

Arts NSW
Walsh Bay Arts Precinct
Sustainability Framework

Final | 24 June 2014

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 233285-00

Arup
Arup Pty Ltd ABN 18 000 966 165



Arup
Level 10 201 Kent Street
PO Box 76 Millers Point
Sydney 2000
Australia
www.arup.com

Table of Contents

1	Introduction	3	7	User Comfort and Welbeing	13
	1.1	Introduction		7.1	Introduction
	1.2	Recommendations		7.2	Space Conditioning Strategy
2	Site and Project Description	5		7.3	Initiatives
	2.1	Background		7.4	Concepts Review Summary
	2.2	Site and Surrounds	8	Transport	16
	2.3	Site Ownership		8.1	Introduction
	2.4	The Project		8.2	Initiatives
3	Director General Requirements	7		8.3	Concept Design Summary
	3.1	Relevant Policies and guidelines	9	Operation	17
	3.2	Summary		9.1	Introduction
4	Energy	8		9.2	Initiatives
	4.1	Introduction		9.3	Concept Design Summary
	4.2	Conditioning of Spaces	10	Community Engagement	18
	4.3	Section J Comsiderations		8.1	Introduction
	4.4	Commercial Events/Arts Space		8.2	Initiatives
	4.5	Performance Spaces		8.3	Concept Design Summary
	4.6	Initiatives			
	4.8	Concept Design Summary			
5	Water	10			
	5.1	Introduction			
	5.2	Initiatives			
	5.3	Concept Design Summary			
6	Materials	11			
	6.1	Introduction			
	6.2	Embodied Energy & the Project			
	6.3	Fitout			
	6.4	Initiatives			
	6.5	Concept Design Summary			

1.0 INTRODUCTION

1.1 Introduction

The Walsh Bay Arts Precinct (WBAP) Sustainability Framework has been developed as part of the Walsh Bay Arts Precinct Concept Design and is based upon the key drivers identified by a number of invested parties during workshops and meetings, and in collaboration with arts representatives, architects and Arup.

WBAP has a vision of growing and developing to become THE Arts destination hotspot on the Sydney Harbour foreshore. The masterplan includes the upgrading of theatre spaces and the overall precinct to bring the 95 year old wharf up to a state-of-the-art arts facility.

This framework addresses the 3 key project objectives with regards to delivering a sustainable site:

- ▶ Activate the precinct with a unique cultural offering and visitor experience
- ▶ Rejuvenate a vital piece of Sydney's waterfront cultural heritage, providing inter-generational benefits for the people of NSW
- ▶ Provide facilities that better enable arts organisations to develop world class productions + experiences + deliver on their strategic visions

It is imperative the site achieves high standards of environmental sustainability. The Sustainability Framework responds to this desire and addresses seven key principles. These form the basis of the report:

- ▶ **Section 4 —Energy and Carbon**
- ▶ **Section 5—Collecting, minimising and re-using water**
- ▶ **Section 6—Sustainable materials**
- ▶ **Section 7—User comfort and well being**
- ▶ **Section 8—Sustainable transport**
- ▶ **Section 9—Sustainable in operation**
- ▶ **Section 10—Social and community Engagement**

Current State

The Walsh Bay Art Precinct is currently a low-impact site with low energy demands due to a number of key elements in practice. The site currently uses:

- ▶ Photovoltaic cells to offset electric energy
- ▶ Primarily naturally ventilated spaces, with operable windows for occupant control
- ▶ Air Conditioning for prime spaces only, where thermal comfort is demanded for business operation
- ▶ Heating only in certain spaces for occupant comfort
- ▶ The original materials of the finger wharfs, which maintain the heritage and history of the site. This also reduces the embodied energy of construction
- ▶ Recycled and re-used props for flooring, further reducing waste

Drivers

For a long time the arts have been among the leading forces in developing high-performance buildings and adopting sustainable principles. This interest has been motivated by a combination of factors, including practical and financial concerns with the long-time operation and ownership of facilities, the demand for advanced facilities and infrastructural capacities, growing environmental awareness from all users, the desire for a smarter and more comfortable space and the aspiration to develop a public profile in line with the increasing concern over climate change and resource limitations.

The Walsh Bay Arts Precinct is perfectly located in an area rich in natural resources and opportunities. As such, the members have accepted responsibility for increasing the performance of the buildings on its precinct based upon high standards of environmental sustainability.

With those principles in mind, this Sustainability Framework looks at the Art Precinct in two ways: as a precinct and as

specific spaces within individual buildings.

The framework has been developed to present the key design aspects to be implemented.

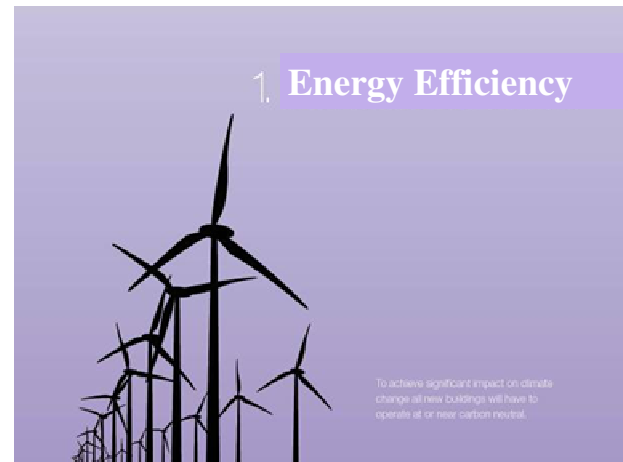
The following sections of this Sustainability Framework document in detail the discussions held and the reasoning for the recommendations provided in this summary.

The framework also details the specific plans and practicality of the key drivers outlined in this executive summary. It classes the points into one of the three categories (base, aspirational, best practice) for future consideration.

Conclusions & Recommendations

The Sustainability Framework recommends a number of initiatives be included as a minimum in the Walsh Bay Arts Precinct. These are listed under each category over the page.

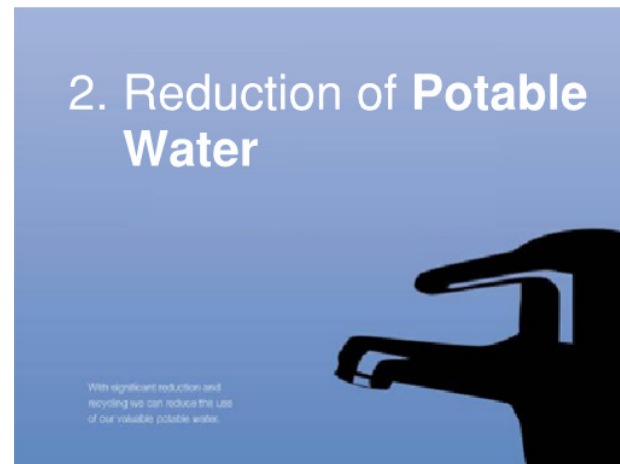
1.2 Recommendations



- ▶ Maximise Natural Ventilation, and adoption of the adaptive comfort model
- ▶ Specify high efficiency systems, including innovative, site specific technologies.
- ▶ Harbour Heat rejection/ heat absorption
- ▶ Onsite Photovoltaic array



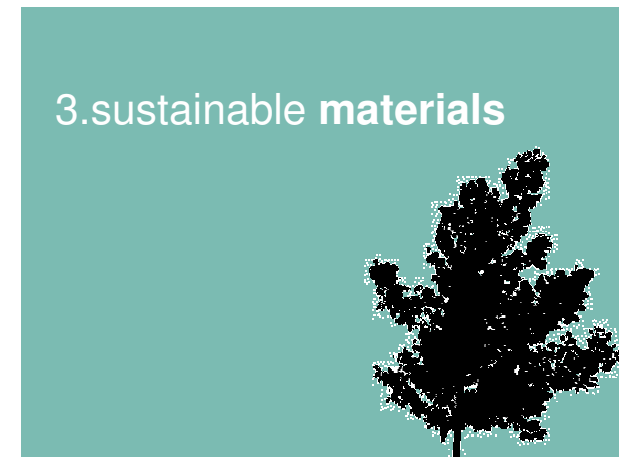
- ▶ On-site bicycle parking facilities for tenants and Visitors
- ▶ Sydney public transport network embedded in site location
- ▶ Connect to Sydney City's current cycleways
- ▶ Link to harbour foreshore walk



- ▶ Reduce potable water demand
- ▶ Efficient, low water use systems
- ▶ Optional future upgrade to collect and store rainwater for reuse
- ▶ Remove parking from Wharves to allow clean run-off of rainwater



- ▶ Maintain an operation plan beyond occupancy for ongoing works
- ▶ Minimize and recycle waste
- ▶ Provide long life LED lighting
- ▶ Increase efficiency and comfort through on-going commissioning and awareness



- ▶ Maintain / fix existing heritage façade and structure.
- ▶ Use opportunity to specific internal materials with low environmental impact.
- ▶ Local and Responsible Sourcing



- ▶ Create diversification of uses and interaction with the local community
- ▶ Open the commercial spaces up to the public domain
- ▶ Lighting of public spaces to provide secure, welcoming areas after hours



- ▶ User-specific design for each space
- ▶ Design to maintain/enhance air and water quality
- ▶ Reduce legionella risk by providing non-water based heat rejection
- ▶ Upgrade existing services and space quality
- ▶ Adopt adaptive comfort and transient space gradings
- ▶ Provide high levels of fresh air
- ▶ Connect buildings and spaces to harbour views
- ▶ Ability for occupants to control windows
- ▶ High visual light levels to increase daylight levels

2.0 SITE AND PROJECT DESCRIPTION

2.1 Background

Arts NSW is proposing to develop a new arts precinct at Walsh Bay which will expand and strengthen the existing cluster of cultural institutions and attractions along Sydney's "Arts and Cultural Ribbon". The arts precinct includes Wharf 4/5, Pier 2/3 and Sydney Theatre. The concept provides for an integrated performing arts and cultural precinct within an enhanced public domain at Walsh Bay. It is envisaged that the arts and cultural program within the Walsh Bay Arts Precinct (WBAP) will complement the other cultural initiatives in surrounding areas, including those proposed at nearby Barangaroo (currently under development).

