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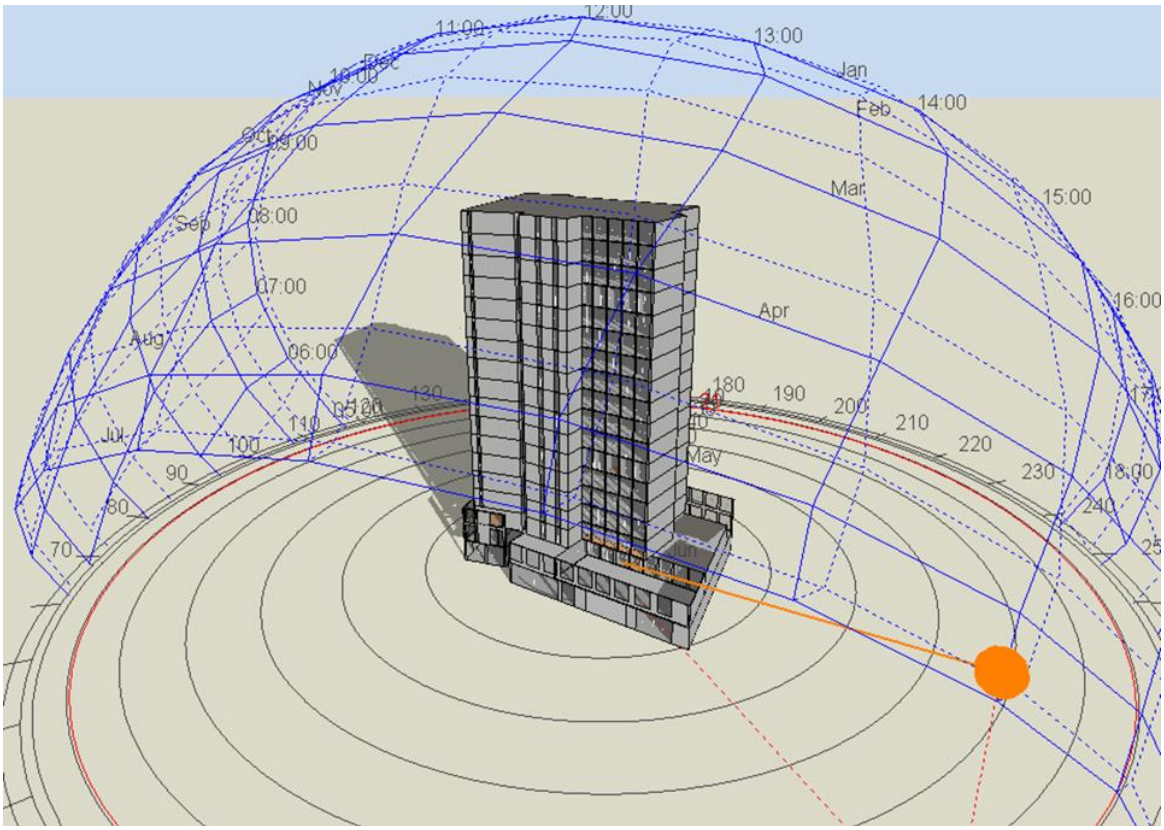
Vipac Engineers & Scientists

Allen Jack & Cottier

90-102 Regent Street Redfern NSW

ESD Assessment Report



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15 Oct 2020

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1 EXCUTIVE SUMMARY

Vipac has been engaged by to undertake the required Ecologically Sustainable Design (ESD) assessments and provide a sustainability report for the proposed student accommodation development at 90-102 Regent Street Redfern NSW.

The principles of ecologically sustainable design will be an integral consideration throughout this development. This report summarises the ESD provisions for the development which demonstrate commitment to environmental sustainability.

The sustainability targets for the development will be achieved in an integrated and staged approach through minimising the need for energy consumption (via passive measures) and then consumption optimisation (energy efficiency) and use of renewable resources where required.

The initiatives presented in this report demonstrate a wide range of measures which will result in high levels of environmental performance and also improvement of occupants' health, productivity, comfort and satisfaction.

Aiming at best practice in energy and environmental targets, the project architect and building services design team will maximise energy efficiency in an integrated and staged approach:

Load Reduction (minimising the need for resource consumption e.g. energy, water and material)	Passive Design
	Building fabric improvements
	Maximise use of natural lighting
	Use of Natural Ventilation (where possible)
Optimising energy and water consumption	High efficiency Heating, Ventilation and Air Conditioning
	High efficiency lighting
	High efficiency hot water systems
	High efficiency appliances
Use of renewable resources (e.g. Solar Energy)	Application of Solar Energy or Solar thermal systems where practical

Benchmarking and compliance requirements:

The development will meet and outperform the following regulatory sustainability requirements:

- BASIX – NSW Department of Planning & Environment
- NCC 2019 Section J (Energy Efficiency)

Sustainability targets beyond the minimum requirements

Although not seeking formal rating certification, where feasible, the design team will consider the sustainable design principles based on the following sustainability tool.

- Green Star Design & As Built Tool – Green Building Council of Australian.

1 INTRODUCTION

The design team recognise the importance of sustainable developments in terms of environmental preservation, occupants' health, safety and wellbeing, as well as in terms of greenhouse gases emissions reduction.

The project architect, consultants and contractors will strive to design and construct the building based on the Environmentally Sustainable Design (ESD) principles which exceed the minimum BASIX and NCC Section J requirements.

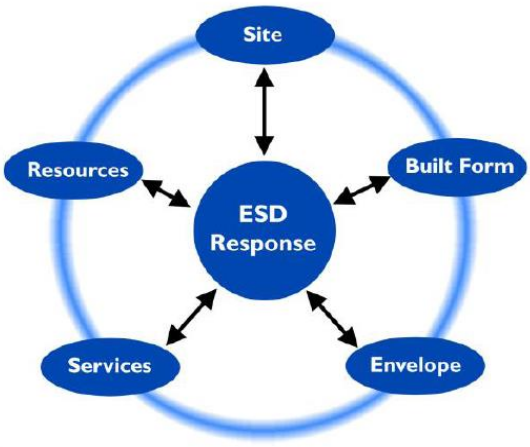
The facade and floor plans are designed with the vision to give occupants the very best in terms of passive heating and passive cooling. This, when combined with other energy efficiency strategies (listed later in the report) will lead to low energy demands for the apartments and base building and therefore lower greenhouse gas emissions during the life of this development.

Natural lighting and natural ventilation (where practical) will be utilised very effectively throughout the development. In addition to thermal comfort, energy and water efficiency, the proposed building design will provide sustainable and efficient operation to the occupants.

The proposed sustainable design initiatives will not only improve the building services life but are low-cost, low maintenance and reliable, especially when compared to often prohibitively complex and expensive retrofits. Furthermore, the passive design principles will facilitate a low-energy and cost-effective operation for the occupants.

The following are some of the design initiatives which will improve the environmental performance of the development and deliver long term energy efficiency during the life of the building.

- Optimising the size of the mechanical plant to ensure the plant is working at its peak efficiency and minimise the capital cost of the plant;
- Having high efficiency lighting and air conditioning equipment will reduce the energy consumption of the buildings;
- Variable Speed Drives (VSD) controls the speed of pumps, fans and other mechanical plant to ensure that they are only using as much power as it is needed;
- Commissioning of all services equipment to ensure their correct operation;
- A high-performance façade will limit the heat entering the buildings, reducing air conditioning system sizes and the energy use over the year;
- Emission reductions and material optimisation;
- Maximise use of non-toxic building materials;
- Maximise use of materials that are recyclable;
- Minimise Waste in Construction;
- Minimise Waste in Operation.
- Renewable Energy generation – Solar PV



2 Benchmarking

The development will meet and outperform the following regulatory sustainability requirements:

- BASIX – NSW Department of Planning & Environment
- NCC 2019 Section J (Energy Efficiency)

Sustainability targets beyond the minimum requirements

Although not seeking formal rating certification, where feasible, the design team will consider the sustainable design principles based on the following sustainability tool.

- Green Star Design & As Built Tool – Green Building Council of Australian.

2.1 NATIONAL CONSTRUCTION CODE (NCC) SECTION J

Section J of the NCC sets regulations for energy efficiencies for all types of buildings with respect to the building's construction, design and activity.

The objective of the NCC Section J is to reduce the greenhouse gas emissions. Section J requires that a building, including its services, must have features to the degree necessary that facilitate the efficient use of energy.

The NCC offers two compliance methods that differ in complexity and flexibility. The two compliance methods are:

- Deemed-to-Satisfy (DTS) Compliance
- JV3 – Verification using a referenced building.

The Deemed-to-Satisfy Provisions in Section J of the NCC 2019 include the following 8 components.

- Part J1 - Building Fabric – Minimum thermal performance constructions for roofs, ceilings, roof lights, walls, glazing and floors in the relevant climate zone.
- Part J2 - Blank in NCC 2019
- Part J5 - Air-Conditioning and – Provisions to reduce the loss of conditioned air and restrict unwanted infiltration to a building.
- Part J4 – Blank in NCC 2019
- Part J5 - Air-Conditioning and Ventilation Systems – Requirements to ensure these services are used and use energy in an efficient manner.
- Part J6 - Artificial Lighting and Power – Requirements for lighting and power to ensure energy is used efficiently within a building.
- Part J7 - Hot Water Supply – Restrictions for hot water supply design except for solar systems within climate zones 1, 2 and 3.
- Part J8 - Facilities for Energy Monitoring

The development will meet and outperform the NCC energy efficiency requirements of Part J.

2.2 BUILDING AND SUSTAINABILITY INDEX (BASIX)

The National Construction Code (NCC) Section J deems that developments with a building class of 1 or 2 in NSW should be assessed against the BASIX rating scheme. The BASIX rating scheme investigates the thermal comfort of the building, energy consumption and water consumption.

There are three input sections: Energy, Thermal Comfort, and Water. Each of these three categories is integrated and often influences each other.

New residential developments in NSW must reduce their energy and water use, according to BASIX requirements developed by the Department of Planning, the objectives of the BASIX scheme are relative to an average development in NSW.

- 40% reduction in water consumption,
- 25% reduction in greenhouse gas emissions, depending on building height,
- Minimum thermal performance requirements for heating and cooling loads.

Achievement of the specified targets is demonstrated through use of a web-based prediction tool. This tool requires input of several aspects of the dwelling's design and produces a BASIX certificate and report listing all of the environmental initiatives proposed and required to achieve the mandatory performance.

A BASIX Certificate is a DA requirement and demonstrates compliance with the NSW Government's sustainability targets. The development will meet and exceed the minimum requirements for all following areas and BASIX Certificate No. 1130725M has been provided.

- Energy Efficiency: 40% reduction (minimum requirements under BASIX: 25%)
- Water Efficiency: 41% reduction (minimum requirements under BASIX: 40%)
- Thermal Comfort: Alternative Assessment pathway in compliance with the requirements of the NSW Department of Planning, Industry and Environment. https://www.planningportal.nsw.gov.au/basix/alternative-assessments/large-boarding

For further information about the BASIX requirements please refer to Appendix C of this report.

2.3 GREEN STAR

Green Star is an environmental rating tool developed by the Green Building Council of Australia (GBCA) that has a holistic approach over a wide range of issues that covers a range of sustainability impact areas. There are various Green Star tools developed to suit a range of different building types including Design and As-Built, Office Interiors, Performance and Communities.

Green Star rating tools use Stars to rate performance:

- 4 Star Green Star Certified Rating (score 45-59) signifies 'Best Practice'
- 5 Star Green Star Certified Rating (score 60-74) signifies 'Australian Excellence'
- 6 Star Green Star Certified Rating (score 75-100) signifies 'World Leadership'

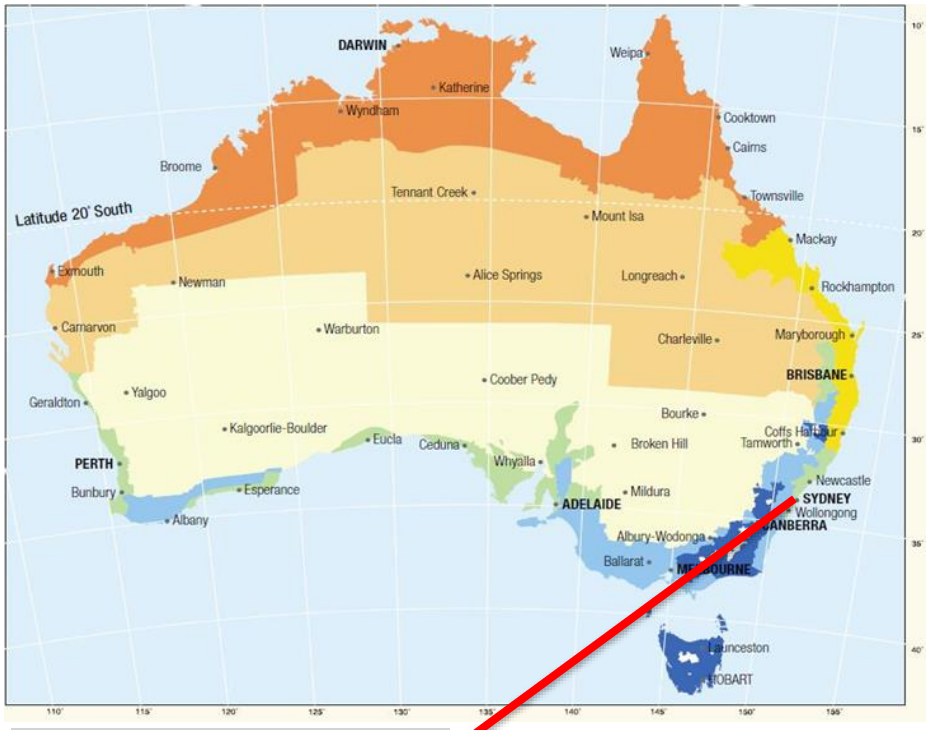
Green Star rating tools include nine separate environmental impact categories as follows.

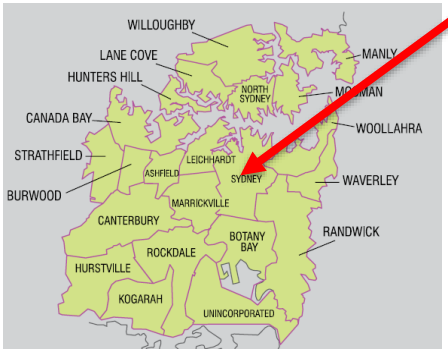
- Management;
- Indoor Environment Quality;
- Energy;
- Transport;
- Water;
- Materials;
- Land Use and Ecology;
- Emissions, and
- Innovation

The development is not seeking a formal Green Star certification, however, where feasible, the design team will consider the sustainable design principles of Green Star.

