ONE SYDNEY HARBOUR BARANGAROO

RESIDENTIAL BUILDING R5 BARANGAROO SOUTH

ESD REPORT – DEVELOPMENT APPLICATION
28 AUGUST 2018

lendlease

One Sydney Harbour
ESD Report Residential Building R5

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1.0 Executive Summary

This ESD summary report has been produced by Lendlease Applied Insight to describe the initiatives that are to be included within residential building R5 proposed as part of Stage 1B Barangaroo South, which contributes to the achievement of the broader sustainability commitments for the Barangaroo Site under the Concept Plan, including the obligations of the precinct's Climate Positive Work Plan dated 20th November 2015.

This project aims to deliver a sustainable residential building, with low operational energy consumption, reduced potable water use, minimisation of waste to landfill and appropriate materials selection while at the same time maintaining a high level of indoor environmental quality through appropriate mechanical design, façade configuration and materials selection. Findings from the Independent Expert Sustainability Certifier's (IESC) World's Best Practice Review from 2014, have been considered whilst establishing the design of this project.

This report discusses project planning commitments, and the initiatives proposed to ensure that these commitments are achieved. The proposed R5 Residential Project will appropriately contribute towards the achievement of the sustainability requirements included in the Statement of Commitments of the approved Concept Plan, specifically there is a commitment to achieving a 5 Star Green Star rating and to meet the requirements of the Building Sustainability Index (BASIX).

The proposed residential development will benefit from Barangaroo South's precinct sustainability initiatives such as the district cooling plant, on-site renewables and generation strategy and precinct recycled water plant. These initiatives are essential to ensure that Barangaroo South achieves sustainability targets such as:

- Minimal operational energy consumption off-set by offsite renewable energy to ensure a carbon neutral precinct.
- The capability to export more recycled water than potable water is imported to ensure a positive water impact.
- An 80% operational waste diverted from landfill, targeting zero net waste to landfill by 2020.
- 20% reduction in embodied carbon (cradle to gate) not including tenant fit outs.
- On site renewables of an amount to offset public realm and recycled water treatment plant energy use.
- Green Star Design and As-Built ratings for all eligible buildings within the precinct.

With the precinct sustainability initiatives and building specific initiatives, the proposed residential development will achieve the sustainability aspirations set for the Barangaroo South precinct and contribute to the achievement of the broader Barangaroo precinct-wide aspirations, as expressed in the Statement of Commitments of the concept plan. In particular, initiatives targeted as part of the Green Star Design and As-Built tool will ensure significant sustainability principles will be incorporated into the design, appropriate management practices are applied through the construction period and facilities and resources are provided to ensure the delivery and operation of the building achieves the sustainability objectives.

2.0 Introduction

This report supports a State Significant Development Application (SSD 6966) submitted to the Minister for Planning pursuant to Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act). The Development Application (DA) seeks approval for construction of a residential flat building (known as Residential Building R5) and associated works at Barangaroo South as described in the Overview of Proposed Development section of this report.

2.1 Overview of Proposed Development

The Residential Building R5 DA seeks approval for the construction and use of a 30 storey residential flat building comprising 210 apartments, ground floor and podium retail, the allocation of car parking, services, plant and storage within the Stage 1B Basement (subject of a separate DA), and the construction of ancillary landscaping and temporary public domain.

2.2 Site Location

Barangaroo is located on the north western edge of the Sydney Central Business District, bounded by Sydney Harbour to the west and north, the historic precinct of Millers Point (for the northern half), The Rocks and the Sydney Harbour Bridge approach to the east; and bounded to the south by a range of new development dominated by large CBD commercial tenants.

The Barangaroo site has been divided into three distinct redevelopment areas (from north to south) – Barangaroo Reserve, Barangaroo Central and Barangaroo South.

The R5 DA Site area is located within Barangaroo South as shown in Figure 1. The DA Site is located on land generally known and identified in the approved Concept Plan as Block 4B.