In 2011/12 Arts NSW engaged the NSW Government Architect to prepare a master plan for the precinct. The master plan proposed:

- the transformation of Pier 2/3 to accommodate the Australian Chamber Orchestra, Bell Shakespeare and Australian Theatre for Young People
- the retention of a large "raw" space in Pier 2/3 for events, festivals and functions
- a major upgrade of ground floor facilities at Wharf 4/5, allowing Bangarra to confirm its place as the premier Indigenous performing arts company and maximise new tourist and engagement opportunities
- the expansion of creative and commercial activities along the shore sheds offering cafes, restaurants, retail and commercial activities to further enhance the visitor experience
- a new north facing waterfront square supported with new boardwalks which will significantly increase public open space and create a central platform for activity, collaborative outdoor performances, events, festivals and public art.

2.2 The Site and Surrounds

The WBAP site is part of the Walsh Bay area which is located adjacent to Sydney Harbour within the suburb of Dawes Point. Walsh Bay is strategically located to the north of Sydney's CBD in the vicinity of major tourist destinations including the Sydney Harbour Bridge, the historic areas of Millers Point and The Rocks, Circular Quay and the Sydney Opera House. The Barangaroo redevelopment precinct is located immediately to the south-west.

Walsh Bay comprises ten berths constructed between 1908 and 1922 for international and inter-state shipping. These are collectively known as the Walsh Bay Wharves. The Walsh Bay Wharves Precinct is listed as an item on the State Heritage Register. Much of Walsh Bay (excluding Wharf 4/5 and Pier 2/3) was redeveloped between 1997 and 2004 by the NSW Government in partnership with the Walsh Bay Partnership (Mirvac and Transfield). The Walsh Bay Wharves comprise the following:

- Pier One which contains the Sebel Pier One Sydney Hotel
- Pier 2/3 is the last remaining undeveloped pier. It has approval for cultural uses, temporary arts events and some commercial events.
- Wharf 4/5 which is occupied by the Sydney Theatre Company, Australian Theatre for Young People, Bangarra Dance Theatre and other arts organisations.
- Pier 6/7 which has been redeveloped for residential apartments and associated boat marina
- Pier 8/9 which has been redeveloped for office uses
- Shore Sheds which contain a range of commercial activities, including restaurants, bars, shops and offices.

The Sydney Theatre is within the WBAP however it is not part of the proposed redevelopment. Given the significant difference in grade between Walsh Bay and Millers Point, there are a number of bridges over Hickson Road which

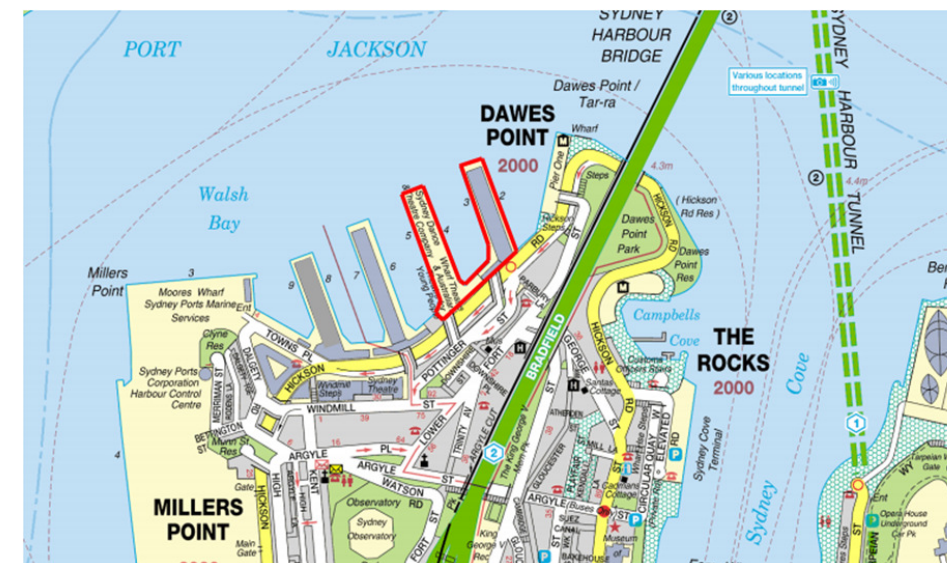


Figure 1: Site Location (Source: UBD Digital Edition 2004)

provide pedestrian access between the site and Millers Point. The bridge linking Pottinger Street and Wharf 4/5 is also used for vehicular parking. To the south-west of the wharves is Hickson Road, which provides the major vehicular access to the site. Hickson Road links the site to Barangaroo to the south-west and Circular Quay and The Rocks to the north-east. Other roads providing access to the site include Pottinger Street which provides access to Millers Point, and Towns Place which also provides access to Millers Point via Dalgety Road and Argyle Street.

The Barangaroo redevelopment project to the south of Walsh Bay comprises three redevelopment areas – the Headland Park, Central Barangaroo and Barangaroo South. The Headland Park is to be located adjacent to the Walsh Bay Precinct and is currently under construction. The park is being built up to reflect a similar landform to other headlands around Sydney Harbour. It is proposed that a 300 space car park and an as yet undefined cultural facility will be located inside the headland. Master planning for Central Barangaroo is currently underway with the intention that it will be the cultural and civic focal point for recreation, events and entertainment. Barangaroo South is being developed as a major commercial and mixed use centre.

2.0 SITE AND PROJECT DESCRIPTION

2.2.1 Pier 2/3

Pier 2/3 is a finger wharf comprising two storeys (and associated shore sheds) and was constructed between 1912 and 1921. It is Sydney's last wharf structure in its original state. Much of it is an empty shell however it does contain some commercial uses. There is a 99 year lease between the Maritime Authority of NSW (now Roads and Maritime Services) and Communities NSW (which now rests with Arts NSW, Department of Trade and Investment) for the finger wharf, the portion of open air wharf apron, the pedestrian link bridge and the wharf substructure. The granting of this lease, amongst other things, allows Pier 2/3 to be used for arts, cultural and creative purposes. The City of Sydney has granted consent for Pier 2/3 to be used as a cultural facility for a range of uses such as rehearsals, exhibitions, workshops, filming and events, including the Sydney Writers' Festival and the Biennale of Sydney. The consent was granted on 21 September 2011 and is for a period of 3 years.

2.2.2 Wharf 4/5

Wharf 4/5 is a four storey timber building which was built around 1917 and used as a steamship berthing and cargo storage facility until the mid 1970s. The Wharf has been progressively upgraded and adaptively reused since the early 1980s. Ten arts and cultural organisations use the facility which comprises a range of performance venues, rehearsal and workshop spaces, a recording studio, café/restaurants and office accommodation.

Wharf 4/5 is recognised as a highly successful adaptive reuse of an important heritage item. Its redevelopment 30 years ago was the subject of numerous architectural and design awards. However, many of its spaces are not fit for purpose and use of the space is not optimised.

2.3 Site Ownership

The land is legally described as follows:

Pier 2/3 - Lot 11 DP 1138931

Pier 2/3 Shore Sheds – Lot 24 DP 1071597

Wharf 4/5 - Lot 65 in DP 1048377

The area of water that the project proposes to build over, with walkways and the bridge, is also owned by RMS. Its land title description is Lot 12 in DP 1138931. The land owner of the WBAP site is the Roads and Maritime Services (RMS). Both Pier 2/3 and Wharf 4/5 are occupied under various lease arrangements with Arts NSW, Department of Trade and Investment, primarily for arts and cultural uses.

2.4 The Project

The Concept Design more than doubles the arts and cultural offerings at Walsh Bay, with new and upgraded production, rehearsal, studio and performance venues. It remains a working arts precinct, with complimentary commercial opportunities

Following the Master Plan, the Concept Design has responded to stakeholder feedback and greater design investigation, resulting in a more resolved concept, with the following key differences from the Master Plan:

- Floating pontoons and connecting bridge have been removed;
- Heritage impacts have been interrogated and minimised;
- Internal planning has been further articulated to meet arts tenants requirements; and
- A stage area canopy has been introduced into the waterfront square.

The main features of the development of Pier 2/3 include:

- New homes for Bell Shakespeare, Australian Chamber Orchestra and the Australian Theatre for Young People, including office accommodation, rehearsal space and performance spaces; and
- Retention of raw heritage space for a range of events and functions, with some improved ancillary facilities.

The proposed refurbishment of Wharf 4/5 ground floor includes:

- Upgraded facilities for Bangarra Dance Theatre and Sydney Dance Company (Sydney Theatre Company facilities are not included in this proposed development)

- Several arts organisations - Accessible Arts, Regional Arts, and the choirs are to relocate from this building

The proposed modifications to Wharf 4/5 Shore Sheds include the provision of upgraded choirs office accommodation and rehearsal space, and new commercial spaces.

