

APPENDIX 17

ESD Report

Barangaroo Headland Park Headland Park Main Works Package ESD Report

Client

Barangaroo Development Authority

**19/10/2010
SBE1004200**

EXECUTIVE SUMMARY

The Barangaroo site is a site of State significance which will perform at a level which provides the environmental leadership to the community. The site aims to deliver a precinct which values the well being of people and the planet by:

- Being water positive
- Generating zero waste
- Achieving carbon neutrality
- Promoting community wellbeing
- 100% on-site renewable energy generation for the public domain

This report outlines the ESD (Ecologically Sustainable Development) principles which are to be incorporated into the Main Works at Barangaroo. In addition the report will also investigate the requirements of the site to mitigate future risks associated with climate change and sea level. In order to address these issues the following initiatives have been included in the Early Works package:

Sea Level Rise

- The site should be built at a reference level above 2.335m (AHD) to address a 100year sea level rise in line with the NSW Sea Level Rise Policy Statement.

Energy and Carbon

- Energy consumption will be minimised where possible
- On Site renewable energy generation of up to 56kWp will meet Headland Park Public Domain demand. Photovoltaics will be located in Headland Park and adjacent to the Northern Cove.
- Off-Site renewable energy to off-set any remaining energy use of the Headland Park including the car park and future Cultural Space.

Transport Emissions

- Integration with local public transport networks through the use of locality maps, timetables, and real-time commuter updates.
- Pedestrian links with local public transport networks
- Infrastructure and support for cyclists and pedestrians
- Preferential small car parking and hybrid car parking stations and dedicated car club spaces.
- 20% of parking spaces will be electric vehicle parking stations
- Levies for vehicles will be incorporated into the cost of car parking to encourage public transport use.

- Public events held at the park with paid tickets to include the cost of public transport within the cost of the ticket.

Water

The Main Works is targeting an 80% water reduction from construction practices. Where possible a rainwater tank will be provided to reduce potable water construction during these works. Where possible this tank will be the same tank as was installed and utilised as part of the Early Works.

The following initiatives are included to ensure a significant water consumption reduction:

- Minimising irrigation requirements through the preferential selection of low irrigation plant species
- Efficient irrigation systems including sub-soil drip irrigation
- Efficient fixtures and fittings to meet the following minimum flow rates

Pollution and Waste

An overall strategy to achieve zero waste for the site will be achieved through the following measures:

- A greater than 90% diversion of construction waste (by mass) from landfill - This will be achieved through the implementation of a waste management plan and quarterly reporting during construction.
- The Barangaroo Zero Waste Action Plan will work towards zero operational waste across Barangaroo by 2020.
- Top soil and fill will be utilised from the greater Barangaroo site in the Early Works for the Headland Park development.
- Green waste from the greater Barangaroo precinct to be utilised as mulch and fertiliser throughout the operation of the precinct.
- An on-site composting facility is to be included at Headland Park. This can be re-used in landscaping in the parklands.
- Recycling points to be located throughout the Public Domain site
- Minimum 20m² waste recycling storage space is to be provided for the Space for a future use

Ecology and Landscaping

- 100% Native and 90% Endemic plant species (excluding lawn) are utilised which have lower irrigation requirements
- Water Quality - Water leaving the site will be treated to meet national best practice standards
- Light pollution will be minimised during the operation of the site.

One Planet Living

Headland Park is targeting a One Planet Living Community status. In order to become an endorsed One Planet Living Community the Headland Park must follow the framework of the ten One Planet principles to ensure all aspects of sustainability have been met.

Construction Practices

Carbon

- On site quarrying of the sandstone to reduce transport emissions.
- 100% Biodiesel construction equipment where possible. Alternatively 20% bio-fuels should be used where possible.
- The site is to commit to 100% Green Power
- Local materials are to be used preferentially where sustainable sources are not compromised

Pollution and Waste

- Waste management plans to reduce waste from construction of the early works.
- Environmental management plan to minimise local environmental disturbances
- Treatment of stormwater during early works to prevent pollution into the harbour including:
 - o Gross pollutant traps
 - o Swales
- Pollution control measures on construction equipment including:
 - o Diesel oxidation catalysts
 - o Diesel particulate matter filters

