SSDA SEARs Ecologically Sustainable Design (ESD) Report

45-53 Macleay St, Potts Point NSW

30th March 2026

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1. Executive Summary

This SSDA ESD Report has been prepared by IGS on behalf of T&P Chimes Development Pty Ltd (the Applicant) to accompany a State Significant Development Application (SSDA) for a shop top housing development at 45-53 Macleay Street, Potts Point NSW (the site).

The proposal seeks approval for the construction and operation of a 16-storey shop-top housing development comprising:

- 44 apartments, including:

– 23 affordable apartments on podium level 1 and 2 which will be managed by a community housing provider (CHP) for 15 years

– 21 market apartments over 12 levels

- Ground floor retail
- Four levels of basement for parking, services and storage
- Vehicular and loading access from McDonald Street
- Landscaping and communal open space.

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 leading practice in energy and environmental targets, the project architect and building services design team will maximise energy efficiency in an integrated and staged approach as described in Table 1 below.

Table 1. Sustainability 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
	Maximise use of Natural ventilation
	Maximise use of native plants and species
Optimising resources consumption (energy, water & materials)	High efficiency Heating, Ventilation and Air Conditioning
	High efficiency lighting
	High efficiency hot water systems
	High efficiency appliances
	Commissioning and tuning of building services post completion
	High efficiency building control, automation and BMS
Indoor Environmental Quality	Thermal Comfort
	Acoustic comfort
	Effective Daylighting / Natural Lighting
	Natural Ventilation
	Volatile Organic Compounds (VOC) & Formaldehyde

	Minimisation
Material	Maximise separation and recycling of demolition and construction materials.
	Minimise use of Ozone Depleting materials
	Avoid specifying materials with environmentally sensitive content
	Participation in waste minimisation training for contractors and sub-contractors.
	Waste minimisation plan to reduce site waste to landfill.
Transport Efficiency	Sustainable transport measures & bicycle racks
Use of renewable resources (renewable energy and rainwater harvesting)	Application of Solar Energy & Heat Pump technology
Land use and Ecology	Maintaining and improving the ecological value of the land
Emissions	Insulation products with low Ozone Depletion Potential
	Refrigerants with Ozone Depletion Potential of zero
	Stormwater Management
	Light Pollution: Minimise light beams directed upwards or outside the buildings.

Benchmarking and compliance requirements:

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

- Standard Secretary's Environmental Assessment Requirements (SEARs) – ESD requirements.
- NCC Section J – Energy Efficiency
- BASIX – Energy, Water and Thermal Comfort.

Sustainability benchmarks beyond the minimum requirements

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

- Green Star Buildings Tool – Green Building Council of Australia.

2.1 Response to SEARs

This report has been prepared in response to the requirements contained within the Secretary's Environmental Assessment Requirements (SEARs) issued for the SSDA (83867719). Specifically, this report has been prepared to respond to the SEARS requirement issued in Table 2 below.

Table 2. SEARs Compliance

Items	Description of Requirement	Section Reference
Identify how ESD principles (as defined in the EP&A Regulation) are incorporated in the design and ongoing operation of the development.	The sustainability targets for the development will be achieved in an integrated and staged approach through first minimising the need for energy consumption (via passive measures) and then consumption optimisation (energy efficiency) and use of renewable resources where required. The outcome of this staged approach is to ensure the development aligns with the ecological sustainable development principles of Section 193 of the EP&A Regulation 2021. The sustainability targets for the development will be achieved through an integrated and staged approach that first minimises demand (passive design and efficient building fabric), then optimises consumption (high-efficiency systems and controls) and, where feasible, incorporates on-site renewable energy generation. This approach is consistent with the ecological sustainable development principles of EP&A Regulation 2021, which requires Environmentally Sustainable Design (ESD) targets aligned with the Competition Brief (including BASIX Energy +5 and full electrification, or an average 7-star NatHERS outcome where this provides a superior environmental result).	Refer to section 5 for the proposed ESD initiatives.
Demonstrate how the concept development will meet or exceed the relevant industry recognised building sustainability and environmental performance standards.	The proposed development will outperform the minimum regulatory requirements of NCC Section J. While a formal Green Star certification is not being pursued, the design team will incorporate sustainable design principles where feasible, guided by established sustainability frameworks. The concept design has been developed to meet and, where practicable, exceed the minimum regulatory requirements of NCC 2022 Section J and the ESD targets set out in Draft Condition B31 – Ecologically Sustainable Development of the Draft Conditions of Consent (Stage 1). In particular, the building is capable of achieving at least BASIX Energy +5 and full electrification, or an average 7-star NatHERS rating across the development where this delivers a superior environmental outcome. While a formal Green Star rating is not currently proposed, the design is informed by recognised industry frameworks (e.g., Green Star, NABERS) and incorporates best-practice measures for energy, water and indoor environmental quality	Refer to Section 5 for the targeted sustainability measures, including strategies for energy and water conservation.

2.2 Consultant Declaration Form

Project Details	
Application number	SSD-83867719
Address of subject land	45-53 Macleay St, Potts Point NSW
Applicant Details	
Applicant name	T&P Chimes Development Pty Ltd
Report Details	
Name of report this declaration relates	SEARs SSDA Ecologically Sustainable Design (ESD) Report
Report reference no.	-
Report date	30 March 2026
Company name (inc. ABN / ACN)	Integrated Group Services (IGS) 68 163 019 029
Author name	Behrooz Shojaei
Author qualifications	Senior ESD Engineer BSc, MEng (UTS), MEngSc (UNSW) Inst. of Engineers Australia – Professional Engineer NABERS AA, GSAP, CBD AA, CEC AD Experience: 20 years
Author address	192-200 Euston Road, Alexandria NSW 2015
Declaration By Consultant	
Name	Behrooz Shojaei
Signature	
Date	30 March 2026

3. Overview

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 regulatory NCC Section J requirements.

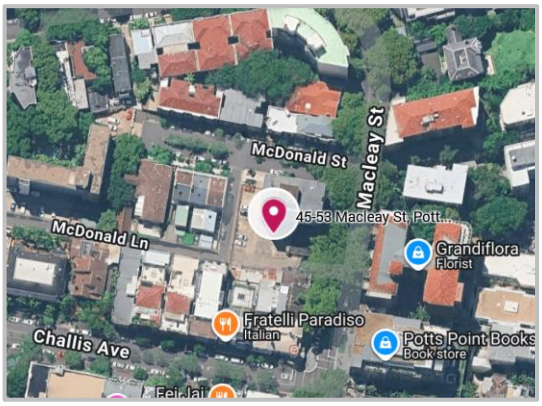


Figure 1. Location – 45-53 Macleay St, Potts Point NSW Source: Google Map.

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 tenancies and base building and therefore lower greenhouse gas emissions during the life of this development.

IGS has been commissioned to prepare this Ecologically Sustainable Design (ESD) assessment report in accordance with the technical requirements of the Secretary's Environmental Assessment Requirements (SEARs) and in support of the preparation of an Environmental Impact Statement (EIS) and State Significant Development Application for the proposed development to the Department of Planning, Housing and Infrastructure (DPHI). This report has been prepared with reference to architectural plans prepared by KHA.

Natural lighting and natural ventilation 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.
- A mixed mode approach allowing the buildings to be naturally ventilated when outdoor conditions are suitable allowing significant energy reduction by not requiring the air conditioning system to operate at all times.
- 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 & Heat Pump technology.

4. Stakeholder Engagement Guidance

This Ecologically Sustainable Design (ESD) Report has been informed by consultation with relevant stakeholders, authorities and members of the project team. The purpose of this engagement was to confirm project objectives, identify any ESD-related constraints or opportunities, and ensure that the proposed sustainability measures are coordinated with the broader planning and design process.

The Ecologically Sustainable Design strategy has been informed by the project SEARs, applicable State and local planning controls, the National Construction Code (NCC) and relevant industry best-practice guidelines, and has been coordinated with the architectural and engineering design teams throughout the concept and SSDA stages.

5. Assessment and Mitigation of Impacts

This section summarises the existing environment, statutory framework, likely ESD-related impacts of the proposal and the mitigation measures adopted in the design.

5.1 Existing Environment

The site at 45-53 Macleay St, Potts Point NSW is located within an established urban area in the City of Sydney LGA, characterised by medium–high density residential and commercial uses supported by public transport and local services.

Key aspects relevant to ESD include:

- **Community and land use:** Predominantly residential and commercial uses with good access to walking, cycling and public transport, offering opportunities to reduce private-vehicle emissions.
- **Natural and built features:** Highly urbanised built form with limited existing vegetation on site, existing utility infrastructure, and adjacent streetscapes and open space that may benefit from improved thermal performance and landscaping.
- **Risks and hazards:** Urban heat island effects and climate-change-driven extreme heat events, as well as typical inner-city constraints on roof and site area for renewables and water harvesting.

5.2 Statutory and Policy Framework

The ESD assessment has been prepared with regard to:

- The Environmental Planning and Assessment Act 1979 and associated Regulation.
- Relevant State Environmental Planning Policies and the [insert] Local Environmental Plan and Development Control Plan.
- National Construction Code 2022, BCA Volume One, Section J Energy Efficiency, and referenced Australian Standards.
- Applicable rating tools and guidance (e.g., BASIX & NatHERS).

These instruments inform the performance benchmarks and design targets adopted in this report.

5.3 Scale and Nature of ESD Impacts

From an ESD perspective, the proposal primarily influences:

- **Operational performance:** Energy use and greenhouse gas emissions, potable water demand and stormwater runoff.
- **Indoor environment:** Thermal comfort, daylight access, ventilation opportunities and material toxicity.
- **Climate resilience:** Contribution to, and sensitivity to, urban heat island effects and extreme weather.

Modelling and qualitative assessment indicate that, with the proposed measures, the development will comply with and exceed minimum NCC 2022 Section J requirements, reduce projected greenhouse gas emissions and potable water use relative to a code-compliant reference building, and improve indoor environmental quality for occupants.

In considering existing, approved and likely future development, the project is expected to:

- Improve environmental performance compared with existing development on the site.
- Be compatible with approved and likely future development and assist in moderating cumulative demand on local infrastructure through efficiency measures.

Other environmental impacts (e.g., traffic, noise, wind, overshadowing) are assessed in the relevant specialist reports; the ESD initiatives do not worsen, and in some cases improve, those outcomes.

5.4 Mitigation and Enhancement Measures

The following measures are proposed to avoid, minimise or offset ESD-related impacts and enhance performance:

- High-performance building envelope (insulation, glazing, external shading and air-tightness).
- High-efficiency HVAC and LED lighting with appropriate zoning and automatic controls.
- On-site renewable energy generation (e.g. rooftop solar PV), where feasible.
- Water-efficient fixtures and fittings, with rainwater harvesting and reuse for appropriate non-potable demands, subject to detailed design.
- Increased landscaping, tree canopy and high-albedo surfaces to mitigate urban heat island effects.
- Support for active and low-emissions transport modes (bicycle parking, end-of-trip facilities, and provision for EV charging where feasible).
- Construction-phase measures to minimise waste and favour low-embodied-carbon and responsibly sourced materials.

Many of these initiatives are embedded in the reference design; others will be refined during detailed design and may be secured via conditions of consent. With these measures in place, residual ESD-related impacts are considered acceptable.

5.5 Cumulative Impacts

In accordance with the NSW Government *Assessing Cumulative Impacts* guidelines, the proposal has been considered in the context of existing, approved and likely future development in the locality. The project is expected to make a positive contribution to cumulative environmental outcomes by:

- Reducing operational energy and water demand per unit floor area, and associated emissions.
- Enhancing resilience to heat and improving local microclimate through landscaping and heat-resilient design.
- Moderating cumulative demands on electricity, water and sewer infrastructure compared with a standard code-compliant building of similar scale.

No unacceptable adverse cumulative ESD impacts have been identified.

6. Assessment Approach

This ESD assessment has been undertaken with regard to the relevant provisions of Sydney LEP 2012 and Sydney DCP 2012 relating to sustainability, energy and water efficiency, building envelope, landscaping and urban design. The proposed development has been reviewed against these controls and is considered generally consistent, noting that the ESD initiatives outlined in this report support achievement of the LEP and DCP objectives for environmentally responsible development.

The assessment draws on site baseline information, including the existing built form and land use, surrounding urban context, local climate, access to public and active transport, available roof and site area for solar and water initiatives, and existing servicing infrastructure. This baseline provides the reference point for evaluating the performance of the proposed development.

A clear methodology has been adopted, comprising:

- review of applicable statutory controls and guidelines;
- development of a code-compliant reference case;
- quantitative assessment (e.g., energy and water modelling where applicable); and
- qualitative review of design measures against best-practice ESD principles.

The proposed development has then been assessed against the baseline conditions using this methodology, demonstrating improvements in predicted operational energy and water use, greenhouse gas emissions and indoor environmental quality compared with a compliant reference building.

Consultation with relevant stakeholders and agencies (as required by the SEARs) has been undertaken by the broader project team, and any ESD-related comments have been addressed through refinement of the design and incorporation of specific measures documented in this report.

Consistent with the NSW Government cumulative impact guidance, potential cumulative impacts from surrounding and future development (including energy and water demand, infrastructure capacity and contribution to urban heat) have been considered. The improved performance of the proposal is expected to make a positive contribution to cumulative environmental outcomes in the locality.

This ESD Report identifies mitigation measures to avoid, minimise or manage impacts resulting from the proposed development. These measures are clearly described as either:

- embedded in the current architectural and engineering design;
- recommended to be secured via conditions of consent (operational measures); or
- requiring amendment or refinement of the architectural plans at detailed design stage.

Following the application of these measures, any outstanding or residual ESD-related impacts are explicitly described and are considered acceptable in the context of the site, relevant controls and best-practice benchmarks.

The assessment is based on the final “lodgement” set of architectural plans and verified gross floor area (GFA) and other key project metrics current at the time of reporting. Any future changes to the architectural documentation will need to be checked for consistency with the ESD assumptions and recommendations outlined in this report.

7. Benchmarking

Benchmarking and compliance requirements:

The development will meet and outperform the following regulatory sustainability requirements, incorporating measures for superior environmental performance:

Table 3. Benchmarking and compliance requirements.

Standard	Requirement Details
Secretary's Environmental Assessment Requirements (SEARs) – ESD requirements	The development will achieve a minimum average 7-star NatHERS rating across all dwellings, or meet a BASIX Energy Score of at least +5 and demonstrate full electrification.
NCC Section J – Energy Efficiency	Compliance will be achieved through the use of highly efficient building fabric (e.g., performance glazing, insulation), efficient HVAC systems (with COPs exceeding 4.0), and efficient lighting (e.g., LED technology and lighting control systems).
BASIX – Energy, Water and Thermal Comfort	The project will meet the requirements of BASIX for Energy, Water, and Thermal Comfort, with a commitment to achieving the minimum BASIX Energy Score of at least +5. Full electrification will be pursued unless the average 7-star NatHERS rating demonstrates a superior environmental outcome. Advanced metering and energy monitoring systems will be installed to support ongoing efficiency and performance benchmarking.

Sustainability benchmarks beyond the minimum requirements

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

- Green Star Buildings Tool – Green Building Council of Australia

7.1 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.
- J1V3 – Verification using a referenced building.

The Deemed-to-Satisfy Provisions in Section J of the NCC 2022 include the following 8 components.

- Part J1 - Energy efficiency performance requirements.
- Part J2 - Energy efficiency.
- Part J3 - Elemental provisions for a sole-occupancy unit of a Class 2 building or a Class 4 part of a building.
- Part J4 - Building Fabric relates to the building fabric and minimum thermal performance for constructions according to climate zone for roofs, ceilings, roof lights, walls, glazing and floors.
- Part J5 – Building Sealing – Provisions to reduce the loss of conditioned air and restrict unwanted infiltration to a building.

- Part J6 - Air-Conditioning and Ventilation – Requirements to ensure these services are used and use energy in an efficient manner.
- Part J7 - Artificial Lighting and Power – Requirements for lighting and power to ensure energy is used efficiently within a building.
- Part J8 - Heated water supply and swimming pool and spa pool plant – Restrictions for hot water supply design except for solar systems within climate zones 1, 2 and 3.
- Part J9 - Energy monitoring and on-site distributed energy resources.

The development will meet and outperform the NCC energy efficiency requirements of Part J4 report will be prepared once the design is further progressed.

7.2 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:

- Green Star Buildings.
- Office Interiors.
- Performance.
- Communities.

Green Star rating tools use Stars to rate performance:

- Legal compliance: The building is compliant with legislation (National Construction Code 2019 or later).
- Good Practice: The building meets the Minimum Expectations of good practice energy and water efficient, good indoor environment quality and built to operate well.
- 4 Star reflects a Best Practice environmental performer. It builds on the Minimum Expectations to deliver a building that is either climate positive or a higher performer in energy, water, and health related issues (15 out of 100 points).
- 5 Star demonstrates Australian Excellence by being a high environmental performer that addresses social issues relevant to the building owner (35 out of 100 points).
- 6 Star showcases World Leadership. It has been built to be a highly efficient building fully powered by renewables that addresses a significant number of environmental and social issues, and contributes to the community (70 out of 100 points).

The diagram in Figure 2 below details the ratings awarded by Green Star Buildings.

Figure 2. The ratings awarded by Green Star Buildings.

Green Star rating tools include eight separate environmental impact categories, as shown Figure 3 and Figure 4 follows.

