ESD DA Report

Jindabyne Police Station

ESD SERVICES

JHA

CONSULTING ENGINEERS

DOCUMENT CONTROL SHEET

Project Number	200411
Project Name	Jindabyne Police Station
Description	ESD DA Report
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Revision History

Issued To	Revision and Date								
Oswaldo Marcelo | Group GSA	REV	DRAFT	A						
	DATE	21/01/2021	28/01/2021						
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1. EXECUTIVE SUMMARY

This Ecologically Sustainable Design (ESD) DA Report identifies the key ESD initiatives that are targeted for the proposed Jindabyne Police Station located at 16-18 Thredbo Terrace, Jindabyne NSW 2627. This report investigates the high level ESD opportunities applicable at concept design stage. This report identifies a number of sustainability opportunities available that would provide on-going energy & water savings as well as create a healthier and more productive environment for future occupants.

The aim of the ESD initiatives is to encourage a balanced approach to designing new facilities for the project; to be resource-efficient, cost-effective in construction and operation, and to deliver enhanced sustainability benefits with respect to the impact on environment and on the health and well-being of the occupants.

Opportunities are grouped into the following ESD categories:

Climate Specific Opportunities

A comprehensive assessment of the site's climate is conducted to determine temperature patterns, precipitation, wind, solar paths and humidity. High level recommendations for glazing, wall insulation and shading are included within the report. A NCC Section J report using JV3 verification method will be undertaken to optimise the thermal specifications of the building fabrics prior to CC.

Indoor Environmental Quality, Health & Wellbeing

The use of low VOC paints, coatings, adhesives, sealants and flooring, and low formaldehyde composite wood products is recommended where possible.

Due to the climate zone and use of the building, good thermal performance is recommended for the building increase occupant comfort and help minimise ongoing heating and cooling costs.

Energy

The energy performance of the building services will impact on the building's ability to achieve a 4.5 star NABERS Energy rating.

Options covered to reduce the electricity load include the use of thermally efficient building design, high thermal performance building fabric, energy efficient air conditioning, LED lighting and controls.

Water

The water efficiency of the building services will impact on the building's ability to achieve a 4.0 star NABERS Water rating.

The report strongly encourages the use of fixtures such as taps, showers, water closets and urinals that have high star ratings through the Australian government's Water Efficiency Labelling Scheme (WELS). The use of 5 Star WELS-rated Taps, Toilet and Urinals will be considered. The use of 4 Star WELS-rated shower (flow rate >6.0 but <= 7.5 L/min) will also be considered. Rainwater collection and reuse for landscape irrigation is recommended.

The above options will be explored and refined in more detail during next phase of the project. Additional ESD options will also be considered if found suitable during subsequent stages when more information is available.

2. INTRODUCTION

JHA has been engaged to provide ESD consultancy service for the proposed Jindabyne Police Station located at 16-18 Thredbo Terrace, Jindabyne NSW 2627. JHA is a member of the Green Building Council of Australia and has accreditation in:

- National House Energy Rating Scheme (NatHERS) / Association of Building Sustainability Assessors (ABSA) – ABSA Accreditation;
- Green Building Council Australia (GBCA) – Green Star Accredited Professional;
- National Australian Built Environment Rating System (NABERS) – NABERS Accreditation; and
- Commercial Building Disclosure (CBD) Program – CBD Accreditation.

This Ecologically Sustainable Design (ESD) Concept Design Report identifies the key ESD initiatives that could be included in the proposed new police station. The Police Station is committed to maintaining a focus on sustainability throughout the phases of design, construction and operation/occupancy.

The report is a holistic and dynamic document which provides an assessment of applicable ESD strategies that all stakeholders can review JHA's considerations and provide feedback for further discussion and review.

The report identifies a number of sustainability opportunities available that would provide on-going energy & water savings as well as provide a healthier and more productive environment for future occupants.

Out of the vast array of ESD initiatives that currently exist, the report identifies the ESD initiatives applicable at concept design stage. In addition, the report acknowledges that this stage of the project is the best time to review these strategies by respective disciplines to investigate feasibility, applicability and cost information over the lifecycle of the project.

The report was also undertaken to identify opportunities for architects in order to deliver a low energy architectural solution. The report aims to aid in environmental decision making for architectural design by exploring climate responsive design strategies.