The Waterfront Square has been further developed from the public domain proposed in the Master Plan to include a central square for events, festivals, markets and public art. As noted above, the pontoons and bridges have been removed and a shade structure/canopy has been introduced over the notional stage area of the Waterfront Square.

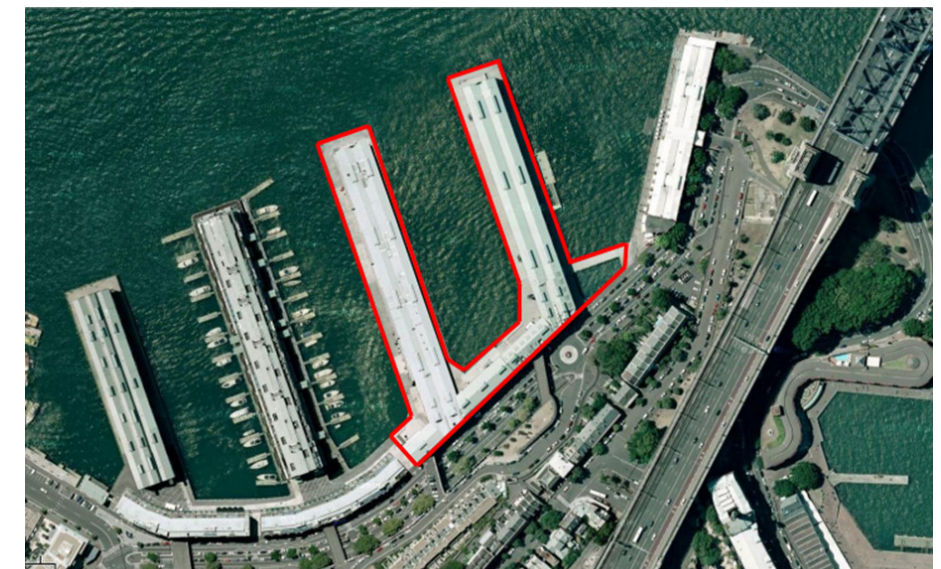


Figure 2: WBAP site (Source: Google Maps)

3.0 DIRECTOR GENERAL REQUIREMENTS

The Director General Requirements (DGRs) and tools used for guidance for this project are outlined in this section:

3.1 Relevant Policies and Guidelines

The following planning provisions and codes apply to the Walsh Bay Arts Precinct with regards to the Ecologically Sustainable Design (ESD):

- National Construction Code/ Building Code of Australia 2013
- Environmental Planning and Assessment Regulation, 2000

Two tools have been used as reference in designing ESD initiatives and performance standards. While the project is not held to these, each have been influential in the Masterplan,

- City of Sydney LEP 2012
- Green Building Council of Australia Green Star Credit targets.

3.1.1 NCC/BCA 2013

The NCC/BCA requirements pertaining to ESD are in Section J—Energy Efficiency of Volume 1. This sets minimum energy benchmarks which must be exceeded for the mechanical conditioning of spaces.

The key strategy for compliance is around reducing the number of spaces defined as ‘conditioned’. By providing primarily naturally ventilated spaces, this reduces the energy consumption of the building. The added benefits allow the retaining of the heritage façade, reduces construction waste and material consumption.

All conditioned spaces as defined in the BCA are required to meet the minimum performance requirements for services and fabric as stated in Section J. To achieve this, replaced windows will be upgraded, the spaces sealed and insulation meeting the Deemed-to-satisfy requirements installed.

Mechanical equipment has been selected to comply or exceed the Minimum Energy Performance Standards (MEPS)

and the criteria outlined in Section J.

3.1.2 Environmental Planning and Assessment Regulation (EPA)

The Director General requirements states that “ESD principals as defined in Section 7(4) Schedule 2 of the Environmental Planning and Assessment Regulation 2000) will be incorporated in the design, construction and ongoing operation of the development”.

This document states:

- (4) The principles of ecologically sustainable development are as follows:
- a. The precautionary principle, namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by:
 - (i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and
 - (ii) an assessment of the risk-weighted consequences of various options,
 - b. Inter-generational equity, namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations,
 - c. conservation of biological diversity and ecological integrity, namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration,
 - d. Improved valuation, pricing and incentive mechanisms, namely, that environmental factors should be included in the valuation of assets and services, such as:
 - (i) polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,
 - (ii) the users of goods and services should pay prices based on the full life cycle of costs of providing goods

and services, including the use of natural resources and assets and the ultimate disposal of any waste, environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.

The intent of these concepts serves as the foundation of this report, with the intent to minimise damage done to our environment.

3.2 Summary

The Walsh Bay Arts Precinct endeavours to go above and beyond the baselines outlined to achieve a carefully thought-out, considerate and intelligent design with the best intent at its heart.

The initiatives targeted are discussed throughout the report, and have been grouped into the 7 subjects listed in the introduction.

4.0 ESD REQUIREMENTS—ENERGY

4.1 Introduction

The design for reducing the energy and carbon impact of the WBAP is commensurate with the concepts below.

- Load Reduction** - through efficient lighting fittings such as LEDs being specified in the site. High quality glazing where windows are to be replaced, providing insulation and sealing to conditioned spaces in line with Section J requirements.
- Passive Systems** - by naturally ventilating corridors and transient spaces where possible. Mixed mode spaces reduce the air conditioned hours and take advantage of the mild climate in Sydney
- Active Systems** - Specified plant equipment is high-efficiency to reduce energy associated with conditioning.
- Energy Transfer** - Harbour heat rejection provides a method for increasing efficiency of heat, reducing the carbon footprint of the building
- Renewables** - Increasing the amount of photovoltaics on the roof to offset the excess electrical demand of the commercial/arts space heating system for Section J compliance. Space allocation on roof for future PV arrays.
- Offsets** - Are not proposed in this project, but would be required to reduce the site energy and carbon emissions to net zero. This can be achieved by buying green power during operation

Where possible and economic, the existing infrastructure will be maintained to reduce capital costs.

4.2 Conditioning of Spaces

The needs of each space differ significantly across the site. A blanket rule for all spaces is not appropriate - the best outcome for one organisation may not be appropriate for others. To provide the best outcome, each space will be designed to meet the specific amenity, comfort and energy needs of the site. When possible, natural ventilation is preferred, and mixed mode provided over full Air conditioned spaces.

A condenser water pipework loop will be provided to serve spaces that may require cooling for future tenant fitouts. This is intended to allow future flexibility and remove the need for tenants to install air cooled condenser units to the heritage façade.

4.3 Section J Considerations:

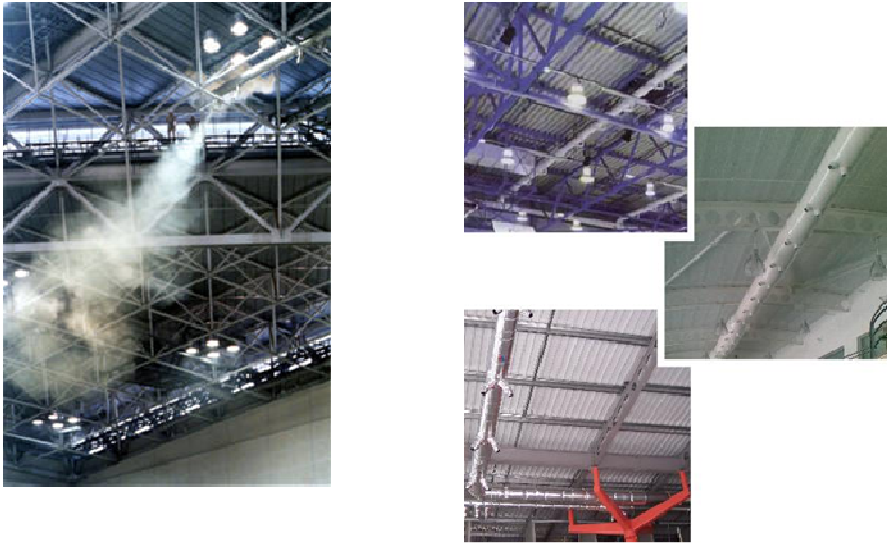
Where spaces are being upgraded to conditioned spaces, the façade must be insulated and sealed to comply with the BCA. This may induce heritage considerations. To limit the cost and heritage effect of this upgrade, many spaces will remain naturally ventilated or exhausted and classed as an unconditioned space. This removes the requirement to upgrade the façade.

All new glazing on site will need to meet the BCA Section J requirements.

Internal conditioned spaces with no adjoining wall to the heritage façade will act as a 'box within a box', allowing a lower level of required insulation to the envelope.

4.4 Commercial Events/Arts Space:

The Commercial Events/Arts Space is to be classed as an unconditioned space. For comfort it shall be served by an overhead ducted air supply system. This will be coupled with a heat pump to provide a high efficiency system.



Overhead ducted air heating will provide occupant amenity for extreme conditions in the *Commercial Events/Art Space*

A photovoltaic array shall be provided on the roof, dedicated to offsetting the electrical energy associated with the operation of this system.

The energy associated with the operation of this system will be offset by the photovoltaic array, which will be sized to provide the energy required to allow heating. This offset allows the commercial events/art space to be considered a non-conditioned space, and thus is not required to meet the Section J requirements for a Class 9b building.