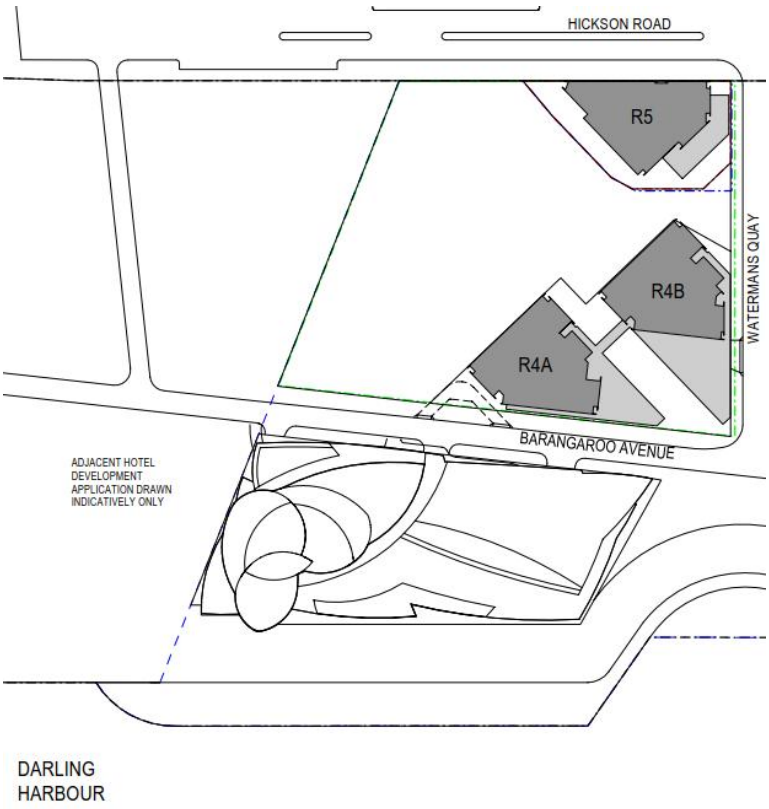

Figure 1: Stage 1B Barangaroo South

2.3 Purpose of This Report

This report has been prepared to accompany the Project Application for Residential Building R5 and associated works at Barangaroo South. This report accompanies the refined R5 design in accordance with the Response to Submissions on the Development Application.

2.4 Referenced Documentation

The calculations for Nationwide House Energy Rating Scheme (NatHERS) and Building Sustainability Index (BASIX) have been undertaken in line with the DA drawings.

Assumptions for energy and water consuming building services such as lighting, mechanical, hydraulic, and vertical transportation services are in line with the Building Services DA reports. Furthermore, the environmental performance of Residential Building R5 is supported by infrastructure within the basement as outlined in the Stage 1B Basement SSDA submission (SSD 6969). Where insufficient information is available, defaults in line with NatHERS and BASIX guidelines have been used.

This report is based on the above-referenced documentation supplied to Lendlease Applied Insight at the date of writing. This documentation is subject to change as the design progresses and specific outcomes may be substituted or omitted whilst still targeting the sustainability aspirations for the Barangaroo South precinct and maintaining compliance.

3.0 Precinct Initiatives

The Barangaroo South precinct has established a range of significant sustainability targets that will be delivered progressively throughout the development phase to contribute to the broader Barangaroo Concept Plan Commitments. This short overview provides the context for considering the Residential R5 application against the aspirations of the broader precinct. The descriptions in the section below are provided for information only and will be subject to more detailed reports and approvals for detailed design, prior to the issue of construction and occupation certificates, as necessary. The proposed precinct wide targets are:

Healthy Buildings:
- 5-Star Green Star Design and As-Built ratings for residential buildings;
- Attuned to Sydney's climate and connected to outdoors;
- Passive design, low energy buildings; and
- Use of some sustainable materials, including recycled content and low emissions.