3 Development Location

The development is located in Redfern NSW which is within the NCC climate zone 5 (warm temperate). The main building classification for the building is Class 9b.





ZONE	DESCRIPTION
1	High humid summer, warm winter
2	Warm humid summer, mild winter
3	Hot dry summer, warm winter
4	Hot dry summer, cool winter
5	Warm temperate
6	Mild temperate
7	Cool temperate
8	Alpine

3.1 INFORMATION USED IN REVIEW

The assessment is based on the following architectural drawings prepared by AJC Architects.

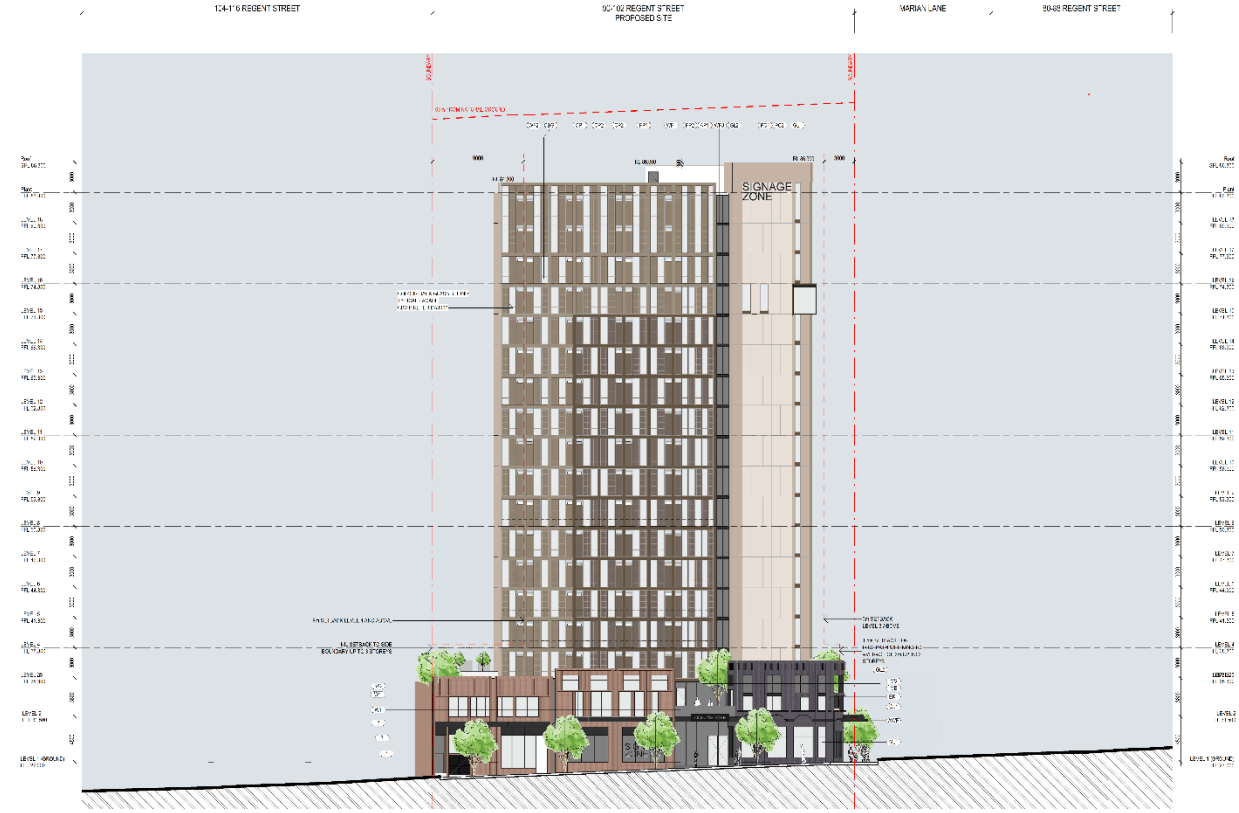
DA0000	COVER SHEET
DA0001	PERSPECTIVE 1
DA0002	PERSPECTIVE 2
DA0003	PERSPECTIVE 3
DA0004	PROJECT SUMMARY
DA0005	VIEW ANALYSIS
DA0006	COMMON SPACE STRATEGY DIAGRAMS
DA1001	SITE PLAN
DA1002	SITE ANALYSIS
DA1003	STREET ELEVATIONS
DA1004	DEMOLITION PLAN
DA1005	SETBACK SITE PLAN
DA1006	SETBACK SITE PLAN COMPLYING
DA1007	SETBACK PLAN
DA2000	BASEMENT FLOOR PLAN
DA2001	GROUND & MEZZANINE FLOOR PLANS
DA2002	TYPICAL FLOOR PLANS
DA2003	LEVEL 6 & 10 COMMUNAL FLOOR PLANS
DA2004	LEVEL 15 & 16 COMMUNAL FLOOR PLANS
DA2005	ROOF PLAN
DA2100	GFA PLANS
DA3001	SECTION A
DA3002	SECTION B
DA3003	SECTION C
DA3004	SECTION D
DA3005	EAST ELEVATION
DA3006	NORTH ELEVATION
DA3007	WEST ELEVATION
DA3008	SOUTH ELEVATION
DA3009	STREET ELEVATIONS
DA3010	STREET SECTIONS
DA4001	NOTIFICATION PLAN
DA4002	NOTIFICATION ELEVATION
DA5003	SIGNAGE DETAIL
DA5101	SHADOW DIAGRAMS EXISTING
DA5102	SHADOW DIAGRAMS PROPOSED
DA5103	SHADOW DIAGRAMS PROPOSED & FUTURE DEVELOPMENT
DA5104	SHADOW DIAGRAMS COMPLYING
DA5201	SUN EYE VIEWS - WINTER SOLSTICE 8-9AM
DA5202	SUN EYE VIEWS - WINTER SOLSTICE 9-10AM
DA5203	SUN EYE VIEWS - WINTER SOLSTICE 10-11AM
DA5204	SUN EYE VIEWS - WINTER SOLSTICE 11-12AM
DA5205	SUN EYE VIEWS - WINTER SOLSTICE 12-1PM
DA5206	SUN EYE VIEWS - WINTER SOLSTICE 1-2PM
DA5207	SUN EYE VIEWS - WINTER SOLSTICE 2-3PM
DA5208	SUN EYE VIEWS - WINTER SOLSTICE 3-4PM
DA5301	VISUAL PRIVACY - 80-88 REGENT STREET
DA5302	VISUAL PRIVACY - 7-9 GIBBONS STREET
DA5303	VISUAL PRIVACY - 11 GIBBONS STREET
DA5304	VISUAL PRIVACY - 13-23 GIBBONS STREET
DA5305	VISUAL PRIVACY - 133-135 REGENT STREET
DA5400	FACADE STRATEGY
DA5401	FACADE DETAIL - REGENT STREET
DA5402	FACADE DETAIL - MARIAN STREET
DA5403	FACADE DETAIL - PRECAST CONCRETE
DA5404	FACADE DETAIL - SOUTH PRECAST CONCRETE
DA5405	INTERIOR VIEWS
DA5504	VISUALISATIONS
DA5505	VISUALISATIONS
DA5506	VISUALISATIONS

3.2 ARCHITECTURAL DRAWINGS

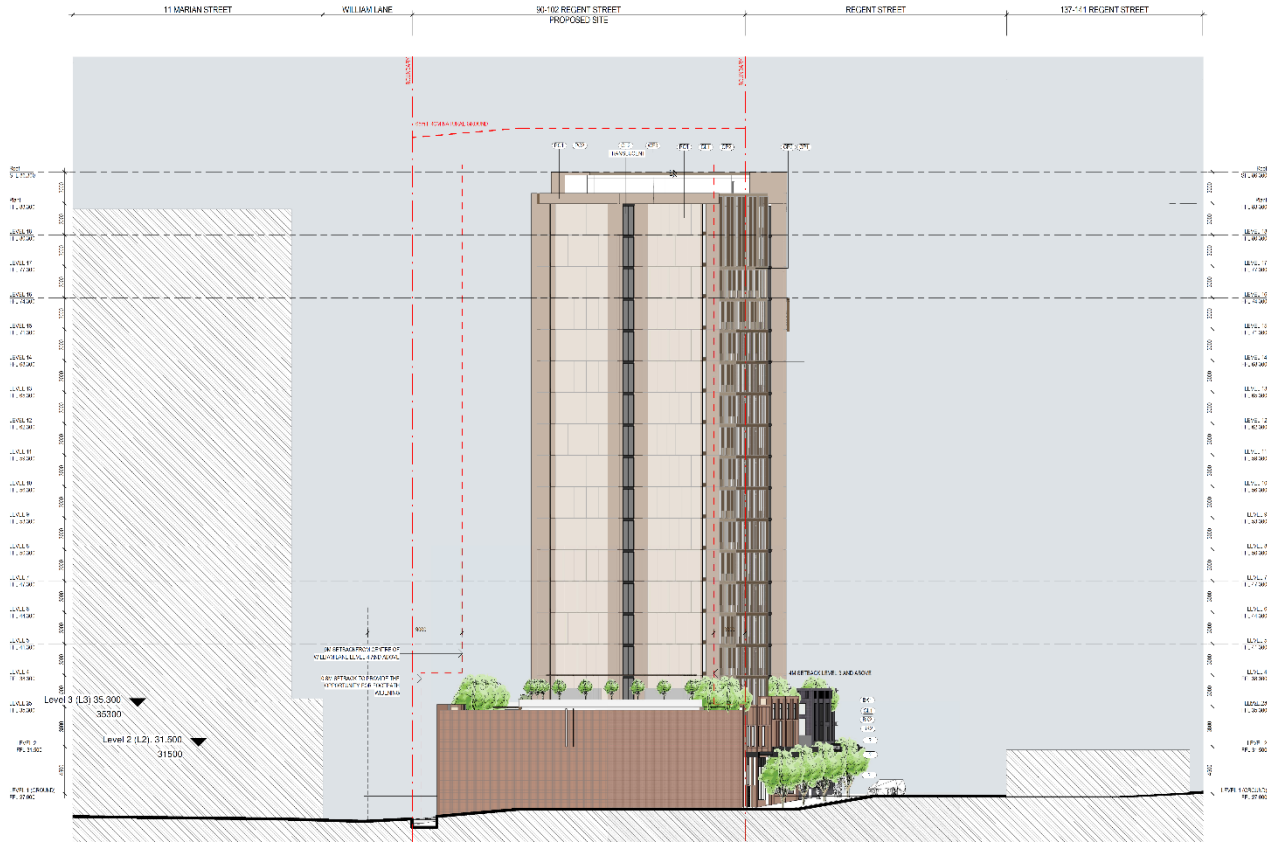
Selected architectural drawings for the proposed development are provided below.

North Elevation:

East Elevation:



South Elevation:



West Elevation:

4 ECOLOGICALLY SUSTAINABLE DESIGN (ESD) INITIATIVES

The principles of ecologically sustainable development are an integral consideration in design and construction of proposed development and also in assessing its benefits and impacts.

The design team will focus on a wide range of ESD strategies which will result in high levels of environmental performance and an increment on occupant's health, productivity, comfort and satisfaction.

4.1 INTEGRATED DESIGN APPROACH

The integrated design process is a process by which all of the design variables that affect one another are considered together and resolved in an optimal fashion. Often referred to as holistic design, this approach considers the development as a whole with the emphasis on integrating the different aspects of building's design.

4.2 GREENHOUSE GAS EMISSION REDUCTION

Greenhouse gas emission reduction is achieved in a staged approach:

- First, reduction in overall energy consumption through demand reduction, passive design and energy efficiency, then;
- Reduction in electricity and gas utility consumption by utilising waste products and renewable energy technologies (where feasible).

The integrated response to energy proposed for this project is summarised below:

1. Load Reduction and Passive Design
2. System Efficiency
3. Capture Waste
4. Renewable Energy (where feasible)

Energy consumption will be reduced through the efficient design of lighting, air-conditioning and ventilation systems, as well as energy efficient water heating and renewable energy technologies (where feasible). The development will consider Greenhouse gas emission reduction in design and operation through utilising energy conservation measures suitable for the development.

The following sections of the report outline the sustainability initiatives that will be considered and further developed by the design team during the detailed design stages.

4.3 MANAGEMENT

The initiatives under the management category promote the adoption of environmental principles from project inception, design and construction phases to the operation of the building and its systems.

This category aims to highlight the importance of a holistic and integrated approach to constructing a building with good environmental performance. The following measures are some of the initiatives targeted within the management category and are subject to further design development. These initiatives aim to reduce environmental impacts at construction and operational stages as well as to maximise building performance at commissioning.

4.3.1 ENVIRONMENTAL RATINGS AND INVOLVEMENT OF A GSAP

Environmental rating schemes such as Green Star (Australia), LEED (US), Living Building Challenge (US) or BREEAM (UK) are used to create a marketable environmental credential based on achievement of a recognised benchmark. Green Star is the most recognised rating scheme in Australia, with hundreds of certified buildings, mostly office buildings. The new Green Star – Design and As-Built chosen as an appropriate benchmark for the project.

Green Star includes a range of categories under which credits are available. Points are scored under each credit, and the total score is used to determine a final rating; 45-59 points for 4 Star, indicating Best Practice, 60-74 points for 5 Star, indicating Australian Excellence; and 75 or more points for 6 Star, indicating World Leadership. The categories are as follows:

- Management

- Indoor environment quality
- Energy
- Water
- Transport
- Materials
- Land use and ecology
- Emissions
- Innovation

Whilst this development is not seeking a formal Green Star, it is recommended to involve a Green Star Accredited Professional (GSAP) as part of the design to prepare the necessary ESD guidelines. The ESD consultant from Vipac (author of this report) is a Green Star Accredited Professional and has been involved in the initial design stages of the development.

4.3.2 COMMISSIONING CLAUSES

Commissioning of building systems to a high standard, with independent oversight, will ensure that a quality process is followed and provide an outside review of the practicalities of the design. An extended building tuning period should be undertaken following defects liability period to ensure that systems are performing as intended, taking into account different seasonal variables, and that any need for recommissioning is identified and carried out.

To adopt commissioning and handover initiatives that ensure that all building services can operate to optimal design potential, such as:

- Where possible, comprehensive pre-commissioning, commissioning, and quality monitoring to be contractually required to be performed for all building services (BMS, mechanical, electrical and hydraulic).