4.5 Performance Spaces:

Performance spaces will be subject to section J compliance, and as such are required to meet certain thermal envelope performance criteria.

No changes are proposed to the Sydney Theatre Company.

4.0 ESD REQUIREMENTS—ENERGY

4.6 Initiatives

4.6.1 Natural Ventilation

Natural ventilation is the preferred servicing option, where a high air velocity of fresh air will temper the air in the space. This will serve as a viable solution for all spaces that do not require significant acoustic treatment.

Servicing strategies are discussed in greater detail in section 7.

4.6.2 High Efficiency Systems

High-efficiency systems shall be installed to reduce energy in the HVAC system design. The simplest way to reduce the loads is through quality equipment. This is driven in the first instance by construction code requirements, which demand a minimum efficiency.

Efficient systems can reduce the overall operating cost significantly, and see a relatively short payback period on the original investment. The equipment for Walsh Bay Arts Precinct shall be selected to exceed the MEPS minimum requirements.

4.6.3 Onsite Renewables

Onsite renewables are a fantastic way to reduce the energy consumption of the site. The location is ideal for taking advantage of natural sources of power such as unblocked sunlight.

Photovoltaics are currently proposed, with an allowance of space for future arrays. The photovoltaic array shall offset the excess electrical energy consumption above code compliance of the Commercial Events/Arts Space.

4.6.4 Harbour Heat Rejection

Harbour heat rejection is an incredibly efficient and spatially minimalist way to allow air conditioning heat rejection. The system rejects heat to (or absorbs heat from) the harbour - almost an energy free system.

The operational costs associated with the process are limited to maintenance and pumping costs, making this a viable long term option. This also removes potable water consumption through evaporative cooling and allows the roof line to remain unencumbered by plant equipment.

4.6.5 Vernacular Architecture

Vernacular architecture uses first principal design to reduce the loads required in the space. Shading, encouraging natural daylight, increased natural air flow and views are all advantages of vernacular architecture. Due to the heritage nature of the site, there are limited opportunities for vernacular architecture.

4.6.6 Domestic solar Power

Domestic solar hot water heating uses the sun's heat to provide heated water to the site. This is much more energy efficient than traditional boilers. The heated water required on site is minimal enough to make this a viable option. Other variants could include water-source heat pumps, which extract heat from the harbour.

4.7 Concept Design Summary

- ▶ Incorporate natural ventilation design strategies into all non-performance/thermally critical spaces in the development where appropriate.
- ▶ Provide mixed-mode ventilation strategies for offices and other appropriate locations as a preference over full air conditioning.
- ▶ Increase window openings to achieve efficient natural ventilation and daylight.
- ▶ Maintain as much of the existing structure, façade and form as possible to reduce the embodied energy consumption of materials
- ▶ Window upgrades shall target minimum performance levels required by BCA Section J
- ▶ Re-use spill air from auditoria to temper surrounding spaces
- ▶ Meter large energy uses individually
- ▶ Target high efficiency mechanical services equipment.
- ▶ Install photovoltaics to offset arts/events space heating. Allow roof space for future PVs.
- ▶ Use LED/fluorescent light fixtures where possible to extend lamp life, reduce energy costs and waste.
- ▶ Install occupancy sensors and high-efficiency lighting in buildings where possible. Provide dimmable lighting where appropriate.

5.0 ESD REQUIREMENTS—WATER

5.1 Introduction

In Australia, water has long been considered a precious and high-demand resource, essential for all living things. Fresh water supplies are increasingly affected by a range of factors including catchment locations, contaminated sources, drought and rising demand. Australia remains the driest inhabited continent in the world with the third largest per capita water consumption rates, and demand for water is fast outstripping supply in many major cities.

In addition to reducing the demand for water, efficient use of water in buildings can save building owners money in operational costs.

The ESD strategy surrounding water is about the responsible reduction of potable water consumption, and where possible increasing the quality of water in the surrounding harbour.

5.2 Initiatives

5.2.1 Rainwater Tanks

Rainwater tanks that collect fresh run-off from the roofs of the buildings will have a significant positive impact on the total consumption of potable water. The systems do require space to store the run-off.

.A 20kL tank has been sized for this purpose under pier 2/3.

5.2.2 Efficient Fixtures

Low flow fittings and high WELS rated fixtures will minimise the potable water demand on the site. This is a simple and cheap way to reduce the impact of potable water consumption, and can be retrofitted to parts of the development that will remain unchanged.

5.2.3 Fill Water Points

Fill water points have a two-fold advantage:

1.) It helps spread awareness about the use and accessibility

of tap water

2.) The embodied energy of bottled water is significant. The costs of producing bottles, transporting and recycling bottled water is often not thought about by the end user.

5.2.4 Harbour Heat Rejection

Harbour heat rejection will save on the use of evaporation in the heat rejection phase. This system will also allow the roof line to be uncompromised by heat rejection systems, unlike the air cooled condenser unit.

5.2.5 Domestic Solar Hot Water

Domestic solar hot water heating uses the sun's heat to provide heated water to the site. This is much more efficient (in terms of energy) than traditional boilers. The heated water required on site is minimal enough to make this a viable option.

This shall be considered for future retrofit, however does not form part of the water or greater ESD strategy for this stage.

5.2.6 Stormwater Water Runoff

Stormwater runoff from the piers may carry with it a number of pollutants that damage marine life and the Sydney Harbour's water quality. To combat this parking on the piers shall be removed, which will increase the quality of water runoff.



Water Meters shall be used to capture data on water use, report leaks and feed into the building management systems



Harbour Heat rejection is an incredibly efficient way of transferring energy, which also consumes no potable water in the heat rejection method.

5.3 Concept Design Summary

- Specify water efficient fixtures to all fittings, including retrofits. This includes:
 - 5 Star WELS WCs
 - 5 Star Urinals
 - 5/6 Star Taps in bathrooms
- Provide Harbour Heat Rejection
- Remove parking from wharves to reduce oil from storm water runoff
- Allowance for rainwater tank & infrastructure to pier 2/3.
- Provide fill water points for water bottle refill
- Consider a solar heating for domestic hot water as a future retrofit

6.0 ESD REQUIREMENTS—MATERIALS

6.1 Introduction

The production and use of building materials can have serious impacts on the environment. Energy is used to extract, produce and transport building materials; natural resources are exploited to be used in building materials; the industrial production process of the materials causes pollution (e.g. fly ash from cement production); and when the material ends up as waste, it becomes difficult to process.

The environmental impact from building materials is reduced by limiting the quantities of virgin building materials used in projects and choosing the least harmful when using virgin building materials.

Given the history of the site, material concerns are high. The heritage façade is to be maintained, as is the form and structure of the building. Where fixes and updates are required, these are to be of the least damaging materials relevant to the function of the precinct.

6.2 Embodied energy & The Precinct

Embodied Energy (EE) is one of several factors contributing to the environmental impact of building projects. In terms of energy consumption over a reasonable life cycle period (e.g. 50 years), the embodied energy usually represents about 20-30 per cent of energy consumption while the operating energy accounts for the remainder.

Embodied energy (EE) is the energy required to provide a product, both directly and indirectly through all processes upstream (i.e. traceable backwards from the finished product to consideration of raw materials). It represents the sum of all energy inputs, which may even include those required in the disposal phase.

The Walsh Bay Precinct shall maintain as much of the existing form and features as possible. As a heritage listed façade, the importance of maintaining the envelope is two-fold/ This passive approach will create a significant saving in energy.

Insulation and refrigerants shall be selected to have no Ozone Depleting Potential.



6.3 Fitout

The focus for the future fitouts should be to reduce the environmental impact of materials through careful selection. Low-impact materials are becoming increasingly common and sought after in the market, allowing a simpler implementation than ever before.

The fitout should target achieving the criteria setout in the Green Star—Public Buildings Pilot Tool and Office Interiors Tool for Indoor Environment Quality and Materials. While no formal rating is being targeted in this project, the criteria outlined provide a framework which will define best practice. The following list describes the ideal targeted outcomes:

- ▶ Implement a hazardous materials survey, and remove any asbestos, lead or polychlorinated Biphenyls found.
- ▶ Procure paints, sealants, fitout items and floor coverings with low levels of Volatile Organic Compounds
- ▶ Procure wooden articles that have either low or no formaldehyde.
- ▶ Flooring and wall coverings selected with no PVC or best practice PVC.
- ▶ Timber is re-used, recycled or FSC-AU certified



LOCAL & RESPONSIBLE SOURCING



BEST PRACTICE MANUFACTURING TECHNIQUES



6.0 ESD REQUIREMENTS—MATERIALS

6.4 Initiatives

6.4.1 No CFC/HCFC or Halons

Not using CFC/HCFC or Halons in the HVAC system's refrigerants and fire retardant systems are common practice. The ozone depletion and global warming potential of these products render their use irresponsible, and in many cases illegal.

This is a base provision that must be met as part of any responsible plan. All refrigerants and insulants shall have a Global Warming Potential of 0.

6.4.2 Asbestos Removal

As with the above, asbestos use is not permitted in the site. Where asbestos has been found in the audit, if found to be unbonded or flaking and safe to do so it should be removed.

This shall only be performed by trained, qualified professionals.

6.4.3 Low-VOC paints, sealants, etc.

The use of materials with a low level of Volatile Organic Compounds (VOC) should be implemented where possible. VOCs are often considered a health risk to humans in high quantities and their use should be minimised.