Energy and Carbon:
- A carbon neutral outcome supported by the use of new offsite renewable energy generation;
- Significant reduction in building energy consumption. The residential buildings throughout the precinct are targeting a 55% carbon reduction from business as usual performance;
- 20% reduction in embodied carbon within the built form;
- Efficient precinct infrastructure using central cooling plant and harbour heat rejection; and
- Onsite photovoltaic generation sized for the public domain and recycled water treatment plant.

Water Positive:
- A water positive outcome – where more water is exported than potable water is imported;
- On-site waste water treatment and water recycling;
- Capacity to export recycled water allowing neighbours to reduce their potable water demands; and
- Sewer mining to reduce network demands.

Zero Waste:
- Greater than 97% diversion of construction waste from landfill; and
- Greater than 80% diversion of operational waste from landfill.

Sustainable Transport:
- A new connection/entry point for the CBD (with provision for light rail, ferries, and the Barangaroo Pedestrian Link);
- Car parking ratios resulting in less car parking spaces than normally provided for CBD commercial buildings;
- Infrastructure and support for cyclists and pedestrians;
- Real-time commuter updates;
- Green travel plan to promote vehicle sharing, small cars and electric cars; and
- Safe, low-speed onsite environment.

Landscape and Biodiversity:
- Use of native flora and encourage habitats for fauna;
- Inclusion of water-sensitive urban design;
- Planning for climate change; and
- Landscaped public spaces and selected green roof features.

Many of these targets involve various third parties and authorities, and will need partnerships, and commitments to achieve these targets. These world leading initiatives will be evaluated, measured and reviewed progressively throughout the project life.

4.0 R5 Residential and Sustainability Contribution

The proposed Residential Building R5 will appropriately contribute towards the achievement of the sustainability requirements included in the Statement of Commitments of the approved Concept Plan and proposed Mod8. The table below summarises these requirements and confirms how the project will address each requirement.

Category	Clause	Approved Concept Plan	Residential Building R5 Commitment
General ESD	78	There is to be an environmental focus on strategies for Water, Energy, Micro-Climate, Environmental Quality / Amenity, Landscape, Transport, Waste and Materials for the development. Each building on site will achieve the primary benchmark of a "5 star" standard of: Green Star 5 star, and Residential: Green Star Residential score >60, and each development will be required to demonstrate how it satisfies each of the following Key Performance Indicators for each of the ESD focus areas referred to below.	The R5 building will be designed and constructed to achieve a 5 Star Green Star Design and As-Builtv1.1 rating.
Water	79	There is to be a 35% reduction in Potable Water Consumption compared to a standard practice development and a 40% reduction in flow to sewer compared to a standard practice development.	The proposed R5 development will consume approximately 45% less mains water than average dwellings within NSW. This BASIX Water Score reported does not allow for the precinct recycling of fire system test water and assumes poorer than 1 Star washing machines thus the likely water performance is 50%+ better than the BASIX benchmark. This is calculated using the NSW Building Sustainability Index (BASIX). Flow to sewer will be reduced by 90%+ as all waste is processed by the recycled water treatment plant.

