
- A permanent pavement along the Promenade; and
- A temporary access way connecting the Promenade to Hickson Road.

All required **services** will be provided to support the intended use including stormwater, sewer, potable water irrigation, telecommunications, security, electrical and public lighting. This will include the provision of all services necessary to support the use of the future temporary pavilion areas and public art / event staging area, and to hold major public events, unless otherwise stated.

Generally permanent services should be provided to support the permanent Barangaroo Central Waterfront Promenade, and temporary services should be provided to support the Barangaroo Central Interim Public Domain unless otherwise stated. Regardless of this approach all services that are required in the Barangaroo Central Waterfront Promenade area for the future operation of the Barangaroo site will be installed. This will ensure that services works are not required in this area in the future.

3 OBJECTIVES

The key objectives of this report are to:

- Describe the overall sustainability objectives of the Barangaroo Central Development;
- Describe the way in which each of the ESD principles has been incorporated into the design, construction and ongoing operation phases of the Barangaroo Central Project;
- Describe the ways in which operational waste management has been incorporated into design; and
- Address the integrated water cycle management aspects of the Project including proposed alternative water supply, proposed end uses of potable and non-potable water, demonstration of water sensitive urban design and water conservation measures.

4 GUIDING DOCUMENTS, STRATEGIES, POLICIES AND PLANS

This assessment has been completed in accordance with the following list of guiding documents, strategies, policies and plans:

- Department of Sustainability, Environment, Water, Population and Communities (2002) *National Strategy for Ecologically Sustainable Development* Australian Government;
- The Metropolitan Plan for Sydney 2036;
- State Environmental Planning Policy Major Development 2005, Schedule 3, Part 12 (Barangaroo Site) clause 8/9;
- Metropolitan Plan for Sydney 2036, NSW Department of Planning and Infrastructure;
- City of Sydney Decentralised Water Master Plan WSUD & Stormwater Infrastructure Report Appendix 3. Water Sensitive Urban Design & Stormwater Infrastructure Improvement Plan (2012) GHD;
- Barangaroo Delivery Authority (2012) Barangaroo Central Performance Brief, Barangaroo Central Stage 1 Public Domain; and
- Barangaroo Delivery Authority (2011) Barangaroo Headland Park Request for Tender: Main Works, RFT No. BDA-MWC-09Built Ecology (2011) Technical Specification, Headland Park Main Works, Sustainability Design Performance Specification.

5 METHODOLOGY

All work contained within this report is based on existing documentation for the Barangaroo Headland Park (BHP) or Barangaroo Central, and other relevant documentation provided by Baulderstone and the Barangaroo Delivery Authority.

This Scope of Works does not include undertaking any new assessments or studies.

5.1 ESD principles in Design, Construction and Operation (including Waste)

The identification and presentation of the ESD initiatives for the Project was completed through the following steps:

- Review relevant documentation and guidelines to extract and summarise ESD design initiatives. The reviewed documentation included those from the Barangaroo Central Site and the BHP Development;
- Consult with the design team to confirm gathered information; and
- Document the full range of sustainability measures that have been incorporated into the Project's design, construction and operation phase. The sustainability measures have been categorised and presented based on the four key sustainability goals of the Project; Energy, Water, Waste and Community, and include two key components:
    - High level sustainability measures and objectives; and
    - Specific initiatives and strategies.

5.2 Integrated Water Management Plan

The Barangaroo Interim Public Domain Water Cycle Management Plan (SLR, 2012) includes initiatives that are in line with best practice management of potable water use, sewage reduction and sustainable stormwater management.

These initiatives ensure that Barangaroo Central fits within the commitment that the Barangaroo precinct as a whole will be water positive by exporting more water than is used within the Barangaroo Development.

Section 7 of this report provides detail on:

- Water demands;
- Non-potable water;
- Sustainable stormwater management (WSUD); and
- The sites water balance.