Maximum acceptable levels should be defined before procurement and imposed on all products used through the construction and installation of fitouts and the new building.

6.4.4 Recycled materials

Where possible, recycled materials are preferred over new materials. The obvious advantages include increasing the life of the product, and therefore reducing the embodied energy associated with their use.

6.4.5 Responsible timber

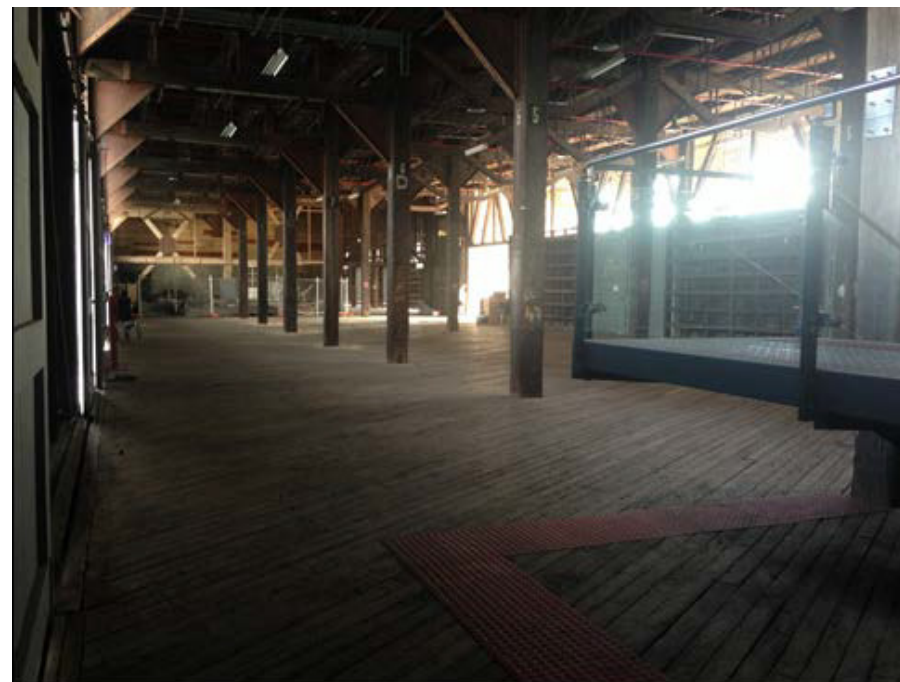
Certified timber, such as FSC, source timber from sources that protect waterways, wildlife, forests and communities. Where possible, timber products shall come from certified sources or recycled timber shall be used.

6.4.5 Locally Sourced

Locally sourced products help both the local economy and reduce the embodied energy associated with transportation. Where possible, locally sourced products shall be preferred.

6.4.6 Building Retention

The existing façade is to be maintained, and where code compliant, this shall be untouched. The existing structure and finish shall be where possible given a 'light touch', reducing the virgin material consumption of the project's refurbishment.



The Commercial Events/Arts Space shall have little or no work done to the building envelope and structure where possible

6.5 Concept Design Summary

- ▶ Maintain the form and materials of the existing building. It is recommended that the current leaky façade is fixed where practicable to extend its life and to reduce discomfort issues
- ▶ An asbestos survey shall be undertaken in line with NOHSC:3002—Guide to the Control of Asbestos Hazards in Buildings and Structures
- ▶ Specify that materials with ozone-depleting substances in their manufacture are not to be used.

Further, the fitouts should target the following Green Star Interiors tool equivalent credits as best practice:

- ▶ Carpets, fitout items, paints, adhesives and sealants should be low VOC in line with IEQ-11
- ▶ Formaldehyde shall be minimised in line with IEQ-12
- ▶ All timber to be from recycled source or FSC or PEFC certified with full Chain of Custody. No wood products to contain formaldehyde.
- ▶ Flooring (Mat-2)
- ▶ Walls and partitions (Mat-3)
- ▶ Chairs (Mat-4)
- ▶ Table (Mat-5)
- ▶ Joinery (Mat-7)
- ▶ Ceilings (Mat-8)
- ▶ PVC (Mat-10)

7.0 ESD REQUIREMENTS—USER COMFORT & WELLBEING

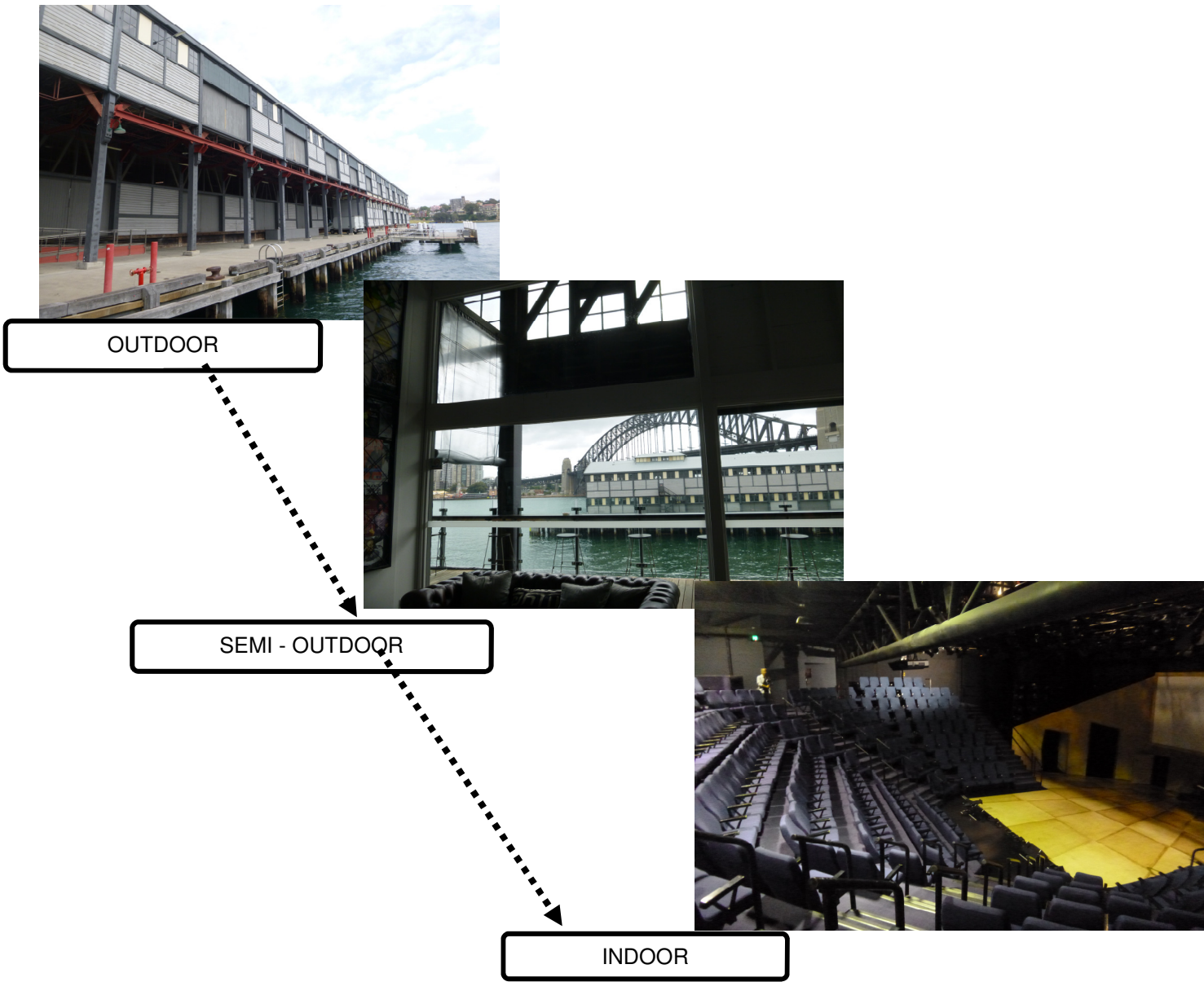
7.1 Introduction

Daylight provides occupants with a healthier environment that will have direct impact on productivity and wellbeing. A major benefit of providing good daylight quality is a reduction on energy consumption due to a reduction on the operation of artificial lighting systems. Providing a visual connection with the external environment also improves workspace quality for increased productivity levels.

To maximise daylight levels, where glazing is required to be replaced, a minimum VLT of 70% is recommended. The lantern design should be optimised to achieve high daylight levels in the spaces directly below. A daylight factor or 2.5% is the recommended target.

Recognising that each space type has its own environmental conditions will enable the right ventilation strategy to be implemented to maintain thermal comfort and air quality whilst reducing energy consumption. The Sustainability Framework proposes different spaces within the WBAP adopt an adaptive comfort strategy so that as occupants move from an outdoor space and gradually transition into a indoor and more controlled environment the criteria will change resulting in further reduction of energy use and increase in the use of passive approaches to achieve comfort conditions.

The specific strategies for maximising user comfort and wellbeing are addressed together with the building services report. Each space's method of deriving comfort is a factor of the servicing strategy.



7.0 ESD REQUIREMENTS—USER COMFORT & WELLBEING

7.2 Space Conditioning Strategy

The following servicing strategies are provided throughout the Walsh Bay Arts Precinct:

7.2.1 Natural Ventilation

The space is not directly controlled and considered an unconditioned space. Windows are sized to provide ventilation.