Materials

- Re-used materials to be used where possible
- Re-used of FCS certified timber to be used where required

Community Wellbeing

- Improve construction worker conditions.
 - o HVAC Protection – Cover ductwork, and cover open grilles.
 - o Source Control – Use low-VOC materials, limit indoor machine exhaust, use low VOC cleaning products

- o Pathway Interruption – Provide areas for construction workers away from construction such as indoor areas where exposure to dust and exhaust can be limited
- o Housekeeping – Regular sweeping and wet mopping of any indoor spaces i.e. office areas
- o Daylighting - Provide natural daylight to indoor office areas
- o Provide 100% improvement on AS1668.2-1991 for outside air rates for office spaces.

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1 Introduction

The construction of Headland Park at Barangaroo consists of two parts. These are the Early Works and the Main Works. The proposed works comprise five main “packages” of works as follows:

- Excavation, filling and land formation,
- Public domain and civil works
- Building architecture
- Landscape architecture
- Waterfront & Maritime Design and Engineering

Given that both Barangaroo Headland Park and the whole development have exemplary sustainability credentials. This report considers sustainability initiatives to be implemented with regard to the Main Works. The Early Works sustainability report addressed sustainability by setting foundations for the main works and the operation of the park.

In order to achieve a high level of sustainability performance on the site it is vital to consider future proofing of the site. In particular as it is a harbour side development, climate change and its effect on sea level rise have to be considered. This will ensure the future viability of the site.

The Barangaroo Headland Park Site will endeavour to achieve exemplar sustainable practices not only during the early works, but also during the Main Works and throughout its operation. The Headland Park intends to operate co-operatively with the Barangaroo Central and Southern precincts to achieve a maximum integrated environmental benefit. The ESD strategy addresses water quality, microclimate, environmental quality / amenity, landscape, transport, waste and materials used for development. This report also outlines the targets for the site.

2 Main Works Overview

Typically, “Early Works” are those activities that ‘enable’ a projects “main works” to commence unfettered and without delay details of the Early Work were provided in the Early Works report.

The proposal includes all works required to construct the final landform including the park and northern cove. In addition the works include construction of a car park with approximately 300 spaces and a space for a future use (as a cultural facility which will be subject to a separate project application) comprising a volume of up to 100,000m³ within the Headland (i.e. below finished ground level). Works include:

- Land formation utilising fill from Stage 1, ranging from the 150,000m³ identified in the Early Works application to approximately 300,000m³ along with excavated material from Stage 3 to build the headland up to finished levels for a nominal one metre topsoil layer.
- Construction of structural earth retaining walls utilising sandstone based materials
- Creation of a naturalistic shoreline and northern cove through excavation / dredging, formation of retaining walls using boulders etc
- Extraction of sandstone for earth retaining walls and naturalistic shoreline
- Placement of up to 80,000m³ of fill from Stage 1 within the sandstone extraction area
- General landscaping and planting
- Construction of a network of pedestrian pathways connecting the foreshore walkway and Merriman Street
- Construction of a shoreline promenade
- Jetty / viewing platform extending into the Northern Cove from the southern shoreline
- Construction of a car park for approximately 300 spaces within the headland with vehicular access from Towns Place and pedestrian access from various locations within Headland Park
- Construction of a space for a future use (as a cultural facility which will be subject to a separate project application) comprising approximately 100,000m³
- Site remediation- limited contamination of fill material was identified on the Headland Park site and no significant groundwater contamination was identified. On-site reuse/placement of impacted fill materials will meet the Site Acceptance Criteria.

The Sydney Harbour Control Tower will remain onsite and be operational in accordance with Sydney Ports Corporation's requirements until future modification or demolition is required..

The proposed works comprise five main “packages” of works as follows:

- Excavation, filling and land formation,
- Public domain and civil works
- Building architecture
- Landscape architecture
- Waterfront & Maritime Design and Engineering

3 Sea Level Rise

3.1 Assessment of Risk

Sea level rise has the potential to have a significant medium to long term impact on developments built today in particular for coastal developments such as Barangaroo is. Over the period of 1870 – 2001 global sea level has risen 20cm and is rising at an ever increasing rate¹.