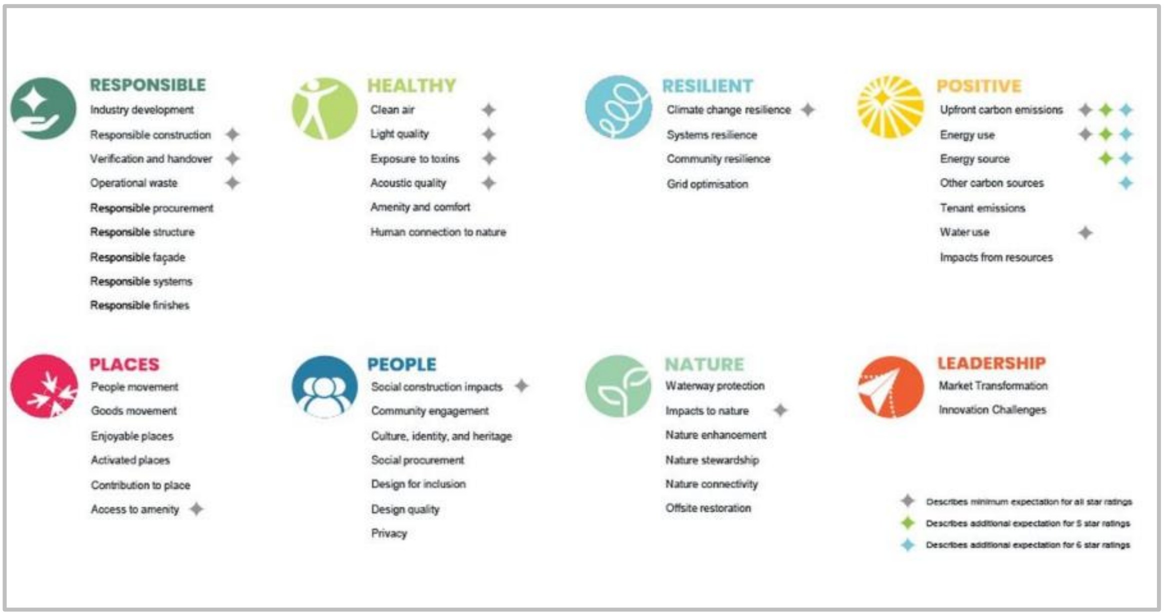


Figure 3. Environmental impact categories list used in Green Star rating tools.

Figure 4. Eight separate environmental impact categories chart used in Green Star rating tools.

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

8. Development Location

The development will be located in Potts Point NSW which is within the NCC climate zone 5 (Warm temperate). The climate zone map of the development is depicted in Figure 5.

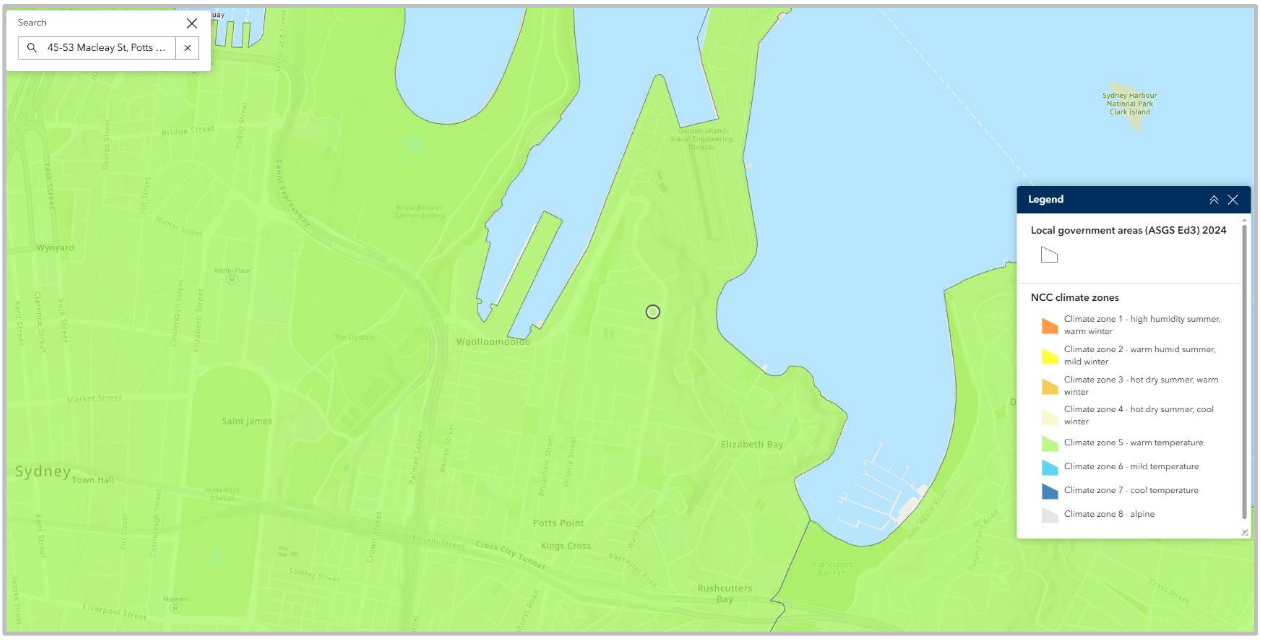


Figure 5. Climate zone map.

8.1 Information Used in Review

Our review is based on the following preliminary architectural drawings by KHA Architects (Table 4).

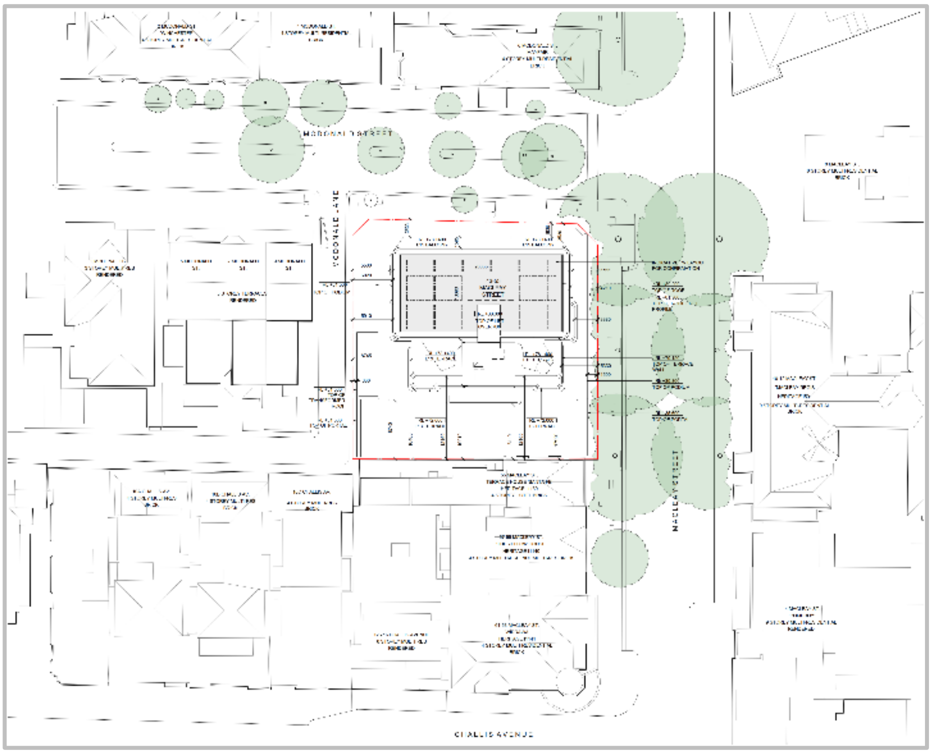
Table 4. Architectural drawing list.

Drawing title	Drawing number
Basement 4 Floor Plan	A1001
Basement 3 Floor Plan	A1002
Basement 2 Floor Plan	A1003
Basement 1 Floor Plan	A1004
Ground Floor Plan	A1010
Level 1 Floor Plan	A1011
Level 2 Floor Plan	A1012
Level 3 Floor Plan, Terrace Level	A1013
Level 4 Floor Plan (Typical 5, 7, 9, 11)	A1014
Level 6 Floor Plan (Typical 8, 10, 12)	A1016
Level 13-14 Floor Plan, Sub-Penthouse	A1023
Level 15 Floor Plan, Penthouse	A1025
Roof Plan	A1026
North Elevation	A3001
East Elevation	A3002
South Elevation	A3003
West Elevation	A3004

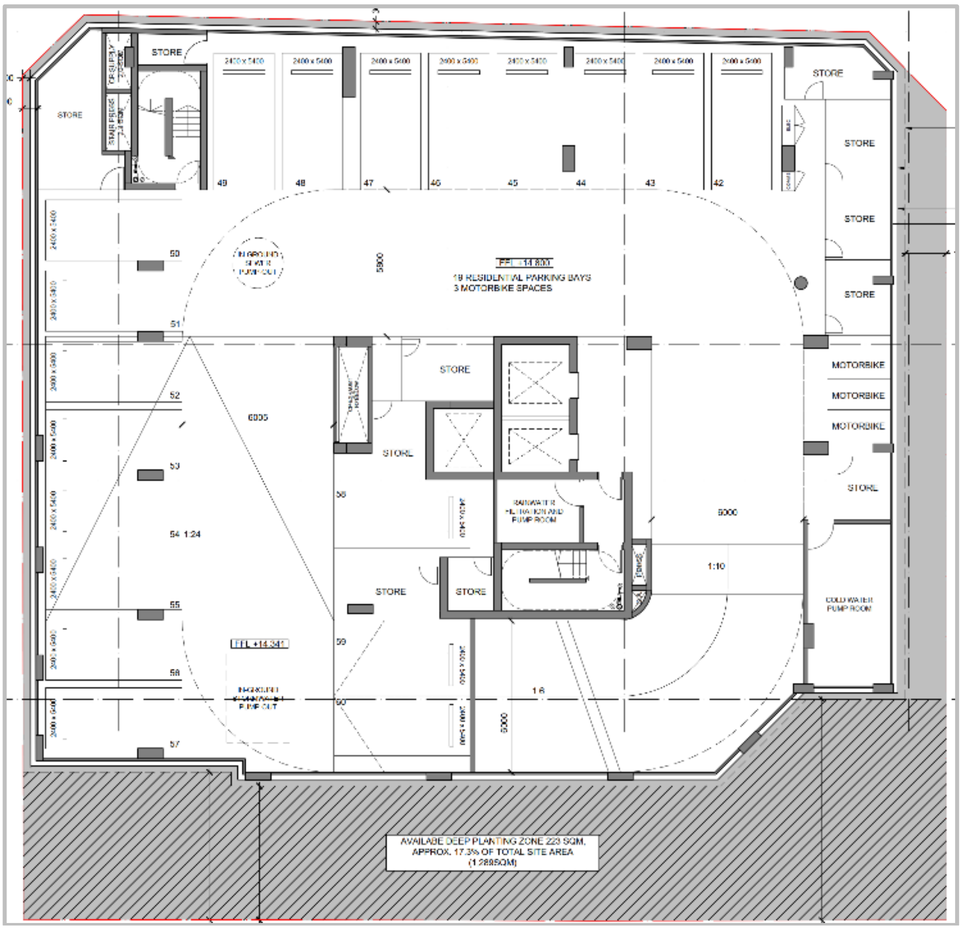
8.2 Architectural Drawings

Selected architectural plans and elevations for the proposed development are provided below.