4.3.3 BUILDING TUNING

After handover, the building owner is expected to implement tuning of all building systems and undertake full re-commissioning 12 months after practical completion;

4.3.4 BUILDING USER'S GUIDE

To produce a Building User's / Occupant's Guide, information management that enables building users / occupants to optimise the building's environmental performance during its operation;

4.3.5 ENVIRONMENTAL MANAGEMENT PLAN

The contractor is expected to adhere to a comprehensive Environmental Management Plan (EMP) for the works. Contractors are recommended to be ISO 14001:2004 certified. Environmental management plans and systems should be implemented to ensure that demolition and construction activities appropriately manage and mitigate environmental impacts.

4.3.6 WASTE MANAGEMENT SYSTEM

To encourage and facilitate effective waste management once the development is in operation, sufficient spatial provision will be made to allow for the effective separation of waste from recycling. Dedicated waste recycling rooms allow space for the separation and storage of recyclable waste during the building's operation, allowing for the following waste streams to be separated:

- Glass;
- Cardboard;
- Paper;
- Organics.
- Plastics,
- Metals.

Waste management solutions are varied and dependant on the extent of commitment of the end user. Recycling, reuse and composting are examples of waste management options.

4.3.7 ENVIRONMENTAL MANAGEMENT AND MAINTENANCE

Effective environmental and waste management will be implemented throughout the demolition, construction and operational stages of this development.

The EMP shall include a Waste Management Plan, specifying recycling targets for demolition and construction waste. It is recommended that construction and demolition contracts stipulate a minimum 90% target for diversion of waste from landfill. This may be achieved through recycling or reuse.

- Identification of appropriate waste sub-contractors for recycling, costs of collection and timing of collection service;
- Participation in waste minimisation training for contractors and sub-contractors;
- Published waste minimisation plan to reduce site waste to landfill;

Provision of separate waste skips for cardboard, timber, metal, soft plastic, polystyrene, insulation, concrete, glass and bricks.

4.4 INDOOR ENVIRONMENTAL QUALITY (IEQ) INITIATIVES

Indoor Environmental Quality initiatives consider the wellbeing of occupants, addressing factors such as heating, ventilating and air conditioning (HVAC), lighting, indoor air quality and building attributes, all of which contribute to good indoor environmental quality.

The following measures are some of the initiatives targeted within the IEQ category for further consideration and development during detailed design.

- Improvement of outside air rate by providing at a rate greater than AS1668.2 requirements. Air-conditioning system will be installed with carbon dioxide monitoring and control to ensure sufficient outside is delivered to occupants.
- Optimisation of the air quality by improving air change effectiveness
- Maximisation of natural lighting level to the building occupants
- Minimisation of the contribution and levels of Volatile Organic Compounds (VOCs) via the use of low VOC paints, adhesives and sealants, carpets and flooring.
- All engineered wood products to be used in the development will have low formaldehyde emission.
- High efficiency lighting system with suitable luminance levels to avoid causing discomfort and strain for the occupants. All fluorescent luminaries are to be installed with high frequency ballasts to avoid discomfort caused by low frequency flicker.
- External Views: The design allows unobstructed external views for the majority of occupied spaces;
- Internal noise level at an appropriate level to ensure the occupants' satisfaction and wellbeing.

4.4.1 THERMAL COMFORT

Thermal comfort can be provided by passive and mechanical means. Passive design initiatives will be considered before the design of the mechanical systems to reduce operational energy costs, with potential reductions in the air conditioning size and ongoing maintenance.

Thermal comfort is a function of the following factors:

- Radiant temperature (45% of net comfort effect);
- Air temperature and humidity (35% of net comfort effect);
- Air movement, clothing and activity (20% of net comfort effect).

Passive heating and cooling design strategies which will improve occupant thermal comfort include:

- Roof insulation not only reduces heat gain and loss, but will also moderate radiant temperatures from the walls, floor and ceiling;

- Building facades with high performance glazing and window frames will have a combination of external shading and high-performance glass to reduce heat transfer and radiant temperatures in proximity to the windows.

Indoor areas will be designed to be protected from excessive summer solar radiation, reducing radiant heat loads on the space, but still providing enough daylight during appropriate times of the year to improve comfort levels.

4.4.2 EFFECTIVE DAYLIGHTING / NATURAL LIGHTING

Daylighting is the architectural and services design to allow maximum daylight penetration into a building whilst minimizing heat gain and thereby reducing indoor lighting loads.

The level of natural light in the building is primarily determined by the extent and type of glazing, and the depth of the building floor plate. Extent of glazing must be optimised to allow maximum daylight, views, and winter sun, while minimising uncomfortable glare and excessive solar heat gains in summer. Glazing should be selected with a high Visual Light Transmission to maximise daylight penetration.

Daylighting strategies will be considered to allow effective control of indoor lighting levels whilst minimising power consumption for the building. High level of architectural input regarding design, orientation and external shading will be considered to effectively maximise natural lighting for the building.

Daylighting strategies combined with dimmable lighting systems will allow high control of indoor lighting levels whilst minimising power consumption for the building.

4.4.3 NATURAL VENTILATION

Where possible (depending on the acoustic limitations), a number of units will benefit from Natural ventilation and when exterior conditions are suitable, occupants will utilise the operable windows and doors to the facade which will provide natural ventilation. When acoustic conditions allow, all rooms can be Naturally Ventilated. The design of the windows, when open will allow the introduction and extraction of air through operable windows.

The materials specification of the windows and doors shall consider issues relating to durability, aesthetics and integration with other façade elements. The final selection of the glass and window system will be subject to detailed design phase of the project.

4.4.4 VOLATILE ORGANIC COMPOUNDS (VOC) & FORMALDEHYDE MINIMISATION

To ensure long term comfort of occupants, all due care will be taken to minimise VOC and formaldehydes used within the building. Maintaining VOC limits below the recommended levels will assist in reducing any potential detrimental impacts on occupant health arising from products which may emit volatile pollutants.

VOC’s are commonly found in carpets, paints, adhesives and sealants uses in construction and extensive exposure to VOC’s can cause Sick Building Syndrome effects (eye, nose and skin irritation, headaches lethargy etc.).

Formaldehydes are found within composite wood products and extensive exposure can cause irritation to eyes, nose and throat, lead to skin ailments and respiratory system ailments such as asthma.

Where possible, contamination of indoor air by common indoor pollutants will be minimised in this development by careful material selection, including:

- Use of low-VOC and water-based paints rather than oil-based paints, stains or sealants, reducing indoor air contamination and consequent side-effects including sick-building syndrome and respiratory problems;
- Selection of low-VOC carpets and adhesives;
- Selection of low formaldehyde composite wood products, avoiding the carcinogenic effects of formaldehyde off-gassing.

4.5 ENERGY CONSERVATION INITIATIVES

It is essential to ensure the building is designed and built to minimise energy consumption and reduce or eliminate greenhouse gas emission to the atmosphere. Energy performance is considered by the design team as a crucial issue.

The energy conservation initiatives aim to reduce the overall energy consumption for the project directly contributing to greenhouse gas emissions and energy production capacity.

Greenhouse reductions are achieved in a staged approach:

- Reduction in overall energy consumption through demand reduction and energy efficiency.
- Reduction in electricity and gas utility consumption by utilising waste products and renewable energy technologies.

Several strategies will be assessed and put in place to minimise energy consumption.

The integrated energy strategies being considered for the development include:

Load Reduction (minimising the need for resource consumption e.g. energy, water and material)	Passive Design
	Building fabric improvements
	Maximise use of natural lighting
	Use of Natural Ventilation (where possible)
Optimising energy and water consumption	High efficiency Heating, Ventilation and Air Conditioning
	High efficiency lighting
	High efficiency hot water systems
	High efficiency appliances
Use of renewable resources (e.g. Solar Energy)	Application of Solar Energy or Solar thermal systems where practical

4.5.1 PASSIVE DESIGN

The development will utilise passive design to minimise the amount of air-conditioning required and therefore significantly reduce the building's energy consumption and greenhouse performance. A building's form, fabric and orientation will have the biggest influence on its thermal comfort and environmental performance. The following factors will be considered in the detailed stages of the design:

- Orientation
- Shading
- Structure
- Insulation
- Glazing

4.5.2 BUILDING ENVELOPE

The building envelope will be designed to reduce heating and cooling requirements through passive design principles. The role of the building envelope is to block solar gains from penetrating the building fabric in summer while optimising daylight and minimising glare. The glazing performance and shading configuration for each orientation will be optimised to ensure that thermal comfort is achieved and solar gains are adequate for the efficient operation of the mechanical system.

Insulation

The building envelope will be treated with the required levels of thermal insulation to reduce heat gains in hot days and to minimise heat losses in cold days through conduction. This will have significant impact on reducing energy consumption.

Insulation reduces the heat transfer between the internal and external conditions. Adequate insulation will be allowed for the ceilings, floors and walls to reduce the heating and cooling load of the building and to reduce the ongoing operational costs. This has a twofold saving through a smaller mechanical system capacity along with operating energy consumption reduction.

All insulations installed are required to meet NCC and AS/NZ 4859.1 and the builder is required to ensure compliance, during construction.

The thermal insulation requirements will be compliant with the minimum BASIX and the NCC Section J requirements.

Glazing and Window Framing

Adequate performance glass will be provided to reduce excessive heat gains in hot conditions, increasing periods when natural ventilation will be able to restore thermal comfort, and therefore reducing the frequency of air conditioning use.

The following glazing parameters will be considered:

- U-Value: a measure of how much heat is passed through the glass.
- Solar Heat Gain Coefficient (SHGC)
- Visible Light Transmission (VLT): the percentage of visible light transmitted by the glass.

Where possible, the glazing will have a low SHGC to avoid heat gains in the summer, and a low U-value to reduce losses in the winter through the glass. The performance of the proposed glazing systems (glass and frame) are required to comply with NFRC100-2001 conditions and using the tested AFRC values.

Consideration will be given to incorporating effective shading features into the design to avoid the necessity for low shading coefficients in the glass, which usually also decrease the visible light transmission (VLT) of the glass. To maximise the natural daylight within the building, VLT should be as high as possible.

Glazing properties will be specified in conjunction with the shading arrangement on each orientation to control solar loads imposed on the mechanical systems, ensuring thermal comfort, optimising daylight penetration and preventing glare. This strategy will effectively minimise direct solar loads whilst maximising daylight penetration and access to views.

To reduce heat losses in cold days, especially at night, the use of blinds will limit the contact between the internal air and the glass, therefore reducing heat losses by conduction.

The glazing performance requirements shall comply with the minimum BASIX and the NCC Section J requirements.

4.5.3 ENERGY EFFICIENT SYSTEMS AND SERVICES

The mechanical and electrical systems for the building will be developed to minimise the need for plant equipment and will be designed to be responsive to the immediate climatic conditions.

Energy consumption will be reduced through the efficient design of lighting, air-conditioning, hot water and ventilation systems. The following energy efficiency initiatives will be further investigated and where feasible incorporated in the building services design.

Efficient Artificial Lighting

Lighting efficiency is important in maintaining low energy consumption for reuse projects. Lighting consumption for a facility such as this could account between 15-25% of the estimated energy use of the facility.

High efficiency lighting and effective control initiatives such as daylight and movement sensors will be considered to reduce artificial lighting energy consumption and allow maximum advantage to be taken of natural lighting.

Lighting power density is required to meet AS1680 and NCC requirements. Energy efficiency for the internal lighting throughout the building is required to be in accordance with NCC energy efficiency requirements and the following.

- High quality LED lighting where applicable;
- Lighting control system based on smart zoning, occupancy profiles and operational hours, dimming controls and timers.

Photoelectric (PE) / Photodiode sensors or similar controls to detect when external lighting should switch on and off to reduce the energy consumption associated with external lighting where possible.

No external lighting is to be installed such that any direct light beam results into the night sky either generated from within the site. The path of any direct light's angle of incidence that is directed to the sky must be obstructed by a non-transparent surface and the lighting design and is to comply with AS4282 'Control of the Obtrusive Effects of Outdoor Lighting.

Efficient Heating, Ventilation & Air-Conditioning (HVAC)

Heating and cooling of the building accounts for a large portion of the building's energy use throughout the year. Selection of highly efficient HVAC equipment with high performance levels not only minimises energy consumption, but also reduces operational energy costs.

The design of the mechanical services will be to industry Best Practise Standards. An emphasis will be placed on providing low energy Heating Ventilation Air Conditioning (HVAC) systems and strategies. To ensure the energy efficient performance of HVAC systems specified and installed mechanical plant will be of high quality and supplied by leading industry manufacturers.

The energy efficiency of HVAC system is required to meet the minimum requirements of the National Construction Code (NCC), Green Star provisions where feasible and relevant Australian Standards including but not limited to AS1668.1, AS1668.2, AS 1682 and AS3666.

The following energy initiatives will be further considered in the detailed design phase:

- The air conditioning strategy is optimized to reduce energy consumption and maximize efficiency. For example, by moderating the amount of fresh air relative to the number of people in the space, through the use of CO2 detectors. The system will be zoned to increase the flexibility in the use of different spaces and reduce overall consumption.
- Variable speed drives will be provided to fans and pumps where feasible.
- Full outside air cycle will be provided to all air handling systems.
- Building commissioning and building tuning to be undertaken to ensure that the building systems function as required to achieve energy efficiency design targets.

All refrigerant plant will be specified such that the refrigerant type has Zero Ozone Depletion Potential (ODP).

When outside conditions are not favourable for the natural ventilation mode of operation, the mechanical system shall deliver thermal comfort when spaces are occupied.

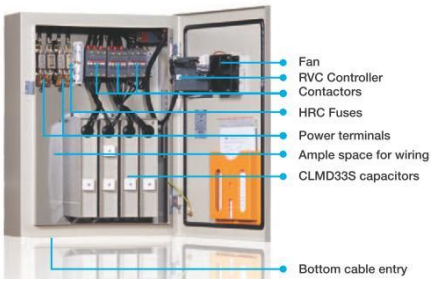
Manually operable windows will allow bedrooms and living rooms to be naturally ventilated when external temperature conditions are favourable. During periods when external temperature conditions prevent the opening of windows or during hot nights when acoustic issues will limit the opening of windows, a dedicated reverse cycle heat pump refrigerant.

Common area ventilation systems are to include variable speed modes where appropriate and are to be linked to light switches where feasible to limit the extent of operation and improve energy efficiency of these areas.

Power Factor Correction

To reduce maximum kVA demand on the electricity grid and lower the demand charges, power factor correction units will be provided at the main switch board(s) in accordance with the NSW Installation and Service Rules.

The power factor correction units proposed will improve the power to a factor of 0.98 or higher.



Monitoring & reporting

To enable effective monitoring and tracking of energy and water consumption, sub-metering will be considered for systems with major energy use, to help identify areas of inefficiency with potential for improvement.