6 ECOLOGICALLY SUSTAINABLE DEVELOPMENT

6.1 Ecologically Sustainable Development Management and Mitigation Measures

6.1.1 Sustainability Objectives

The objectives for the sustainable design and delivery of Barangaroo are to:

- provide next generation infrastructure of a scale that allows for an innovative precinct-wide network to support the twin challenges of reduced potable water demand and reduction in greenhouse gas emissions;
- provide a place to live and work, by seeking to be a liveable neighbourhood and lively work environment. Over time Barangaroo's range of cultural, educational and recreational amenities and programs will ensure its position as a great destination for Sydney-siders and visitors to the city;
- provide a comprehensive remediation outcome for Barangaroo and in doing so become a benchmark for the reuse of degraded post-industrial landscapes;
- work with government agencies, private sector and community to provide timely and co-ordinated delivery of social and community infrastructure and programs; and
- co-ordinate transport and access outcomes to ensure, reduced dependency on car travel to the city supported by new and safe pedestrian and cycle links to a range of transport modes and ease of connectivity with the CBD.

6.1.2 Best Practice Sustainability

The Project aims to provide environmental leadership to the community by incorporating Best Sustainability Practices and One Planet Living Principles – during the early works, main works as well as throughout operation. The following overarching sustainability goals have been defined for the Barangaroo Precinct:

- Water Positive - more water recycled and exported from the site than is used within the site;
- Zero Waste – through prevention, minimisation, recycling and re-use;
- Carbon Neutral – by generating more new renewable energy the total net greenhouse gas emissions; and
- Socially Sustainable – through learning development programs, effective community infrastructure and a commitment to cultural and public arts facilities.

The following summarises the Project's sustainability focus.

> *Barangaroo's goal is to be the first precinct of its size in the world to be climate positive. Barangaroo will enhance the wellbeing of our community by seeking to operate as a carbon neutral, water positive and zero waste precinct.*
>
> *Barangaroo is one of 17 precincts worldwide selected by the Clinton Foundation to participate in the Climate Positive Development Program. Barangaroo's selection is based on world leading sustainability targets that apply across the precinct.*
>
> *Barangaroo will be developed as a public private partnership with Australian investment and will incorporate an Australian innovation and financial hub and world class transport infrastructure. It will be a place for young people with mixed use, education and research facilities, a place with Australian grassroots appeal.*

This Project seeks to ensure people live happy and healthy lives within a fair share of the earth's resources. Our philosophy is underpinned by a commitment to community wellbeing, moving beyond sustainable buildings and into sustainable precincts and sustainable lifestyles.

Barangaroo is focusing on a holistic and inclusive range of social outcomes across the 5 key areas of culture and identity; lifelong learning; community services; active and healthy living; and community investment.

To achieve these outcomes at Barangaroo we will provide safe, equitable and effective community infrastructure and services to meet the needs of Barangaroo's community. This includes: cultural, community, youth and children's facilities and services, public art, and lifelong learning, skilling and employment opportunities.

Over time Barangaroo's range of cultural, educational and recreational amenities and programs will ensure its position as a great destination for visitors to the city as well as all of Sydney.

In addition to working with sustainability leaders globally, Barangaroo is seeking to lead and support our national benchmarking tools. It hopes to achieve this through targeting world leadership Green star design and as-built ratings for commercial buildings, combined with the highest level of operational performance benchmarking under the NABERS ratings system and by piloting and sponsoring the new Green Star Communities tool.

Barangaroo seeks to leave a legacy in sustainable design and operation which reflects the next generation of green buildings and community spaces.

In working to achieve these aims, the operation and construction phases of the Project will integrate various ESD initiatives and thereby deliver a range of social, economic, and environmental benefits

This is the first stage in the development of Barangaroo Central the overall Barangaroo ESD goals and objectives will inform future development.

The range of initiatives that will be implemented across this Project have been categorised into the following groups:

- Energy and carbon;
- Water reduction;
- Waste reduction; and
- Social benefit.

These initiatives are presented in the tables below.

6.1.3 Energy and Carbon Management

Achieving carbon neutrality is a key consideration for the Barangaroo precinct. The primary method for achieving this goal is by reducing consumption and achieving efficiency wherever possible. Purchasing of green power, implementing a Travel Action Plan, managing resource efficiency and effectively engaging the staff and community will all assist the Project to meet this goal.

The following table outlines the specific initiatives/strategies have been incorporated into the design.