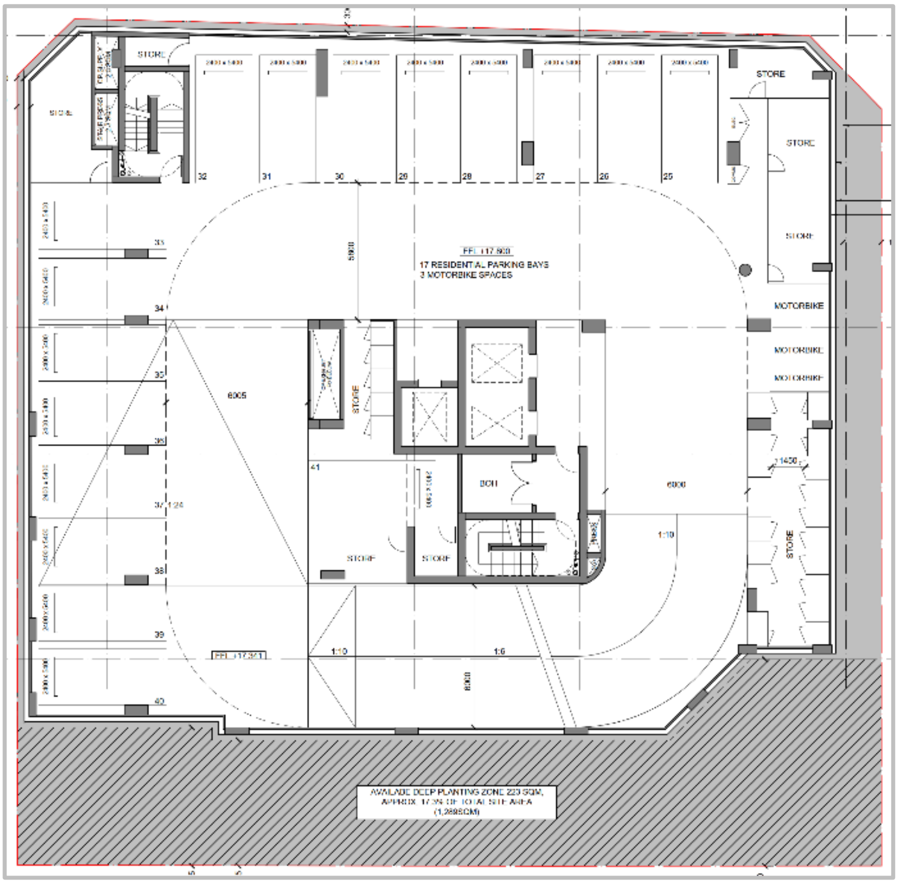
Site Plan



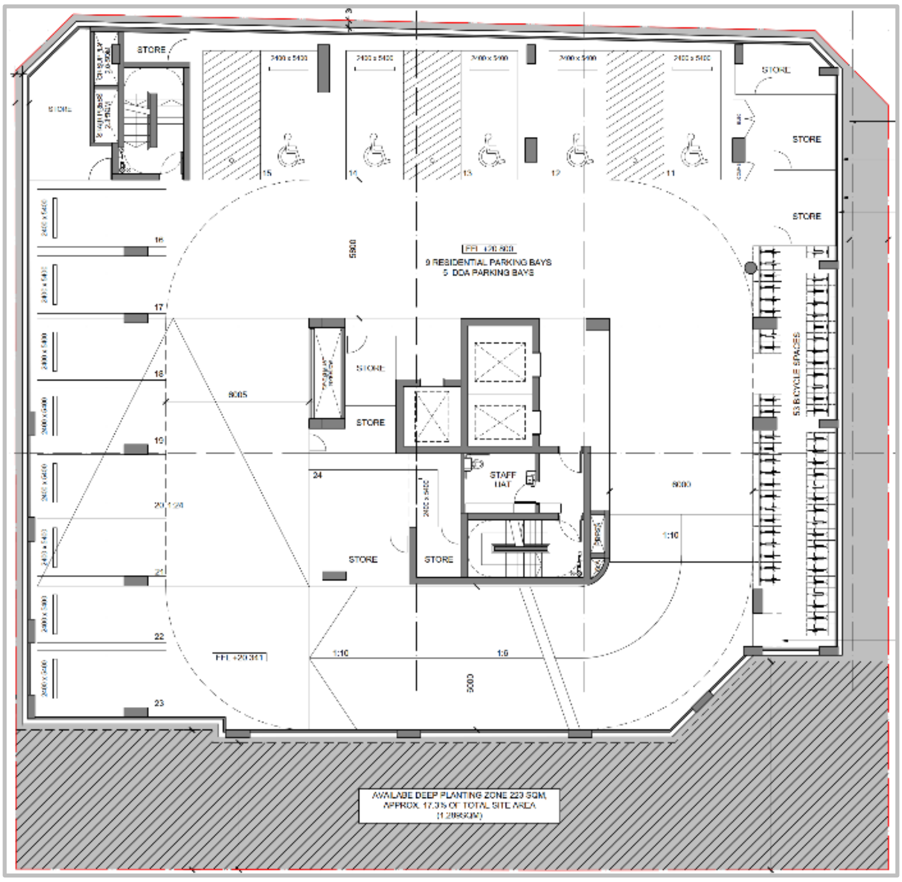
Basement 04 Floor Plan



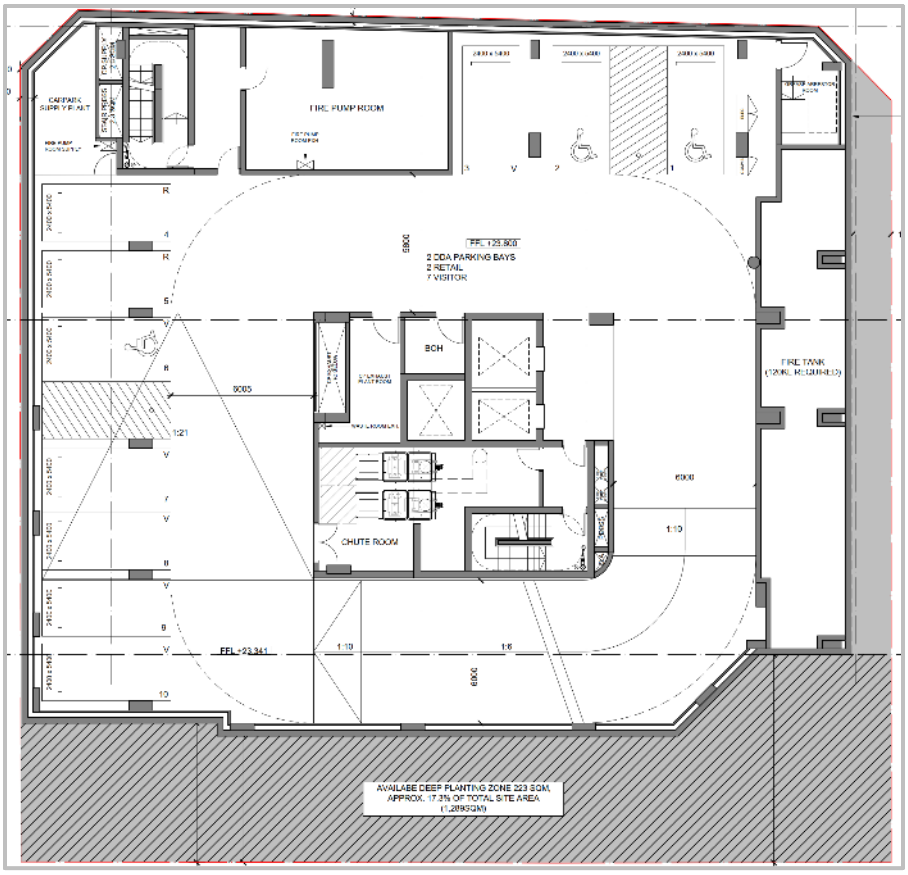
Basement 03 Floor Plan



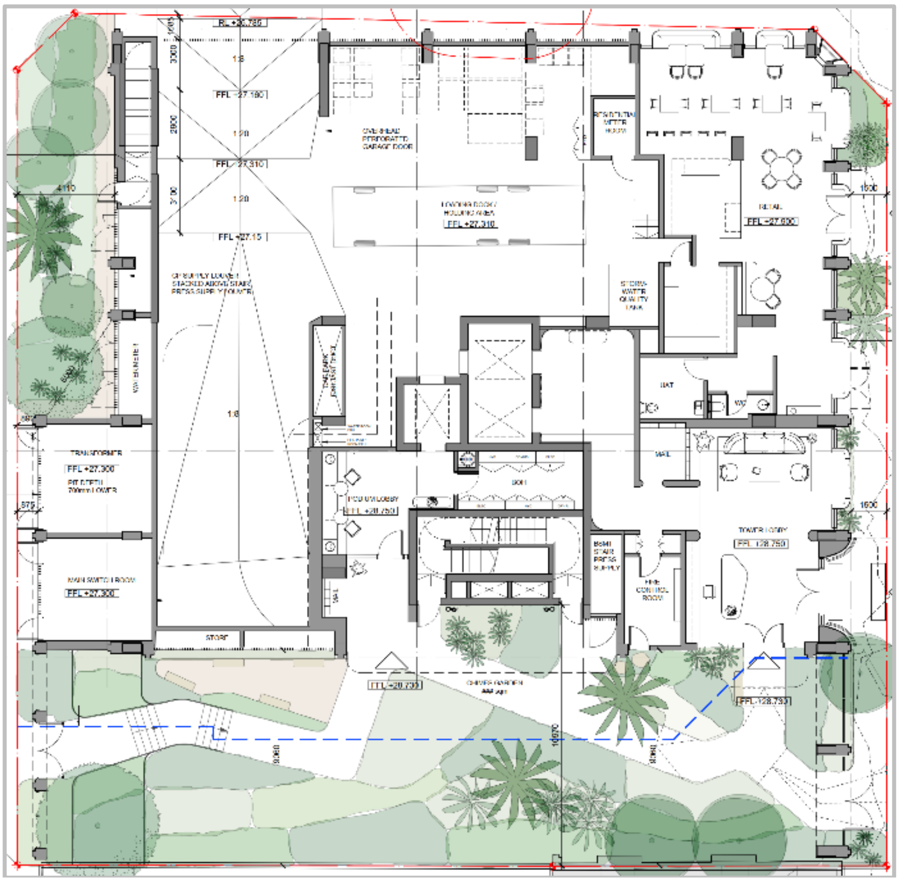
Basement 02 Floor Plan



Basement 01 Floor Plan



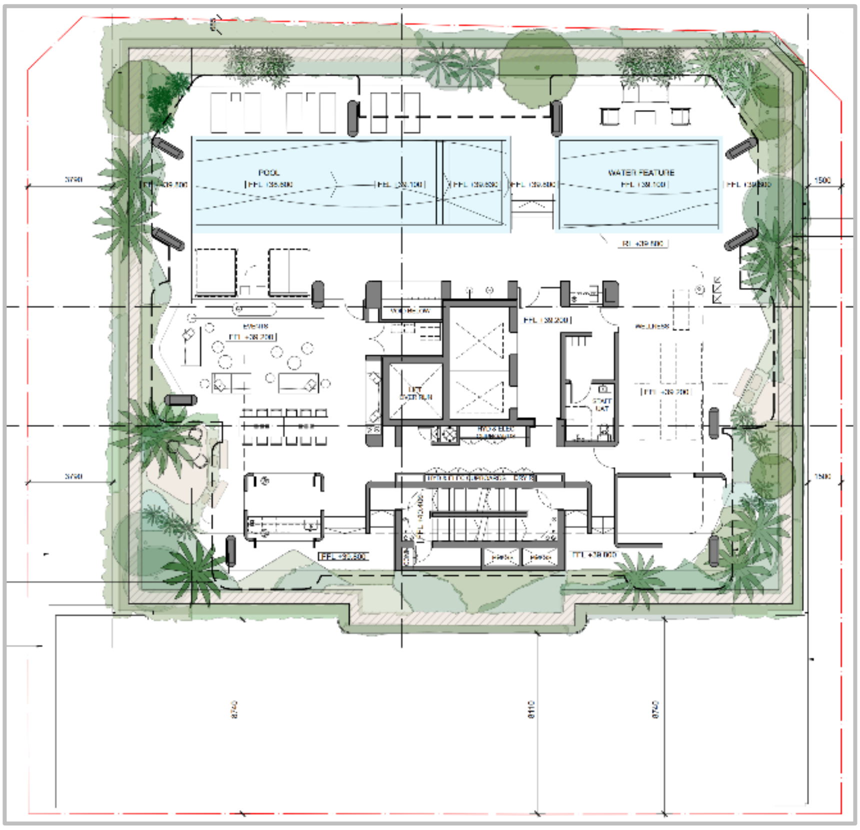
Ground Floor Plan



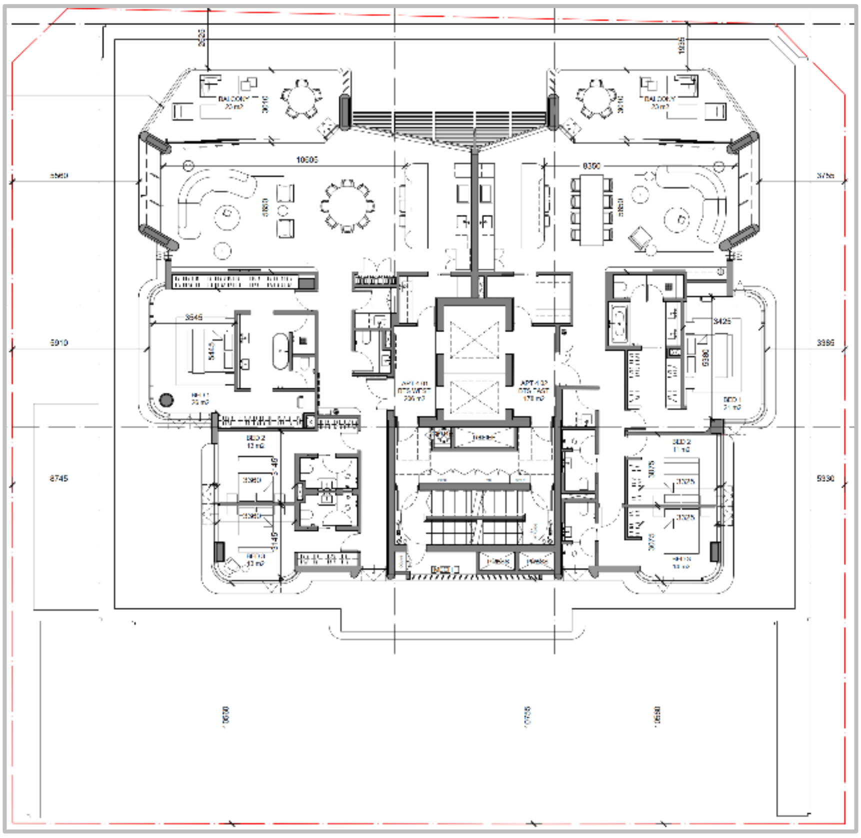
Level 1 Floor Plan

Level 02 - Floor Plan

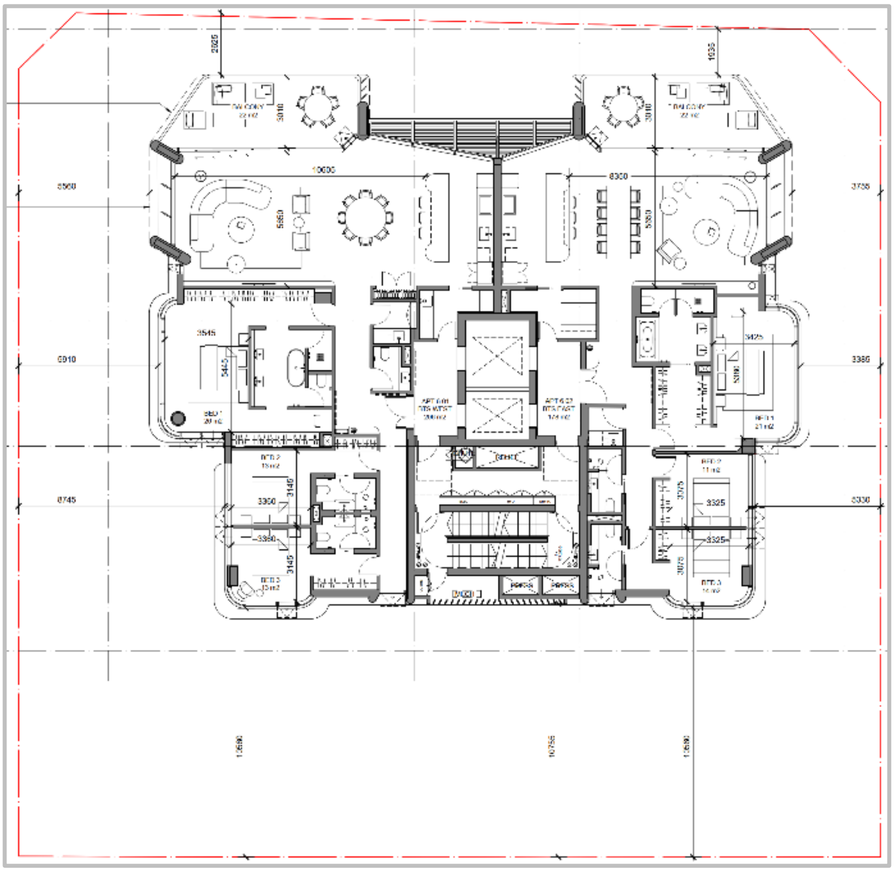
Level 03 - Floor Plan



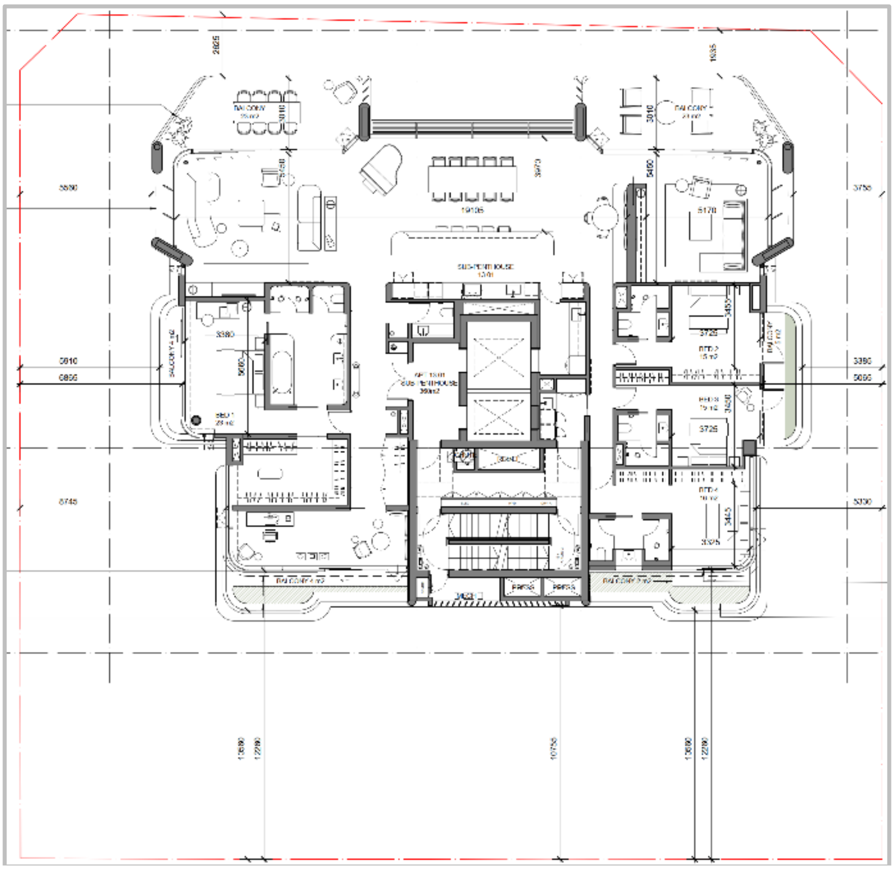
Level 4 Floor Plan (Typical 5, 7, 9, 11)



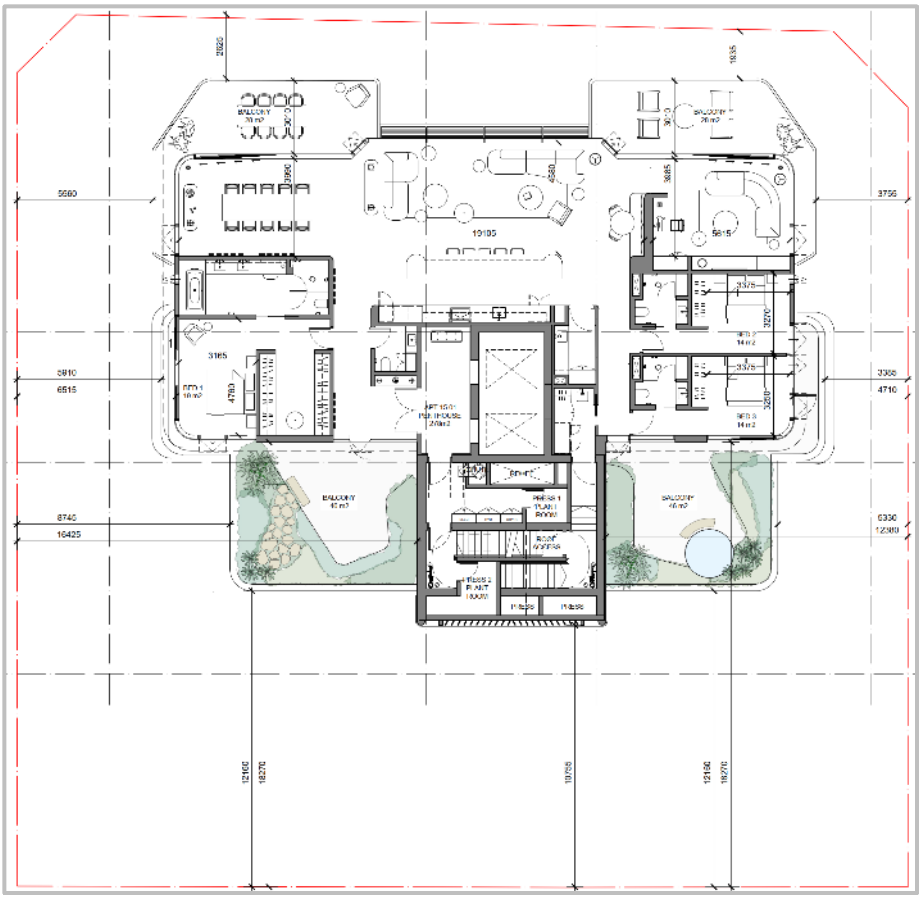
Level 6 Floor Plan (Typical 8, 10, 12,)