7.2.2 Mechanically-Assisted Natural Ventilation

As above, this is a non-conditioned space that uses natural air movement to condition the space. A fan is provided so that under certain conditions, air is driven into the space, to force air movement when required.

7.2.3 Ventilation

An exhaust or supply fan is provided to circulate air. This is unconditioned, e.g. internal bathrooms, kitchens, etc.

7.2.4 Full A/C

Offices are served by a fan coil unit in the ceiling void, and chilled/heated water recirculated to a plant. Outdoor air is provided by a supply air fan. Auditoria and performance spaces conditioned have a dedicated air handling unit, with it's own outdoor air fan and exhaust air.

7.2.5 Mixed Mode

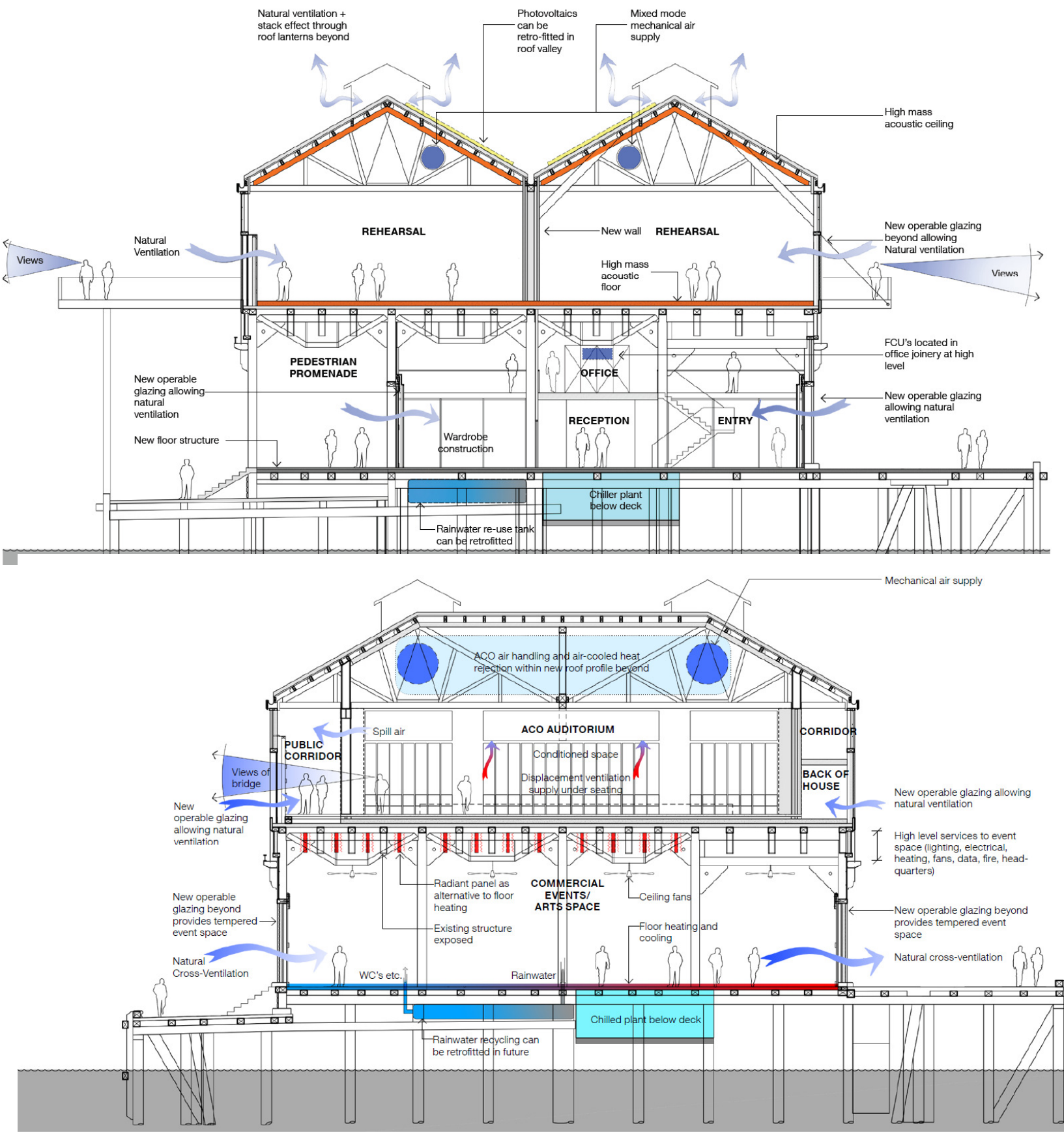
Mixed mode offices have systems for Full A/C and operable windows to allow the spaces to operate naturally ventilated when the outdoor conditions permit.

7.2.6 Heated

Heated spaces are either by overhead gas radiant or full air distribution depending on the space.

7.2.7 Cold Shell

A condenser water pipework loop will be provided to serve spaces that may require cooling to be installed in the future by tenants.



7.0 ESD REQUIREMENTS—USER COMFORT & WELLBEING

7.3 Initiatives

7.3.1 Maximised Daylight

Maximising the daylight increases occupant wellness as well as reducing the need for artificial lighting. Increase glazing in lanterns.

7.3.2 Increased Views

Increased views have the obvious advantages of increased value, and occupant comfort. This will be a tough aspect to increase, considering the heritage status of the façade.

7.3.3 Local Outdoor shade structures

Simple shade structures can reduce the radiant temperature in a space significantly. Shades provide comfort islands to users, increasing the usability of the domain in periods of significant heat.

7.3.4 Individual space design

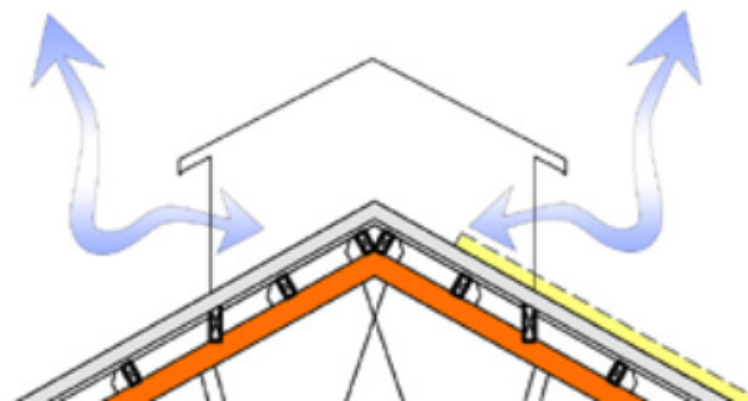
Designing each space individually guarantees the most suitable outcome for each space. It also removes the risk and costs of including unnecessary plant and services equipment

7.3.5 Health (Reduced Legionella Risk)

Use of harbour heat rejection allows the site to have no water-based cooling towers. Cooling towers provide bacteria a chance to grow, increasing the risk of Legionella. Harbour heat rejection significantly reduces this risk compared to traditional water-based heat rejection methods.

7.4 Concepts Review Summary

- ▶ Maximise the area of workspace with access to natural daylight and views to the outdoors.
- ▶ Large, user-operable windows to increase outdoor air
- ▶ High-VLT glazing selection
- ▶ Space-specific temperature requirements
- ▶ Optimise lanterns to maximise daylight levels
- ▶ Connect spaces to the outdoors with water views, and transient temperature gradient
- ▶ Provide temporary shading structures to the outdoor space.



Roof lanterns can be designed to increase outdoor air rates and sunlight to the spaces directly below through proper design

8.0 ESD REQUIREMENTS—TRANSPORT

8.1 Introduction

Motor vehicles in general, and the use of private cars in particular, are responsible for many forms of pollution. Global warming is directly affected by motor vehicle use due to the high amounts of energy required to build cars and supporting infrastructure and services, as well as the fuels that in turn lead to greenhouse gas emissions within exhaust fumes. Car exhaust fumes also increase the levels of polluting particles in the air, which are a contributing cause of asthma and other respiratory illnesses.

There is a need to maximise alternative transport options if the use and environmental impact of car commuting is to be reduced. Options available may include trains, buses, light rail and trams, water-based transport such as ferries, as well as pedestrian and cycling opportunities. Of all of these alternatives, walking is the most 'sustainable', with no associated embodied energy or pollutants; cycling is similarly not polluting the environment.

8.2 Initiatives

8.2.1 Public Transport

Taking advantage of Sydney's existing network is a simple and effective way to increase the use of public transport to the space.

8.2.2 Bicycle facilities

Providing safe, secure bicycle parking for all users of the space will encourage sustainable transport options to the space. 86 spaces minimum shall be designed for.

These spaces shall be provided in a combination of covered, dedicated areas and on grade outside the site. They shall serve both tenants and visitors.

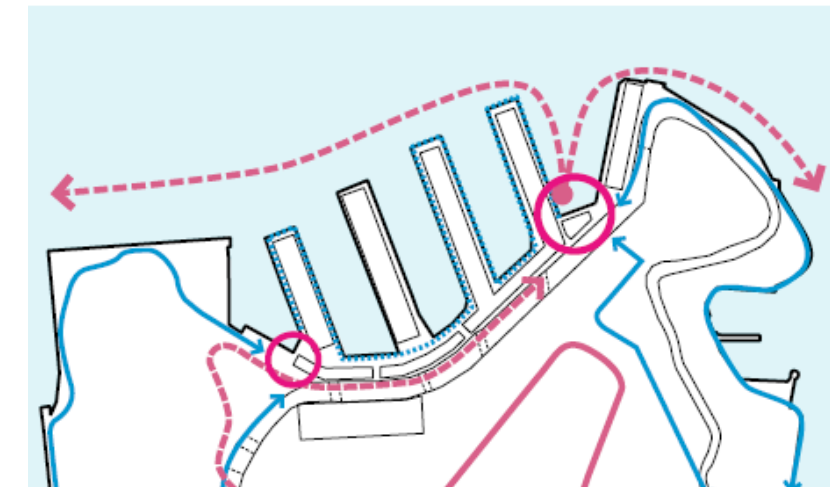


Bicycle racks will be provided securely within the site and on grade for ease of all users

8.2.3 Interconnectivity

Connecting services, and connecting the cycle path to the existing foreshore allows tourists and cyclists to include the precinct as part of any tour. It also enhances the users experience of accessing the space.