Category	Clause	Approved Concept Plan	Residential Building R5 Commitment
Energy	80	There is to be a 35% reduction in Greenhouse Gas Emissions compared to a standard practice development. 20% of power is to be purchased from low impact, renewable sources or alternatively there should be a 20% reduction in GHG emissions through carbon offsets. The purchase of renewable energy should be at World Best Practice level.	The proposed R5 development has the potential to result in 55% less greenhouse gas emissions when compared to an existing building benchmark of 137kgCO_{2e}/m^2. This is calculated using the NSW Building Sustainability Index (BASIX). Residual emissions will be offset as part of Barangaroo South's carbon neutral commitment.
Micro-Climate	81	Key public open spaces (parks and squares) are to receive direct sunlight in mid-winter.	The shadow diagrams for the development indicate that Hickson Park to the north will receive direct sunlight during mid-winter.
Landscape	82	Primarily non-invasive plant species are to be used on the site.	This requirement is met by the proposed development through the choice of appropriate non-invasive plant species.
Transport	83	Ensure that there is sufficient public transport to achieve points under the public transport credit for Green Star Rating Tools for buildings and a future Green Star Tool for residential buildings.	Proximity to Wynyard station trains and buses within short walking distances will ensure a high score in the Green Star public transport credit.
Waste	84	Centralised recycling areas are to be provided in all buildings and 100% of waste bins for public use are to allow for waste separation.	Waste collection areas for the building will be in the basement and will allow for the streaming of waste and recyclables.
Wind	85	Wind tunnel modelling and verification of proposed treatments will be carried out at the building design application stage due to the significant exposure of the site to the southerly and westerly winds. Any development proposal for the southern portion of the site should be subjected to a wind tunnel study, carried out in accordance with the procedures outlined in industry recognised guidelines such as the Australasian Wind Engineering Society Quality Assurance Manual.	This is addressed by a wind report.

5.0 Conclusion

The proposed Residential Building R5 will support the sustainability aspirations set for the Barangaroo South precinct and the broader Barangaroo site, as expressed by the Concept Plan Statement of Commitments. In addition, the project is committed to a 5 Star Green Star Design and As-built rating and will meet the requirements of the Building Sustainability Index (BASIX). The project will benefit from the precinct wide sustainability initiatives such as the district cooling plant, on-site renewables strategy and precinct recycled water plant. These initiatives are essential to ensure the precinct achieves the many sustainability objectives.

6.0 Appendix – BASIX Summary Report

6.1 Introduction and Summary

This appendix summarises the assumptions made for the BASIX assessment of the One Sydney Harbour residential buildings (R4A, R4B, and R5) within the Barangaroo Stage 1B development. Given limitations of the BASIX tool, the three buildings have been assessed independently. These assumptions are in line with current design intent.

The Building Sustainability Index (BASIX) sets energy reduction, thermal comfort and water reduction targets for new residential developments based on the average energy and water consumption of dwellings in NSW. For buildings with 6 or more stories such as the Barangaroo Stage 1B residential buildings, a 20% reduction in energy consumption and a 40% reduction in water use are required to pass.

For Thermal Comfort, BASIX awards a pass/fail based on heating and cooling maximum average loads set by BASIX; however, the thermal performance of a development will affect its energy score. A development that has excellent thermal performance reduces its reliance upon air conditioning, and is therefore awarded in BASIX with a positive contribution to its energy score.

The results of the BASIX assessment with the inputs as described in the sections below are:

Building	Energy	Thermal Comfort	Water
R5	24% reduction	Pass	46% reduction

6.2 Spatial Details

Due to limitations in the BASIX tool, the BASIX assessment has been split across 3 certificates, one per residential building. As directed by ePlanning NSW, shared facilities within the podiums or shared basement have been pro-rated to each tower by the number of dwellings:

	R5
Number of dwellings	210

In summary, for the purposes of this assessment:

- The basement has elements dedicated to each residential building.
- The basement also has shared facilities like carparks which are assigned in proportion to apartment numbers.

6.3 Water

This section outlines the assumptions made for the water consumption and supply.

Central system & common areas Water

Summary

While green landscape areas are indicated on DA drawings, the proportion of lawn versus planting is uncertain at this stage. The area of proposed green landscaping is therefore split between lawn and planting as per the table below.

Rooftop garden area	Units	R5
Common area lawn[1]	m^2	92
Common area garden – vegetated area excluding lawn[1]	m^2	92
Common area garden – indigenous or low water use species[1]	m^2	0

Notes 1) For the common podium roof top garden, native or endemic species should be targeted to minimise water consumption. However, the area has been assumed to be covered half with exotic species and half with lawn to enable flexibility as the design progresses.