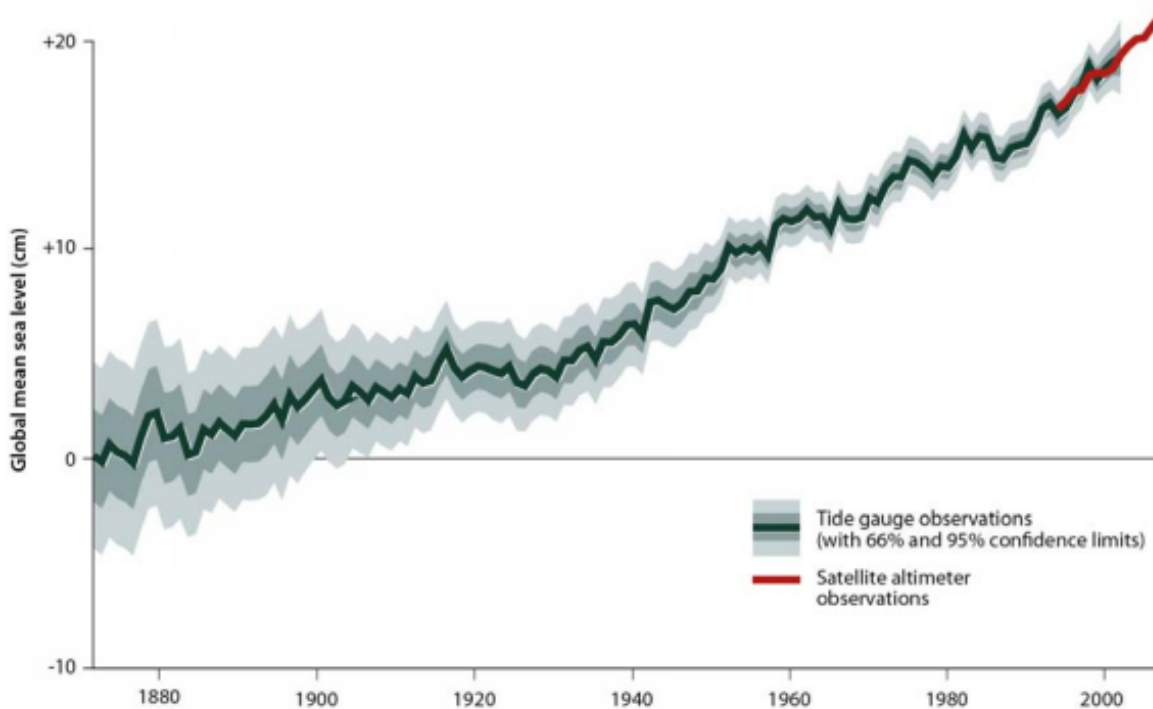


Figure 1: Annual averages of global mean sea level (cm)²

Current projections indicate the sea level rise along the NSW coast relative to 1990 mean sea levels are as follows¹:

- 40cm by 2050
- 90cm by 2100

It should also be noted that the higher rates of sea level rise are possible. As noted by the NSW sea level policy statement sea level rise may result in the following:

- Increased or permanent tidal inundation of land by seawater
- Recession of beach and dune systems and to a lesser extent cliffs and bluffs
- Changes in the way the tides behave in estuaries

¹ Refer to the Department of Environment, Climate Change and Water 2009 Technical note: Derivation of the NSW Government's sea level rise planning benchmarks for further details

² UNEP/GRID-Arendal 2007a

- Saltwater extending further upstream in estuaries
- Higher saline water tables in coastal areas and
- Increased coastal flood levels due to reduced ability to effectively drain low-lying coastal areas.

Particularly for Headland Park the following may result from increased sea level rise:

- Reduced area for vegetation and parkland through tidal inundation. As sea levels rise sea walls, and features may become engulfed by the water, making them redundant. If the sea level were to rise above sea walls this would result in flooding of the parkland reducing the amount of usable area.
- Increased harbour pollution. Sea levels may rise above where there are currently water sensitive urban design initiatives such as bio-swales or gross pollutant traps. If these initiatives fall below the water line, they will become ineffective in managing stormwater entering the harbour.