Table 1 Energy and Carbon reduction Initiatives

Category	Strategy
Material / Resource Consumption	Low-paper, low printing, recycling, and water and energy efficiency measures are employed within the Site Office that Baulderstone occupies, also as part of the Barangaroo Headland development.
	Precise estimating, checking and ordering of materials and arrangements with suppliers for return of surplus items/quantities where practicable to reduce resource use
	Where appropriate, contracts with major suppliers to stipulate requirement that delivery vehicles are appropriately maintained and emissions comply with relevant criteria/standards
	100% of electricity during construction will use Green Power
	All permanent lights used within the site will use energy efficient globes.
	All reasonable effort will be made to use up to 20% (B20) biofuels within diesel-run plant machinery and vehicles. This will be dependent on suppliers and their willingness to use this type of fuel within their machines
	Any materials used on-site will be of high quality to facilitate low maintenance requirements and a long life span. For example; • the boardwalk will be constructed of suitable hardwood and will have a 50 year design life. • the water taxi pontoon and access ramp with be provided, and will have a 100 year design life.
	Where possible, during construction, materials will make use of recycled products. For example: • all timber supplied must be in accordance with the Chain of Custody rules of the respective forest certification scheme. • all concrete used on the site (the structural concrete slab for beneath the boardwalk, and any precast structures) will use, as a minimum, 20% flyash within the mix.
Transport	A Construction Green Travel Action Plan has been developed to minimise and control the impact from transport during construction. Initiatives within the plan include: • Limited parking will be provided on-site for construction workers to encourage the use of public transport or cycling/walking to work which will reduce air and noise emissions • Limited parking will be provided for visitors to the precinct to encourage use of public transport
	Where appropriate, contracts with major suppliers will stipulate requirements that ensure that delivery vehicles are appropriately maintained and emissions comply with relevant criteria/standards.
	Provision of infrastructure and support for cyclists. For example, the tree-lined promenade will

Category	Strategy
	provide access along the harbour-edge for pedestrians and cyclists. The lower level boardwalk will provide water-edge access for pedestrians. A portion of the promenade will accommodate deep water berthing and infrastructure for special events. A pontoon will provide small boat, drop-off access.
	Access into, through and out of the site for visitors (pedestrians, cyclists and water transport) will be simple and easy through a few major landmark entries, and a number of smaller entry points from adjacent parks and residential areas. This will encourage the use of the site and clearly demonstrate integration of non-vehicle transportation.

6.1.4 Water Management

The Barangaroo Precinct aims to generate more water than it needs. This will be achieved through the use of stormwater collection and treatment systems, targeting and managing water use, and training/engaging staff in water conservation and management.

Table 2 Water Reduction Initiatives

Category	Initiative
Construction	The earthworks will be built over the existing hardstand pavements and will ensure that catchments, subsoil drainage, stormwater networks and overland flow paths are coordinated
	Run-off from the site during construction and operation will be minimised through infiltration and sediment and erosion controls
	Use of harvested rainwater and recycled water from a Blackwater Treatment plant (BWTP) located in Barangaroo South to supply all non-potable water demands associated with the Barangaroo Central Waterfront Promenade and Interim Public Domain.
Operation	Native low-irrigation plant species are proposed within the landscaping of the Interim Public Domain area.
	Use of water efficient hand basins, waterless urinals and by 3.1L/flush toilets in amenities blocks provided for events
	Including connection provisions to the public domain to support future pavilion, public art and event requirements.
	Recycled water from a Blackwater Treatment Plant (BWTP) located in Barangaroo South will supply all toilet flushing water demands associated with the events and future pavilions at the Barangaroo Central site. If fit for purpose, recycled water will be used for irrigation.

6.1.5 Waste Management

Construction of the Barangaroo Central Project will aim to meet the principles of the waste management hierarchy, in order of the below preference list (shown in **Figure 2**).