3. PROJECT INFORMATION

The proposed development consists of a new police station building and a new police accommodation building, as well as a new carport and a vehicle storage structure. The subject site for the proposed development is located at 16-18 Thredbo Terrace, Jindabyne NSW 2627.

Figure 1 – Site Location

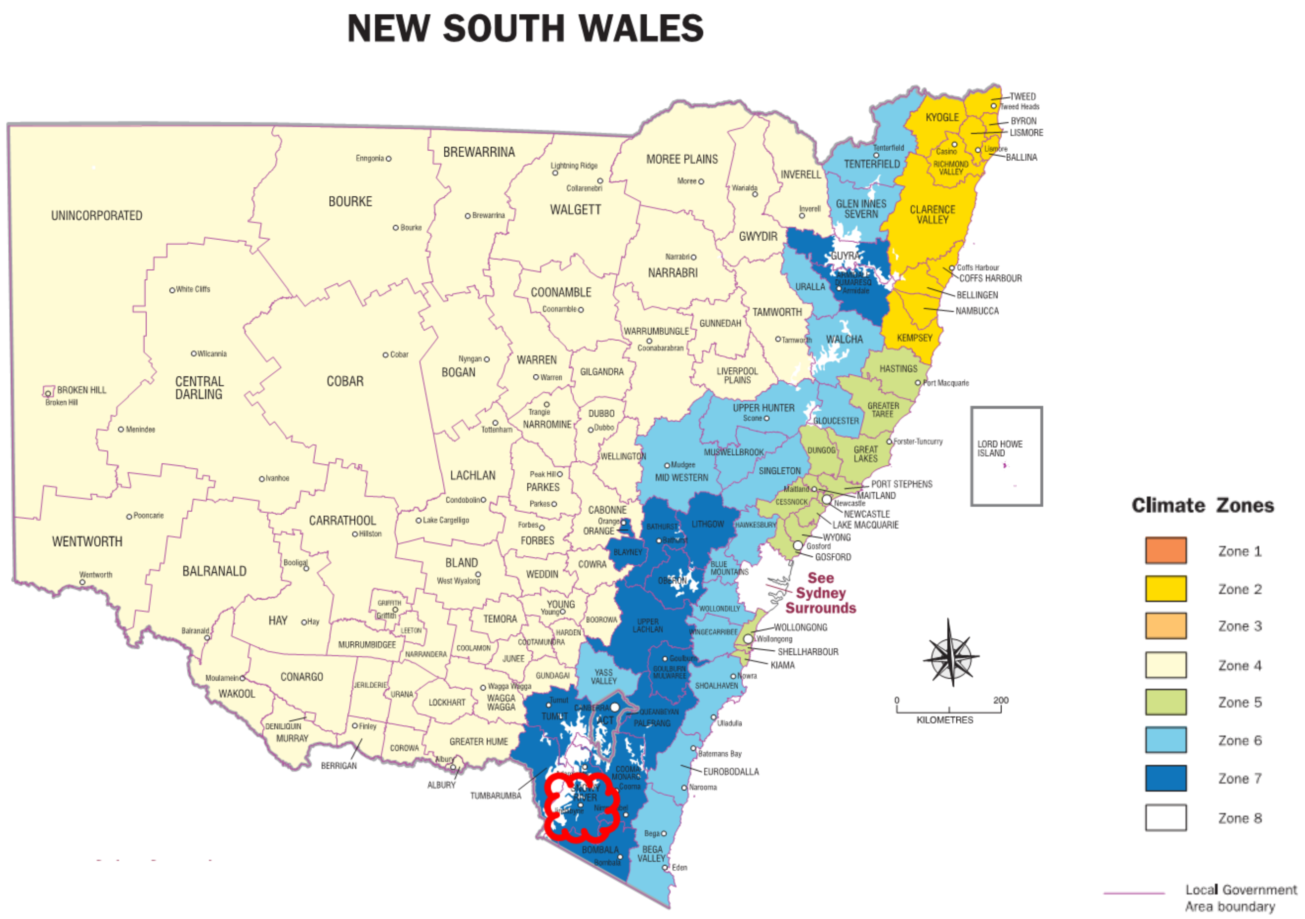
4. CLIMATE SPECIFIC OPPORTUNITIES

4.1 SITE AND CLIMATE

Jindabyne is a village in south-east New South Wales, Australia that overlooks Lake Jindabyne near the Snowy Mountains, in Snowy Monaro Regional Council. Jindabyne is one of the highest settlements of its size in Australia, at 918 metres above sea level. Light snowfalls sometimes occur during winter. Jindabyne is a popular holiday destination year round, especially in winter, due to its proximity to major ski resort developments within the Kosciuszko National Park.