3.2 Risk Mitigation

For the Headland Park development at Barangaroo a 90cm sea rise should be allowed for within the base design, inclusive of the ground level and the height of the sea wall. The design should also accommodate for daily tides, and storm surges above the reference level (RL) measured by Australian Height Datum (AHD). As per AS4997-2005 the design of maritime structures needs to account for a storm surge of a 1:100 year storm. The height of this storm surge is 1.435m RL. Daily tides do not exceed this level; as such it is recommended the additional sea level rise of 0.9m be accommodated above this 1:100 year storm surge level. The Headland Park site should be built at a RL greater than 2.335m (AHD). A review of the architectural schematics indicates that the lowest RL is 2.65m (AHD). This would accommodate both daily tides and sea level rise and a 1:100 year storm surge.

4 Energy and Carbon

An overall target of carbon neutrality has been set for the Barangaroo Precinct. As part of this target the Headland Park Public Domain is set to be powered by 100% Renewable Energy.

4.1 Public Domain

The following strategies will be employed to achieve 100% On-Site Renewable Energy power for the Public Domain at Headland Park.

- Energy consumption will be avoided and minimised where possible

Energy minimisation will be employed as the primary strategy in reducing energy consumption and hence carbon emission associated with energy on the site. Energy will be minimised through the following initiatives;

- o Efficient lighting design
 - o Efficient lighting control systems
 - o Efficient design and selection of irrigation systems for reduced pumping energy
 - o Implementation of sub-metering to ensure energy consumption can be monitored and improved.
- On Site Renewable Energy Generation

While energy will be minimised where possible, renewable energy generation technologies will be required to meet the carbon and energy targets of the site. Photovoltaics will be integrated into the design of the Headland Park to offset the energy consumption of the Public Domain. On Site renewable energy generation of up to 56kWp will meet Headland Park Public Domain demand. Photovoltaics will be located in Headland Park and adjacent to the Northern Cove.

4.2 The future Cultural Space and Car park.

While the future Cultural Space and Car Park do not have to meet the requirement of being powered by 100% renewable energy it does still need to meet the requirement to achieve Carbon Neutrality.

Energy minimisation will be employed as the primary strategy in reducing energy consumption and hence carbon emission associated with energy on the site. Energy will be minimised through the following initiatives;

- Efficient lighting design
- Where possible maximise natural daylight penetration to the space
- Efficient lighting control systems including:
 - o Floor by floor activation
 - o Occupancy sensors

- o Dimmable ballasts - to reduce the need for over illumination at the start of the lamps life. Lamps illumination is often over designed to account for a reduction of illumination at the end of the lamps life.
- Low energy air conditioning systems for the future Cultural Space, where possible and appropriate
- Low energy ventilation systems for the car park, where possible and appropriate
- Reduced water consumption on site for reduced energy associated with water pumping
- Implementation of sub-metering to ensure energy consumption can be monitored and improved
- Pollutant monitoring in the Car Park to reduce the need for ventilation
- Use of real-time interactive car park signage directing users to use the upper levels of the car park, thus reducing the need for ventilation and lighting of the lower car park

Following this carbon neutrality will be achieved for the future Cultural Space and Car Park through the implementation of the following initiatives in the following order of preference:

- Installation of on-site renewable energy
- Installation of off-site renewable energy
- Purchasing of carbon off-sets.

5 Transport Emissions

Reducing emissions from transport will be achieved by promoting cycling and walking, the use of public transport and promoting sustainable transport measures in the car park facilities. This includes the following initiatives:

- Integration with local public transport networks through the use of locality maps, timetables, and real-time commuter updates.
- Pedestrian links with local public transport networks
- Infrastructure and support for cyclists and pedestrians including:
 - Cycle ways and interlinked pedestrian footpaths
 - Bicycle parking stations for 30 bikes will be provided with the provision for future expansion up to 150 spaces.
 - Provision for the future installation of bicycle share/hire facilities allowing people to hire bicycles from the park.
 - Consideration will be given to incorporating pedestrian/cycle transport as the priority mode of transportation.
 - Consideration will be given to the connection of pedestrian/cycle paths with those off-site.
- Preferential small car parking and hybrid car parking stations
- Dedicated share/ car club spaces
- 20% of parking spaces will be electric vehicle charging stations
- Levies for vehicles will be incorporated into the cost of car parking to encourage public transport use.
- Carbon offsets integrated within the cost of the parking
- Public events held at the park with paid tickets to include the cost of public transport within the cost of the ticket.