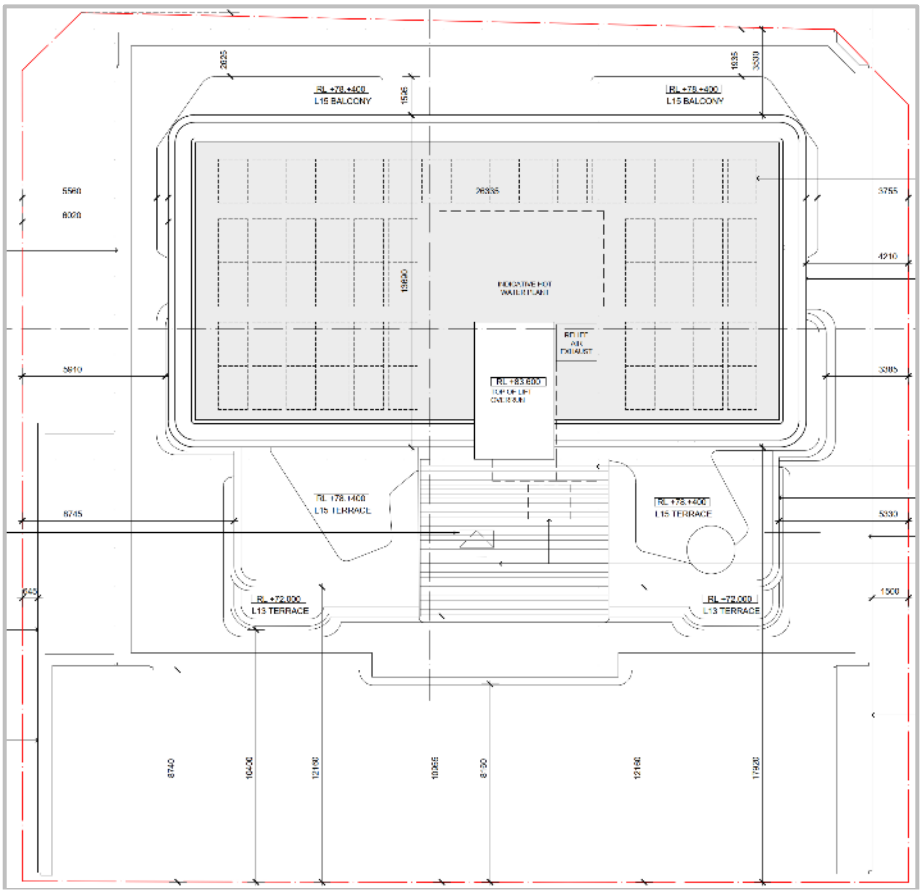
Level 13 Floor Plan (Typ. 14) Sub-Penthouse



Level 15 Floor Plan Penthouse



Roof Plan

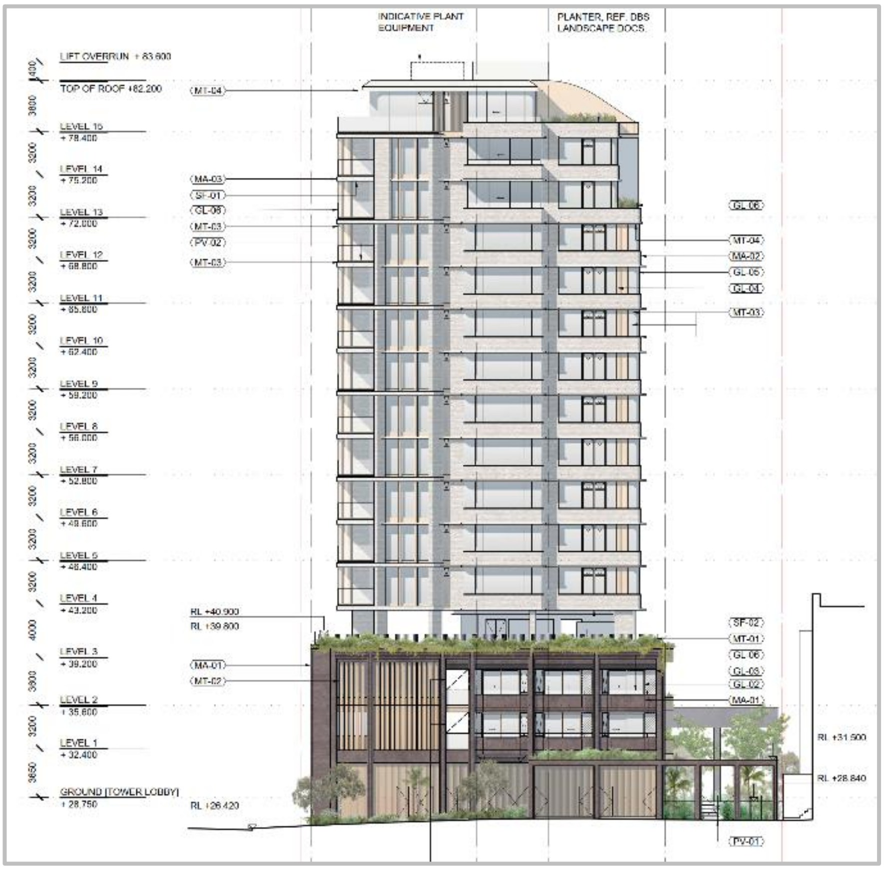


North Elevation

East Elevation

South Elevation

West Elevation



9. 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.

9.1 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.

9.2 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, rainwater harvesting 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.

9.3 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.

9.3.1 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. Ratings can be useful for marketing to the occupants and for demonstrating ESD achievement for planning submissions.

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.

A Green Star Accredited Professional (GSAP) is involved as part of the design and construction to prepare the necessary ESD guidelines.

9.3.2 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).

9.3.3 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.

9.3.4 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.

9.3.5 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.

9.3.6 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 80% 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.

9.4 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.

9.4.1 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.

The approximate annual Dry-bulb temperature and comfort range for the site is shown in Figure 6:

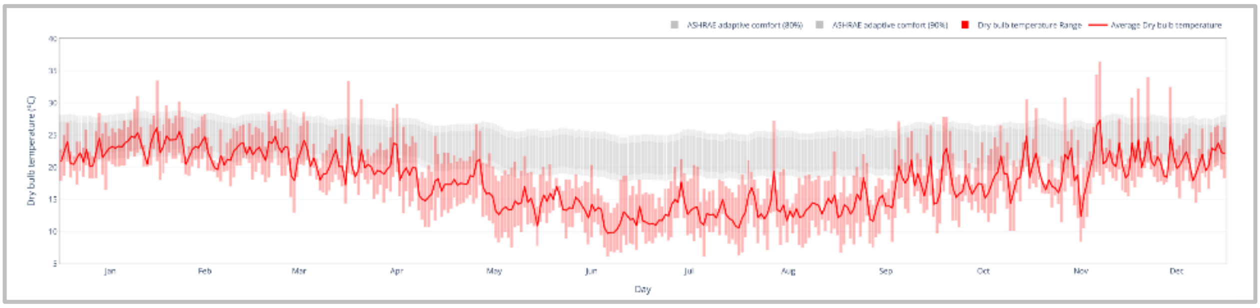


Figure 6. Annual Dry-bulb temperature and comfort range

9.4.2 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.

9.4.3 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.

VOCs 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.

9.5 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 items which are listed in Table 5 below:

Table 5. The integrated energy strategies.

Load Reduction (Minimising the need for energy consumption)	Passive Design
	Building fabric improvements
	Maximise use of natural lighting
	Maximise use of natural ventilation
Optimising energy consumption	High efficiency Heating, Ventilation and Air Conditioning
	High efficiency LED lighting with occupancy controls
	High efficiency hot water systems
	High efficiency appliances
	Commissioning and tuning of building services post completion
	High efficiency building control, automation and BMS
Use of renewable resources (renewable energy and rainwater harvesting)	Application of Solar Energy & Heat Pump technology

9.5.1 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.

Climate data for the site

The following indicative site information data can be used to inform the design team (Figure 7).

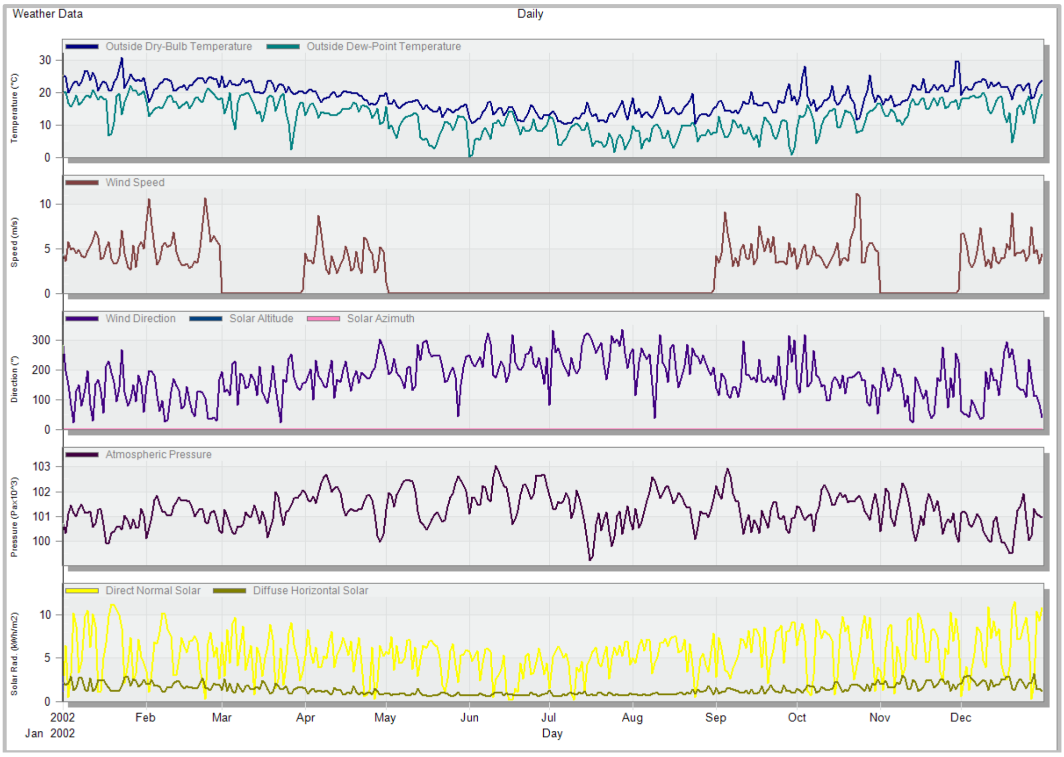


Figure 7. Climate data for the site.

Wind data based on the nearest weather station

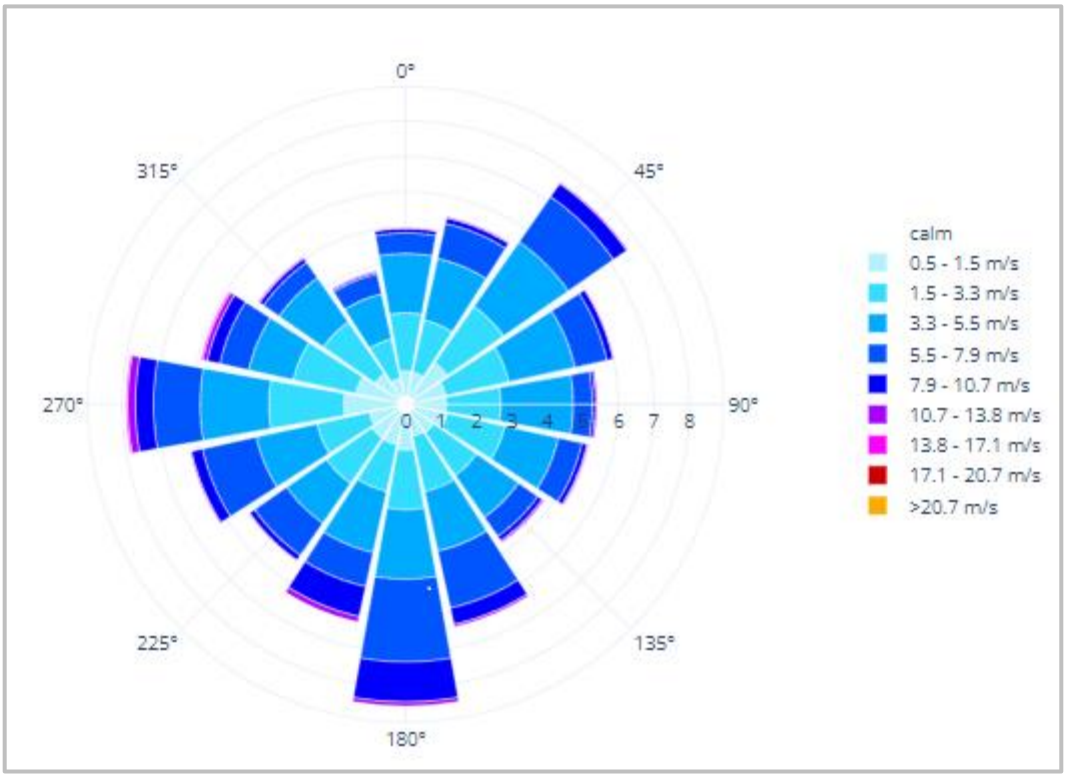


Figure 8. Wind data based on the nearest weather station

Sun path and temperature chart for the site

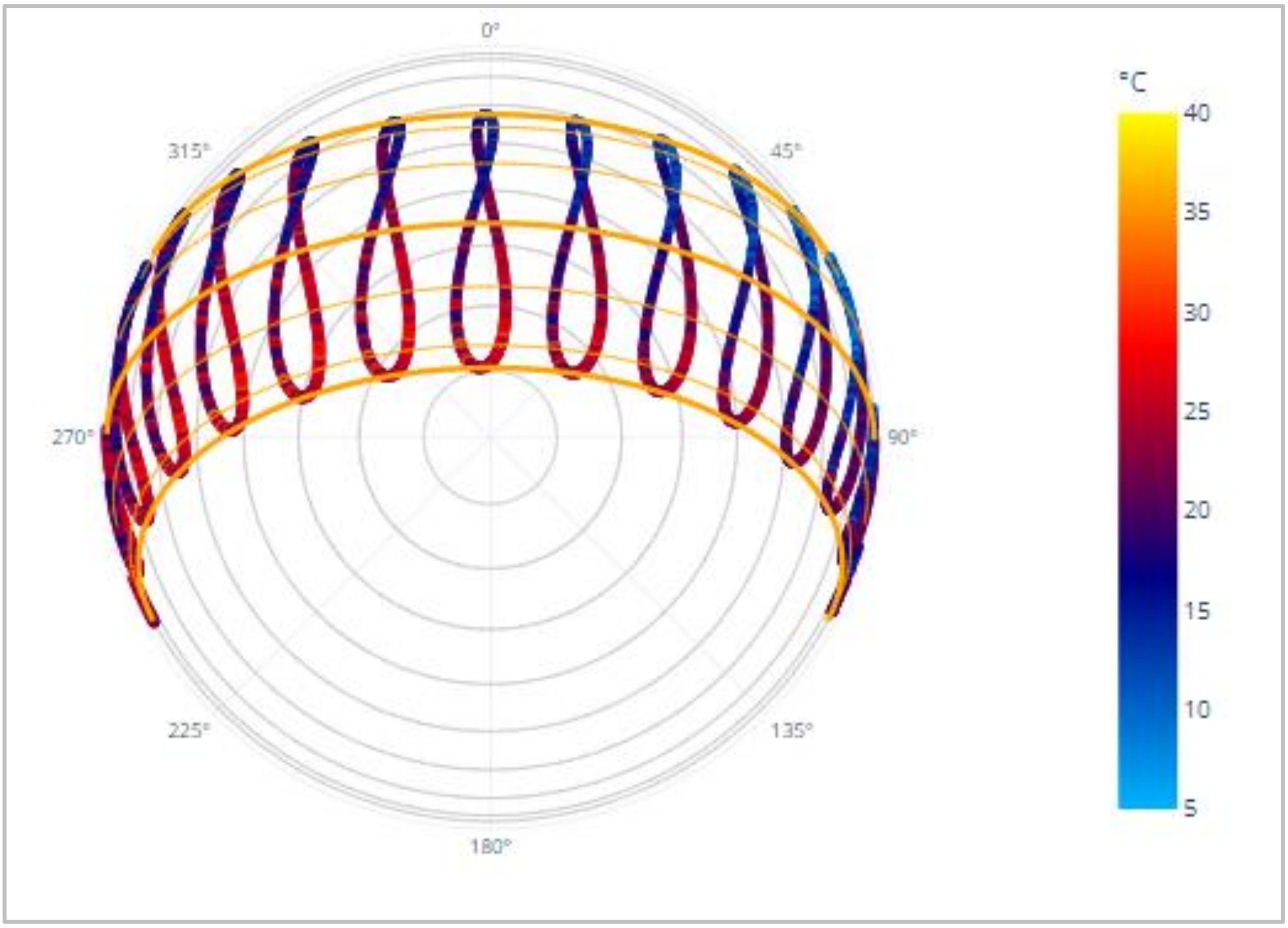


Figure 9. Sun path and temperature chart for the site.

9.5.2 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.

9.5.2.1 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.

9.5.2.2 Glazing and Window Framing

Adequate performance glass will be provided to reduce excessive heat gains in hot conditions, 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) is required to comply with NFRC100-2001 conditions and using the tested AFRC values.

Passive Design and Shading:

Consideration has been given to incorporating effective shading features into the design to maintain high comfort levels and reduce cooling loads without compromising natural light.