Metering is to be provided throughout the building and central services for all major building plant and equipment. An effective monitoring system is to be provided to monitor energy and water consumption throughout the building as required.

Ongoing reporting may allow the manager of the facility to set goals for energy consumption reductions and attributed energy costs to particular uses. By monitoring energy, losses and wastage can be identified, therefore improving the overall performance of the building in operation. This initiative is subject to further design development and review.

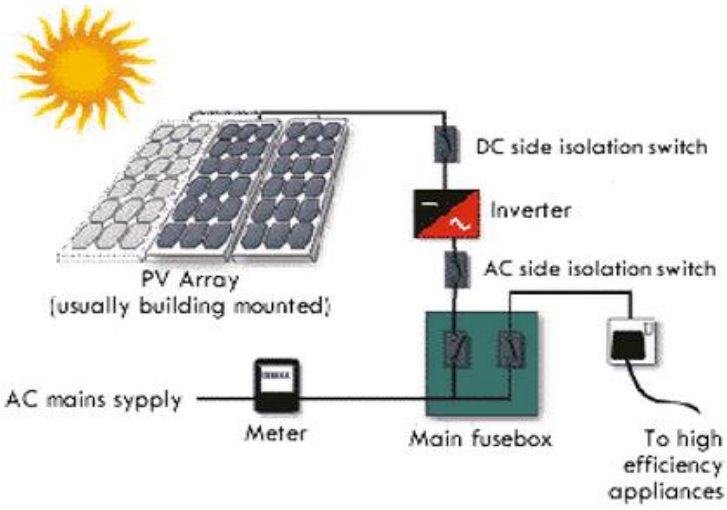
Hot Water Systems

High efficiency central gas hot water systems will be used to provide the Domestic Hot Water demands for the facility.

4.5.4 RENEWABLE ENERGY – SOLAR PHOTOVOLTAIC (PV) SYSTEM

Photovoltaic (Solar PV) is a common and widely accepted technology to generate electricity onsite. The generated electricity can be harnessed and used to power any number of devices. It is proposed that the PV panels are mounted on the roof where they will be out of sight and produce the optimum energy output.

PV modules have a very long lifetime with many manufacturers guaranteeing an output of at least 80% of manufactured capacity for 20 years. Another benefit of PV is that it can be installed in various system sizes and the modular design of the systems allows retrofitting of additional panels if required in the future.



There are generally three types of solar panels available: mono-crystalline (proposed for this development), poly-crystalline and amorphous. Each of these have their advantages and disadvantages and efficiencies range from 6% for amorphous to 19% for mono-crystalline

A 40 kW PV system is currently considered for this development. The exact system sizing, configuration and final design will be completed during the design stage. The expected renewable energy generation by the system is approx. 60.8 MWh per annum.

Solar PV - System Components

The Photovoltaic (PV) system may consist of the following main components or of equal capacity.

Total nominal power: **40 kW**

Approx. roof space requirements: **280 m^2**

Estimated Capital Costs (without battery): **$50,000 (Exc GST) after rebates**

Estimated Payback Period: **< 4 yrs**

Components	Brand, Model & Quantity
PV Inverter	SMA – Quantity: 4 x 10kW
PV Panels	LG - Neon 330 – capacity: 330W - Quantity: 120 Approx.
Battery storage	Tesla Powerpack or other similar systems
PV mounting frame and system balance	Quantity: depending on the requirements and final design

The exact sizing, configuration and final design will be completed during the design stage. Please refer to Appendices A & B for technical data sheets of the proposed PV panels (LG) and grid-connected solar PV inverter (SMA).

Solar PV - Projected energy generation based on a 40-kW system

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Grid system presizing

Geographical Site	**Sydney**		Country	**Australia**	
Situation	Latitude	-33.87° S	Longitude	151.20° E	
Time defined as	Legal Time	Time zone UT+10	Altitude	42 m	
Collector Plane Orientation	Tilt	10°	Azimuth	0°	

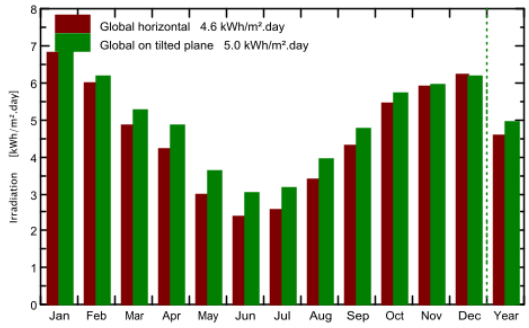
PV-field installation main features

Module type	Standard
Technology	Monocrystalline cells
Mounting method	Facade or tilt roof
Back ventilation properties	Ventilated

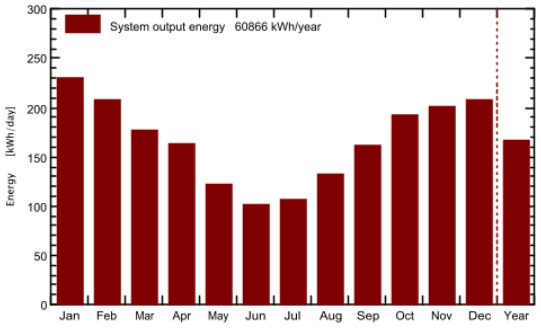
System characteristics and pre-sizing evaluation

PV-field nominal power (STC)	Pnom	40.0 kWp		
Collector area	Acoll	250 m²		
Annual energy yield	Eyear	60.9 MWh	Specific yield	1,522 kWh/kWp

Meteo and incident energy



System output



	Gl. horiz. kWh/m².day	Coll. Plane kWh/m².day	System output kWh/day	System output kWh
Jan.	6.84	6.86	230.6	7149
Feb.	5.99	6.19	208.2	5829
Mar.	4.87	5.25	176.6	5475
Apr.	4.23	4.86	163.4	4902
May	2.99	3.64	122.2	3789
June	2.40	3.01	101.3	3038
July	2.56	3.17	106.6	3304
Aug.	3.38	3.94	132.5	4108
Sep.	4.32	4.79	160.9	4826
Oct.	5.46	5.73	192.7	5973
Nov.	5.89	5.97	200.7	6020
Dec.	6.22	6.19	208.1	6452
Year	4.59	4.96	166.8	60866

4.6 TRANSPORT SUSTAINABILITY MEASURES

The use of transport (both private and commercial) is a major contributor to environmental pollution and the excessive consumption of natural resources. The following sustainable transport principles are recommended.

- Improve amenity for active transport users (pedestrians and cyclists), with attention paid to the needs of students who generally have a greater reliance on active transport,
- Promote nearby cyclist facilities to enhance the uptake of cycling to the facility,

Given the site location of the development, the occupants will be able to take advantage of local public transport networks and available facilities around the site such as retail shops.

The following measures are some of the initiatives included as part of the green travel plan to reduce dependence on motorised vehicles, encouraging walking, cycling and the use of mass public transport.

- **Provision of zero car parking.**
- **Cyclist facilities:** provision of bicycle racks in a prominent location to promote use of cycling.
- **Public Transport:** The building is close to public transport with a number of bus routes served; building occupants are encouraged to use mass transport to travel.
- **Trip Reduction:** The development is located adjacent to a number of local amenities, reducing the need for trips;
- **Active transport:** William Lane widening footpaths and connecting to the through site link at 13-23 Gibbons St to create a better pedestrian environment and encourage walking.

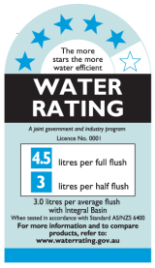
4.7 WATER CONSERVATION AND MANAGEMENT INITIATIVES

The water conservation category aims to reduce the overall water potable consumption and provide effective mechanisms for recycling of water uses on site.

The approach to water efficiency for the development will focus on reducing water demand through conservation measures and water reuse systems. Water conservation strategies proposed for this project include:

- Reducing the potable water consumed within the development through demand management.

4.7.1 DEMAND MANAGEMENT



Strategies to minimise consumption include water-efficient fittings and fixtures, water-efficient appliances and low-water use air-conditioning and irrigation systems. In order to reduce the overall water consumption for this development, the following initiatives will be considered.

All water fixtures to be installed to the building are to be water efficient and where possible exceed the BASIX requirements. The following criteria are provided as a guide and subject to further design development.

Water Fixtures	Hand wash basins – 5 Star WELS;
	Kitchen taps – 5 Star WELS;
	Showerheads – 3 Star WELS or higher;
	Toilets – 3 Star WELS or higher;
Appliances	Central clothes washers rating – 2.5 Star WELS or higher
Air Conditioning	Minimise use of water-cooled systems
Landscape Irrigation (where applicable)	Native and water efficient species
	Sub-surface irrigation

4.7.2 LANDSCAPE SELECTION

The use of native, drought-resistant planting will be considered to reduce water consumption used in irrigation. Sub-soil irrigation systems should be considered where non-native species are selected.

4.7.3 WATER CONSUMPTION MONITORING AND REPORTING

Where practical, it is recommended that all major water uses within the building to be provided with water meters. This includes central services, irrigation systems, potable water, non-potable water sources.

Water monitoring will assist to identify abnormal usage patterns usually associated with leaks, helping to reduce the considerable water lost in this way. In addition, it would also allow to measure and verify the impact of any water efficiency measures implemented in the facilities.

4.8 MATERIALS

This category aims to reduce the consumption of natural resources and encourage the reuse of materials. The various environmental and human health impacts arising from building materials are reduced when special attention is given to the selection of ecologically preferable materials.

To minimise the environmental impact of the development, preference will be given to environmentally responsible materials during the selection process, according to the following principles:

- Avoidance of ecologically sensitive products (such as scarce minerals and old-growth forest)
- Selection of materials with a low embodied energy and high recycled content;
- Low toxicity material selection;
- Low impact on the indoor environment;
- Durability, flexibility and recyclability;
- Emissions in manufacture and composition, including greenhouse gases and ozone depleting substances;
- Waste reduction
- Provisions for appropriate recycling storage space that facilitates recycling

The targeted initiatives will reduce embodied energy and environmental impacts caused by the whole life cycle of building materials.

4.8.1 REUSE AND CONSERVATION OF MATERIALS

Where possible reuse the building material to conserve embodied energy and water. By conserving the building fabric or structure the waste volumes are significantly reduced for the development.

4.8.2 NEW MATERIALS

Material specifications for the project will consider elements of sustainability that relate to the following factors of durability, embodied energies, renewable sources content, ease of manufacturing, ability to be recycled / reused / reconditioned, maintenance, local availability, VOC content, emission production, affordability and toxicity.

Where feasible the materials specified for this project are to consider the above environmental measures through a comparison between different product types and manufacturers where possible. The design team is to adopt this approach in assessing suppliers and products for the development.

Interiors finishes will consider the concentration of Volatile Organic Compounds with products for adhesives, paints, carpets and floor sealants. The design team will work with suppliers and contractors to identify opportunities to reduce the level of VOC's within products and finishes.

4.8.3 MATERIALS WITH OZONE DEPLETION POTENTIAL

Selection of insulation will be targeted to minimise Ozone Depletion Potential (ODP).

4.8.4 OPERATIONAL WASTE MINIMISATION

To encourage and facilitate effective waste management once the facility is in operation, sufficient spatial provision will be made to allow for the effective separation of waste from recycling. Dedicated waste recycling rooms allow space for the separation and storage of recyclable waste during the building's operation, allowing for the following waste streams to be separated:

- Glass;
- Cardboard;
- Paper;
- Organics.
- Plastics,
- Metals.

Waste management solutions are varied and dependant on the extent of commitment of the end user. Recycling, reuse and composting are examples of waste management options.

The following waste streams have currently been identified:

- Office waste
- Paper and cardboard
- Plastics
- PET bottles and containers, cans and glass
- Compostable material
- Grease and fats
- Cigarette butts
- Light tubes
- Toxic or hazardous materials
- Foam
- Cleaning products and other substances going down drains
- Composting of organic waste from the restaurant, for re-use within the Greenhouse.

4.8.5 TIMBER

Where possible, timber will be supplied from sustainable sources including Forestry Stewardship Council (FCS) certified plantation timbers and recycled products. No timber (either solid or veneer form) will be sourced from rainforests or old-growth forests.

4.8.6 PVC MINIMISATION

PVC is being phased out in the European Union, as there is widespread evidence to its harmful environmental impact, particularly during disposal or fire. PVC is used in almost all electrical and data cabling and for drainage pipework. Alternatives to PVC products will be used where feasible:

- HDPE and polypropylene pipe work instead of PVC pipe for water supply and drainage systems;
- Linoleum and other natural products instead of vinyl floor coverings;
- Composite materials for electrical cabling.

4.9 LAND USE AND ECOLOGY

This initiative refers to improvements through Reuse of Land or Change of Ecological Value. The site has been previously built on, and is not a Greenfield. The new development will aim to enhance permeable area and vegetation improving the ecological value of the site.

4.10 EMISSIONS

In addition to the reduction in greenhouse emissions as a result of lower on-site energy usage, emissions to land, air and water will be minimised. The following measures are some of the initiatives targeted within the emissions category:

- Where available, thermal insulation products should be selected which have a low Ozone Depletion Potential in their manufacture and composition, reducing the impacts of insulation on the atmosphere;
- Where feasible, refrigerants will have an Ozone Depletion Potential of zero; and integrated refrigerant leak detection will ensure early identification of leaks;
- Estimated wastewater discharge to sewer will be significantly reduced relative to a standard building through the implementation of water efficiency measures;

- Watercourse Pollution: Design that minimises stormwater run-off to and the pollution of the natural watercourses.
- Light Pollution: No light beam will be directed upwards or outside the building. External lighting will be in accordance with AS 4282-1997. This will assist to minimise interference and disturbance to neighbouring properties and wildlife.

5 Disclaimer

This report is prepared using the information described above and inputs from other consultants. Whilst Vipac has endeavoured to ensure the information used is accurate, no responsibility or liability to any third party is accepted for any loss or damage arising out of the use of this report by any third party. Any third party wishing to act upon any material contained in this report should first contact Vipac for detailed advice which will take into account that party's particular requirements.

Computer performance assessment provides an estimate of building performance. This estimate is based on a necessarily simplified and idealised version of the building that does not and cannot fully represent all the intricacies of the building once built. As a result, simulation results only represent an interpretation of the potential performance of the building. No guarantee or warrantee of building performance in practice can be based on simulation results alone. Vipac and its employees and agents shall not be liable for any loss arising because of, any person using or relying on the Report and whether caused by reason or error, negligent act or omission in the report. The draft BASIX assessment has been prepared indicatively and using the limited architectural and building services design with the view to conduct a detailed assessment once the design is further developed.