6 Water

The Headland Park will form part of the overall water positive strategy for the Barangaroo Precinct. Water consumption will be reduced through efficiency in design and demand reduction strategies, and offset by stormwater and rainwater harvesting.

The following initiatives are recommended to ensure a significant water consumption reduction:

- Minimising irrigation requirements through the preferential selection of low irrigation plant species
- Efficient irrigation systems such as sub-soil drip irrigation
- Efficient fixtures and fittings to meet the following minimum flow rates:
 - o Taps – 4L/min
 - o Showers – 7.5 L/min
 - o Toilets – 3.3L average flush
 - o Urinals – waterless

6.1 Water Harvesting

Harvesting and storing rainwater has a dual environmental benefit; firstly it reduces potable water demand, but also reduces stormwater run-off into the harbour. In addition reducing potable water demand will also reduce the energy requirement of pumping the water and processing and treating it to potable standards as localised system don't have to pump water as far, and often have newer pipes which cause less water loss during piping of water.

A total tank capacity of 1250kL will be installed to capture stormwater from the Headland Park site. The Integrated Water Management Plan provided by Warren Smith and Partners demonstrated that a 1250kL tank is sufficient to provide for two weeks irrigation requirements without rain. This is expected to provide 75% of the annual operational water requirements of the site. Recycled water will be provided from Stage 1 to top-up the remaining non-potable water requirements for the site.

7 Waste Minimisation

An overall strategy to achieve zero waste for the site will be achieved through the following measures:

- A greater than 90% diversion of construction waste (by mass) from landfill - This will be achieved through the implementation of a waste management plan and quarterly reporting during construction.
- Operational waste from the site will be collected and processed within the greater Barangaroo precinct.
- Top soil and fill will be utilised from the greater Barangaroo site in the Early Works for the Headland Park development.
- Green waste from the greater Barangaroo precinct to be utilised as mulch and fertiliser throughout the operation of the precinct.
- An on-site composting facility is to be included at Headland Park. This can be re-used in landscaping in the parklands.
- Recycling points to be located throughout the Public Domain site
- Minimum 20m² waste recycling storage space is to be provided for the future Cultural Space

8 Ecology and Landscaping

Given the large proportion of landscaping on the site, this is an important component of the sustainability of the site. In this section other local environmental is also considered including reducing the pollution entering into Sydney Harbour. The following initiatives are recommended for the site:

- 100% Native and 90% endemic plant species will be used for landscaping (excluding lawn areas)
- Water Quality - Water leaving the site will be treated to meet national best practice standards – reducing TSS (Total Suspended Solids) by 80%, nutrients by 45% and litter reduction by 95%. This will be achieved through the inclusion of the following water sensitive urban design initiatives
 - o Gross Pollutant Traps
 - o Swales/Bio-swales
 - o Stormwater collection and re-use