The proposed development specifically utilises integrated external sun hoods strategically positioned over windows and glazed areas to provide effective shading:

- **Integrated Shading Strategy:** The use of these external sun hoods is key to mitigating direct solar heat gain during summer months. This approach reduces the reliance on glazing with a low Shading Coefficient (SC).
- **Daylight Optimisation:** By minimising the need for dark or highly reflective coatings, the design maintains a high Visible Light Transmission (VLT) in the glass. This ensures maximum daylight penetration into the interior spaces, enhancing internal amenity and reducing the need for artificial lighting.
- **Orientation-Specific Shading:** The design of the sun hoods is tailored to the building's orientation for optimal performance:
  - The design incorporates horizontal sun hoods integrated with vertical fins and deep returns to effectively manage the challenging low-angle sun exposure typical of mornings and afternoons

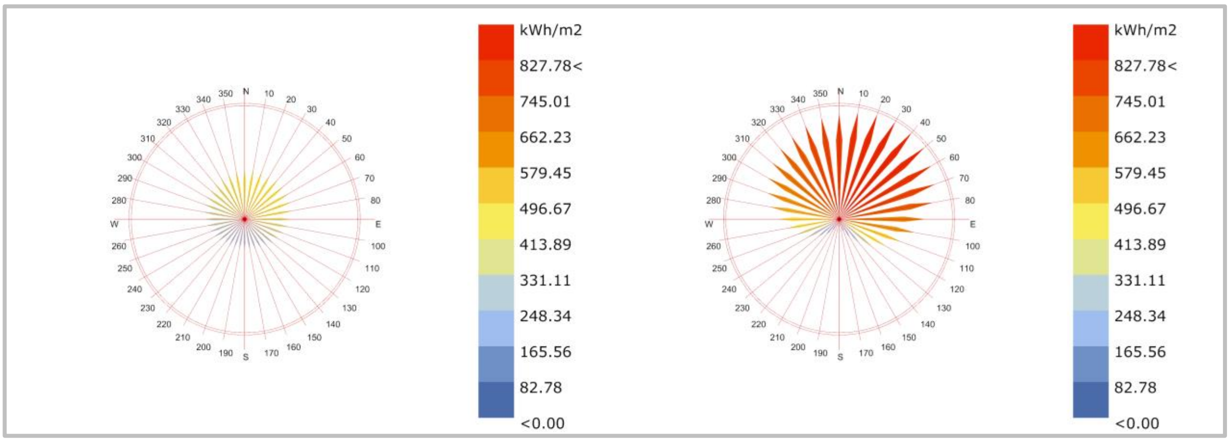
- **Energy Efficiency:** This passive design measure leads directly to a reduction in peak cooling loads and overall energy consumption for mechanical systems.

To maximise the natural daylight within the building, VLT should be as high as possible. A high VLT value not only enhances the quality of the indoor environment and maintains a strong visual connection to the exterior, but also significantly reduces the demand for artificial lighting during the day, contributing directly to lower energy consumption and operational costs.

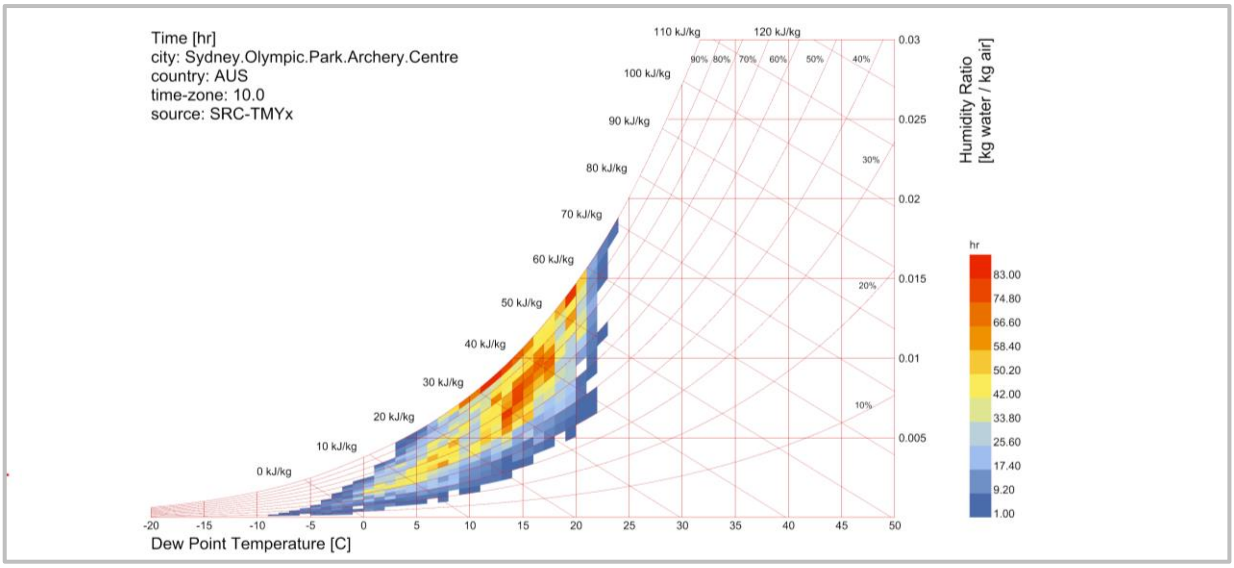
Glazing properties will be specified in conjunction with the shading arrangement on each orientation to control solar loads imposed on the mechanical systems, ensuring thermal comfort, optimising daylight penetration, and preventing glare. This strategy will effectively minimise direct solar loads whilst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

Solar Radiation Rose



Psychrometric Chart



9.5.3 Energy Efficient Systems and Services

The mechanical and electrical design for the buildings 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.

5.5.3.1. 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.
- 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.

5.5.3.2. 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.

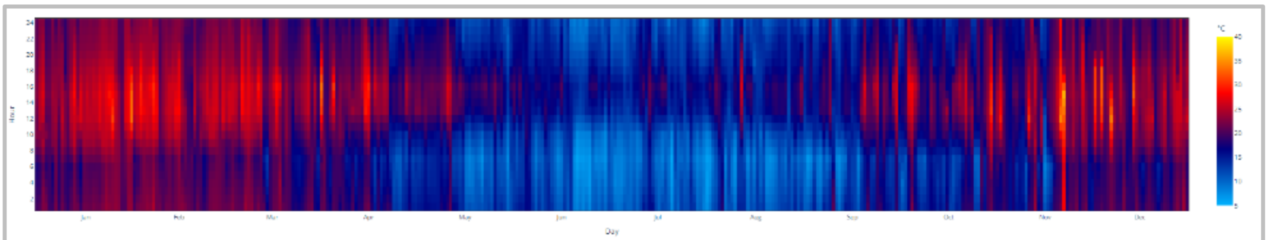
The following energy initiatives will be further considered in the detailed design phase:

- 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).

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.

The Mechanical services will be designed to satisfy the minimum Green Star and NABERS requirements.

Heatmap Chart based on the data from the nearest weather station is depicted in Figure 10 below:

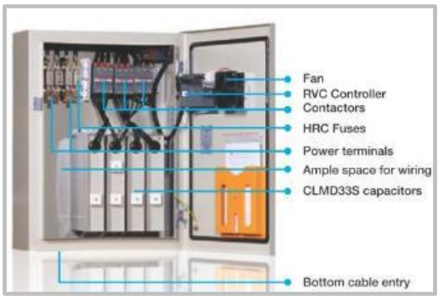


Descriptive statistics

month	mean (°C)	std (°C)	min (°C)	1% (°C)	25% (°C)	50% (°C)	75% (°C)	99% (°C)	max (°C)
Jan	22.78	2.55	16.4	18.03	21	22.6	24.4	30.16	33.5
Feb	22.67	2.48	16.9	18.04	20.78	22.4	24.32	29	38.2
Mar	21.45	2.86	12.9	15.2	19.6	21.2	23.3	28.11	29
Apr	19.16	3.66	10.7	11.7	16.8	19.3	21.2	29.7	33.4
May	15.86	3.64	7.4	8.4	13.2	15.6	18.6	24.51	26.7
Jun	13.14	3.07	6	6.72	11	13.3	15.6	19.38	20.5
Jul	12.8	2.82	6	7.67	10.5	12.5	14.9	20.06	21.3
Aug	13.71	3.28	6.2	6.9	11.7	13.4	15.9	22.67	27.3
Sep	15.83	3.84	6.6	8	13.4	15.4	18.3	25.68	27.2
Oct	17.9	3.69	9.7	10.6	15.3	17.55	20.2	27.76	30.6
Nov	19.8	4.06	8.3	10.58	17.4	19.6	22	31.48	36.5
Dec	21.26	3.04	14.4	15.6	19.1	20.8	22.8	31.66	34
Year	18	4.83	6	7.9	14.3	18.3	21.5	28.64	36.5

Figure 10. Heatmap Chart.

5.5.3.3. 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.

5.5.3.4. 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.

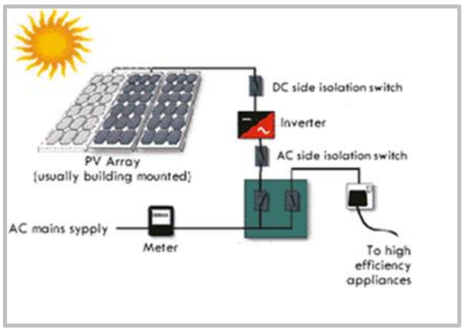
Metering is to be provided throughout the building and central services for all major building plant and equipment. An effective monitoring system is to be provided to monitor energy and water consumption throughout the building as required.

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.

5.5.3.5. Hot Water Systems

High efficiency heat pump hot water systems will be used to provide the Hot Water demands for the buildings.

9.5.4 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 8% for amorphous to 22% for mono-crystalline

A 13 kW Solar PV system has been nominated for the development. The expected renewable energy generation by the overall 13 kW system is approx. 15.6 MWh per annum.

9.5.4.1 Solar PV - System Components

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

Total nominal power:	**13 kW**
Approx. roof space requirements:	**81 m^2**

The Figure below illustrates the predicted arrangement and placement of the Solar PV panels on the roof.

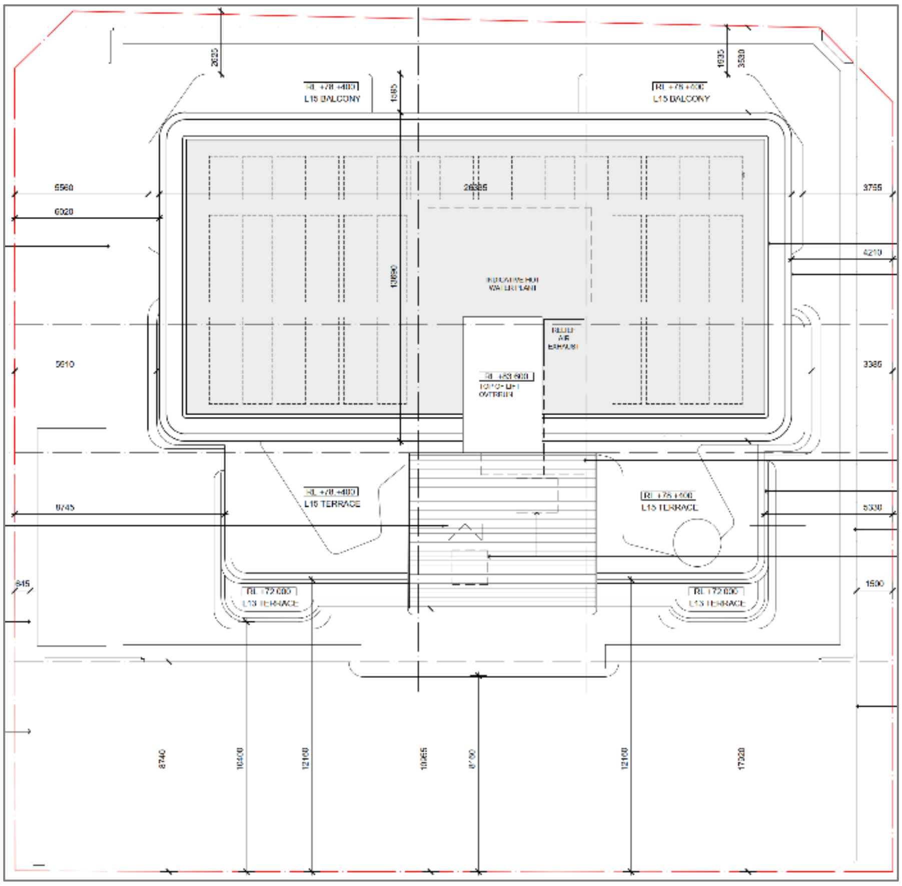
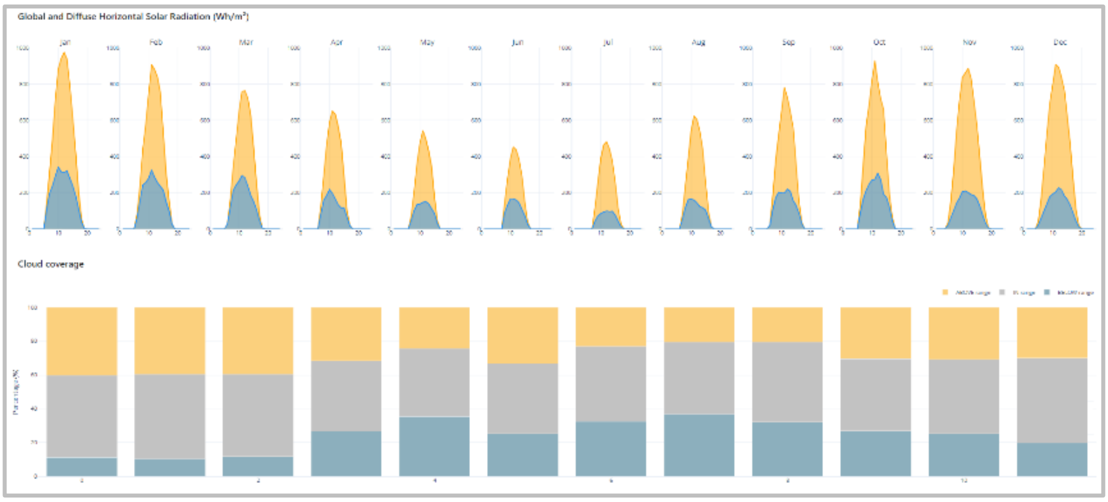


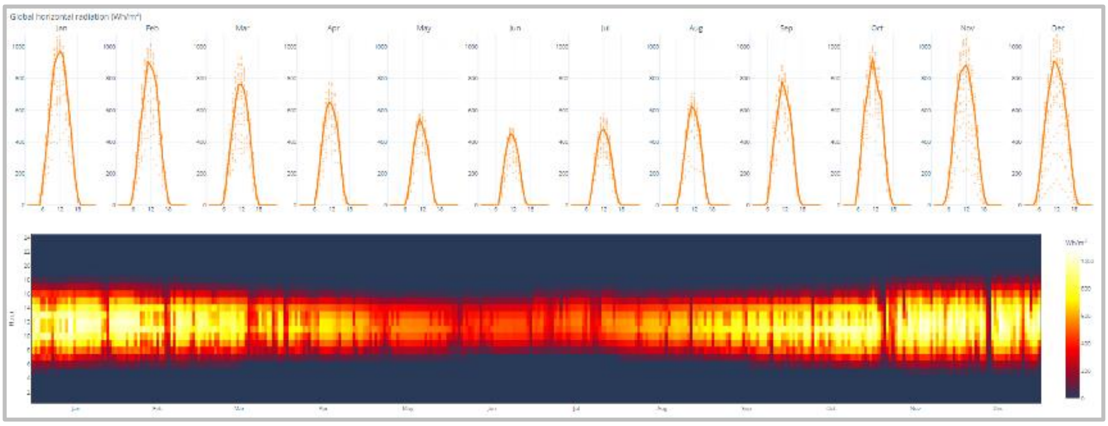
Table 6. Solar PV components information.

Components	Brand, Model & Quantity
Sample PV Inverter	Sungrow 12kW – SG12RT - Quantity: 1
Sample PV Panels	Trina Vertex 600 W - TSM-DEG20C.20 Approx. Quantity: 22
Sample Battery storage (if required)	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 (Trina) and grid-connected inverter (Sungrow).

9.5.4.2 Solar Ration and Cloud Coverage for the site





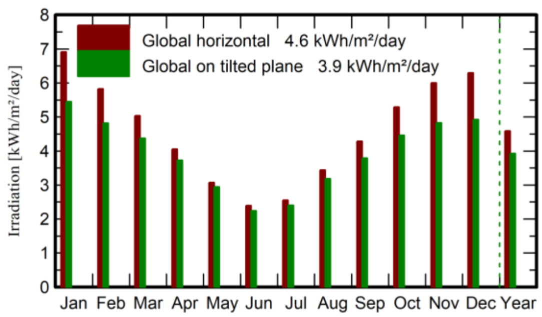
9.5.4.3 Solar PV - Projected energy generation based on 13 kW system

Grid system presizing

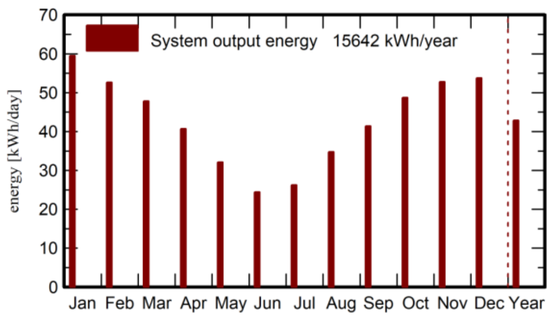
System summary

Nominal power	13.0 kWp	Total area	81 m²
Module type	Standard	Supports for modules	Flat roof
Technology	Monocrystalline cells	Ventilation property	Free air circulation
Annual yield	15.6 MWh		
Specific prod.	1203 kWh/kWp		

Meteo and incident energy



System output



	Horizontal global kWh/m²/day	Coll. plane kWh/m²/day	System output kWh/day	System output kWh
Jan.	6.91	5.45	59.51	1845
Feb.	5.83	4.82	52.66	1474
Mar.	5.03	4.37	47.79	1481
Apr.	4.05	3.73	40.72	1222
May	3.07	2.94	32.13	996
June	2.39	2.24	24.44	733
July	2.55	2.40	26.21	813
Aug.	3.44	3.18	34.74	1077
Sep.	4.28	3.79	41.39	1242
Oct.	5.29	4.46	48.73	1511
Nov.	6.00	4.83	52.76	1583
Dec.	6.30	4.92	53.75	1666
Year	4.59	3.92	42.85	15642

9.6 Net Zero Statement

Achieving Net Zero emissions is critical to meeting the NSW government's ambitious targets of reducing greenhouse gas emissions by 70% by 2035 and achieving net zero by 2050. According to the Sustainable Buildings SEPP (SB SEPP) and Section 35C of the Environmental Planning and Assessment Act Regulation, large developments must submit a Net Zero Statement demonstrating how the building will either be fossil fuel-free upon occupation or transition to fossil fuel-free operation by 1 January 2035.