Performance of the completed building may be significantly affected by the quality of construction; the quality of commissioning, ongoing management of the building, and the way the building is operated, monitored and maintained.

APPENDIX A - TECHNICAL DATASHEETS FOR SAMPLE PV PANELS (330 W)

LG325N1C-A5 | LG330N1C-A5

LG NeON® 2

ABOUT LG ELECTRONICS

LG Electronics embarked on a solar energy research programme in 1985, using our vast experience in semi-conductors, chemistry and electronics. LG Solar modules are now available in 32 countries. In 2013, 2015 and 2016 the LG NeON® range won the acclaimed Intersolar Award in Germany, which demonstrates LG Solar's lead in innovation and commitment to the renewable energy industry.

With over 200 lesser known brand panels selling in Australia, LG solar panels offer a peace of mind solution, as they are backed by an established global brand.

KEY FEATURES

Proven Field Performance

LG has been involved in a number of comparison tests of the LG panels against many other brand panels. LG NeON® models are consistently among the best performing in these tests.

Low LID

The N-type doping of the NeON® cells results in extremely low Light Induced Degradation (LID) when compared with the standard P-type cells. This means more electricity generation over the life of the panel, as the panel degrades less.

LG Corrosion Resistance Certification

LG NeON® 2 panels can be installed confidently right up to the coastline. The panels have received certification for Salt Mist Corrosion to maximum severity 6 and Ammonia Resistance.

Extensive Testing Programme

LG solar panels are tested between 2 to 4 times the International Standards at our in-house testing laboratories, ensuring a very robust and longer lasting solar module.

Strict Quality Control Reliable for the Future

The quality control of LG world-class solar production is monitored and improved using Six Sigma techniques via 500+ monitoring points to effectively maintain and improve our uncompromising quality.

Cyclone Wind Load Resistance

LG modules have a strong double walled frame. When it comes to wind forces (rear load) many competitor modules are certified to 2400 Pascals. LG modules are certified to more than double - 5400 Pascals, which provides at least double the strength and durability to a standard module.

Multi Anti-reflective Coatings Increase Output

LG is using an anti-reflective coating on the panels glass as well as on the cell surface to ensure more light is absorbed in the panel and not reflected. More absorbed light means more electricity generation.

Positive Tolerance (0/+3%)

If you buy a 330 Watt panel then the flash test of this panel will show somewhere between 330W and 340W. Some competitor panels have -/+ tolerance, so you could get a flash test result below the rated Watt, meaning you pay for Watts you never get.

Improved High Temperature Performance

Solar panels slowly lose ability to generate power as they get hotter. LG NeON® 2, has an improved temperature co-efficient to standard modules, which means in hot weather LG NeON® 2 panels will deliver higher output.

Anti PID Technology for Yield Security

PID (Potential Induced Degradation) affects the long term ability of panels to produce high level electricity output. LG panels have anti PID technology and have been successfully tested by leading third party laboratories regarding PID resistance.

"CELLO" Technology Increases Power

"CELLO" Multi wire busbar cell technology lowers electrical resistance and increases panel efficiency, giving more power per panel and provides a more uniform look to the panel.

Fully Automated Production in South Korea

All LG solar panels are manufactured in a custom designed and fully automated production line by LG in Gumi, South Korea ensuring extremely low tolerances. This means great quality and build consistency between panels.

LG NeON® 2

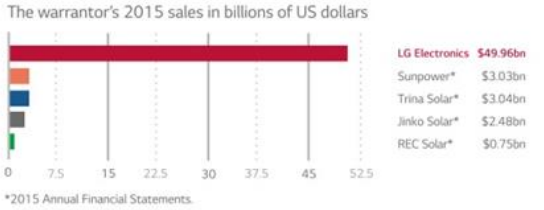
LG NeON® 2 – ENHANCED. MORE EFFICIENT. ADVANCED.

LG NeON® 2 solar modules now offer even more output. Featuring a classy design and with a total of 60 cells, it can withstand a load of 6,000 pascals. LG has lengthened its product warranty from 10 to 12 years and has improved its linear performance guarantee to 84.8 % of nominal output after 25 years. The LG NeON® 2 is an excellent choice for high performing long lasting solar systems.

LOCAL WARRANTY, GLOBAL STRENGTH

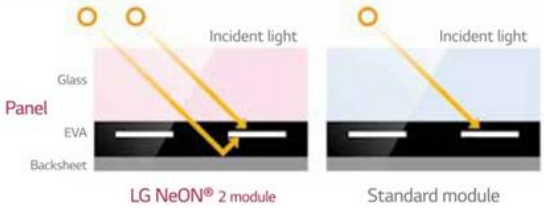
LG Solar is part of LG Electronics Inc., a global and financially strong company, with over 50 years of experience in technology.

Good to know: LG Electronics Australia Pty Ltd is the warrantor in Australia and NZ for your solar modules. So LG support, via offices in every Australian mainland state and NZ and through our 70 strong, Australia wide dealer network, is only a phone call away.



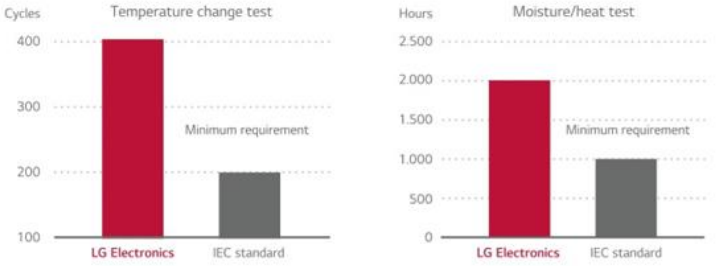
HIGHER OUTPUT, HIGHER YIELD

The NeON® Cell produces energy from both the front and the back of the cell. This innovative approach allows the absorption of light from the back of the cell which raises the panel's efficiency and power output. Standard panels only absorb light from the front.



EXCELLENT QUALITY, INDEPENDENTLY TESTED

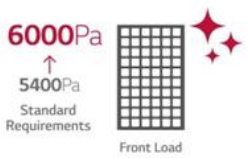
You can rely on LG. We test our products with at least double the intensity specified in the IEC standard. (International Quality Solar Standard).

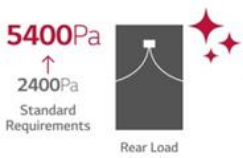


Our panel range have won a string of International Awards.

POWERFUL DESIGN, GUARANTEED ROBUST

With reinforced frame design, the LG NeON 2 can endure a front load of 6000 Pa which is the equivalent of 1048 kg over the size of the module. The rear load/wind load of the module is 5400 Pa which is more than twice the wind load resistance of standard modules (2400 Pa).





Longer Product Warranty

10yrs +2yrs

LG offers a two year longer product warranty for parts and labour than many competitors. 10 years to an impressive 12 years.

LG325N1C-A5 | LG330N1C-A5

LG NeON® 2

Mechanical Properties

Cells	6 x 10
Cell Vendor	LG
Cell Type	Monocrystalline / N-type
Cell Dimensions	161.7 x 161.7 mm
# of Busbar	12 (Multi Wire Busbar)
Dimensions (L x W x H)	1686 x 1016 x 40 mm
Front Load	6000 Pa
Rear Load	5400 Pa
Weight	18.0 kg
Connector Type	Genuine MC4, IP68 (Male: PV-KST4) (Female: PV-KBT4)
Junction Box	IP68 with 3 bypass diodes
Length of Cables	2 x 1000 mm
Front cover	High transmission tempered glass
Frame	Anodised aluminum with protective black coating

Certifications and Warranty

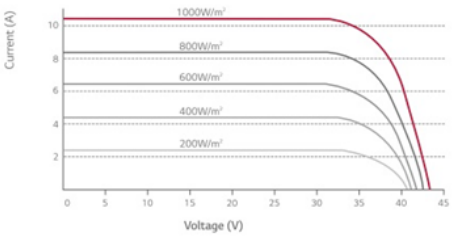
Certifications	ISO 9001
	IEC 61215, IEC 61730-1/-2, UL1703
	IEC 61701(Salt Mist Corrosion Test)
	IEC 62716 (Ammonia Test)
Module Fire Rating	Class C
Product Warranty	12 Years
Output Warranty of Pmax (Measurement Tolerance ± 3%)	Linear Warranty[1]

[1] 1) 1st year: 98%, 2) After 1st year: 0.55%p annual degradation, 3) 84.8% for 25 years

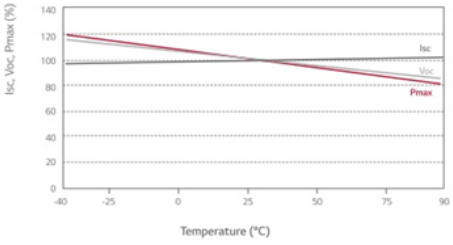
Temperature Characteristics

NOCT	45 ± 3 °C
Pmax	-0.37 %/°C
Voc	-0.27 %/°C
Isc	0.03 %/°C

Current – Voltage characteristics at various irradiance levels



Current – Voltage characteristics at various cell temperatures



Electrical Properties (STC[2])

Module Type	325 W	330 W
Maximum Power Pmax (W)	325	330
MPP Voltage Vmpp (V)	33.3	33.7
MPP Current Impp (A)	9.77	9.80
Open Circuit Voltage Voc (V)	40.8	40.9
Short Circuit Current Isc (A)	10.41	10.45
Module Efficiency (%)	19.0	19.3
Operating Temperature (°C)	-40 ~ +90	
Maximum System Voltage (V)	1000	
Maximum Series Fuse Rating (A)	20	
Power Tolerance (%)	0 ~ +3	

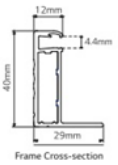
[2] STC (Standard Test Condition): Irradiance 1000 W/m², Module Temperature 25 °C, AM 1.5.
The nameplate power output is measured and determined by LG Electronics at its sole and absolute discretion.

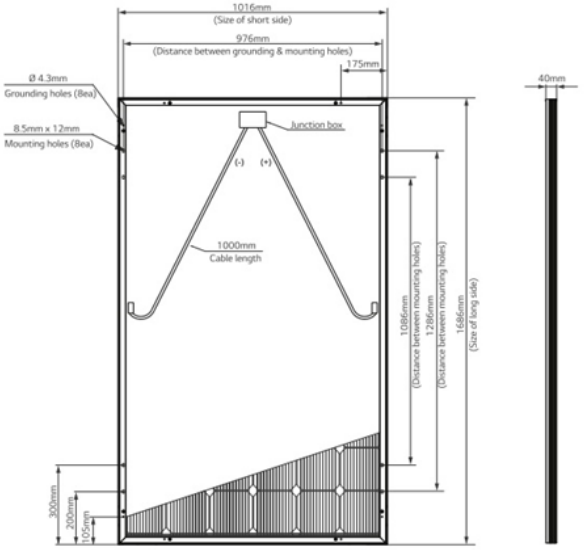
Electrical Properties (NOCT[3])

Module Type	325 W	330 W
Maximum Power Pmax (W)	240	243
MPP Voltage Vmpp (V)	30.8	31.2
MPP Current Impp (A)	7.78	7.81
Open Circuit Voltage Voc (V)	38.0	38.1
Short Circuit Current Isc (A)	8.38	8.41

[3] NOCT (Nominal Operating Cell Temperature): Irradiance 800 W/m², ambient temperature 20 °C, wind speed 1 m/s

Dimensions (mm)





LG Life's Good

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Solar Business Division
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Product specifications are subject to change without prior notice.
Date: 04/2017

APPENDIX B - TECHNICAL DATASHEETS FOR SAMPLE PV INVERTER

SUNNY TRIPOWER
15000TL / 20000TL / 25000TL

Efficient
- Maximum efficiency of 98.4%

Safe
- DC surge arrester (SPD type II) can be integrated

Flexible
- DC input voltage of up to 1000 V
- Multistring capability for optimum system design
- Optional display

Innovative
- Cutting-edge grid management functions with Integrated Plant Control
- Reactive power available 24/7 (Q on Demand 24/7)

SUNNY TRIPOWER
15000TL / 20000TL / 25000TL

The versatile specialist for large-scale commercial plants and solar power plants

The Sunny Tripower is the ideal inverter for large-scale commercial and industrial plants. Not only does it deliver extraordinary high yields with an efficiency of 98.4%, but it also offers enormous design flexibility and compatibility with many PV modules thanks to its multistring capabilities and wide input voltage range.
The future is now: the Sunny Tripower comes with cutting-edge grid management functions such as Integrated Plant Control, which allows the inverter to regulate reactive power at the point of common coupling. Separate controllers are no longer needed, lowering system costs. Another new feature–reactive power provision on demand (Q on Demand 24/7).

SUNNY TRIPOWER
15000TL / 20000TL / 25000TL

Technical Data	Sunny Tripower 15000TL
Input (DC)	
Max. DC power (at cos φ = 1) / DC rated power	15330 W / 15330 W
Max. input voltage	1000 V
MPP voltage range / rated input voltage	240 V to 800 V / 600 V
Min. input voltage / start input voltage	150 V / 188 V
Max. input current input A / input B	33 A / 33 A
Number of independent MPP inputs / strings per MPP input	2 / A:3; B:3
Output (AC)	
Rated power (at 230 V, 50 Hz)	15000 W
Max. AC apparent power	15000 VA
AC nominal voltage	3 / N / PE; 220 V / 380 V 3 / N / PE; 230 V / 400 V 3 / N / PE; 240 V / 415 V
AC voltage range	180 V to 280 V
AC grid frequency / range	50 Hz / 44 Hz to 55 Hz 60 Hz / 54 Hz to 65 Hz
Rated power frequency / rated grid voltage	50 Hz / 230 V
Max. output current / Rated output current	29 A / 21.7 A
Power factor at rated power / Adjustable displacement power factor	1 / 0 overexcited to 0 underexcited
THD	≤ 3%
Feed-in phases / connection phases	3 / 3
Efficiency	
Max. efficiency / European Efficiency	98.4% / 98.0%
Protective devices	
DC-side disconnection device	●
Ground fault monitoring / grid monitoring	● / ●
DC surge arrester (Type II) can be integrated	○
DC reverse polarity protection / AC short-circuit current capability / galvanically isolated	● / ● / –
All-pole sensitive residual-current monitoring unit	●
Protection class (according to IEC 62109-1) / overvoltage category (according to IEC 62109-1)	I / AC: III; DC: II
General data	
Dimensions (W / H / D)	661 / 682 / 264 mm (26.0 / 26.9 / 10.4 inch)
Weight	61 kg (134.48 lb)
Operating temperature range	–25 °C to +60 °C (–13 °F to +140 °F)
Noise emission (typical)	51 dB(A)
Self-consumption (at night)	1 W
Topology / cooling concept	Transformerless / Opticool
Degree of protection (as per IEC 60529)	IP65
Climatic category (according to IEC 60721-3-4)	4K4H
Maximum permissible value for relative humidity (non-condensing)	100%
Features / function / Accessories	
DC connection / AC connection	SUNCLIX / spring-cage terminal
Display	○
Interface: RS485, Speedwire/Webconnect	○ / ●
Data interface: SMA Modbus / SunSpec Modbus	● / ●
Multifunction relay / Power Control Module	○ / ○
OptiTrack Global Peak / Integrated Plant Control / Q on Demand 24/7	● / ● / ●
Off-Grid capable / SMA Fuel Save Controller compatible	● / ●
Guarantee: 5 / 10 / 15 / 20 years	● / ○ / ○ / ○
Planned certificates and permits * Does not apply to all national appendices of EN 50438	ANRE 30, AS 4777, BDEW 2008, C10/11:2012, CE, CEI 0-16, CEI 0-21, EN 50438:2013*, G59/3, IEC 60068-2-x, IEC 61727, IEC 62109-1/2, IEC 62116, NBR 16149, NEN EN 50438, NRS 097-2-1, PPC, RD 1699/413, RD 661/2007, Res. n°7:2013, SI4777, TOR D4, TR 3.2.2, UTE C15-712-1, VDE 0126-1-1, VDE-AR-N 4105, VFR 2014
Type designation	STP 15000TL-30

APPENDIX C – BASIX CERTIFICATE

BASIX® Certificate

Building Sustainability Index www.basix.nsw.gov.au

Multi Dwelling

Certificate number: 1130725M

This certificate confirms that the proposed development will meet the NSW government's requirements for sustainability, if it is built in accordance with the commitments set out below. Terms used in this certificate, or in the commitments, have the meaning given by the document entitled "BASIX Definitions" dated 10/09/2020 published by the Department. This document is available at www.basix.nsw.gov.au

Secretary
Date of issue: Friday, 02 October 2020
To be valid, this certificate must be lodged within 3 months of the date of issue.