This will become part of interlinking the precinct to the Sydney Harbour foreshore.



The intent is to incorporate the existing transport network, and extend it where required to tie into the site.

8.3 Concept Design Summary

- Designated Bicycle Parking for tenants, visitors and the community
- Encourage public modes of transportation
- Provide a space for information about travel options
- Connect cycle ways to Sydney's cycle network

9.0 ESD REQUIREMENTS—OPERATION

9.1 Introduction

The operation plan surrounds simplifying and reducing required maintenance as much as possible. The key concepts surround proper planning at the inception stage to reduce ongoing maintenance required.

9.2 Initiatives

9.2.1 Recycling

Recycling of materials can reduce the embodied energy and extend the product life of many products. This is also a simple measure than can be placed around the site at minimal cost.

Recycling bins shall be located around the site next to each waste disposal bin.

9.2.2 Knowledge Sharing

Sharing knowledge is a great way to help the local community and guests take responsibility for their actions. Informatics and ways of allowing people to know what affects their actions take is a great way to curb poor practice.

At current this is not part of the strategy, however shall be considered in future developments as a retrofit item.

9.2.3 Ongoing Maintenance

Ongoing maintenance is an important part of continuing sustainability. Over time, products lose efficiency and performance if they are not maintained.

9.2.4 Waste Management Plan

Implementing a detailed waste management plan is crucial to the success of the sustainable operation. This includes setting targets and striving to meet them. This is recommended to be in line with the Waste Management Plan outlines of *Man-7 Waste Management* in the Green Star Public Building Pilot Tool

9.2.5 Tracking and Monitoring

Sub metering on major water and energy uses can assist in commissioning, driving efficiency and discovering leaks in water. It is also great for trend setting, benchmarking and understanding energy and water use.

Meters shall be monitored automatically, with alarms for significant disruption from trends to assist in the ongoing operation of the building.

9.3 Concept Design Summary

- ▶ Develop an ongoing tuning/ commissioning strategy to provide an efficient running building
- ▶ Develop a Waste Management Plan
- ▶ Identify maintenance, replacement requirements
- ▶ Locate recycling and compost bins throughout the precinct with instructions on proper use of what can and cannot be recycled.
- ▶ Develop an Environmental Management Plan commensurate with Man-6 of the Green Star Public Buildings Pilot Tool

10.0 ESD REQUIREMENTS—COMMUNITY ENGAGEMENT

10.1 Introduction

The site achieves engagement with the greater community through its landmark location on Sydney's harbour foreshore and the welcoming layout of the precinct. The strategies for engagement are centred about maximising the usability and amenity of the space.

10.2 Initiatives

10.2.1 Social Spaces

Bars, Restaurants and cafés are great ways to bring people to the precinct outside of shows. The local community can be encouraged to use the area for social reasons, transforming the precinct into one of the places to be. Consider making the enclosed water body a local harbour pool as part of the social space.

10.2.2 Space hire

Using the precinct for markets and functions will increase knowledge of the precinct. This can also be a revenue stream out of hours.

10.2.3 Extended hours

Opening the space up to out of hours use for TAFE style classes, evening dance classes and the like is a great way to extend the usefulness of the buildings.

10.3 Concepts Review Summary

- ▶ Space use to encourage the local community, through open gathering spaces, cafes, etc.
- ▶ Space hire for markets, festivals, functions and the like to increase the use and knowledge of the precinct.
- ▶ Open buildings to the public square
- ▶ Lighting the space at night to provide an encouraging and secure location.



Lighting up areas of the waterfront square increases security at night and makes the space welcoming. Image: Hammer Hall, Melbourne

APPENDIX A - CONCLUSION AND RECOMMENDATION MATRIX

The following sustainability framework is designed to influence decisions regarding initiatives discussed in this document.

This document is intended to serve as a reference going forward. It can be used as a benchmark and should be referred to when making decisions about the site.

Walsh Bay Arts Precinct, Sustainability Framework

Energy and Carbon			
Strategy	Intention	Design Requirements	Benefits and Background
Greenhouse Gas Emissions	Reduce Greenhouse Gas Emissions through passive design approach, vernacular architecture and energy efficiency of buildings in operation	► Optimise building massing and orientation where possible to respond to local climate conditions and optimise opportunity for passive strategies (natural daylighting, natural heating & cooling, natural ventilation) ► Energy performance to Meet NCC DTS Compliance for Part J1 & J2	Reduce greenhouse gas emissions associated with the energy consumption in operation and associated operational costs
Efficient HVAC Systems/ Passive Design	Provide passive systems wherever possible, and simple, decentralised systems where not	► Target Minimum Energy Performance Standards (MEPS) for any installed systems or NCC Section J target for services ► Naturally Ventilate The vast majority of spaces ► Adopt mixed mode systems with adaptive comfort plus physiological cooling through air movement. ► Use of Harbour Heat Rejection in place of conventional cooling towers/ air cooled condensers	Any installed systems should be simple, cost effective and low maintenance in order that they can be easily maintained using local tradesperson. Best practice surrounds eliminating the requirement for systems where possible.
Peak Energy Demand Reduction	Reduce peak demand on energy infrastructure	► Reduce peak load by 15-30% through use of passive design, efficient fittings and onsite generation	Reduce peak demand on energy supply infrastructure
Lighting strategies	Reduce artificial lighting energy consumption	► Use LED light fixtures where possible to extend lamp life and reduce re-lamping costs and waste. ► Design lighting levels accordingly with the use of the space and daylight availability. Perimeter zones to have dimmable lighting on separate control to internal lighting zones. ► Install occupancy detection for lighting areas in the building. Provide sensors for all individual spaces. ► Reduce max NCC Section J lighting power density by min of 40%	These initiatives will encourage lighting systems to be designed in accordance with space use and daylight availability whilst reducing unnecessary energy expenditure and therefore cutting carbon emissions.
Energy Sub-Metering	Facilitate ongoing management of energy consumption	► Install sub-metering site-wide for substantive energy uses within each building with an effective mechanism for monitoring energy consumption data ► The following energy uses should be metered separately regardless of the size of equipment load: Chillers, Boilers, AHU's, Pumps, lighting as a minimum. ► For each building, provide sub-metering separately for each tenant's lighting and separately for power	Measuring the energy use by occupants within a building highlights differences in energy use, allowing building managers to fine tune operations to minimise consumption and identify problems at an early stage. It also provides infrastructure that can be used by real-time feedback systems that can be used to display energy consumptions to educate users

Water			
Strategy	Intention	Design Requirements	Benefits and Background
Potable Water Efficiency	To reduce potable water consumption by building occupants	► All sanitary fixtures and fittings to be water efficient: All toilet flush - 5 Star WELS rated All urinals - 5 Star WELS rated All indoor taps to be 5/6 Star WELS rated All showerheads to be 6 Star WELS rated	The aim of these initiatives is to reduce potable water consumption by firstly minimising waste of potable water through efficient fixtures. Capturing rainwater is an essential sustainable initiative for the building and waste water treatment and reuse reduces the consumption of potable water for uses that don't need this level of treatment such as cooling towers and wc flush.
Water Metering	To monitor and manage water consumption	► Install water meters for all major water uses in individual buildings, including the following as a minimum (where installed): • Bathrooms • Showers • Evaporative rejection systems • Rainwater supply ► Provide a mechanism for monitoring water consumption data and to alert the facilities management of any changes in water consumption trends such as leaks during the building's operation (through BMS)	Measuring the water use by occupants within a building highlights differences in water use, allowing building managers to fine tune operations to minimise consumption and identify problems at an early stage. It also provides infrastructure that can be used by real-time feedback systems that can be used to display water consumptions to educate users
Landscape Irrigation and Stormwater	Reduce potable water consumed by landscape irrigation	N/A	Besides enhancing ecological value of the site, vegetation significantly increases water demand. Xeriscape gardens are low maintenance and will contribute to water conservation strategies. Vegetation absorbs runoff water, which prevents harmful pollutants from negatively effecting the local aquaculture. This also reduces runoff to the sewer, which runs to the harbour.
Domestic Hot Water	Reduce carbon and energy associated with the heating of water for domestic uses	► Size solar panel roof area to meet 100% of domestic hot water demand in peak summer. Provide gas boosted heating to supplement demand during winter.	Reduce carbon associated with domestic hot water heating