Figure 2 Waste Management Hierarchy

The Waste Management approach for this Project includes construction and operational strategies that focus on the top three levels of the waste management hierarchy and includes:

- Commitment to an 80% increase in operational waste recycled, reused and/or reduced by 2014 with zero waste sent to landfill by 2020.
- 90% diversion of waste from landfill during construction

Waste management for this Project not only includes the amount of waste sent to landfill, but also the amount of recycled/re-used waste utilised during the construction of the Project. All reasonable effort will be made during construction to utilise waste materials (on-site or off-site) within construction. For example, waste from industrial processes (i.e. flyash/slag) will be included as at least 20% of all concrete mixes for the site.

Detailed waste reduction initiatives are presented in the table below.

Table 3 Waste Management Measures

Category	Initiative
Construction	The use of remediated and validated soils from Barangaroo North and/or South will be considered for use within the Project site, based on the suitability of the soil
	The use of recycled materials within construction materials is being optimised (where appropriate, to maintain compliance with the relevant Australian Standards) during construction and operation. For example, • all concrete used on the site (the structural concrete slab for beneath the boardwalk, and any precast structures) will use, as a minimum, 20% flyash within the mix.
	Irrigation using Harvested Stormwater from the Headland Park stormwater harvesting system.
	Use of harvested rainwater and recycled water from a Blackwater Treatment plant (BWTP) located in Barangaroo South to supply all non-potable water demands associated with the Barangaroo Central Interim Public Domain.
	Re-use of the existing caissons, including extensive cathodic protection works
Operation	Recycling bins will be provided for the community during general recreation and public events
	A site wide approach to the collection of segregated waste streams will be applied at the Barangaroo precinct. On site waste stream segregation for paper and cardboard, co-mingled recycles, glass, soft plastics, cooking oil, electronic and organic waste is proposed.
	Green waste from the greater Barangaroo Precinct will be sent to a local, approved recycling facility for re-use as mulch and fertiliser. Where appropriate, this re-use will take place back within the Barangaroo Precinct.

6.1.6 Community Development

The Barangaroo Precinct development has a commitment to community development. The Project's understanding of the complexities inherent in community development is evidenced in the following:

- The Community Development Strategy's grounding in the use of facilities, programs and initiatives as a lever for community development - building trust, social capital, capacity and eventually ownership and participation over time.
- Recognition that places are for people and that in order to create a great destination developers must engage, understand and ensure that the design and future programming of Barangaroo responds to the needs, drivers and aspirations of the emerging community who will live, learn, work and play there.
- Designing a physical environment, infrastructure elements as well as programs, events and activities which responds to the appetites of the future residents, workers and visitors and leverages the inherent assets of the precinct, is integral in creation of a great destination that is recognised locally, regionally, and globally over time
- Barangaroo facilitates place integration, linking with the harbour, the neighbourhoods, the city and its culture and history

Barangaroo's Community Development Strategy is shown in the figure below.

Figure 3 Barangaroo Community Development Strategy

Detailed community development initiatives are presented within the below table.

Table 4 Community Development Initiatives

Category	Initiative
Local Community	The community has been engaged in the decision-making process as part of the development of the whole Barangaroo site and will have opportunity to comment on this application
	The site provides ample opportunity for sociability, personal development, and community participation
	Open space for recreation and leisure
	The integration of a natural landscape and a practical area
	Flexibility in design so that a multi-use space can evolve and respond to change over time
	Use of design principles that encompasses natural assets and promotes environmental awareness for the community