NSW GOVERNMENT | Planning, Industry & Environment

Project summary	
Project name	90-102 Regent St Redfern NSW
Street address	90-102 Regent Street Redfern 2016
Local Government Area	Sydney City Council
Plan type and plan number	deposited 3954
Lot no.	1-3
Section no.	2
No. of residential flat buildings	1
No. of units in residential flat buildings	381
No. of multi-dwelling houses	0
No. of single dwelling houses	0

Project score			
Water	✔ 41		Target 40
Thermal Comfort	✔	concession	Target Pass
Energy	✔ 40		Target 25

For BASIX Certificate:
If any changes to this BASIX certificate are required, please contact Vipac with following details:
- Project reference: 90-102 Regent St Redfern NSW
- Contact number: 0430 108 801

Certificate Prepared by
Name / Company Name: Vipac
ABN (if applicable): 33005453627

Description of project

Project address	
Project name	90-102 Regent St Redfern NSW
Street address	90-102 Regent Street Redfern 2016
Local Government Area	Sydney City Council
Plan type and plan number	deposited 3954
Lot no.	1-3
Section no.	2
Project type	
No. of residential flat buildings	1
No. of units in residential flat buildings	381
No. of multi-dwelling houses	0
No. of single dwelling houses	0
Site details	
Site area (m²)	1288
Roof area (m²)	568
Non-residential floor area (m²)	-
Residential car spaces	0
Non-residential car spaces	0

Common area landscape			
Common area lawn (m²)	370.0		
Common area garden (m²)	33.0		
Area of indigenous or low water use species (m²)	-		
Assessor details			
Assessor number	N/A		
Certificate number	N/A		
Climate zone	N/A		
Project score			
Water	✔ 41		Target 40
Thermal Comfort	✔	concession	Target Pass
Energy	✔ 40		Target 25

Description of project

The tables below describe the dwellings and common areas within the project

Residential flat buildings - Building1, 381 dwellings, 18 storeys above ground

Dwelling no.	No. of bedrooms	Conditioned floor area (m²)	Unconditioned floor area (m²)	Area of garden & lawn (m²)	Indigenous species (min area m²)
2.01	1	14.0	0.0	0.0	0.0
2.05	1	14.0	0.0	0.0	0.0
2.09	1	14.0	0.0	0.0	0.0
2.13	1	14.0	0.0	0.0	0.0
2.17	2	26.0	0.0	0.0	0.0
3.04	1	16.0	0.0	0.0	0.0
3.08	1	16.0	0.0	0.0	0.0
3.12	1	22.0	0.0	0.0	0.0
3.16	1	16.0	0.0	0.0	0.0
3.20	1	16.0	0.0	0.0	0.0
4.01	1	21.0	0.0	0.0	0.0
4.05	1	16.0	0.0	0.0	0.0
4.09	1	16.0	0.0	0.0	0.0
4.13	1	16.0	0.0	0.0	0.0
4.17	1	16.0	0.0	0.0	0.0
4.21	1	16.0	0.0	0.0	0.0
5.02	1	16.0	0.0	0.0	0.0
5.06	1	16.0	0.0	0.0	0.0

Dwelling no.	No. of bedrooms	Conditioned floor area (m²)	Unconditioned floor area (m²)	Area of garden & lawn (m²)	Indigenous species (min area m²)
2.02	1	14.0	0.0	0.0	0.0
2.06	1	14.0	0.0	0.0	0.0
2.10	1	14.0	0.0	0.0	0.0
2.14	1	14.0	0.0	0.0	0.0
3.01	1	21.0	0.0	0.0	0.0
3.05	1	16.0	0.0	0.0	0.0
3.09	1	16.0	0.0	0.0	0.0
3.13	1	16.0	0.0	0.0	0.0
3.17	1	16.0	0.0	0.0	0.0
3.21	1	16.0	0.0	0.0	0.0
4.02	1	16.0	0.0	0.0	0.0
4.06	1	16.0	0.0	0.0	0.0
4.10	1	16.0	0.0	0.0	0.0
4.14	1	16.0	0.0	0.0	0.0
4.18	1	16.0	0.0	0.0	0.0
4.22	1	16.0	0.0	0.0	0.0
5.03	1	16.0	0.0	0.0	0.0
5.07	1	16.0	0.0	0.0	0.0

Dwelling no.	No. of bedrooms	Conditioned floor area (m²)	Unconditioned floor area (m²)	Area of garden & lawn (m²)	Indigenous species (min area m²)
2.03	1	14.0	0.0	0.0	0.0
2.07	1	14.0	0.0	0.0	0.0
2.11	1	14.0	0.0	0.0	0.0
2.15	1	14.0	0.0	0.0	0.0
3.02	1	16.0	0.0	0.0	0.0
3.06	1	16.0	0.0	0.0	0.0
3.10	1	16.0	0.0	0.0	0.0
3.14	1	16.0	0.0	0.0	0.0
3.18	1	16.0	0.0	0.0	0.0
3.22	1	16.0	0.0	0.0	0.0
4.03	1	16.0	0.0	0.0	0.0
4.07	1	16.0	0.0	0.0	0.0
4.11	1	22.0	0.0	0.0	0.0
4.15	1	16.0	0.0	0.0	0.0
4.19	1	16.0	0.0	0.0	0.0
4.23	1	16.0	0.0	0.0	0.0
5.04	1	16.0	0.0	0.0	0.0
5.08	1	16.0	0.0	0.0	0.0

Dwelling no.	No. of bedrooms	Conditioned floor area (m²)	Unconditioned floor area (m²)	Area of garden & lawn (m²)	Indigenous species (min area m²)
2.04	1	14.0	0.0	0.0	0.0
2.08	1	14.0	0.0	0.0	0.0
2.12	1	14.0	0.0	0.0	0.0
2.16	1	14.0	0.0	0.0	0.0
3.03	1	16.0	0.0	0.0	0.0
3.07	1	16.0	0.0	0.0	0.0
3.11	1	16.0	0.0	0.0	0.0
3.15	1	16.0	0.0	0.0	0.0
3.19	1	16.0	0.0	0.0	0.0
3.23	1	16.0	0.0	0.0	0.0
4.04	1	16.0	0.0	0.0	0.0
4.08	1	16.0	0.0	0.0	0.0
4.12	1	16.0	0.0	0.0	0.0
4.16	1	16.0	0.0	0.0	0.0
4.20	1	16.0	0.0	0.0	0.0
5.01	1	21.0	0.0	0.0	0.0
5.05	1	16.0	0.0	0.0	0.0
5.09	1	16.0	0.0	0.0	0.0

Dwelling no.	No. of bedrooms	Conditioned floor area (m^2)	Unconditioned floor area (m^2)	Area of garden & lawn (m^2)	Indigenous species (min area m^2)
5.10	1	16.0	0.0	0.0	0.0
5.14	1	16.0	0.0	0.0	0.0
5.18	1	16.0	0.0	0.0	0.0
5.22	1	16.0	0.0	0.0	0.0
6.03	1	16.0	0.0	0.0	0.0
6.07	1	16.0	0.0	0.0	0.0
6.11	1	22.0	0.0	0.0	0.0
6.15	1	16.0	0.0	0.0	0.0
6.19	1	16.0	0.0	0.0	0.0
6.23	1	16.0	0.0	0.0	0.0
7.04	1	16.0	0.0	0.0	0.0
7.08	1	16.0	0.0	0.0	0.0
7.12	1	16.0	0.0	0.0	0.0
7.16	1	16.0	0.0	0.0	0.0
7.20	1	16.0	0.0	0.0	0.0
8.01	1	21.0	0.0	0.0	0.0
8.05	1	16.0	0.0	0.0	0.0
8.09	1	16.0	0.0	0.0	0.0
8.13	1	16.0	0.0	0.0	0.0
8.17	1	16.0	0.0	0.0	0.0
8.21	1	16.0	0.0	0.0	0.0
9.04	1	16.0	0.0	0.0	0.0
9.08	1	16.0	0.0	0.0	0.0

Dwelling no.	No. of bedrooms	Conditioned floor area (m^2)	Unconditioned floor area (m^2)	Area of garden & lawn (m^2)	Indigenous species (min area m^2)
5.11	1	22.0	0.0	0.0	0.0
5.15	1	16.0	0.0	0.0	0.0
5.19	1	16.0	0.0	0.0	0.0
5.23	1	16.0	0.0	0.0	0.0
6.04	1	16.0	0.0	0.0	0.0
6.08	1	16.0	0.0	0.0	0.0
6.12	1	16.0	0.0	0.0	0.0
6.16	1	16.0	0.0	0.0	0.0
6.20	1	16.0	0.0	0.0	0.0
7.01	1	21.0	0.0	0.0	0.0
7.05	1	16.0	0.0	0.0	0.0
7.09	1	16.0	0.0	0.0	0.0
7.13	1	16.0	0.0	0.0	0.0
7.17	1	16.0	0.0	0.0	0.0
7.21	1	16.0	0.0	0.0	0.0
8.02	1	16.0	0.0	0.0	0.0
8.06	1	16.0	0.0	0.0	0.0
8.10	1	16.0	0.0	0.0	0.0
8.14	1	16.0	0.0	0.0	0.0
8.18	1	16.0	0.0	0.0	0.0
8.22	1	16.0	0.0	0.0	0.0
9.05	1	16.0	0.0	0.0	0.0
9.09	1	16.0	0.0	0.0	0.0

Dwelling no.	No. of bedrooms	Conditioned floor area (m^2)	Unconditioned floor area (m^2)	Area of garden & lawn (m^2)	Indigenous species (min area m^2)
5.12	1	16.0	0.0	0.0	0.0
5.16	1	16.0	0.0	0.0	0.0
5.20	1	16.0	0.0	0.0	0.0
6.01	1	21.0	0.0	0.0	0.0
6.05	1	16.0	0.0	0.0	0.0
6.09	1	16.0	0.0	0.0	0.0
6.13	1	16.0	0.0	0.0	0.0
6.17	1	16.0	0.0	0.0	0.0
6.21	1	16.0	0.0	0.0	0.0
7.02	1	16.0	0.0	0.0	0.0
7.06	1	16.0	0.0	0.0	0.0
7.10	1	16.0	0.0	0.0	0.0
7.14	1	16.0	0.0	0.0	0.0
7.18	1	16.0	0.0	0.0	0.0
7.22	1	16.0	0.0	0.0	0.0
8.03	1	16.0	0.0	0.0	0.0
8.07	1	16.0	0.0	0.0	0.0
8.11	1	22.0	0.0	0.0	0.0
8.15	1	16.0	0.0	0.0	0.0
8.19	1	16.0	0.0	0.0	0.0
8.23	1	16.0	0.0	0.0	0.0
9.06	1	16.0	0.0	0.0	0.0
9.10	1	16.0	0.0	0.0	0.0

Dwelling no.	No. of bedrooms	Conditioned floor area (m^2)	Unconditioned floor area (m^2)	Area of garden & lawn (m^2)	Indigenous species (min area m^2)
5.13	1	16.0	0.0	0.0	0.0
5.17	1	16.0	0.0	0.0	0.0
5.21	1	16.0	0.0	0.0	0.0
6.02	1	16.0	0.0	0.0	0.0
6.06	1	16.0	0.0	0.0	0.0
6.10	1	16.0	0.0	0.0	0.0
6.14	1	16.0	0.0	0.0	0.0
6.18	1	16.0	0.0	0.0	0.0
6.22	1	16.0	0.0	0.0	0.0
7.03	1	16.0	0.0	0.0	0.0
7.07	1	16.0	0.0	0.0	0.0
7.11	1	22.0	0.0	0.0	0.0
7.15	1	16.0	0.0	0.0	0.0
7.19	1	16.0	0.0	0.0	0.0
7.23	1	16.0	0.0	0.0	0.0
8.04	1	16.0	0.0	0.0	0.0
8.08	1	16.0	0.0	0.0	0.0
8.12	1	16.0	0.0	0.0	0.0
8.16	1	16.0	0.0	0.0	0.0
8.20	1	16.0	0.0	0.0	0.0
9.01	1	21.0	0.0	0.0	0.0
9.07	1	16.0	0.0	0.0	0.0
9.11	1	22.0	0.0	0.0	0.0