4.1.1 BCA CLIMATE ZONE

The site is located within Climate Zone 7 as defined by the National Construction Code (NCC / BCA).



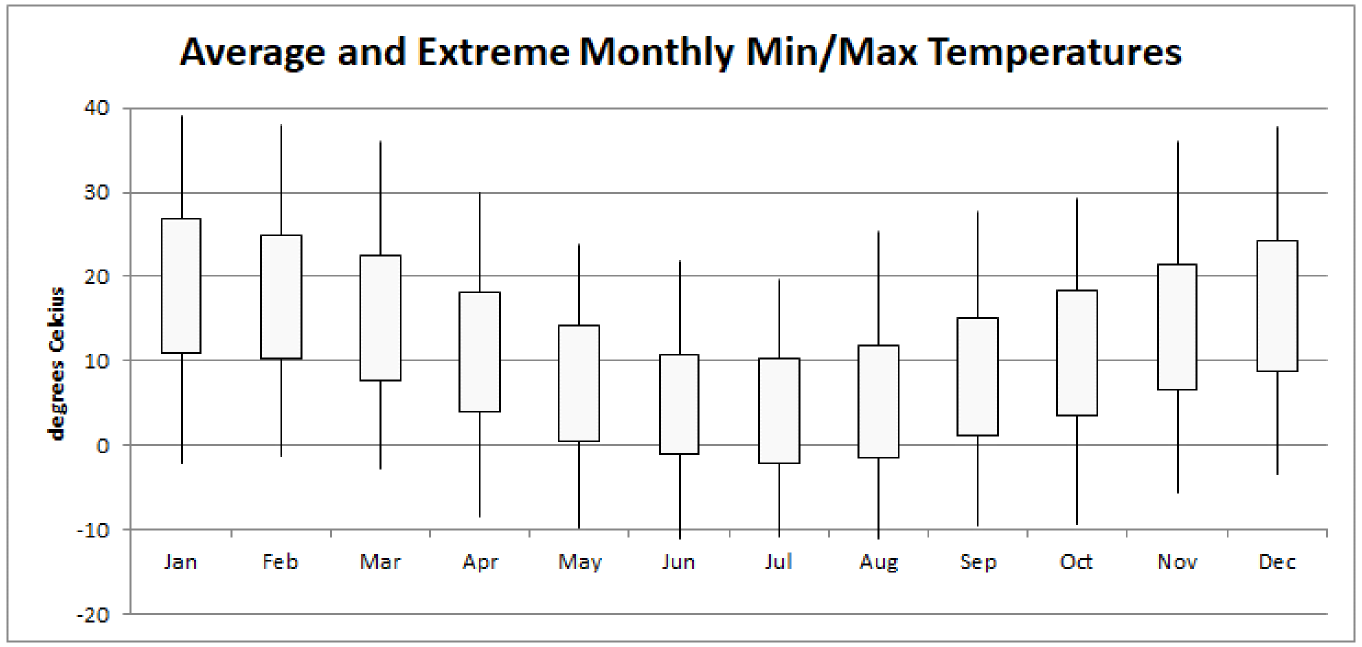
BCA Climate Zones for Sydney Urban Zones

This climate zone is described as Climate Zone 7 – Cool temperate.

4.1.2 CLIMATE ANALYSIS

Climatic analysis of a location allows feasibility assessment for the passive design strategies. A detailed assessment of the Bureau of Meteorology's long term Climate and Weather data for Cooma Airport (as representative for Jindabyne) is conducted to derive effective design strategies for proposed site.