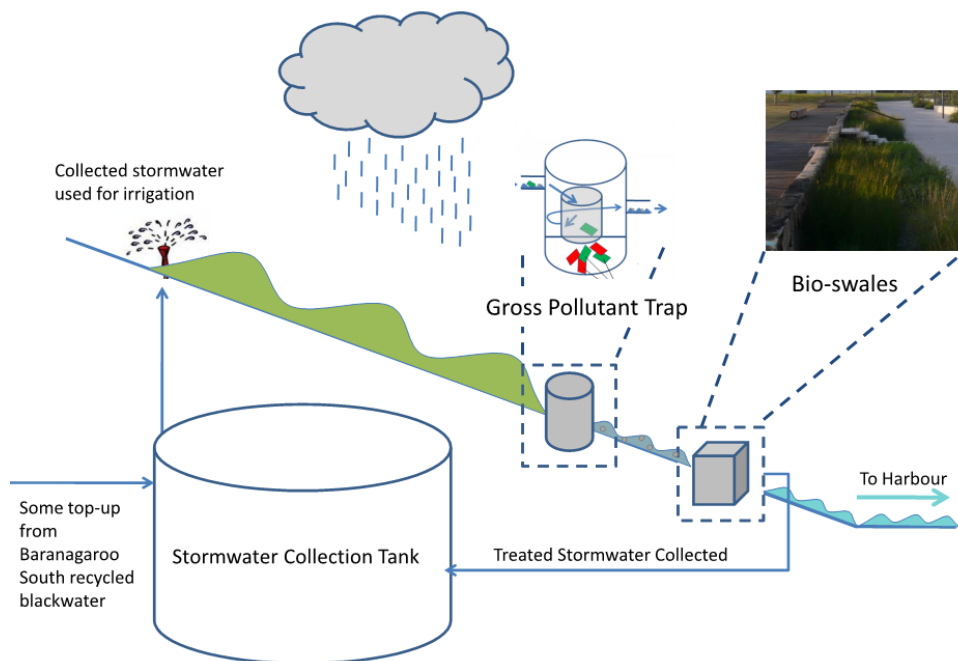


Figure 2: Stormwater Collection Strategy

- Minimise light pollution during the operation of the site.

9 One Planet Living

Headland Park is targeting a One Planet Living Community status. In order to become an endorsed One Planet Living Community the Headland Park must follow the framework of the ten One Planet principles to ensure all aspects of sustainability have been met. The ten One Planet Principles are as follows:

- Zero Carbon
- Zero Waste
- Sustainable Transport
- Sustainable Materials
- Local and Sustainable Food
- Sustainable Water
- Land Use and Wildlife
- Culture and Heritage
- Equity and Local Economy
- Health and Happiness

In addition to the previously mentioned initiatives for Headland Park, additional initiatives are outlined in the One Planet Living Map (see Appendix A).

10 Construction Practices

Construction processes can have an impact on not only the local environment such as through localised pollution, but also have a greater global impact such as through carbon emissions and products used. In 2004 it was estimated that the construction and manufacturing industries together contributed to 7.5% of the national CO₂-e emissions in Australia⁴.

10.1 Construction Equipment

Construction equipment can be a significant source of emissions. Using low emissions fuels and pollution control will help reduce the emissions localised emissions as well as global emissions.

Fuels

Almost all construction equipment runs off diesel engines. We recommend that sustainable fuels be used in construction equipment. This includes:

- 100% biodiesel fuels. Biodiesel can be produced from new or used vegetable oils, and animal fats. It can be harvested from renewable sources such as palm oil or corn starch. Using a fuel that is 100% biodiesel will likely require some engine modification to ensure that the engine avoids maintenance and performance issues.

Should 100% biodiesel fuels not be available we recommend:

- Biodiesel/Diesel Fuel Mix. Biodiesel fuel can be mixed with petroleum based biodiesel. A fuel with a biodiesel component of 20% (B20) or less can be used in diesel vehicles without the need for engine modification.

Pollution Control

Installing pollution control equipment on construction vehicles will reduce the amount of particulate matter which will be exhausted. Pollution control equipment includes:

- Diesel oxidation catalysts

Diesel oxidation catalysts can reduce particulate matter between 20 – 50%, hydrocarbons by 50% and carbon monoxide by 40%.⁵

- Diesel particulate matter filters

Diesel particulate matter filters are ceramic devices that collect particulate matter in the exhaust stream. The high temperature of the exhaust stream heats the ceramic structure to allow the particles to break down into less harmful components. In order for this filter to operate effectively the fuel must have a sulphur content less than 15 parts per million.⁵

⁴ http://www.emissionstatement.com.au/Climate_Change_Australia.html

⁵ http://www.epa.gov/ne/eco/gb3/pdfs/GB3_ConstructionEmissions.pdf

10.2 Construction Management

Waste Management

During the construction and demolition process there will inevitably be large quantities of waste produced. It is important to develop a waste management plan. A waste management plan should be developed and implemented for the main works construction. The waste management plan should describe how all the generated waste will be monitored, which types of waste will be collected for recycling and re-use on site, how the recycling will occur, and who is responsible for the various aspects of the plan.

Environmental Management

A formal environmental management system will ensure that local environmental impacts have been addressed. These may include site disturbance, pollution, construction waste, water and energy use. Due to the nature of the site being next to Sydney Harbour particular attention should be made to ensuring harbour pollution is managed throughout the construction process. Gross pollutant traps should be included on the site to ensure any large pieces of rubbish are not washed out into the harbour. Swales and bio-retention swales should also be included these will improve filtration and reduce run-off from the site. Swales also assist in natural filtration and treatment of stormwater before it enters the harbour.