Category	Initiative
	The use of public transport is being encouraged for all staff and contractors to the site. This will reduce congestion and noise for the surrounding businesses and communities
	Where feasible, local suppliers, products and services will be preferred over a non-local option to reduce transport emissions and promote and support local businesses, assuming that the supplier meets the sustainable procurement requirements
	Ongoing economic benefits to the local area through public events and encouraged tourism and leisure visits
	A number of easy access points are being provided for the community including walking paths from Hickson Road, and water access for small and large boats
Ongoing Community Development	Job creation and potential reduction in unemployment numbers
	Aboriginal employment will exceed the NSW Government's Construction Guidelines by 10%
	1 in 5 workers, including sub-contractors, will be an apprentice or trainee
	Formal and informal programs, activities and events which foster an active and healthy lifestyle for residents, workers and visitors at Barangaroo. For example, interactive public art, open air cinema, wellbeing centre, recreational boating, semi-formal sports etc.
	Barangaroo Skills Exchange (BSX) program which provides onsite learning and training opportunities
Infrastructure	Delivery of public infrastructure in the local area
	Pedestrian links with local public transport networks, infrastructure for cyclists and reduced parking availability, will be provided as part of the greater Barangaroo site
	The design of this area will allow significant space for public recreation, leisure and, minor and major events. The design includes the following key social benefits: • A pontoon has been included in design to encourage visitors to the area and facilitate short-term stopping • Furniture including seats, rubbish bins, drinking fountains and bike racks are included • Planting including an interim lawn of a suitable quality to support the expected leisure and recreation activities such as touch football, and occasional major events; • Provision of infrastructure for two future Pavilions and a Public Art and Event Staging Area including all necessary services to support the intended end use of these facilities. • The landscaping design includes trees to provide shaded area along the Central Waterfront Promenade and the Interim Public Domain
Visual Amenity	Services and infrastructure elements will be as invisible as possible. For example, through use of screening and planting to cover
	The Central precinct will provide open space / public domain for Sydneysiders

Category	Initiative
	The public domain within Barangaroo Central will promote a *rich* experience through innovative design and activation
	The use of open space
	Regeneration is about reclaiming the decommissioned port facilities and creating a new urban spatial experience for the people of Sydney and its visitors enabling a catalyst for the surrounds and broader Sydney.
Heritage and Biodiversity	All plants used within the Barangaroo Precinct will be native, and of which 90% will be endemic plant species. This will create habitats, and provide movement corridors for target wildlife, particularly bird species.
	This also encourages and adds to the relaxing ambience of the area

6.2 Conclusion

The Barangaroo Waterfront Promenade and Interim Public Domain (the first stage of the Barangaroo Central development), and the general Barangaroo Precinct, aims to be a world leader in sustainability. The Project aims to provide environmental leadership to the community by incorporating Best Sustainability Practices and One Planet Living Principles – during delivery and throughout operation. The following overarching sustainability goals have been defined for the Barangaroo Precinct:

- Water Positive - more water recycled and exported from the site than is used within the site;
- Zero Waste – through prevention, minimisation, recycling and re-use;
- Carbon Neutral – by generating more new renewable energy the total net greenhouse gas emissions; and
- Socially Sustainable – through learning development programs, effective community infrastructure and a commitment to cultural and public arts facilities.

The high-level sustainability objectives of this Project are:

- provide next generation infrastructure of a scale that allows for an innovative precinct-wide network to support the twin challenges of reduced potable water demand and reduction in greenhouse gas emissions;
- provide a place to live and work, by seeking to be a liveable neighbourhood and lively work environment. Over time Barangaroo's range of cultural, educational and recreational amenities and programs will ensure its position as a great destination for Sydney-siders and visitors to the city;
- provide a comprehensive remediation outcome for Barangaroo and in doing so become a benchmark for the reuse of degraded post-industrial landscapes;
- work with government agencies, private sector and community to provide timely and co-ordinated delivery of social and community infrastructure and programs; and
- co-ordinate transport and access outcomes to ensure, reduced dependency on car travel to the city supported by new and safe pedestrian and cycle links to a range of transport modes and ease of connectivity with the CBD.

To address and meet the above requirements a long list of sustainability initiatives and strategies have been included into the design of this Project. The below points show how the various initiatives link with and correspond to the four principles of ESD:

- The range of energy efficiency measures and carbon management initiatives in place to minimise impacts of the Project on climate change;
- The strong focus on resource efficiency, as well as the flexibility in design to allow the space to evolve and change over time, illustrates the consideration of intergenerational equity in the Project;
- Minimising the use of virgin materials, and a strict water management regime designed to minimise pollution and reduce potable water use are evidence of the way in which the conservation of biological diversity has been included as a principle in Project design; and

  A focus on precise estimating of materials, minimising the use of virgin materials, recycling wastes and water, and using local suppliers shows that the Project has considered the importance of improving the valuation and pricing of environmental resources.

7 INTEGRATED WATER MANAGEMENT PLAN

This section describes the integrated water cycle management initiatives that will be undertaken to support the overall Barangaroo goal to be water positive.