9.6.1 Limitations Due to Current Project Stage

At this early stage of the project, a full detailed energy assessment is not feasible. A comprehensive energy assessment requires detailed information on mechanical design, equipment specifications, building systems, and operational schedules. Without these critical data points, any full simulation or precise estimation would be premature and potentially misleading.

Therefore, this report presents a preliminary Net Zero pre-assessment based on typical energy consumption profiles for similar buildings, informed by industry benchmarks and best practice assumptions.

9.6.2 Net Zero Approach

Net Zero initiatives adopted for this development aim to minimise operational energy emissions through the elimination of fossil fuel use, enhancement of energy efficiency, and integration of renewable energy generation and storage systems. The key design strategies proposed for this development include:

- High-performance building envelope with enhanced insulation, shading, airtightness, and glazing.
- Electrification of heating, cooling, and hot water systems, prioritising heat pumps and electric technologies.
- Optimised HVAC and lighting systems with smart controls and sensors.
- Integration of onsite renewable energy generation such as rooftop photovoltaics (PV).
- Provision for future transition infrastructure to enable fossil fuel systems to be fully replaced by electric alternatives by 2035.

9.6.3 Emission Considerations and Compliance

While precise emissions estimates require detailed energy modelling, this preliminary assessment confirms that the project will be designed to meet the fossil fuel-free or transition requirements mandated by NSW regulations. Infrastructure and space allowances for electrification will be integrated into the design to ensure compliance with the Net Zero Statement requirements.

9.7 NABERS Embodied Emissions

Embodied emissions refer to the greenhouse gas emissions generated throughout the lifecycle of building materials—from extraction, manufacturing, transportation, construction, through to end-of-life disposal. These emissions represent a significant portion of a building's total environmental impact and must be addressed alongside operational emissions to achieve true sustainability.

In compliance with Section 35BA of the Environmental Planning and Assessment Act Regulation, a NABERS Embodied Emissions Materials Form might be required.

This form discloses the number of embodied emissions attributable to the development and supports transparency and accountability in reducing the building's carbon footprint.

9.7.1 Methodology and Data

The embodied emissions assessment is based on detailed quantification of materials used across the building's structure, envelope, internal walls, services, and external works. Quantities are reported primarily in metric units (such as cubic metres, kilograms, and square metres), supported by cost data where applicable, and exclude labour and equipment.

Due to the early project stage, some quantities have been estimated based on previous projects and best available data. The form captures at least 80% of the total material costs for the main contractor scope, consistent with NSW Government guidelines.

9.7.2 Integration with Project Sustainability

This embodied emissions disclosure complements the operational Net Zero commitments of the project by addressing the lifecycle emissions associated with building materials. The project team is committed to reducing embodied carbon through material selection, use of recycled content, and exploring low-carbon alternatives wherever feasible.

9.8 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 specific user groups likely to have a greater reliance on active transport such as youths, office employees, and nearby community groups.
- Promote nearby cyclist facilities to enhance the uptake of cyclists to the site.
- Integrate transport initiatives into community engagement and communication strategies.

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 recommended to reduce dependence on motorised vehicles, encouraging walking, cycling and the use of mass public transport.

- **Cyclist facilities:** where possible, provision of bicycle racks to promote the use of cycling to work.
- **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 to work.
- **Trip Reduction:** The development is located adjacent to several local amenities, reducing the need for trips.
- **Fuel efficient vehicles:** encouraging the use of more fuel-efficient vehicles by providing adequate parking spaces at prime parking spot solely dedicated for use by small cars, car-pool participants or other alternative fuel vehicles and EV charging points.

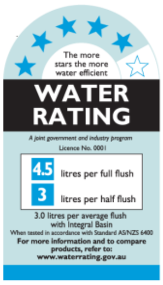
9.9 Water Conservation and Management Initiatives

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.
- Substituting mains water required to meet this demand by utilising alternative sources such as rainwater.

9.9.1 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 outperform the minimum requirements. The following criteria are provided as a guide and subject to further design development (Table 7).

Table 7. Surplus design criteria.

Water Fixtures	Hand wash basins – 6 Star WELS;
	Kitchen taps (where provided) – 6 Star WELS
	Showerheads (where provided) – 4 Star WELS or higher
	Toilets – 4 Star WELS or higher
Appliances	Dishwashers (where provided) – 4 Star WELS or higher
Air Conditioning	Minimise use of water-cooled systems
Landscape Irrigation (where applicable)	Native and water efficient species
	Sub-surface irrigation
	Rainwater usage for landscape

9.9.2 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.

The landscape design shall enhance Biodiversity in terms of Landscape Area and Diversity of Species

9.9.3 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, rainwater tanks, 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.

9.10 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.

9.10.1 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.

9.10.2 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.

9.10.3 Materials with Ozone Depletion Potential

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

9.10.4 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:

- 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.

9.10.5 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.

9.10.6 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.

9.11 Land Use and Ecology

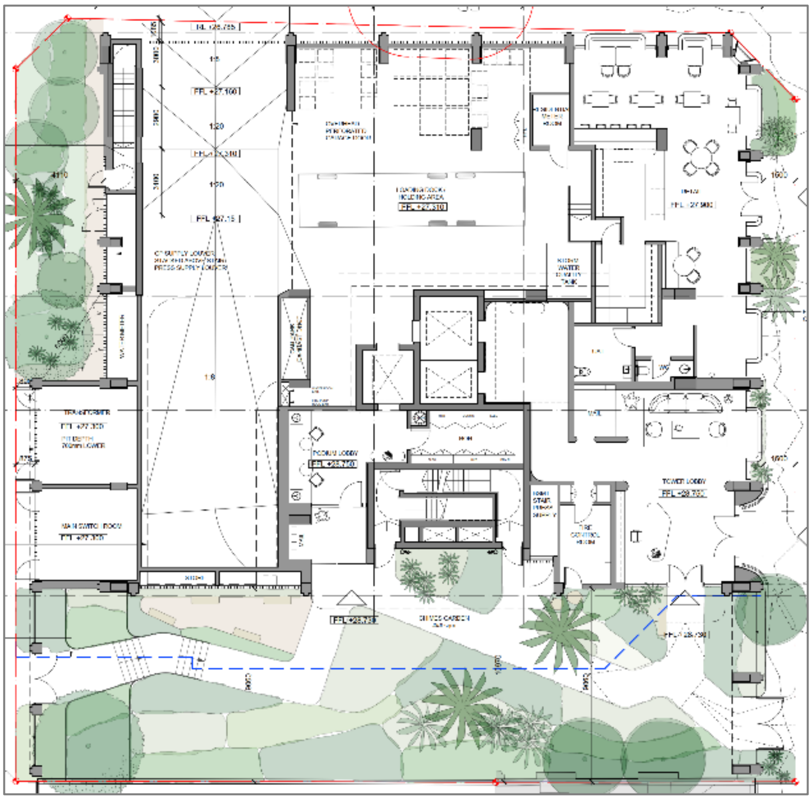
This initiative refers to improvements through Reuse of Land or Change of Ecological Value. The site has been previously built on, and is not a Greenfield.

The development will actively aim to enhance permeable area and vegetation, improving the ecological value and stormwater management capacity of the site.

Specific measures detailed in the architectural plans confirm this commitment:

- **Landscaped Southern Boundary:** A substantial landscaped garden is proposed along the southern boundary of the site. This feature maximises the area dedicated to planting, helping to increase the overall permeable surface area and promote deep-root vegetation growth.
- **Increased Tree Canopy:** The planting strategy includes the introduction of new, locally appropriate tree species, which will increase the tree canopy cover over time, mitigating the urban heat island effect and providing essential habitat.

The commitment to maximising soft landscaping is confirmed in the architectural drawings:



The Architectural Site Plan confirms the arrangement of the proposed landscaping, demonstrating the enhanced permeable area and vegetation coverage along the southern boundary and across the site.

9.12 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.

10. Climate Change Adaptation

10.1 NARCliM Climate Change Projections

The information provided in this section of the report follows the climate change projections based on the NSW and ACT Regional Climate Modelling (NARCliM) project. NARCliM is a multi-agency research partnership between the NSW and ACT governments and the Climate Change Research Centre at the University of NSW. NSW Government funding comes from the Office of Environment and Heritage (OEH), Sydney Catchment Authority, Sydney Water, Hunter Water, NSW Office of Water, Transport for NSW, and the Department of Primary Industries.

Climate change projections are presented for the near future (2030) and far future (2070), compared to the baseline climate (1990–2009). The projections are based on simulations from a suite of twelve climate models run to provide detailed future climate information for NSW and the ACT.

The climate change projections are made for the following 5 parameters:

1. Temperature extremes.
2. Hot days.
3. Cold nights.
4. Rainfall.
5. Fire weather.

Reference: https://climatechange.environment.nsw.gov.au/
NSW Office of Environment and Heritage (OEH)

10.1.1 Temperature

Potts Point NSW is expected to experience an increase in all temperature variables (average, maximum and minimum) for the near future and the far future

- Maximum temperatures are projected to increase by 0.7°C in the near future and up to 1.9°C in the far future. Spring will experience the greatest change in maximum temperatures, increasing by up to 2.2°C in the far future. Increased maximum temperatures are known to impact human health through heat stress and increasing the number of heatwave events.
- Minimum temperatures are projected to increase by 0.6°C in the near future up to 2°C in the far future. Increased overnight temperatures (minimum temperatures) can have a considerable effect on human health.

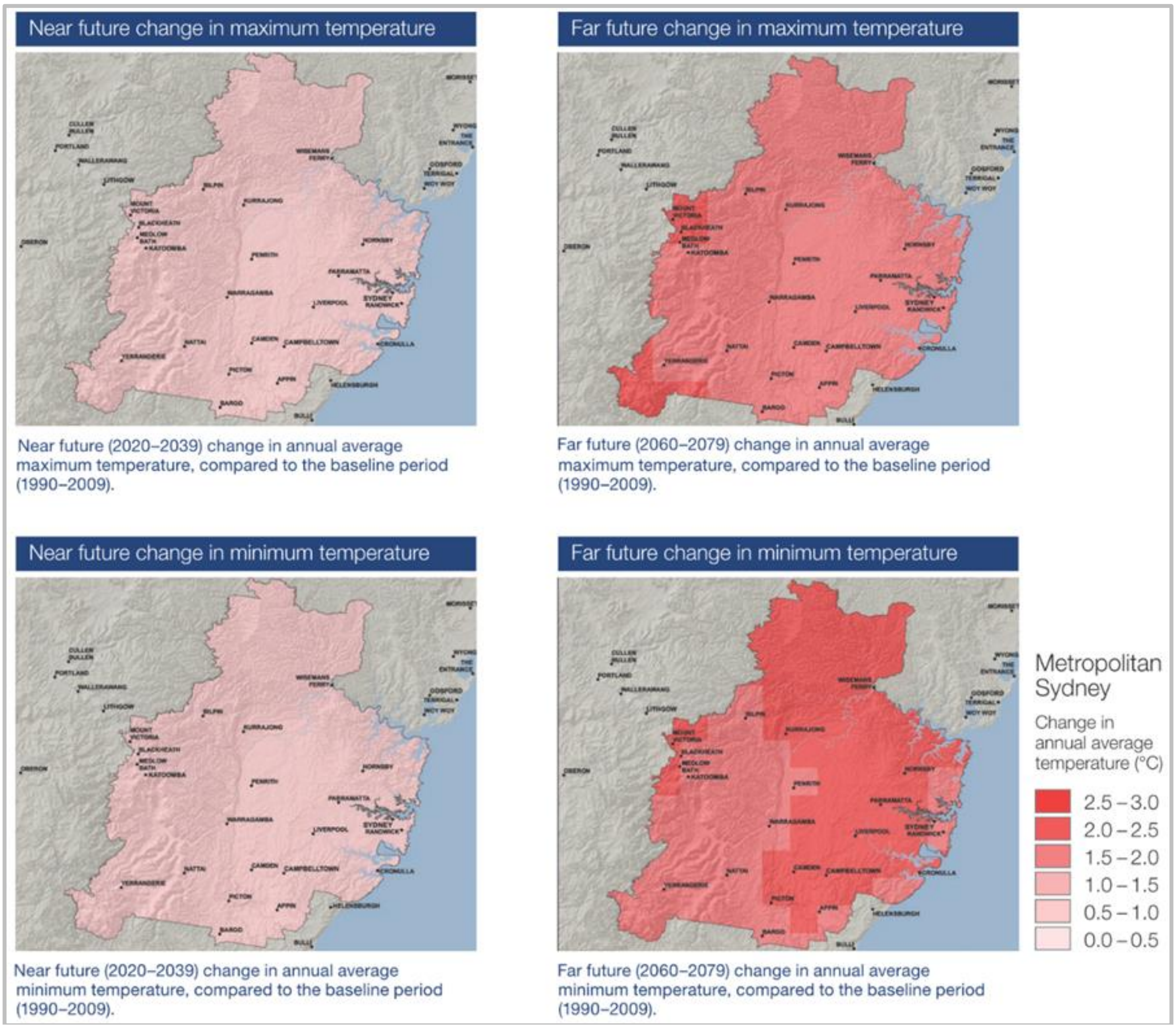


Figure 11. Annual average temperature – Sydney variation map.

10.1.2 Hot days (days per year above 35°C)

Currently Potts Point NSW experiences fewer than 10 days above 35°C each year due to its proximity to the coast. Seasonal changes are likely to have considerable impacts on bushfire danger, infrastructure development and native species diversity.

- The facility is expected to experience more hot days in the near future and in the far future.
- These increases in hot days are projected to occur mainly in spring and summer although in the far future hot days are also extending into autumn.

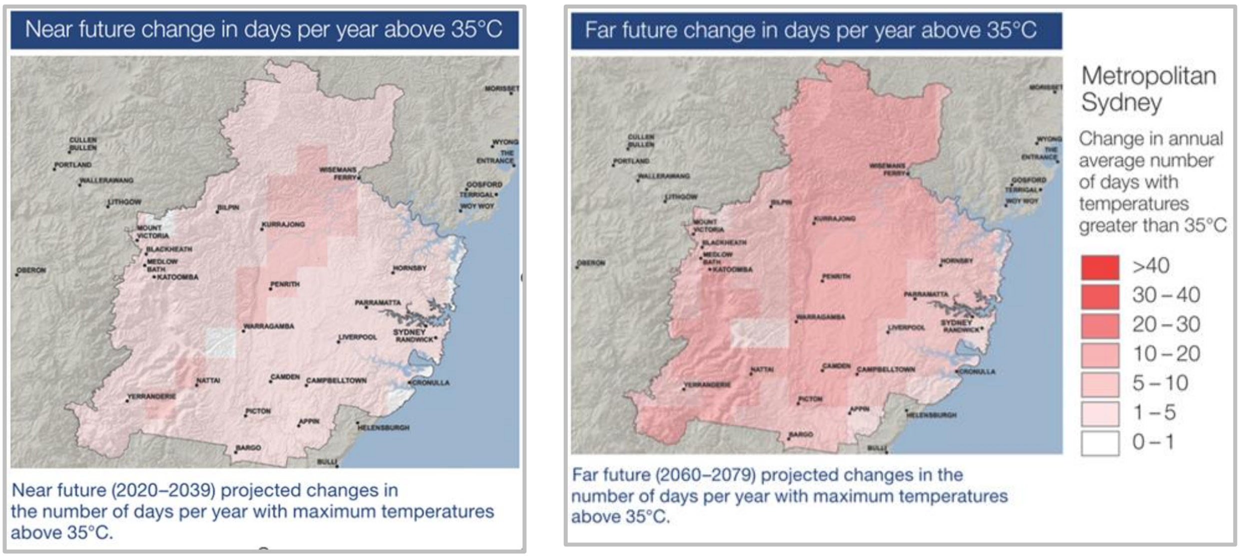


Figure 12. Change in annual average number of days with temperatures greater than 35°C – Sydney variation map.

10.1.3 Cold nights (days per year below 2°C)

Most of the emphasis on changes in temperatures from climate change has been on hot days and maximum temperatures, but changes in cold nights are equally important in the maintenance of our natural ecosystems and agricultural/horticultural industries. For example, some common temperate fruit species require sufficiently cold winters to produce flower buds.

- The greatest decreases are projected to occur in the south-west and in the Blue Mountains, with decreases of up to 20 nights by 2030 and more than 40 fewer cold nights by 2070.
- NARCliM projections suggest that Potts Point NSW will not see a considerable decrease in cold nights (see the white areas in the map).