Alternative Water Supply & Use

Barangaroo Recycled Water Treatment Plant	Units	R5
Water supply[1]	-	Note 1
Area of common landscape – using recycled water	m^2	0
No. of car washing bays[2] – using recycled water	No.	0

Notes 1) The residential towers will be connected to the Barangaroo South Recycled Water Treatment Plant (RWTP) as an alternative water supply. The precinct RWTP is designed to fully meet the non-potable water demands, consistent with the district plant's design.

Pool and Spa

There are no common area pools or spas proposed.

Other

It has been assumed that any common shower and amenities in all buildings are fitted with water efficient fixtures as per the table below. At this stage, the only common area amenities consists of a small bathroom on the ground floor. The fire sprinkler systems will be tested in a closed system, where the test water will be reticulated through the basement and drained to the precinct fire tank in stage 1A.

Common Area Fixtures	WELS rating
Showerheads	3 star (> 7.5, but ≤ 9L/min)
Toilets	4 star
Taps	4 star
Clothes Washers	No common laundry facility

Fire Sprinkler System	Yes/No
Fire sprinkler contained in a closed system?[1]	No

Notes 1) The fire system test water is predominantly recycled into the precinct fire services water tank. Due to gravity return not being possible to the fire services tank, a small amount of test water at level B1 and below is returned to the recycled water treatment plant. As this does not strictly meet the closed system criteria within BASIX we have not assumed this benefit within BASIX. We have not pursued an alternative assessment within BASIX to recognise the benefit as it is not needed for compliance.

Individual Dwellings Water

Fixtures and Alternative Water
The assumptions listed below have been made for the water fixtures and fittings installed for all dwellings in all buildings.

Fixtures	Water supply	WELS rating
Showerheads	Potable mains	3 star >7.5L/min & ≤9L/min
Toilets	Blackwater plant	4 star
Kitchen taps	Potable mains	4 star
Bathroom taps	Potable mains	4 star
Clothes washer	Potable mains[1]	Not specified
Dishwasher	Potable mains	Low/mid rise - 5.0 star High rise/penthouse - 5.5 star

Notes 1) It is proposed that both potable and non-potable water connections are provided to laundries. Potable water has been assumed here to give a conservative result.

It is assumed that:

- There is no private landscaping to the dwellings and that all balconies are hard surface. Any private landscaping to the penthouses should be confirmed following the layout.
- A hot water diversion system will not be installed.

Pool & Spa
There are no pools or spas proposed within individual dwellings.

6.4 Thermal Comfort

The dwellings on all representative floors within the R5 building of Barangaroo One Sydney Harbour (OSH) have been assessed to determine the minimum thermal performance characteristics required to meet the Thermal Comfort requirements set by BASIX. The BASIX Thermal Comfort section is passed where the following heating and cooling loads are not exceeded on both an individual dwelling and building average basis:

	Heating MJ/m^2.annum	Cooling MJ/m^2.annum
Individual dwellings	50	41
Average	40	32

The results of the Thermal Comfort section will also contribute towards the Energy score.

An alternative assessment methodology to model the performance of the open cavity façade (OCF) system proposed has been approved and utilised to assess the thermal performance of dwellings relative to the BASIX thermal comfort targets. Model assumptions include the following.

The site is predominantly open and bounded to the north by the undeveloped Barangaroo Central precinct, to the east by the Sydney CBD and to the west by Sydney Harbour. The Crown Hotel Resort has development approval and is currently under construction and therefore it has been assumed as provided site shading in the thermal analysis undertaken.

The dwellings have been modelled in accordance with the BASIX Thermal Comfort Protocol (December 2014) in the FirstRate5 software package (version 5.2.8a). The energy simulation was performed using preloaded Sydney weather data.

Minimum insulation and façade performance requirements are noted on the DA drawings.

Results

The following table gives the average loads based on the heating and cooling loads extracted from the FirstRate5 thermal simulations. Due to the large number of thermally unique apartments not all results have been reproduced here.