These initiatives will include:

- Use of water efficient hand basins, waterless urinals and by 3.1L/flush toilets in amenities blocks provided for events;
- Extension of the Headland Park stormwater harvesting system to irrigate the permanent public foreshore and temporary lawn during establishment only;
- Use of recycled water from the Blackwater Treatment Plant in Barangaroo South to supply all non-potable water demands associated with toilet flushing and irrigation if of a suitable quality; and
- Connection provisions to the public domain to support future landscape and public art requirements and events.

Stormwater management within the site will achieve City of Sydney and NSW State best practice stormwater pollution reduction targets. These targets are as follows:

- Litter and vegetation larger than 5mm: 90% reduction on the Baseline Annual Pollutant Load;
- Total Suspended Solids (TSS): 85% reduction on the Baseline Annual Pollutant Load;
- Total Phosphorus (TP): 65% reduction on the Baseline Annual Pollutant Load; and
- Total Nitrogen (TN): 45% reduction on the Baseline Annual Pollutant Load

The Stormwater Management Strategy also provides for the safe conveyance of floodwaters.

The Baseline Annual Pollutant Load refers to the pollutant load generated from the proposed new development site with no stormwater quality improvement systems implemented.

7.1 Interim Public Domain Works Water Balance

A water balance for the Interim Public Domain was estimated using event patronage numbers and horticulturalist recommendations on irrigation.

7.1.1 Irrigation

The landscaping plan for the Interim Public Domain includes turf and trees to form an event and public recreation space. An avenue of trees along the public permanent foreshore will also be established and retained.

During establishment, the irrigation demand for turf and trees is as follows:

- Turf establishment – 4 mm day during summer and 2mm day during winter; and
- Tree establishment – 1.75 kL/year.

Stormwater harvesting will satisfy 70 to 80% of irrigation demands within the Headland Park. Additional demand placed on the tanks during establishment of the Interim Open Space will approximately double the water demands placed on the Headland Park stormwater harvesting system. Under this scenario, an additional 1ML could be drawn from the proposed tank annually. This is likely to be sufficient to supply irrigation of permanent trees along the shoreline promenade. However, additional irrigation during turf establishment will require potable water or recycled effluent from the Barangaroo South to make up the difference. Dependent on the period of turf establishment and time of year, this volume may be 5 ML/year and up to 29 ML/year if intensive turf irrigation occurs across the first year of establishment.

7.1.2 Potable and Non Potable Water for Temporary Amenities

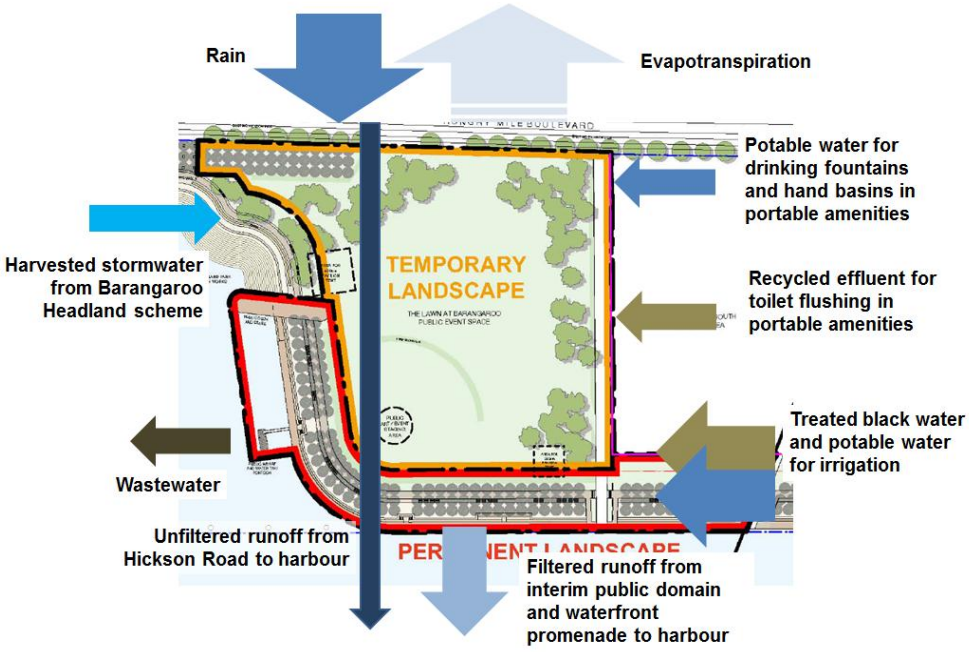
Proposed events in the Interim Public Domain will attract over 41,100 patrons each year. Temporary amenity buildings will be supplied with potable water for hand basins and recycled waste water for toilet flushing. Amenity blocks will be fitted with water saving devices including:

- Taps in hand basins – 4L/min – approximately 0.3 ML/year;
- Toilets – 3.3L average flush – approximately 1.7 ML/year;
- Urinals – waterless with no annual water demand; and
- Drinking water fountains will potentially generate – 0.5 to 1 ML/year.

7.2 Water Balance

The Interim Public Domain annual water balance presented in Figure 4 adopts the condition where the landscape is established, turf irrigation has ceased and trees are irrigated only as required to prevent stress during dry spells. The water balance includes the volumes of stormwater runoff generated within the park and conveyed under the park from Hickson Road.

Figure 4 Annual water balance for Barangaroo Interim Public Domain



7.3 Stormwater Management and Water Sensitive Urban Design

The Water Sensitive Urban Design approach to stormwater management across the Interim Public Domain will ensure that the site achieves best practice stormwater pollutant reduction targets and mitigate stormwater impacts on groundwater.

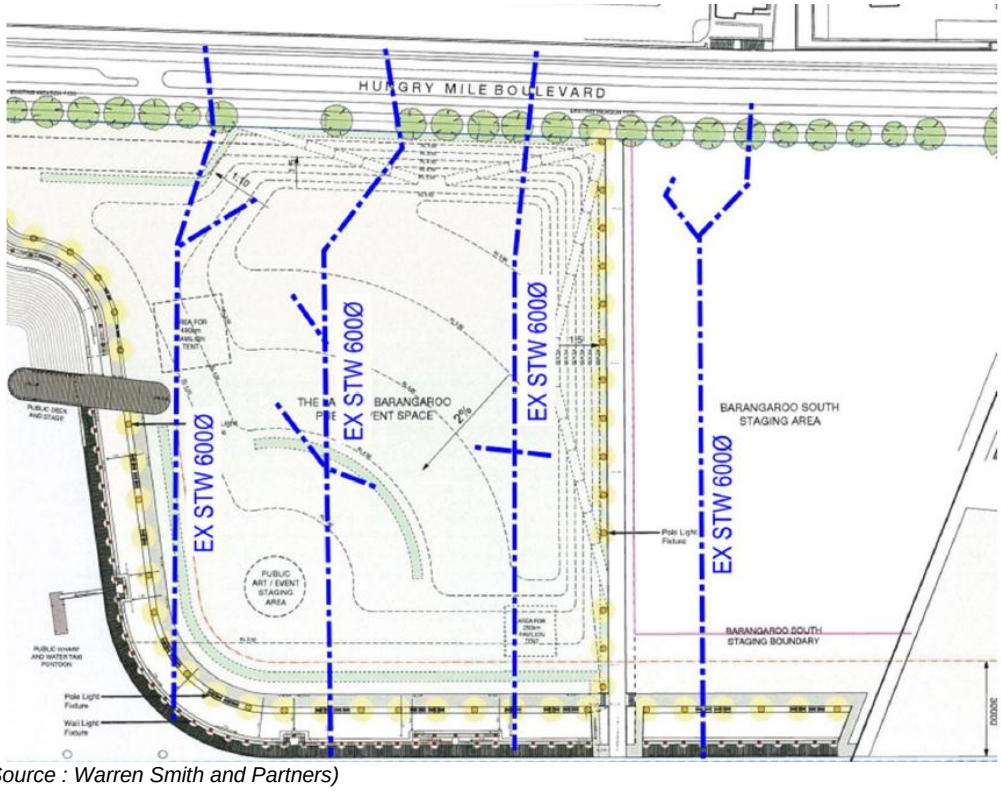
7.3.1 Stormwater Quantity and Flood Management

A Stormwater Management Strategy was prepared for the Project by Warren Smith and Partners which provides site drainage and the safe conveyance of flood waters through the site.