Monthly Min/Max Temperatures

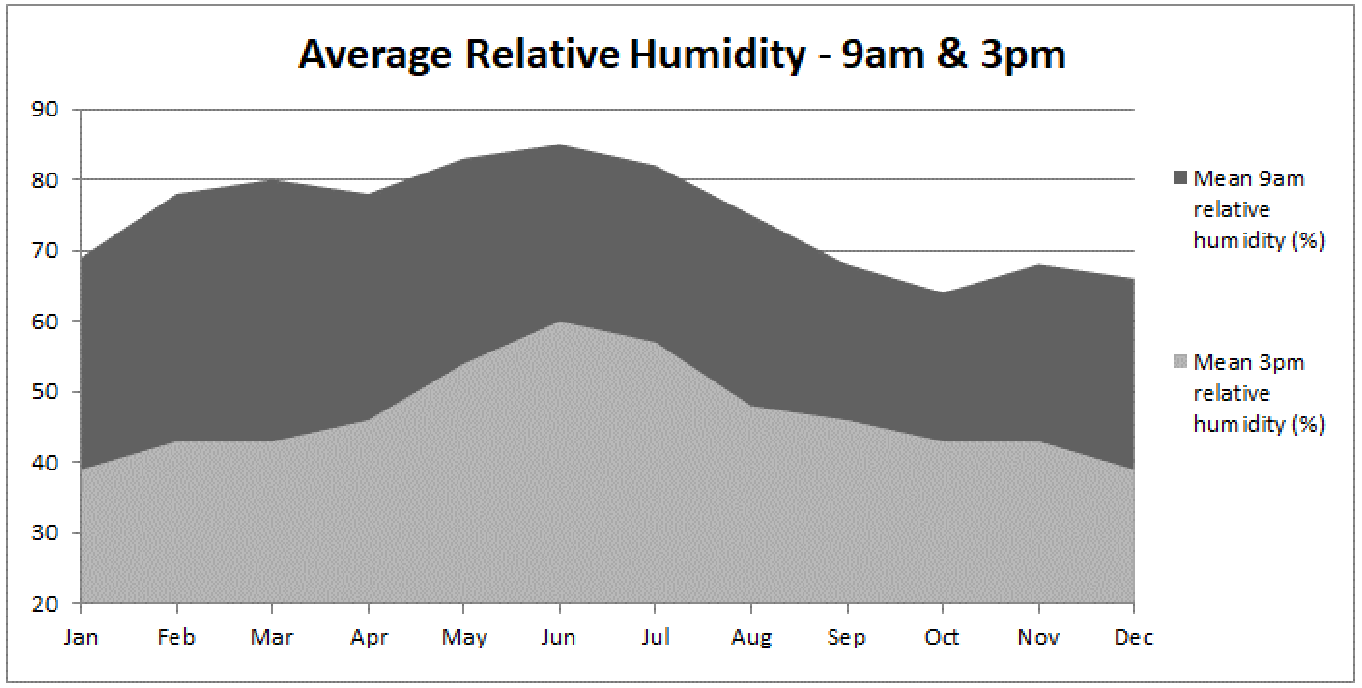


Average and Extreme Monthly Min/Max Temperatures

Key characteristics include high diurnal range, both in summer and winter, low rainfall, with a slight peak in spring–summer and a notable drop in winter. Snowfalls are common in the region, but usually light. Owing to its position on the leeward side of the ranges, Jindabyne receives foehn winds which swiftly melt snow after a westerly frontal system has passed through.

The average maximum temperature in the hottest months is around 25°C. The average minimum temperature in the coolest months is around -1.5°C. For this climate zone, heating is the more important consideration when designing the building.