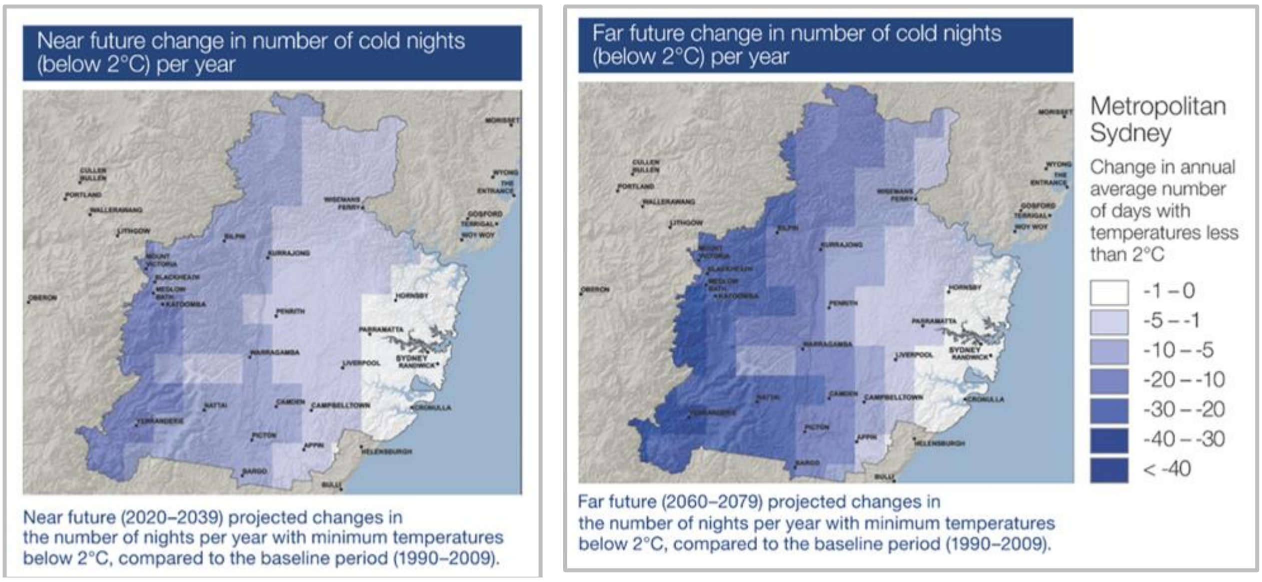


Figure 13. Change in annual average number of days with temperature less than 2°C – Sydney variation map.

10.1.4 Rainfall

Changes in rainfall patterns have the potential for widespread impacts. Seasonal shifts can often impact native species' reproductive cycles as well as impacting agricultural productivity, for example crops that are reliant on winter rains for peak growth. The majority of models (8 out of 12) agree that autumn rainfall will increase in the near future and the far future (7 out of 12). Rainfall is projected to increase in autumn.

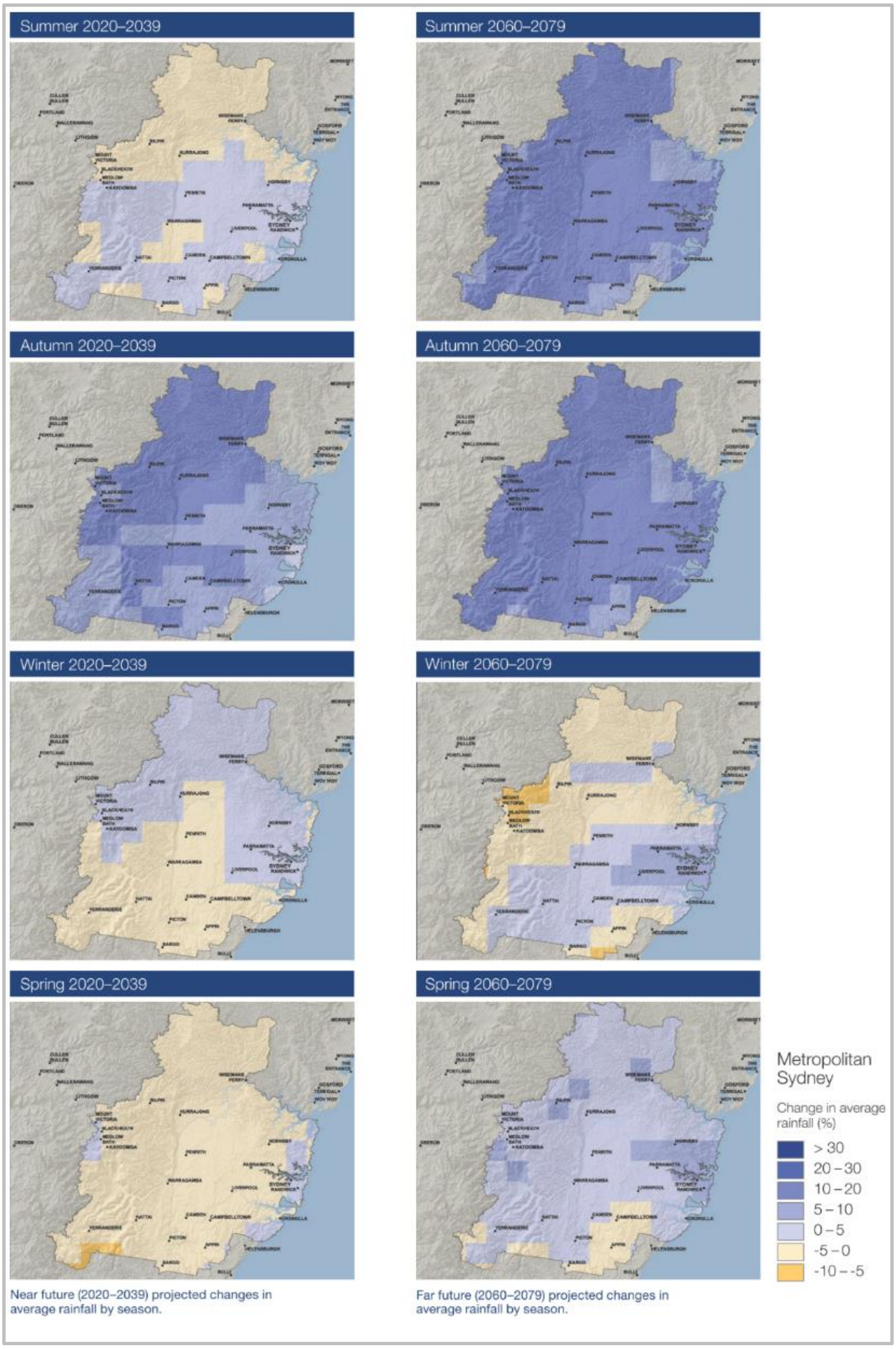


Figure 14. Change in average rainfall (%) – Sydney variation map.

10.1.5 Fire weather

The Bureau of Meteorology issues Fire Weather Warnings when the FFDI (Forest Fire Danger Index) is forecast to be over 50. High FFDI values are also considered by the Rural Fire Service when declaring a Total Fire Ban.

Projected regional climate changes

- Metropolitan Sydney is expected to experience an increase in average and severe fire weather in the near future and the far future.
- The increases are projected mainly in summer and spring in the far future. These changes are projected in prescribed burning periods (spring) and the peak fire risk season (summer).
- The majority of models (7 out of 12) project an increase of severe fire weather in spring in the near future, with a greater confidence in the increase in the far future.

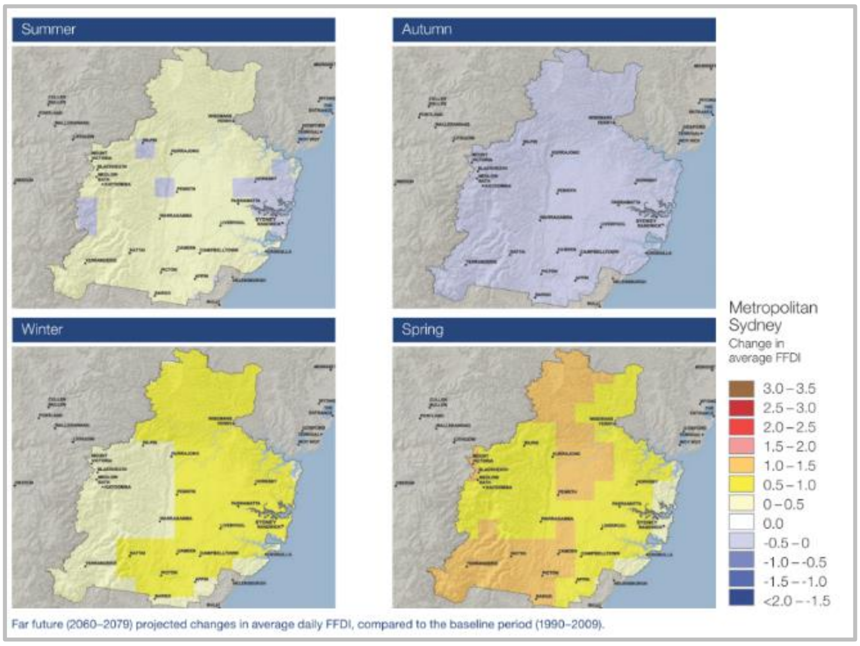


Figure 15. Change in average FFDI – Sydney variation map.

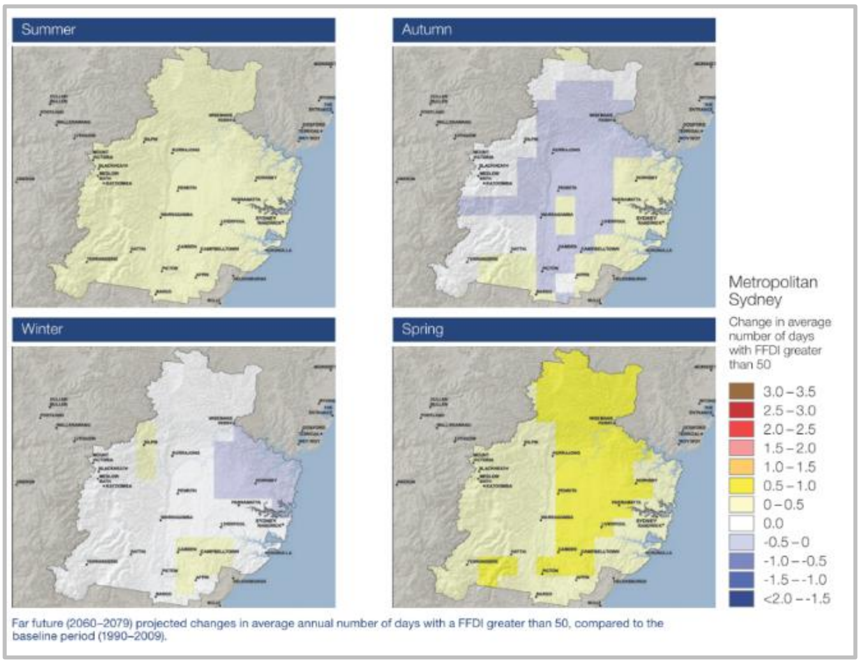


Figure 16. Change in average number of days with FFDI greater than 50 – Sydney variation map.

10.2 Climate Change Adaptation Plan

The climate change adaptation plan (CCAP) follows the ISO31000 Risk Management Process.

The plan involves three key steps to develop risks and mitigation strategies collaboratively with key project stakeholders.

1. Review of the development and context.

2. Risk analysis.
3. Mitigation Strategies.

10.2.1 Risk Assessment Framework

To assess risks systematically, a likelihood scale was used to determine how likely a risk was to occur, followed by consequence assessment. The first stage of the assessment is to define the likelihood of a given risk. The likelihood level can be described as the frequency or probability for a risk to occur.

Table 8. Risk likelihood matrix.

Likelihood	**Almost Certain** expected in most circumstances.
	Likely will probably occur in most circumstances.
	Possible might occur at some time.
	Unlikely could occur at some time.
	Rare may occur, only in exceptional circumstances.

Table 9. Example Consequence Scale and Success Criteria (AGO 2007).

	Public Safety	Local Economy and Growth	Community and Lifestyle	Environment and Sustainability	Financial /Time Program/Budgets
Catastrophic	Large numbers of serious injuries or loss of life	Precinct decline leading to widespread business failure	The area is considered very unattractive, moribund, and unable to support its community	Major widespread loss of environmental amenity and progressive irrecoverable environmental damage	Loss or increased cost of 50% or greater of annual budget.
Major	Isolated instances of serious injuries or loss of lives	Precinct stagnation such that businesses are unable to thrive	Severe and widespread decline in services and quality of life within the community	Severe loss of environmental amenity and a danger of continuing environmental damage	Loss or increased cost of 25%-50% of annual budget.
Moderate	Small numbers of injuries	Significant general reduction in precinct economic performanc e	General applicable decline in services	Isolated but significant instances of environmental damage that might be reversed with intensive efforts	Loss or increased cost of 10%-25% of annual budget
Minor	Serious near misses or minor injuries	Isolated areas in precinct decline	Isolated but noticeable examples of decline in services	Minor instances of environmental damage that could be reversed	Loss or increased cost of 5% to 10% of annual budget
Insignificant	Appearanc e of a threat but no actual harm	Minor shortfall to forecast growth	There would be minor areas in which the region was unable to maintain its current services	No environmental damage	Loss or increased cost of less than 5% of annual budget

Risk likelihood and consequence were then combined using the risk assessment matrix in Table below, leading to the systematic development of a risk rating used to prioritise risk management strategies.

Table 10. Example Risk matrix:

Show	**Matrix Score**				
Risk Rating Number + Name	Insignificant	Minor	Moderate	Major	Catastrophic
Almost Certain	Medium	High	High	Critical	Critical
Likely	Medium	Medium	High	Critical	Critical
Possible	Low	Medium	Medium	High	Critical
Unlikely	Low	Low	Medium	Medium	High
Rare	Low	Low	Low	Medium	High

Risk management strategies listed in Table 11 aim to reduce risk levels by reducing either likelihood or consequence of the risk, or both. The objective is to develop cost-effective options for treating/controlling each identified risk and minimise its impact to the project.

Table 11.. Risk management.

Show	**Matrix Score**				
Risk Rating Number + Name	Insignificant	Minor	Moderate	Major	Catastrophic
Almost Certain	Medium	High	High	Critical	Critical
Likely	Medium	Medium	High	Critical	Critical
Possible	Low	Medium	Medium	High	Critical
Unlikely	Low	Low	Medium	Medium	High
Rare	Low	Low	Low	Medium	High

10.2.2 Risk Assessment outcomes

Climate variable	Risk Statement	Likelihood	Consequence	Level of Risk	Adaptation actions	Residual Likelihood	Residual Consequence	Residual level of Risk
Increase in hot days	Accelerated structural material fatigue and degradation of facades leading to increased maintenance and repair costs	Rare	Catastrophic	High	Select materials which have a higher temperature tolerance if required. Review material datasheets for in-service temperature range and allow for increase in peak temperatures.	Rare	Moderate	Low
Increase in hot days	Brownouts/ Blackouts leading to failure of critical electrical equipment	Possible	Major	High	Ensure that existing plans to add to backup generation based on demand is followed through. Consider use of Solar Energy with Battery Energy Storage Systems (BESS).	Possible	Minor	Medium
Increased rainfall variability	Parapet roof retains water due to blockage in syphonic drainage system leading to structural failure.	Possible	Major	High	Check the design includes overflow outlets in parapet. Add to design if required.	Rare	Major	Medium
Increased rainfall variability	Parapet roof retains water due to insufficient capacity in the syphonic drainage system leading to structural failure.	Possible	Major	High	Overflow systems in place in the form of overflow slots. The capacity of these can be increased if required to allow for increased rainfall intensity.	Rare	Major	Medium

Climate variable	Risk Statement	Likelihood	Consequence	Level of Risk	Adaptation actions	Residual Likelihood	Residual Consequence	Residual level of Risk
Increased rainfall variability	Onsite Water Detention Tank (OSD) cannot deal with increased flows leading to overflow and flooding of adjacent areas.	Possible	Major	High	If necessary, overflow system to be provided. Hydraulic engineers to check if systems can manage the increased flows and implement further measures if required.	Rare	Major	Medium
Increased rainfall variability	Overland flow of water leads to pooling around the electrical infrastructure, causing electrical failure and power outage.	Possible	Catastrophic	Critical	Primary storm water drainage system to be designed to cater for a minimum of a 100-year storm. System to also have full backup of either piped overflow or overland flow designed to a higher storm intensity.	Rare	Major	Medium
Increased intensity of storm events	Mechanical plant on the roof (if any) are damaged by extreme hail event leading to failure of ventilation system.	Possible	Major	High	Consider options for protecting the mechanical plant in design. Implement if required.	Rare	Major	Medium

Climate variable	Risk Statement	Likelihood	Consequence	Level of Risk	Adaptation actions	Residual Likelihood	Residual Consequence	Residual level of Risk
Increased intensity of storm events	Severe hail blocking roof drains causing increased water ingress into building envelope and potential structural impacts, leading to increased maintenance costs	Possible	Major	High	Screen outlets with hail guards. Planned overflow slots should allow rain to overflow for all but the most severe hail events.	Rare	Major	Medium
Increased intensity of storm events	Airborne debris causing damage to exterior building elements and increased maintenance costs.	Possible	Major	High	Check wind load thresholds in engineering for façade and glazing. If required, adopt heat treated glazing for greater impact strength.	Rare	Major	Medium
Increased intensity of storm events	Wind driven rain penetrates the building, creating slip hazards for public circulation spaces.	Likely	Moderate	High	Consider in design and highlight risk for building managers. Include wet weather management plan in facilities management contract.	Rare	Moderate	Low
Increased fire weather	Smoke ingress into facility via HVAC system causing increased health risks for the occupants.	Almost certain	Major	Critical	Evacuation plan to be developed by FM company, including use of link to nearby hospitals for particularly vulnerable occupants. Consider use of non-latching outside air smoke detectors to shut down outside air systems in the event of a bushfire situation.	Almost certain	Insignificant	Medium

10.2.3 Recommendations

Many of the potential risks to the building are already addressed by existing design features of the building or are being explored as an immediate consequence of this process. All those identified through the workshop and subsequent discussions as requiring additional action are set out in table below, along with responsibility for those actions.

This information should be added to the overall project risk register, with actions implemented and recorded, and subsequently reported in the Green Star documentation.