Thermal Performance	Units	Compliance Requirement	R5
Average area adjusted heating load	MJ/m^2.annum	40	19.8
Average area adjusted cooling load	MJ/m^2.annum	32	20.6
Average star rating	Stars		5.6

6.5 Energy

The energy section of BASIX calculates a percentage reduction in expected greenhouse gas emissions compared with an average NSW dwelling. It considers the energy demands of the central systems, as well as the energy demands of the common areas and dwellings from the domestic hot water system, the HVAC system, lifts, lights and appliances.

Central Systems

Central Domestic Hot Water System

A gas-fired plant is proposed for each building. The hot water reticulation system will be continuous flow, eliminating the heat losses associated with storage systems. The facility to connect to the waste heat from a future cogeneration system utilising a renewable fuel source located in the Stage 1A basement will be provided.

Central Hot Water System	All Buildings
System type	Gas fired storage system
Insulation – external piping	No external piping
Insulation – internal piping	R 0.75

Central Cooling and Heating System

The development will be connected to the Barangaroo South precinct district cooling plant (DCP) which will use water from the adjacent harbour for heat rejection. The heating hot water will be provided by one gas fired heating hot water (HHW) unit for each building. These systems will provide the heating and cooling via individual fan coil units to each apartment.

Central Cooling System	District Cooling Plant
System type	Chilled water fan coil units
Energy source	Electric driven compressor
Heat rejection method[1]	Air cooled condenser
Unit efficiency[2]	High – COP > 4.5

Central heating system	Individual Buildings
System type	Fan coil + heated water
Energy source	Gas HHW Unit

Notes 1) The BASIX portal does not have the option of a seawater cooling system. All other BASIX options available assume water consumption (for cooling towers), therefore the air cooled condenser option achieves the closest outcomes.

2) ePlanning NSW have provided an alternative method to acknowledge a portion of the District Cooling Plant's higher efficiency. A COP > 5.5 has been assumed for BASIX purposes.

Alternative Energy Supply

A rooftop photovoltaic system is proposed for the One Sydney Harbour residential buildings and Stage 1B infrastructure. Capacity is proposed to be maximised, however for the purposes of the BASIX certificate a capacity of only 80% of the current estimate potential is included.

Photovoltaic System	R5
Rated electrical output (peak kW)[1]	45 kW

The building will also have the ability to accept electricity and waste heat (where available) from a proposed cogeneration system using a renewable fuel source located in the stage 1A basement. It is proposed that the waste heat from the future system would be reticulated to each building for use in heating pools / spas and for domestic hot water.

Lifts
The plans indicate 3 residential lifts the number of lifts in each building. Lifts will also service four basement levels and three podium levels in addition to the residential levels.

	Key Worker Housing Lift	On Market Lifts
Quantity	1	2
System type	Gearless traction with VVVF motor	Gearless traction with VVVF motor
Number of floors served[1]	23	34

Notes 1) BASIX does not account for recuperation (regenerative breaking) and permanent magnet (PM) motors. The proposed lift supplier has estimated the benefits of recuperation and PM motors to be 43% in energy savings relative to the most efficient option that can be selected within the BASIX tool. The ePlanning team have approved an alternative method to input a reduced number of equivalent floors for each lift to account for the energy savings for the above technologies. While a 43% reduction in lift energy is estimated to improve the BASIX score by 3-4% the alternative assessment has not been applied for the purposes of the planning application given that compliance can be demonstrated without this.

Pool and Spa
There are no pools or spas.

Sauna
There are no saunas.