The Interim Public domain earthworks will include the construction of a temporary raised embankment along Hickson Road. A new culvert is proposed beneath the park to prevent ponding in Hickson Road during heavy rain. The proposed culvert will replace four existing stormwater pipes which drain under the existing asphalt surface of the park site.

All turf areas will drain to grassed swales before overflowing to stormwater drainage pits that flow to the Harbour.

Figure 5 Barangaroo Central overland flow management strategy



(Source : Warren Smith and Partners)

7.3.2 Stormwater Quality Management and Water Sensitive Urban Design

A water sensitive urban design approach is proposed for the management of stormwater from the Interim Public Domain.

All turfed areas will drain to grassed swales that will collect and filter stortmwater from minor rain events. Runoff from storm events will overflow to stormwater drainage pits that flow to the Harbour. The target loads were calculated using stormwater pollution export and treatment model (MUSIC software) and are summarised in Table 5.

Table 5 Stormwater quality modelling results for the interim public domain and permanent foreshore

Stormwater Pollutant Loads	Project without treatment (baseline) (kg / year)	Project with grassed swales (kg / year)	% Reduction in pollutants from Project stormwater	City of Sydney DCP stormwater objectives met?
Gross Pollutants	83.5	83.5	0%	No
TSS	2180	732	66%	No
TP	3.49	1.9	46%	No
TN	25.9	17.7	32%	No

In order to include some stormwater filtration into the permanent public foreshore pavement areas, passive irrigation of stormwater to tree pits located may be included into detailed design. This will improve the stormwater pollution reductions for the site and may achieve Council's DCP targets.

During construction, stormwater pits are to be blocked with sandbags and filter fabric to ensure that any silt laden runoff is filtered before entering the stormwater network and Darling Harbour.

7.3.3 Groundwater Management

The Interim Public Domain will cover the existing asphalt surface in fill material and turf. Infiltrated stormwater will be collected by sub surface drainage and discharged to Darling Harbour. Limited contamination of fill material will occur under the Interim Public Domain and no significant groundwater contamination will occur.

7.4 Climate Change and Sea Level Rise

Under the NSW sea level rise planning benchmarks, increases above 1990 mean sea levels of 40 cm by 2050 and 90 cm by 2100 have been adopted as benchmarks allowing for consideration of sea level rise over different timeframes. A Barangaroo Desktop Hydrodynamic Assessment (SMEC, 2010) identifies that Waves reach up to 0.70m significant wave height and 2.39s wave period for a 1 in 100 year wind speed. The majority of the permanent public foreshore will be established to a RL 3.1 which will accommodate 90cm of sea level rise by 2100 and an additional 70cm of 1-in-100 year waves in Darling Harbour on top of the 2010 high water level in Sydney Harbour (RL +1.0).

7.5 Conclusion

To best manage the available water resources, reduce the embodied energy of water used on site and substitute potable water on a fit-for-purpose basis, the following hierarchy shall be applied:

1 Reduction of Interim Public Domain water demands through:

   a) use of water efficient hand basins, waterless urinals and 3.1L/flush toilets in portable amenities blocks during events; and

   b) use of turf and native tree species in the Interim Public Domain landscaping, provide irrigation only during plant establishment and cease irrigating after establishment.

2 Prioritise stormwater for potable water substitution by extension of the Headland Park stormwater harvesting system to irrigate the permanent public foreshore;

3 Use recycled water from the Blackwater Treatment Plant in Barangaroo South to supply all non-potable water demands associated with toilet flushing in portable amenity blocks during events, and for irrigation if fit for purpose.

4 Subject to the construction program, prioritise the establishment of turf between the months of April and September to greatly reduce the associated water demand and the reliance on irrigation. Establishing turf during this period will ensure that the Interim Public Domain does not impact on the reliability of the Headland Park harvesting strategy.

5 The proposed water sensitive urban design approach to stormwater management will ensure Interim Public Domain Works delivers stormwater pollution reduction.