Sustainable Materials			
Strategy	Intention	Design Requirements	Benefits and Background
Internal materials	Reduce health impacts associated with material finishes and assemblies across the precinct	► Install low VOC materials finishes. ► For paints, VOC limits shall be in accordance with the Good Environmental Choice Australia (GECA) standard GECA-23-2005. ► For adhesives and sealants, VOC limits shall be in accordance with the limits adopted by the South Coast Air Quality Management District (California, USA) Rule 1168. ► Carpet VOC levels shall be in accordance with the Good Environmental Choice Australia (GECA) standard GECA-50-2010 v2 for Carpets. Other floor coverings shall be in accordance with GECA 25-2010 v2 for Floor Coverings. ► Fitout items VOC levels shall be in accordance with the Good Environmental Choice Australia (GECA) standard GECA-28-2010 v2 for Furniture & Fittings	Adhering to emission limits for VOCs minimises the risk of adverse health effects that can be caused when these substances are released at room temperature from internal materials.
Resource Efficiency	Reduce embodied energy and resource depletion associated with the project	► Adopt a site wide strategy for resource efficiency: -Refuse materials that are not needed (dematerialisation) -Reduce materials that are (dual purpose cladding) -Reuse & recycle materials wherever possible (timber, steel, aggregate, flyash) -Rebuy wherever possible (reclaimed furniture)	Following the principles of resource efficiency ensures materials are only installed where necessary. It also encourages the use of reused and recycled material content to reduce the embodied energy of the final material
Recycled material content	Prolong the useful life of existing products and materials and encourage the uptake of products with recycled content		Construction waste makes up around 40% of all waste generated within Australia. Reusing products or sourcing recycled materials reduces the amount of waste going to landfill
Local material sourcing	To reduce embodied energy associated with transportation of materials		Cement replacement contributes to a reduction on greenhouse gas emissions as the production of cement is responsible by approximately 90% of emissions from the concrete production. Using industrial by- products to replace Portland cement, such as fly ash or blast furnace slag reduces the mining of resources and GHG emissions.
Timber	To encourage the use of reused timber and timber sourced from forests whose conservation values are not degraded	►95% (by cost) of all timber used is from a reused source or is certified by a scheme accredited by FSC International or PEFC and has a full Chain of Custody (CoC)	Ensures that biodiversity and existing forests are not compromised by illegal-harvesting practices.

User Comfort & Wellbeing (Indoor)			
Strategy	Intention	Design Requirements	Benefits and Background
External Views and visual comfort	To provide occupants with a visual connection to the external environment	► Increased windows and visual light transmittance to encourage visual comfort ► Skylights to increase natural light into the space and reduce artificial lighting energy, to target 2.5% daylight factor in affected spaces	A visual connection with the external environment improves workspace quality, increased productivity and occupant satisfaction. Other benefits include an increased rental price for tenancies
Environmental conditions (wider temperature range)	To provide a range of spaces with a mix of environmental conditions to maintain thermal comfort with reduced energy consumption	► Define temperature ranges and ways of controlling it appropriate to each space, use and activity e.g. provide a suitable mix of outdoor unshaded, outdoor shaded, semi-indoor and indoor spaces to suit a range of environmental conditions and class formats, with relaxed temperature bands where appropriate: - Outdoor, unshaded - temperature range 10-35 degrees C - Outdoor, shaded, wind baffle (cafe, commercial/arts space) - temperature range 15-30 degrees C - Semi-indoor / outdoor (rehearsal, workshops, etc.) - temperature range 18-28 degrees C - Indoor semi-conditioned (Various offices) - temperature range 19-36 degrees C - Indoor conditioned theatres, boardroom, critical spaces (21-24°C) - Indoor naturally ventilated where possible (corridors, circulation, breakout) - Indoor mixed mode (some offices where required, recording studios)	Some dance classes and the like could be taken outdoors whilst more controlled, lab work can be undertaken in conditioned spaces. Providing a range of spaces increases variety and occupant satisfaction with class setting and also allows environmental conditions to be relaxed where appropriate. Acceptable operative temperature ranges for naturally conditioned spaces based on studies undertaken by the American Society of Heating, Refrigerating, and Air-conditioning Engineers (ASHRAE). Such a range indicates the "adaptive comfort" range that most (i.e. either 80 or 90 percent) would find acceptable. By adjusting temperature ranges for buildings according to such methodology, the building can save energy and decrease operational use on the mechanical system.
Daylight (internal)	To maximise daylight penetration into the floor plate, improving indoor visual quality and reducing tenant lighting energy consumption.	► Target maximising daylight through increased window area, skylights and the like	One of the main benefit of providing good daylight quality to a building is a reduction on energy consumption due to a reduction on the operation of artificial lighting systems. Daylight will also provide office occupants with a healthier environment that will have direct impact on productivity and wellbeing.

Sustainable Transport			
Strategy	Intention	Design Requirements	Benefits and Background
Public Transport	To encourage responsible and Carbon-minimal forms of transport for users to the site	► Systems are interconnected to the Sydney CBD public transport network ► Provide no car parking spaces to encourage other forms of transport	Public transport is many times less carbon intensive than individual cars.
Cyclist Facilities	To facilitate the use of bicycles by occupants and visitors	► Provide secure bicycle storage for 5% of all occupants (all staff, users and visitors) at 75% occupancy ► Provide showers for users (target 1 per 10 bicycle parking spots) ► Provide changing facilities adjacent to showers ► Provide one secure locker per bicycle space in the changing facility	Bicycle facilities encourage users to reduce the use of fossil fuel vehicles. Sustainable benefits are not limited to a reduction in fossil fuel consumption and in greenhouse gas emissions. It includes social benefits in a regional scale such as reduction in traffic and road accidents as well as positive impact on wellbeing and health of the population. Sydney is provided with a variety of cyclist lanes and facilities. Providing demand for this infrastructure can potentially encourage public sectors to invest in that area to finalise connections between campus location and the CBD

Operation			
Strategy	Intention	Design Requirements	Benefits and Background
Recycling Waste Storage	To provide facilities that encourage and facilitate the recycling of waste	► A dedicated storage area shall be provided for the separation and collection of recyclables including cardboard, plastics, metals, cooking oil, organic materials (compost). ► Separate recycle bins to be distributed throughout the campus adjacent to general waste bins with clear instructions on the type of waste that can be recycled. ► Bins and storage areas to be easily accessible to all users and recycling waste handling companies.	Reducing Operational waste will reduce pressure to landfills. It will also help on occupant's environmental education and awareness
Construction Waste Management	Minimise the amount of construction waste going to disposal	► Implement a Waste Management Plan (WMP) for construction works. ► Target 60% of demolition and construction waste to be reused or recycled. Retain waste (quarterly) reports to ensure targets are met ► Ensure the WMP includes a section on erosion and sedimentation to ensure construction works do not pollute surrounding areas	Construction and demolitions are responsible for numerous impacts – from site disturbance, pollution, waste generation, water and energy use. Minimising these impacts through responsible actions and standardised methods such as the ISO 14001 can result in: •Reduced raw material use; •Reduced energy and water consumption; •Improve process efficiency; •Reduced disposal costs; •Reduced waste to landfill
Environmental Management Plan	Minimise environmental impacts of all sources during construction stage.	► Ensure an Environmental Management Plan (EMP) for the construction works is implemented in accordance with Section 3 of the NSW Environmental Management System guidelines 2009.	
Commissioning and building tuning plan	Ensure all building services operate to optimal design potential	► Ensure new buildings are fully commissioned within one year of operation.	Ensuring an effective commissioning and building tuning plan is in place can ensure installed systems and building fabric operates efficiently and as intended. The plan can eliminate misunderstandings and enable occupants and facility managers to understand the best way to operate the building to reduce operational costs.
Efficient equipment selection	Ensure any new equipment to be installed is energy efficient	► Select energy efficient appliances, fixtures, equipment, whitegoods (if any), etc.	Selecting the most energy efficient equipment reduces operational costs and minimises associated carbon emissions.
Building Services Procurement	Ensure services are procured based on considering the life cycle cost and environmental impact associated with operation, replacement and maintenance		
Green Orientation and ongoing education	Encourage transfer of information to new and ongoing users to optimise the sustainable performance of the campus		Buildings can be designed and constructed in the most sustainable manner but once occupied, even the most sustainable building can perform poorly if the users do not fully understand it should be used. Facilitating an ongoing understanding of how the building should perform empowers occupants to better operate their facilities. It can create behavioural changes by highlighting how individual actions contribute to resource consumption and energy use.

Social and Community			
Strategy	Intention	Design Requirements	Benefits and Background
Public performance feedback system / Informatics	Monitor and communicate resources use		Promotes environmental education and awareness amongst occupants and the broader community.
Out of hours use	Maximise building use and provide additional facility to local community	► Use buildings for e.g. evening classes, weekend workshops. ► Provide community with access to cafes, studios, facilities and bars at weekends and after hours ► Establish precinct as a main hub for events in Sydney to attract the community into the campus. (Art and music Festivals, moonlight cinema, markets)	Providing the precinct with out of hours flexibility maximises the use of the new facilities and gives back to the community.
Community space	Contribute to community wellbeing		Allocating a part of the grounds to a community allotment or vegetable patch engages locals with the development and offers something back to locals. Provides community members with a sense of responsibility.

Benchmarks and targets			
Strategy	Intention	Design Requirements	Benefits and Background
Sustainability Framework	Facilitate ongoing management and monitoring of sustainability drivers	► Monitor Energy, Water and Waste use ► Target % reduction established using existing targets	Target-setting is a strategic process to establish performance goals for energy, water, and waste. Establishing a baseline and a target performance facilitates ongoing management of the campus to ensure it operates as efficiently as possible, reducing the resource demand of the precinct and community as a whole.