Dwelling no.	No. of bedrooms	Conditioned floor area (m^2)	Unconditioned floor area (m^2)	Area of garden & lawn (m^2)	Indigenous species (min area m^2)
9.12	1	16.0	0.0	0.0	0.0
9.16	1	16.0	0.0	0.0	0.0
9.20	1	16.0	0.0	0.0	0.0
10.01	1	21.0	0.0	0.0	0.0
10.05	1	16.0	0.0	0.0	0.0
10.09	1	16.0	0.0	0.0	0.0
10.13	1	16.0	0.0	0.0	0.0
10.17	1	16.0	0.0	0.0	0.0
10.21	1	16.0	0.0	0.0	0.0
11.02	1	16.0	0.0	0.0	0.0
11.06	1	16.0	0.0	0.0	0.0
11.10	1	16.0	0.0	0.0	0.0
11.14	1	16.0	0.0	0.0	0.0
11.18	1	16.0	0.0	0.0	0.0
11.22	1	16.0	0.0	0.0	0.0
12.03	1	16.0	0.0	0.0	0.0
12.07	1	16.0	0.0	0.0	0.0
12.11	1	22.0	0.0	0.0	0.0
12.15	1	16.0	0.0	0.0	0.0
12.19	1	16.0	0.0	0.0	0.0
12.23	1	16.0	0.0	0.0	0.0
13.04	1	16.0	0.0	0.0	0.0
13.08	1	16.0	0.0	0.0	0.0
9.13	1	16.0	0.0	0.0	0.0
9.17	1	16.0	0.0	0.0	0.0
9.21	1	16.0	0.0	0.0	0.0
10.02	1	16.0	0.0	0.0	0.0
10.06	1	16.0	0.0	0.0	0.0
10.10	1	16.0	0.0	0.0	0.0
10.14	1	16.0	0.0	0.0	0.0
10.18	1	16.0	0.0	0.0	0.0
10.22	1	16.0	0.0	0.0	0.0
11.03	1	16.0	0.0	0.0	0.0
11.07	1	16.0	0.0	0.0	0.0
11.11	1	22.0	0.0	0.0	0.0
11.15	1	16.0	0.0	0.0	0.0
11.19	1	16.0	0.0	0.0	0.0
11.23	1	16.0	0.0	0.0	0.0
12.04	1	16.0	0.0	0.0	0.0
12.08	1	16.0	0.0	0.0	0.0
12.12	1	16.0	0.0	0.0	0.0
12.16	1	16.0	0.0	0.0	0.0
12.20	1	16.0	0.0	0.0	0.0
13.01	1	21.0	0.0	0.0	0.0
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13.09	1	16.0	0.0	0.0	0.0
9.14	1	16.0	0.0	0.0	0.0
9.18	1	16.0	0.0	0.0	0.0
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10.19	1	16.0	0.0	0.0	0.0
10.23	1	16.0	0.0	0.0	0.0
11.04	1	16.0	0.0	0.0	0.0
11.08	1	16.0	0.0	0.0	0.0
11.12	1	16.0	0.0	0.0	0.0
11.16	1	16.0	0.0	0.0	0.0
11.20	1	16.0	0.0	0.0	0.0
12.01	1	21.0	0.0	0.0	0.0
12.05	1	16.0	0.0	0.0	0.0
12.09	1	16.0	0.0	0.0	0.0
12.13	1	16.0	0.0	0.0	0.0
12.17	1	16.0	0.0	0.0	0.0
12.21	1	16.0	0.0	0.0	0.0
13.02	1	16.0	0.0	0.0	0.0
13.06	1	16.0	0.0	0.0	0.0
13.10	1	16.0	0.0	0.0	0.0
9.15	1	16.0	0.0	0.0	0.0
9.19	1	16.0	0.0	0.0	0.0
9.23	1	16.0	0.0	0.0	0.0
10.04	1	16.0	0.0	0.0	0.0
10.08	1	16.0	0.0	0.0	0.0
10.12	1	16.0	0.0	0.0	0.0
10.16	1	16.0	0.0	0.0	0.0
10.20	1	16.0	0.0	0.0	0.0
11.01	1	21.0	0.0	0.0	0.0
11.05	1	16.0	0.0	0.0	0.0
11.09	1	16.0	0.0	0.0	0.0
11.13	1	16.0	0.0	0.0	0.0
11.17	1	16.0	0.0	0.0	0.0
11.21	1	16.0	0.0	0.0	0.0
12.02	1	16.0	0.0	0.0	0.0
12.06	1	16.0	0.0	0.0	0.0
12.10	1	16.0	0.0	0.0	0.0
12.14	1	16.0	0.0	0.0	0.0
12.18	1	16.0	0.0	0.0	0.0
12.22	1	16.0	0.0	0.0	0.0
13.03	1	16.0	0.0	0.0	0.0
13.07	1	16.0	0.0	0.0	0.0
13.11	1	22.0	0.0	0.0	0.0

Dwelling no.	No. of bedrooms	Conditioned floor area (m^2)	Unconditioned floor area (m^2)	Area of garden & lawn (m^2)	Indigenous species (min area m^2)
13.12	1	16.0	0.0	0.0	0.0
13.16	1	16.0	0.0	0.0	0.0
13.20	1	16.0	0.0	0.0	0.0
14.01	1	21.0	0.0	0.0	0.0
14.05	1	16.0	0.0	0.0	0.0
14.09	1	16.0	0.0	0.0	0.0
14.13	1	16.0	0.0	0.0	0.0
14.17	1	16.0	0.0	0.0	0.0
14.21	1	16.0	0.0	0.0	0.0
15.02	1	16.0	0.0	0.0	0.0
15.06	1	16.0	0.0	0.0	0.0
15.12	1	16.0	0.0	0.0	0.0
15.16	1	16.0	0.0	0.0	0.0
15.20	1	16.0	0.0	0.0	0.0
16.01	1	21.0	0.0	0.0	0.0
16.05	1	16.0	0.0	0.0	0.0
16.09	1	16.0	0.0	0.0	0.0
16.13	1	16.0	0.0	0.0	0.0
16.17	1	16.0	0.0	0.0	0.0
16.21	1	16.0	0.0	0.0	0.0
17.02	1	16.0	0.0	0.0	0.0
17.06	1	16.0	0.0	0.0	0.0
17.10	1	16.0	0.0	0.0	0.0

Dwelling no.	No. of bedrooms	Conditioned floor area (m^2)	Unconditioned floor area (m^2)	Area of garden & lawn (m^2)	Indigenous species (min area m^2)
13.13	1	16.0	0.0	0.0	0.0
13.17	1	16.0	0.0	0.0	0.0
13.21	1	16.0	0.0	0.0	0.0
14.02	1	16.0	0.0	0.0	0.0
14.06	1	16.0	0.0	0.0	0.0
14.10	1	16.0	0.0	0.0	0.0
14.14	1	16.0	0.0	0.0	0.0
14.18	1	16.0	0.0	0.0	0.0
14.22	1	16.0	0.0	0.0	0.0
15.03	1	16.0	0.0	0.0	0.0
15.07	1	16.0	0.0	0.0	0.0
15.13	1	16.0	0.0	0.0	0.0
15.17	1	16.0	0.0	0.0	0.0
15.21	1	16.0	0.0	0.0	0.0
16.02	1	16.0	0.0	0.0	0.0
16.06	1	16.0	0.0	0.0	0.0
16.10	1	16.0	0.0	0.0	0.0
16.14	1	16.0	0.0	0.0	0.0
16.18	1	16.0	0.0	0.0	0.0
16.22	1	16.0	0.0	0.0	0.0
17.03	1	16.0	0.0	0.0	0.0
17.07	1	16.0	0.0	0.0	0.0
17.11	1	22.0	0.0	0.0	0.0

Dwelling no.	No. of bedrooms	Conditioned floor area (m^2)	Unconditioned floor area (m^2)	Area of garden & lawn (m^2)	Indigenous species (min area m^2)
13.14	1	16.0	0.0	0.0	0.0
13.18	1	16.0	0.0	0.0	0.0
13.22	1	16.0	0.0	0.0	0.0
14.03	1	16.0	0.0	0.0	0.0
14.07	1	16.0	0.0	0.0	0.0
14.11	1	22.0	0.0	0.0	0.0
14.15	1	16.0	0.0	0.0	0.0
14.19	1	16.0	0.0	0.0	0.0
14.23	1	16.0	0.0	0.0	0.0
15.04	1	16.0	0.0	0.0	0.0
15.08	1	16.0	0.0	0.0	0.0
15.14	1	16.0	0.0	0.0	0.0
15.18	1	16.0	0.0	0.0	0.0
15.22	1	16.0	0.0	0.0	0.0
16.03	1	16.0	0.0	0.0	0.0
16.07	1	16.0	0.0	0.0	0.0
16.11	1	22.0	0.0	0.0	0.0
16.15	1	16.0	0.0	0.0	0.0
16.19	1	16.0	0.0	0.0	0.0
16.23	1	16.0	0.0	0.0	0.0
17.04	1	16.0	0.0	0.0	0.0
17.08	1	16.0	0.0	0.0	0.0
17.12	1	16.0	0.0	0.0	0.0

Dwelling no.	No. of bedrooms	Conditioned floor area (m^2)	Unconditioned floor area (m^2)	Area of garden & lawn (m^2)	Indigenous species (min area m^2)
13.15	1	16.0	0.0	0.0	0.0
13.19	1	16.0	0.0	0.0	0.0
13.23	1	16.0	0.0	0.0	0.0
14.04	1	16.0	0.0	0.0	0.0
14.08	1	16.0	0.0	0.0	0.0
14.12	1	16.0	0.0	0.0	0.0
14.16	1	16.0	0.0	0.0	0.0
14.20	1	16.0	0.0	0.0	0.0
15.01	1	21.0	0.0	0.0	0.0
15.05	1	16.0	0.0	0.0	0.0
15.11	1	22.0	0.0	0.0	0.0
15.15	1	16.0	0.0	0.0	0.0
15.19	1	16.0	0.0	0.0	0.0
15.23	1	16.0	0.0	0.0	0.0
16.04	1	16.0	0.0	0.0	0.0
16.08	1	16.0	0.0	0.0	0.0
16.12	1	16.0	0.0	0.0	0.0
16.16	1	16.0	0.0	0.0	0.0
16.20	1	16.0	0.0	0.0	0.0
17.01	1	21.0	0.0	0.0	0.0
17.05	1	16.0	0.0	0.0	0.0
17.09	1	16.0	0.0	0.0	0.0
17.13	1	16.0	0.0	0.0	0.0

Dwelling no.	No. of bedrooms	Conditioned floor area (m^2)	Unconditioned floor area (m^2)	Area of garden & lawn (m^2)	Indigenous species (min area m^2)
17.14	1	16.0	0.0	0.0	0.0
17.18	1	16.0	0.0	0.0	0.0
17.22	1	16.0	0.0	0.0	0.0
18.03	1	16.0	0.0	0.0	0.0
18.07	1	16.0	0.0	0.0	0.0
18.11	1	21.0	0.0	0.0	0.0
18.15	1	16.0	0.0	0.0	0.0
18.19	1	16.0	0.0	0.0	0.0
18.23	1	16.0	0.0	0.0	0.0

Dwelling no.	No. of bedrooms	Conditioned floor area (m^2)	Unconditioned floor area (m^2)	Area of garden & lawn (m^2)	Indigenous species (min area m^2)
17.15	1	16.0	0.0	0.0	0.0
17.19	1	16.0	0.0	0.0	0.0
17.23	1	16.0	0.0	0.0	0.0
18.04	1	16.0	0.0	0.0	0.0
18.08	1	16.0	0.0	0.0	0.0
18.12	1	16.0	0.0	0.0	0.0
18.16	1	16.0	0.0	0.0	0.0
18.20	1	16.0	0.0	0.0	0.0

Dwelling no.	No. of bedrooms	Conditioned floor area (m^2)	Unconditioned floor area (m^2)	Area of garden & lawn (m^2)	Indigenous species (min area m^2)
17.16	1	16.0	0.0	0.0	0.0
17.20	1	16.0	0.0	0.0	0.0
18.01	1	21.0	0.0	0.0	0.0
18.05	1	16.0	0.0	0.0	0.0
18.09	1	16.0	0.0	0.0	0.0
18.13	1	16.0	0.0	0.0	0.0
18.17	1	16.0	0.0	0.0	0.0
18.21	1	16.0	0.0	0.0	0.0

Dwelling no.	No. of bedrooms	Conditioned floor area (m^2)	Unconditioned floor area (m^2)	Area of garden & lawn (m^2)	Indigenous species (min area m^2)
17.17	1	16.0	0.0	0.0	0.0
17.21	1	16.0	0.0	0.0	0.0
18.02	1	16.0	0.0	0.0	0.0
18.06	1	16.0	0.0	0.0	0.0
18.10	1	16.0	0.0	0.0	0.0
18.14	1	16.0	0.0	0.0	0.0
18.18	1	16.0	0.0	0.0	0.0
18.22	1	16.0	0.0	0.0	0.0

Description of project

The tables below describe the dwellings and common areas within the project

Common areas of unit building - Building1

Common area	Floor area (m²)
Gym (No. 1)	46.0
Switch room (No. 1)	30.0
Plant or service room (No. 1)	24.0
Hallway/lobby type (No. 1)	1206.0

Common area	Floor area (m²)
Lift car (No.1)	-
Garbage room (No. 1)	65.0
Other internal common area (No. 1)	234.0

Common area	Floor area (m²)
Lift car (No.2)	-
Community room (No. 1)	139.0
Ground floor lobby type (No. 1)	98.0

Schedule of BASIX commitments

1. Commitments for Residential flat buildings - Building1
    (a) Dwellings
        (i) Water
        (ii) Energy
        (iii) Thermal Comfort
    (b) Common areas and central systems/facilities
        (i) Water
        (ii) Energy

2. Commitments for multi-dwelling houses

3. Commitments for single dwelling houses

4. Commitments for common areas and central systems/facilities for the development (non-building specific)
        (i) Water
        (ii) Energy

Schedule of BASIX commitments

The commitments set out below regulate how the proposed development is to be carried out. It is a condition of any development consent granted, or complying development certificate issued, for the proposed development, that BASIX commitments be complied with.