10.3 Construction Resource Minimisation

Resource Minimisation

Where materials are used on site, care should be taken to minimise their use. Where possible materials should be obtained from sustainable sources, preferably this should include recycled materials. Where timber is concerned, FSC certified timber should be used. Fill and top soil should be retained from the Barranagaroo site where possible. Excess fill and top soil from the Southern and Central Barangaroo precincts should be utilised in the early works of Headland Park.

Construction Energy Use

Electricity is a requirement of the construction process. While it is unfeasible to install renewable energy systems on site for the required electricity, it is feasible for the construction to sign up to 100% green power. Utilising 100% Green Power will reduce the emissions associated with the construction of the early works at Headland Park.

Construction Water Use

Given that a water tank is planned to be installed on site as part of the early works. Construction should be staged such that rain/stormwater can be utilised in the main works construction process.

Materials Transport

Sourcing materials which are processed and manufactured locally reduced the total transport emissions associated with them. However, locally sources materials are not always more sustainable. Preference should be given to the selection of local products where there is no difference in the sustainable source of the materials i.e. recycled, re-used materials or FSC certified timber.

10.4 Construction Worker Environment Quality

Construction workers are often required to work in conditions below what is considered acceptable in the commercial industry today. Often they will work in offices which have no outside air component in the air conditioning system and no natural daylighting. It is recommended that the quality of the workplace for the construction workers be addressed in the following ways:

- HVAC Protection – Cover ductwork, and cover open grilles.
- Source Control – Use low-VOC materials, limit indoor machine exhaust, use low VOC cleaning products
- Pathway Interruption – Provide areas for construction workers away from construction such as indoor areas where exposure to dust and exhaust can be limited
- Housekeeping – Regular sweeping and wet mopping of indoor spaces i.e. indoor office spaces
- Daylighting - Provide natural daylight to indoor office areas
- Provide 100% improvement on AS1668.2-1991 for outside air rates for office spaces.

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- 100% on-site renewable energy generation for the public domain

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Transport Emissions

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Ecology and Landscaping

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One Planet Living

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- The site is to commit to 100% Green Power
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 - o Swales
- Pollution control measures on construction equipment including:
 - o Diesel oxidation catalysts
 - o Diesel particulate matter filters

Materials

- Re-used materials to be used where possible
- Re-used of FCS certified timber to be used where required

Community Wellbeing

- Improve construction worker conditions.
 - o HVAC Protection – Cover ductwork, and cover open grilles.
 - o Source Control – Use low-VOC materials, limit indoor machine exhaust, use low VOC cleaning products

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- o

APPENDIX A – ONE PLANET LIVING MAP



- 1 Zero carbon
- 2 Zero waste
- 3 Sustainable transport
- 4 Sustainable materials
- 5 Local and sustainable food
- 6 Sustainable water
- 7 Land and wildlife
- 8 Culture and heritage
- 9 Equity and local economy
- 10 Health and happiness

Headland Park will incorporate Photovoltaics. Yellow zones indicate the areas for the installation. All public domain energy at Barangaroo will be powered by on-site renewables

Recycling waste storage areas will be provided throughout the site

Green waste from the Park will be composted on-site in a vertical composting facility or similar off-site unit.

Bicycle parking for 30 bikes will be provided with the provision for future expansion up to 150 spaces

Should retailers come on-site healthy and sustainable food choices will be included in lease conditions

Low-impact and recycled materials will be used on site, including for street furniture

Storm-water will be captured and treated on-site. Water leaving the site will be treated to National Best Practice Standards

75% of public domain water demand will be met through stormwater captured on-site. The remaining non-potable demand will be served by recycled water from Stage 2

100% of species planted will be native with 90% endemic, attracting native wildlife

Inter-tidal Biodiversity Diversity achieved from multi layered sea walls rather than vertical walls

Artworks will be integrated into Headland Park to make the parklands an artwork

An arts and cultural facility will be integrated into the future Cultural Space

Training and apprenticeship programs will be included within construction contracts

Free WiFi

An integrated educational facility will be provided to bring together the other educative aspects of BHP

Diversity of land/water edge experience provided

Activation of northern cove for public use