Summary of adaptation actions required to achieve revised risk rating is presented in Table 12:

Table 12. Adaptation Actions Required to Achieve Revised Risk Rating.

Risk Statement	Initial Risk	Residual Risk	Action requiring implementation	Design / Operations	Proposed Responsibility
Brownouts/Blackouts leading to failure of critical electrical equipment.	High	Medium	Where possible, Solar PV with Battery Energy Storage System (BESS).	Design and operations	Electrical Engineer
Accelerated structural material fatigue and degradation of façades, leading to increased maintenance and repair costs	High	Low	Review material datasheets for in-service temperature range and allow for a nominal tolerance on peak temperatures based on today's values. Select materials which have a higher temperature tolerance if required.	Design	Façades Engineer, Structural Engineer
Water restrictions during prolonged droughts leading to inability to deliver core services.	High	Low	Develop a Drought Management Plan. Water restrictions would likely be signposted well in advance. Consider alternative water supply.	Operations	Facilities Manager
Parapet roof retains water due to blockage in symphonic drainage system leading to structural failure.	High	Medium	Check the design includes overflow outlets in parapet. Add to design if required.	Design	Hydraulic Engineer
Parapet roof retains water due to insufficient capacity in the symphonic drainage	High	Medium	Check whether capacity of overflow slots and drainage system is sufficient to allow for increased rainfall intensity. Increase either/both if required.	Design	Hydraulic Engineer, Architect

system leading to structural failure.					
Onsite Water Detention Tank (OSD) cannot deal with increased flows leading to overflow and flooding.	High	Medium	Ensure secondary overflow system provided and check if systems can manage increased flows. Implement further measures if required.	Design	Civil Engineer
Overland flow of water leads to pooling around electrical infrastructure, causing electrical failure and power outage.	Critical	Medium	Primary storm water drainage system to be designed to cater for a minimum of a 100- year storm. System to also have full backup of either piped overflow or overland flow designed to a higher storm intensity. Consider other feasible mitigation measures as required.	Design	Hydraulic Engineer, Architect, Electrical Engineer
Mechanical plant on the roof (if any) are damaged by extreme hail event leading to failure of ventilation system.	High	Medium	Consider options for protecting the mechanical plant in design. Implement if required.	Design	Mechanical Engineer
Severe hail blocking roof drains causing increased water ingress into building envelope and potential structural impacts, leading to increased maintenance costs	High	Medium	Screen outlets with hail guards.	Design	Hydraulic Engineer
Airborne debris causing damage to exterior building elements and increased maintenance costs -	High	Medium	Check wind load thresholds in engineering for façade and glazing. Adopt heat treated glazing for greater impact strength if required.	Design	Façades Engineer, Structural Engineer

particularly discussed potential increase in wind loadings due to CC.					
Wind driven rain penetrates the building, creating slip hazards for public circulation spaces	High	Low	Consider in design and highlight risk for building managers. Include wet weather management plan in facilities management contract.	Design and operations	Architects and Facilities Manager
Smoke ingress into facility via HVAC system causing increased employee health risks	Critical	Medium	Evacuation plan to be developed by FM company, including use of link to nearby hospitals for particularly vulnerable occupants. Consider use of non-latching outside air smoke detectors to shut down outside air systems in the event of a bushfire situation.	Design and operations	Mechanical Engineer, Facilities Manager, Owner

11. Disclaimer

This report is prepared using the information described above and inputs from other consultants. Whilst IGS 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 IGS 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. IGS 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 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 (600 W)

Vertex

BIFACIAL DUAL GLASS MONOCRYSTALLINE MODULE

PRODUCT: TSM-DEG20C.20

PRODUCT RANGE: 580-600W

600W	0~+5W	21.2%
MAXIMUM POWER OUTPUT	POSITIVE POWER TOLERANCE	MAXIMUM EFFICIENCY

High customer value

- Lower LCOE (Levelized Cost of Energy), reduced BOS (Balance of System) cost, shorter payback time
- Lowest guaranteed first year and annual degradation;
- Designed for compatibility with existing mainstream system components
- Higher return on Investment

High power up to 600W

- Up to 21.2% module efficiency with high density interconnect technology
- Multi-busbar technology for better light trapping effect, lower series resistance and improved current collection

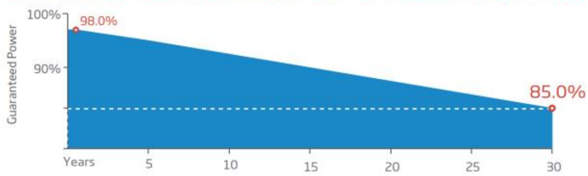
High reliability

- Minimized micro-cracks with innovative non-destructive cutting technology
- Ensured PID resistance through cell process and module material control
- Resistant to harsh environments such as salt, ammonia, sand, high temperature and high humidity areas
- Mechanical performance up to 5400 Pa positive load and 2400 Pa negative load

High energy yield

- Excellent IAM (Incident Angle Modifier) and low irradiation performance, validated by 3rd party certifications
- The unique design provides optimized energy production under inter-row shading conditions
- Lower temperature coefficient (-0.34%) and operating temperature
- Up to 25% additional power gain from back side depending on albedo

Trina Solar's Vertex Bifacial Dual Glass Performance Warranty



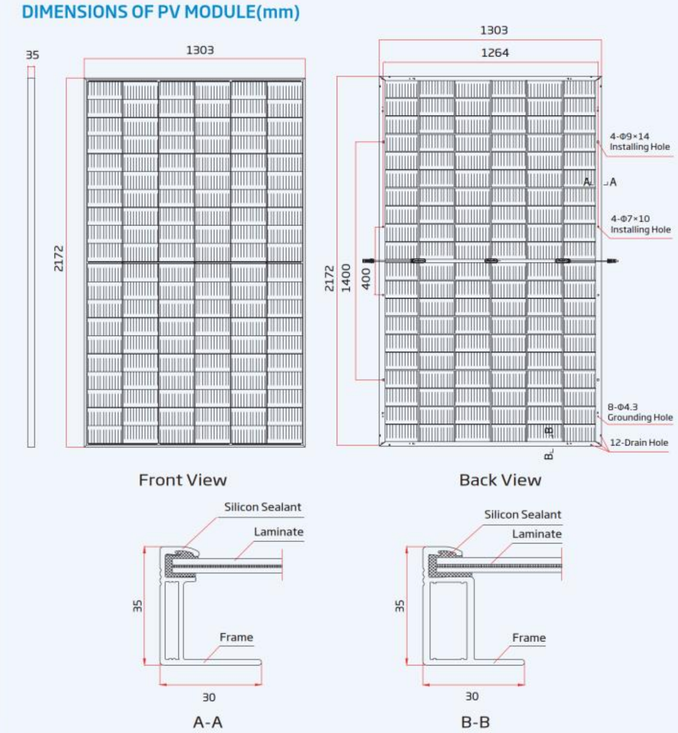
Comprehensive Products and System Certificates

IEC61215/IEC61730/IEC61701/IEC62716/UL61730
ISO 9001: Quality Management System
ISO 14001: Environmental Management System
ISO14064: Greenhouse Gases Emissions Verification
ISO45001: Occupational Health and Safety Management System

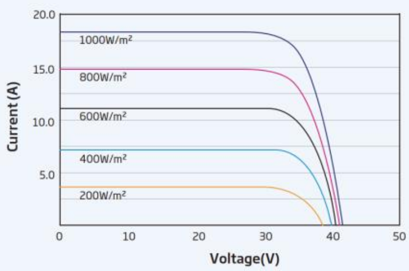
Trinasolar

Vertex BIFACIAL DUAL GLASS MONOCRYSTALLINE MODULE

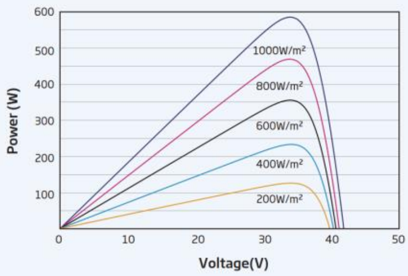
DIMENSIONS OF PV MODULE(mm)



I-V CURVES OF PV MODULE(590 W)



P-V CURVES OF PV MODULE(590 W)



ELECTRICAL DATA (STC)

Peak Power Watts-PMAX (Wp)*	580	585	590	595	600
Power Tolerance-PMAX (W)			0 ~ +5		
Maximum Power Voltage-VMPP (V)	33.8	34.0	34.2	34.4	34.6
Maximum Power Current-IMPP (A)	17.16	17.21	17.25	17.30	17.34
Open Circuit Voltage-Voc (V)	40.9	41.1	41.3	41.5	41.7
Short Circuit Current-Isc (A)	18.21	18.26	18.31	18.36	18.42
Module Efficiency η m (%)	20.5	20.7	20.8	21.0	21.2

STC: Irrdiance 1000W/m2, Cell Temperature 25°C, Air Mass AM1.5. *Measuring tolerance: ±3%.

Electrical characteristics with different power bin (reference to 10% Irradiance ratio)

Total Equivalent power -PMAX (Wp)	621	626	631	637	642
Maximum Power Voltage-VMPP (V)	33.8	34.0	34.2	34.4	34.6
Maximum Power Current-IMPP (A)	18.36	18.41	18.46	18.51	18.55
Open Circuit Voltage-Voc (V)	40.9	41.1	41.3	41.5	41.7
Short Circuit Current-Isc (A)	19.48	19.54	19.59	19.65	19.71
Irradiance ratio (rear/front)			10%		

Power Bifaciality:70±5%.

ELECTRICAL DATA (NOCT)

Maximum Power-PMAX (Wp)	439	443	447	451	454
Maximum Power Voltage-VMPP (V)	31.5	31.7	31.9	32.0	32.2
Maximum Power Current-IMPP (A)	13.93	13.97	14.01	14.06	14.10
Open Circuit Voltage-Voc (V)	38.5	38.7	38.9	39.1	39.3
Short Circuit Current-Isc (A)	14.68	14.72	14.76	14.80	14.84

NOCT: Irradiance at 800W/m², Ambient Temperature 20°C, Wind Speed 1m/s.

MECHANICAL DATA

Solar Cells	Monocrystalline
No. of cells	120 cells
Module Dimensions	2172×1303×35 mm (85.51×51.30×1.38 inches)
Weight	35.3 kg (77.8 lb)
Front Glass	2.0 mm (0.08 inches), High Transmission, AR Coated Heat Strengthened Glass
Encapsulant material	EVA/POE
Back Glass	2.0 mm (0.08 inches), Heat Strengthened Glass (White Grid Glass)
Frame	35mm(1.38 inches) Anodized Aluminium Alloy
J-Box	IP 68 rated
Cables	Photovoltaic Technology Cable 4.0mm² (0.006 inches²), Portrait: 280/280 mm(11.02/11.02 inches) Length can be customized
Connector	MC4 EVO2 / TS4*

*Please refer to regional datasheet for specified connector.

TEMPERATURE RATINGS

NOCT(Nominal Operating Cell Temperature)	43°C (±2°C)
Temperature Coefficient of PMAX	- 0.34%/°C
Temperature Coefficient of Voc	- 0.25%/°C
Temperature Coefficient of Isc	0.04%/°C

MAXIMUMRATINGS

Operational Temperature	-40~+85°C
Maximum System Voltage	1500V DC (IEC) 1500V DC (UL)
Max Series Fuse Rating	35A

WARRANTY

12 year Product Workmanship Warranty
30 year Power Warranty
2% first year degradation
0.45% Annual Power Attenuation

(Please refer to product warranty for details)

PACKAGING CONFIGUREATION

Modules per box: 25/36 pieces
Modules per 40' container: 549 pieces

Trinasolar

CAUTION: READ SAFETY AND INSTALLATION INSTRUCTIONS BEFORE USING THE PRODUCT.

Version number: TSM_EN_2021_B
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APPENDIX B - TECHNICAL DATASHEETS FOR SAMPLE PV INVERTERS

SG5.0/6.0/7.0/8.0/10/12RT

Multi-MPPT String Inverter for 1000 Vdc System

HIGH YIELD

- Lower startup & wider MPPT voltage
- Compatible with bifacial modules
- Built-in PID recovery function

SMART MANAGEMENT

- Smart IV curve scanning
- 24 / 7 Live monitoring
- Remote firmware updates

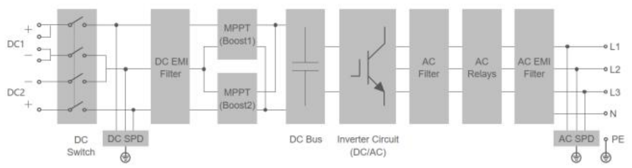
SAFE AND DURABLE

- Quick arc fault circuit interrupter
- Build-in Type II DC & AC SPD
- High anti-corrosion rating C5

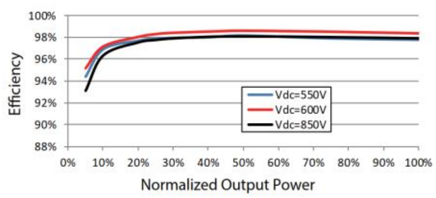
EASY AND USER FRIENDLY

- 18 kg compact design
- Unique push-in connectors
- Fast and easy commissioning via App

CIRCUIT DIAGRAM(SG10RT)



EFFICIENCY CURVE



SUNGROW
Clean power for all

Type designation	SG5.0RT	SG6.0RT	SG7.0RT	SG8.0RT	SG10RT	SG12RT
Input (DC)						
Recommended max. PV input power	7.5 kWp	9.0 kWp	10.5kWp	12 kWp	15 kWp	18 kWp
Max. PV input voltage	1100 V *					
Min. PV input voltage / Start-up input voltage	180V / 180V					
Rated input voltage	600 V					
MPP voltage range	160 V – 1000 V					
No. of independent MPP inputs	2					
No. of PV strings per MPPT	1 / 1	1 / 1	2 / 1	2 / 1	2 / 1	2 / 1
Max. PV input current	25 A (12.5 A / 12.5 A)		37.5 A (25 A / 12.5 A)			
Max. DC short-circuit current	32 A (16 A / 16 A)		48 A (32 A / 16 A)			
Max. current for DC connector	30 A					
Output (AC)						
Rated AC output power	5000 W	6000 W	7000 W	8000 W	10000 W	12000 W
Max. AC output apparent power	5500 VA**	6600 VA**	7700 VA**	8800 VA**	11000 VA**	13200 VA**
Rated AC output apparent power	5500 VA**	6600 VA**	7700 VA**	8800 VA**	11000 VA**	13200 VA**
Max. AC output current	8.3 A	10 A	11.7 A	13.3 A	16.7 A	20 A
Rated AC output current(at 230V)	7.2 A	8.7 A	10.1 A	11.6 A	14.5 A	17.4 A
Rated AC voltage	3 / N / PE, 220 / 380 V 3 / N / PE, 230 / 400 V 3 / N / PE, 240 / 415 V					
AC voltage range	180V – 276V / 311V - 478V					
Rated grid frequency	50 Hz / 60 Hz					
Grid frequency range	45 – 55 Hz / 55 – 65 Hz					
Harmonic (THD)	<3 % (at rated power)					
Power factor at Rated power / Adjustable power factor	>0.99/0.8 leading – 0.8 lagging					
Feed-in phases / Connection phases	3 / 3-PE					
Efficiency						
Max. efficiency	98.40%	98.40%	98.40%	98.50%	98.50%	98.50%
European efficiency	97.40%	97.40%	97.70%	97.80%	97.90%	97.90%
Protection&Function						
Grid monitoring	Yes					
DC reverse connection protection	Yes					
AC short-circuit protection	Yes					
Leakage current protection	Yes					
Surge Protection	DC Type II / AC Type II					
Ground fault monitoring	Yes					
DC switch	Yes					
PV String current monitoring	Yes					
Arc fault circuit interrupter (AFCI)	Yes					
PID recovery function	Yes					
General Data						
Dimensions (W*H*D)	370*480*195 mm					
Weight	18 kg					
Mounting method	Wall-mounting bracket					
Topology	Transformerless					
Degree of protection	IP65					
Night power consumption	< 6 W					
Corrosion	C5					
Operating ambient temperature range	-25 ℃ to 60 ℃					
Allowable relative humidity range (non-condensing)	0% – 100%					
Cooling method	Natural cooling					
Max. operating altitude	4000 m					
Display	LED					
Communication	WLAN / Ethernet / RS485 / DI / DO					
DC connection type	MC4 (Max. 6 mm²)					
AC connection type	Plug and play					
Grid Compliance	IEC / EN 61000-6-1/2/3/4, IEC 61000-3-2/3/11/12, IEC / EN62109-1/2, IEC 61727, IEC 62116, IEC 61683, IEC 60068-2-1/2/14/30/64/27,IEC TS 62910 , EN50530, AS/NZS 4777.2:2020, VDE-AR-N-4105, DIN VDE0126-1-1/A1, EN50549-1, DEWA, VFR 2019, UTE C15-712-1, PSE NC RfG, UNE 206006/7 IN, MEA/PEA, G98, UNE 217002:2020, NTS V2 TypeA					
Grid Support	LVRT, HVRT,active & reactive power control and power ramp rate control					

*: The inverter enters the standby state when the input voltage ranges between1,000V and 1,100V. If the maximum DC voltage in the system can exceed 1000V, the MC4 connectors included in the scope of delivery must not be used. In this case MC4 Evo2 connectors must be used.
** For Germany, max. AC output power: SG5.0RT is 5000VA, SG6.0RT is 6000VA, SG7.0RT is 7000VA, SG8.0RT is 8000VA, SG10RT is 10000VA, SG12RT is 12000VA.