1. Commitments for Residential flat buildings - Building1

(a) Dwellings

(i) Water	Show on DA plans	Show on CC/CDC plans & specs	Certifier check
(a) The applicant must comply with the commitments listed below in carrying out the development of a dwelling listed in a table below.			
(b) The applicant must plant indigenous or low water use species of vegetation throughout the area of land specified for the dwelling in the "Indigenous species" column of the table below, as private landscaping for that dwelling. (This area of indigenous vegetation is to be contained within the "Area of garden and lawn" for the dwelling specified in the "Description of Project" table).	✔	✔	
(c) If a rating is specified in the table below for a fixture or appliance to be installed in the dwelling, the applicant must ensure that each such fixture and appliance meets the rating specified for it.		✔	✔
(d) The applicant must install an on demand hot water recirculation system which regulates all hot water use throughout the dwelling, where indicated for a dwelling in the "HW recirculation or diversion" column of the table below.		✔	✔
(e) The applicant must install: (aa) a hot water diversion system to all showers, kitchen sinks and all basins in the dwelling, where indicated for a dwelling in the "HW recirculation or diversion" column of the table below; and (bb) a separate diversion tank (or tanks) connected to the hot water diversion systems of at least 100 litres. The applicant must connect the hot water diversion tank to all toilets in the dwelling.		✔ ✔	✔ ✔
(e) The applicant must not install a private swimming pool or spa for the dwelling, with a volume exceeding that specified for it in the table below.	✔	✔	
(f) If specified in the table, that pool or spa (or both) must have a pool cover or shading (or both).		✔	
(g) The pool or spa must be located as specified in the table.	✔	✔	
(h) The applicant must install, for the dwelling, each alternative water supply system, with the specified size, listed for that dwelling in the table below. Each system must be configured to collect run-off from the areas specified (excluding any area which supplies any other alternative water supply system), and to divert overflow as specified. Each system must be connected as specified.	✔	✔	✔

	Fixtures					Appliances		Individual pool				Individual spa		
Dwelling no.	All shower-heads	All toilet flushing systems	All kitchen taps	All bathroom taps	HW recirculation or diversion	All clothes washers	All dish-washers	Volume (max volume)	Pool cover	Pool location	Pool shaded	Volume (max volume)	Spa cover	Spa shaded
All dwellings	3 star (> 7.5 but <= 9 L/min)	3 star	5 star	5 star	no	no washing machine taps	-	-	-	-	-	-	-	-

	Alternative water source							
Dwelling no.	Alternative water supply systems	Size	Configuration	Landscape connection	Toilet connection (s)	Laundry connection	Pool top-up	Spa top-up
None	-	-	-	-	-	-	-	-

(ii) Energy	Show on DA plans	Show on CC/CDC plans & specs	Certifier check
(a) The applicant must comply with the commitments listed below in carrying out the development of a dwelling listed in a table below.			
(b) The applicant must install each hot water system specified for the dwelling in the table below, so that the dwelling's hot water is supplied by that system. If the table specifies a central hot water system for the dwelling, then the applicant must connect that central system to the dwelling, so that the dwelling's hot water is supplied by that central system.	✔	✔	✔
(c) The applicant must install, in each bathroom, kitchen and laundry of the dwelling, the ventilation system specified for that room in the table below. Each such ventilation system must have the operation control specified for it in the table.		✔	✔
(d) The applicant must install the cooling and heating system/s specified for the dwelling under the "Living areas" and "Bedroom areas" headings of the "Cooling" and "Heating" columns in the table below, in/for at least 1 living/bedroom area of the dwelling. If no cooling or heating system is specified in the table for "Living areas" or "Bedroom areas", then no systems may be installed in any such areas. If the term "zoned" is specified beside an air conditioning system, then the system must provide for day/night zoning between living areas and bedrooms.		✔	✔
(e) This commitment applies to each room or area of the dwelling which is referred to in a heading to the "Artificial lighting" column of the table below (but only to the extent specified for that room or area). The applicant must ensure that the "primary type of artificial lighting" for each such room in the dwelling is fluorescent lighting or light emitting diode (LED) lighting. If the term "dedicated" is specified for a particular room or area, then the light fittings in that room or area must only be capable of being used for fluorescent lighting or light emitting diode (LED) lighting.		✔	✔

(ii) Energy	Show on DA plans	Show on CC/CDC plans & specs	Certifier check
(f) This commitment applies to each room or area of the dwelling which is referred to in a heading to the "Natural lighting" column of the table below (but only to the extent specified for that room or area). The applicant must ensure that each such room or area is fitted with a window and/or skylight.	✔	✔	✔
(g) This commitment applies if the applicant installs a water heating system for the dwelling's pool or spa. The applicant must:			
(aa) install the system specified for the pool in the "Individual Pool" column of the table below (or alternatively must not install any system for the pool). If specified, the applicant must install a timer, to control the pool's pump; and		✔	
(bb) install the system specified for the spa in the "Individual Spa" column of the table below (or alternatively must not install any system for the spa). If specified, the applicant must install a timer to control the spa's pump.		✔	
(h) The applicant must install in the dwelling:			
(aa) the kitchen cook-top and oven specified for that dwelling in the "Appliances & other efficiency measures" column of the table below;		✔	
(bb) each appliance for which a rating is specified for that dwelling in the "Appliances & other efficiency measures" column of the table, and ensure that the appliance has that minimum rating; and		✔	✔
(cc) any clothes drying line specified for the dwelling in the "Appliances & other efficiency measures" column of the table.		✔	
(i) If specified in the table, the applicant must carry out the development so that each refrigerator space in the dwelling is "well ventilated".		✔	

	Hot water	Bathroom ventilation system		Kitchen ventilation system		Laundry ventilation system	
Dwelling no.	Hot water system	Each bathroom	Operation control	Each kitchen	Operation control	Each laundry	Operation control
All dwellings	central hot water system 1	individual fan, ducted to façade or roof	interlocked to light	individual fan, ducted to façade or roof	manual switch on/off	natural ventilation only, or no laundry	-

	Cooling		Heating		Artificial lighting						Natural lighting	
Dwelling no.	living areas	bedroom areas	living areas	bedroom areas	No. of bedrooms &/or study	No. of living &/or dining rooms	Each kitchen	All bathrooms/ toilets	Each laundry	All hallways	No. of bathrooms &/or toilets	Main kitchen
2.17	central cooling system 1	central cooling system 1	central heating system 1	central heating system 1	2 (dedicated)	1 (dedicated)	yes (dedicated)	yes (dedicated)	yes (dedicated)	yes (dedicated)	0	no
All other dwellings	central cooling system 1	central cooling system 1	central heating system 1	central heating system 1	1 (dedicated)	1 (dedicated)	yes (dedicated)	yes (dedicated)	yes (dedicated)	yes (dedicated)	0	no

	Individual pool		Individual spa		Appliances & other efficiency measures							
Dwelling no.	Pool heating system	Timer	Spa heating system	Timer	Kitchen cooktop/oven	Refrigerator	Well ventilated fridge space	Dishwasher	Clothes washer	Clothes dryer	Indoor or sheltered clothes drying line	Private outdoor or unsheltered clothes drying line
All dwellings	-	-	-	-	gas cooktop & gas oven	2.5 star	-	-	-	-	-	-

(iii) Thermal Comfort	Show on DA plans	Show on CC/CDC plans & specs	Certifier check
(a) The development will be a Class 3 building. The applicant must include in the documentation accompanying the application for a construction certificate (or complying development certificate, if applicable), a report demonstrating that the development will meet Section J of the National Construction Code - Volume 1.	✔	✔	✔

(b) Common areas and central systems/facilities

(i) Water	Show on DA plans	Show on CC/CDC plans & specs	Certifier check
(a) If, in carrying out the development, the applicant installs a showerhead, toilet, tap or clothes washer into a common area, then that item must meet the specifications listed for it in the table.		✔	✔
(b) The applicant must install (or ensure that the development is serviced by) the alternative water supply system(s) specified in the "Central systems" column of the table below. In each case, the system must be sized, be configured, and be connected, as specified in the table.	✔	✔	✔
(c) A swimming pool or spa listed in the table must not have a volume (in kLs) greater than that specified for the pool or spa in the table.	✔	✔	
(d) A pool or spa listed in the table must have a cover or shading if specified for the pool or spa in the table.		✔	
(e) The applicant must install each fire sprinkler system listed in the table so that the system is configured as specified in the table.		✔	✔
(f) The applicant must ensure that the central cooling system for a cooling tower is configured as specified in the table.		✔	✔

Common area	Showerheads rating	Toilets rating	Taps rating	Clothes washers rating
All common areas	3 star (> 7.5 but <= 9 L/min)	3 star	5 star	2.5 star

Central systems	Size	Configuration	Connection (to allow for...)
Fire sprinkler system (No. 1)	-	-	-

(ii) Energy	Show on DA plans	Show on CC/CDC plans & specs	Certifier check
(a) If, in carrying out the development, the applicant installs a ventilation system to service a common area specified in the table below, then that ventilation system must be of the type specified for that common area, and must meet the efficiency measure specified.		✔	✔

(ii) Energy	Show on DA plans	Show on CC/CDC plans & specs	Certifier check
(b) In carrying out the development, the applicant must install, as the "primary type of artificial lighting" for each common area specified in the table below, the lighting specified for that common area. This lighting must meet the efficiency measure specified. The applicant must also install a centralised lighting control system or Building Management System (BMS) for the common area, where specified.		✔	✔
(c) The applicant must install the systems and fixtures specified in the "Central energy systems" column of the table below. In each case, the system or fixture must be of the type, and meet the specifications, listed for it in the table.	✔	✔	✔

	Common area ventilation system		Common area lighting		
Common area	Ventilation system type	Ventilation efficiency measure	Primary type of artificial lighting	Lighting efficiency measure	Lighting control system/BMS
Gym (No. 1)	ventilation supply only	time clock or BMS controlled	light-emitting diode	manual on / manual off	No
Lift car (No.1)	-	-	light-emitting diode	connected to lift call button	No
Lift car (No.2)	-	-	light-emitting diode	connected to lift call button	No
Switch room (No. 1)	ventilation supply only	thermostatically controlled	light-emitting diode	manual on / manual off	No
Garbage room (No. 1)	ventilation exhaust only	-	light-emitting diode	motion sensors	No
Community room (No. 1)	ventilation (supply + exhaust)	time clock or BMS controlled	light-emitting diode	motion sensors	No
Plant or service room (No. 1)	no mechanical ventilation	-	light-emitting diode	manual on / manual off	No
Other internal common area (No. 1)	no mechanical ventilation	-	light-emitting diode	time clocks	No
Ground floor lobby type (No. 1)	no mechanical ventilation	-	light-emitting diode	time clock and motion sensors	No
Hallway/lobby type (No. 1)	ventilation (supply + exhaust)	time clock or BMS controlled	light-emitting diode	time clock and motion sensors	No

Central energy systems	Type	Specification
Central hot water system (No. 1)	gas-fired boiler	Piping insulation (ringmain & supply risers): (a) Piping external to building: R0.75 (~32 mm); (b) Piping internal to building: R0.75 (~32 mm)

Central energy systems	Type	Specification
Central cooling system (No. 1)	variable refrigerant volume units	Energy source: electric driven compressor Heat rejection method: air cooled condenser Unit efficiency (min): low - COP < 3.5
Central heating system (No. 1)	variable refrigerant volume units	Energy source: electric driven compressor + air sourced evaporator Unit efficiency: low - COP < 3.5
Lift (No. 1)	gearless traction with V V V F motor	Number of levels (including basement): 19
Lift (No. 2)	gearless traction with V V V F motor	Number of levels (including basement): 19

4. Commitments for common areas and central systems/facilities for the development (non-building specific)

(b) Common areas and central systems/facilities

(i) Water	Show on DA plans	Show on CC/CDC plans & specs	Certifier check
(a) If, in carrying out the development, the applicant installs a showerhead, toilet, tap or clothes washer into a common area, then that item must meet the specifications listed for it in the table.		✔	✔
(b) The applicant must install (or ensure that the development is serviced by) the alternative water supply system(s) specified in the "Central systems" column of the table below. In each case, the system must be sized, be configured, and be connected, as specified in the table.	✔	✔	✔
(c) A swimming pool or spa listed in the table must not have a volume (in kLs) greater than that specified for the pool or spa in the table.	✔	✔	
(d) A pool or spa listed in the table must have a cover or shading if specified for the pool or spa in the table.		✔	
(e) The applicant must install each fire sprinkler system listed in the table so that the system is configured as specified in the table.		✔	✔
(f) The applicant must ensure that the central cooling system for a cooling tower is configured as specified in the table.		✔	✔

Common area	Showerheads rating	Toilets rating	Taps rating	Clothes washers rating
All common areas	3 star (> 7.5 but <= 9 L/min)	3 star	5 star	2.5 star

(ii) Energy	Show on DA plans	Show on CC/CDC plans & specs	Certifier check
(a) If, in carrying out the development, the applicant installs a ventilation system to service a common area specified in the table below, then that ventilation system must be of the type specified for that common area, and must meet the efficiency measure specified.		✔	✔
(b) In carrying out the development, the applicant must install, as the "primary type of artificial lighting" for each common area specified in the table below, the lighting specified for that common area. This lighting must meet the efficiency measure specified. The applicant must also install a centralised lighting control system or Building Management System (BMS) for the common area, where specified.		✔	✔
(c) The applicant must install the systems and fixtures specified in the "Central energy systems" column of the table below. In each case, the system or fixture must be of the type, and meet the specifications, listed for it in the table.	✔	✔	✔

Central energy systems	Type	Specification
Alternative energy supply	Photovoltaic system	Rated electrical output (min): 40.0 peak kW

Notes

1. In these commitments, "applicant" means the person carrying out the development.
2. The applicant must identify each dwelling, building and common area listed in this certificate, on the plans accompanying any development application, and on the plans and specifications accompanying the application for a construction certificate / complying development certificate, for the proposed development, using the same identifying letter or reference as is given to that dwelling, building or common area in this certificate.
3. This note applies if the proposed development involves the erection of a building for both residential and non-residential purposes (or the change of use of a building for both residential and non-residential purposes). Commitments in this certificate which are specified to apply to a "common area" of a building or the development, apply only to that part of the building or development to be used for residential purposes.
4. If this certificate lists a central system as a commitment for a dwelling or building, and that system will also service any other dwelling or building within the development, then that system need only be installed once (even if it is separately listed as a commitment for that other dwelling or building).
5. If a star or other rating is specified in a commitment, this is a minimum rating.
6. All alternative water systems to be installed under these commitments (if any), must be installed in accordance with the requirements of all applicable regulatory authorities. NOTE: NSW Health does not recommend that stormwater, recycled water or private dam water be used to irrigate edible plants which are consumed raw, or that rainwater be used for human consumption in areas with potable water supply.

Legend

1. Commitments identified with a "✔" in the "Show on DA plans" column must be shown on the plans accompanying the development application for the proposed development (if a development application is to be lodged for the proposed development).
2. Commitments identified with a "✔" in the "Show on CC/CDC plans and specs" column must be shown in the plans and specifications accompanying the application for a construction certificate / complying development certificate for the proposed development.
3. Commitments identified with a "✔" in the "Certifier check" column must be certified by a certifying authority as having been fulfilled. (Note: a certifying authority must not issue an occupation certificate (either interim or final) for a building listed in this certificate, or for any part of such a building, unless it is satisfied that each of the commitments whose fulfilment it is required to monitor in relation to the building or part, has been fulfilled).