Other Central Systems
The following energy details of central systems are additional fields required by BASIX:

	All Buildings
Building Management System (BMS)	Yes
Active power factor correction (PFC)	Yes
Common area clothes drying line	No
Common area electric/gas clothes dryer	No common clothes dryer
Common area clothes washer	No common laundry facility

Common Areas

Ventilation

Common Area	Ventilation System Type	Efficiency Measure
Car park	Ventilation (supply + exhaust)	CO monitors + VSD fan
Lift motor room	Air conditioning system	Thermostatically controlled
Garbage room (Basement)	Ventilation exhaust only	n/a
Garbage room (Tower)	Ventilation exhaust only	n/a
Community Room	Air conditioning system	Time clock or BMS controlled
Plant or service rooms	Ventilation supply only	Interlocked to light
Grease Arrester rooms	Ventilation exhaust only	None i.e. continuous
Plant or service rooms (Naturally ventilated)	No mechanical ventilation	n/a
Plant or service rooms (Conditioned)	Air conditioning system	Thermostatically controlled
Other internal common area (Fire stair)	No mechanical ventilation	-
Other internal common area (Amenities)	Ventilation exhaust only	Interlocked to light
Ground floor lobby	Air conditioning system	Time clock or BMS controlled
Hallways/ lobbies (Podium)	Ventilation supply only	Time clock or BMS controlled
Hallways/ lobbies (Tower)	Ventilation supply only	Time clock or BMS controlled
Hallways/ lobbies (Basement)	Ventilation supply only	Time clock or BMS controlled
Hallways/ lobbies (Keyworker)	Ventilation supply only	Time clock or BMS controlled
Store rooms (Enclosed)	Ventilation supply only	Time clock or BMS controlled
Security & Control rooms	Air conditioning system	Time clock or BMS controlled

It is assumed that common area ventilation will be controlled via the BMCS using daylight or motion sensors, or alternatively by time clock, to ensure that mechanical ventilation energy is only consumed when necessary.

ePlanning NSW have provided an alternative method to account for efficiencies in the duty point and run time estimates of common area ventilation systems that currently cannot be reflected in the BASIX tool. At the time of submitting this planning application, this alternative assessment had not been applied and therefore the BASIX Energy score can be considered conservative. We estimate that this would increase the energy score by between 3 and 4%.

Lighting
The BASIX tool requires inputs for the primary lighting type in each zone, where the primary lighting type is defined as the lamp type fitted to 80% or more of the light fittings to be installed. The following fittings have been assumed for the common areas.

Common Area	Primary Lighting System Type	Efficiency Measure	BMS Controlled?
Undercover car park area	LED	Time clock & motion sensor	Yes
Lift car	LED	Connected to lift call button	Yes
Lift motor room[1]	Fluorescent	Motion sensors	Yes
Garbage rooms[1]	Fluorescent	Motion sensors	Yes
Community rooms	LED	Time clock & motion sensor	Yes
Plant or service rooms[1]	Fluorescent	Motion sensors	Yes
Other internal common area (fire stair) [1]	Fluorescent	Motion sensors	Yes
Other internal common area (amenities) [1]	Compact Fluorescent	Motion sensors	Yes
Ground floor lobby	LED	Time clock & motion sensor	Yes
Hallways/ lobbies	LED	Time clock & motion sensor	Yes

Notes 1) These areas should have LED lighting however the BASIX portal does not provide LEDs as a lighting option for these space types.

Similar to the common area mechanical ventilation system, it is assumed that a lighting control system or connection to the BMCS via motion sensors or a time clock will be installed as a controls mechanism to ensure that lighting energy is not consumed where there are no occupants. A lighting controls system will also be implemented in the basement BOH areas, by both motion sensors and time clocks. Furthermore, it is assumed that the lighting controls in the lifts are triggered by the lift call button to avoid wasting energy in these spaces.

ePlanning NSW have provided an alternative method to account for efficiencies in the circuit load and run time estimates of common area lighting that currently cannot be reflected in the BASIX tool. At the time of submitting this planning application, this alternative assessment had not been applied and therefore the BASIX Energy score can be considered conservative.

Dwellings

Hot Water
It is proposed that all domestic hot water (DHW) demand to the dwellings will be met by the central domestic hot water plant.

Ventilation
Ventilation within dwellings is provided for bathrooms, kitchens and laundries. Each dwelling has an individual laundry as no common laundry facilities are provided.

Exhaust location	Exhaust system type	Operation Control
Bathroom	Individual motorised damper into central duct + VSD	Manual switch on/off
Kitchen	Individual motorised damper into central duct + VSD	Manual switch on/off
Laundry	Individual motorised damper into central duct + VSD	Manual switch on/off

Motorised dampers are proposed to enable the central ventilation fans to be controlled to minimise ventilation energy consumption

Cooling & Heating
It has been assumed that all heating and cooling in the dwellings will be serviced by individual fan coil units. These fan coil units will receive chilled water from the harbour-water cooled district cooling plant, and receive heating hot water from the gas fired heating hot water (HHW) plant in each tower. It has been assumed that the air conditioning in the dwellings will not be day-night zoned.

As discussed earlier, BASIX has accepted an alternative method that recognises a portion of the higher efficiency of Barangaroo South's district cooling plant. However, this has not been applied to achieve the score indicated.

Variable speed fan coil units with digital / electrically commutated motors are proposed for the apartments. We do not believe that BASIX would be fully accounting for the fan energy savings benefits of these technologies thus the BASIX energy score is considered conservative with all else equal.

Lighting

The BASIX tool also takes into account energy consumption from lighting based on the lighting strategy. For each dwelling, the BASIX tool awards the number of bathrooms and kitchens that are naturally lit by either a window or skylight. BASIX awards the rooms which are primarily lit by fluorescent or LED lamps as these are more energy efficient lighting options; and further awards projects where these fittings cannot be replaced by alternatives.

R5 Unit Code	Naturally lit bathrooms/toilets	Naturally lit kitchen	Bedrooms lit by LEDs	Living/dining rooms lit by LEDs	Dedicated LED fittings?
PO5-01	0	No	3	1	Yes
PO5-02	0	No	1	1	Yes
PO5-03	0	No	1	1	Yes
PO5-04	0	No	1	1	Yes
PO5-05	0	No	3	1	Yes
PO5-06	0	No	2	1	Yes
LA5-01	1	No	3	1	Yes
LA5-02	0	No	1	1	Yes
LA5-03	0	No	1	1	Yes
LA5-04	0	No	1	1	Yes
LA5-05	0	No	2	1	Yes
LA5-06	0	No	2	1	Yes
LA5-07	0	No	1	1	Yes
LA5-08	0	No	2	1	Yes
MA5-01	0	No	3	1	Yes
MA5-02	0	No	2	1	Yes
MA5-03	0	No	1	1	Yes
MA5-04	0	No	1	1	Yes
MA5-05	0	No	2	1	Yes
MA5-06	0	No	2	1	Yes
MA5-07	0	No	1	1	Yes
MA5-08	0	No	2	1	Yes
LO5-01	0	No	3	1	Yes
LO5-02	0	No	2	1	Yes
LO5-03	0	No	1	1	Yes
LO5-04	0	No	1	1	Yes
LO5-05	0	No	2	1	Yes
LO5-06	0	No	2	1	Yes
LO5-07	0	No	1	1	Yes
LO5-08	0	No	2	1	Yes
UA5-01	0	No	3	1	Yes
UA5-02	0	No	2	1	Yes
UA5-03	0	No	1	1	Yes
UA5-04	0	No	1	1	Yes
UA5-05	0	No	2	1	Yes
UA5-06	0	No	2	1	Yes
UA5-07	0	No	1	1	Yes
UA5-08	0	No	2	1	Yes
DA5-01	0	No	5	1	Yes
DA5-02	0	No	2	1	Yes
DA5-03	0	No	4	1	Yes
DA5-04	0	No	2	1	Yes

Pool & Spa
There are no private pools to the Skyhomes.

Appliances

Appliance	All
Cooktop	Gas
Oven	Electric
Refrigerator	3 Star
Ventilated fridge space	No
Dishwasher	3.5 star
Clothes washer	Not specified
Clothes dryer	2 star

Other
It is assumed that:

- There are **no** indoor clothes drying lines provided.
- There are **no** private outdoor clothes drying lines provided.