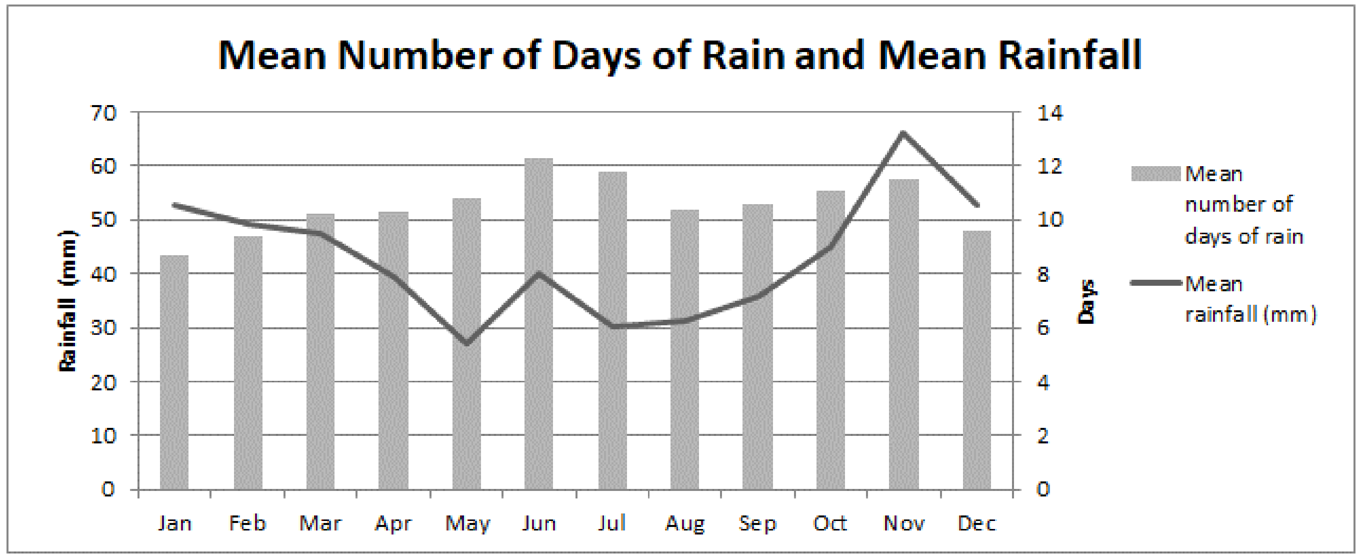
Relative Humidity



Relative Humidity in the Morning and Afternoon

The average relative humidity in the morning being 75% and in the afternoon being 47%. Design should assess the risk of condensation due to the high humidity in the morning.

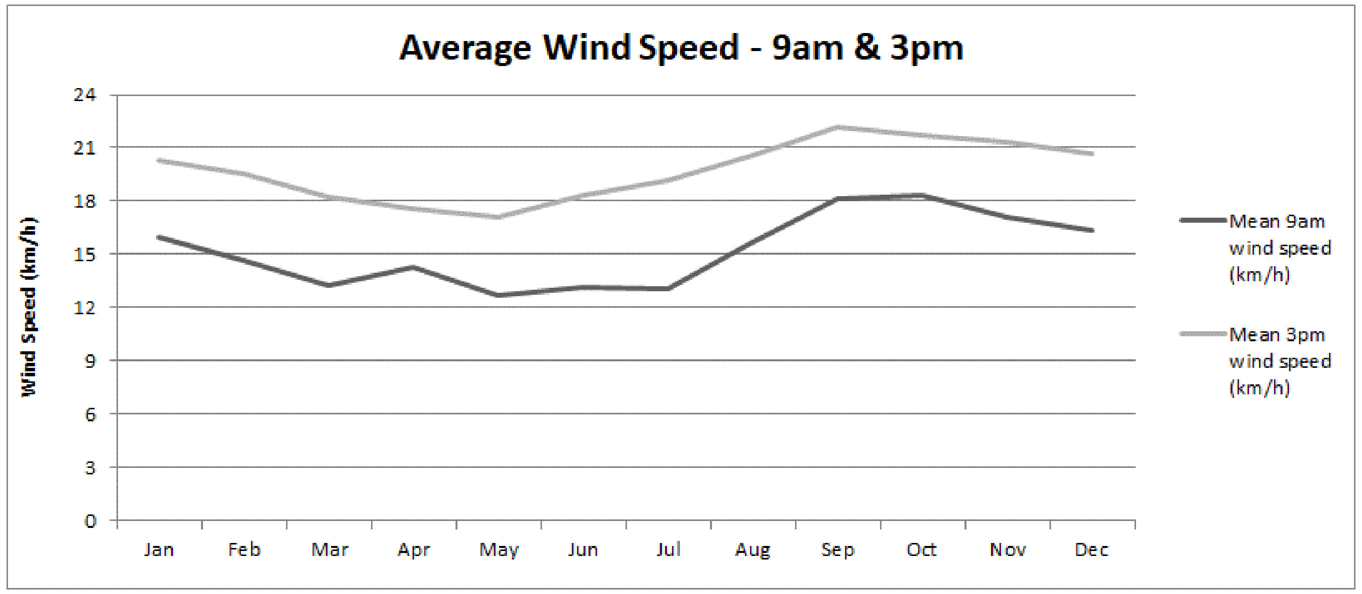
Rainfall and Rain Days



Average monthly rainfall and rainfall days

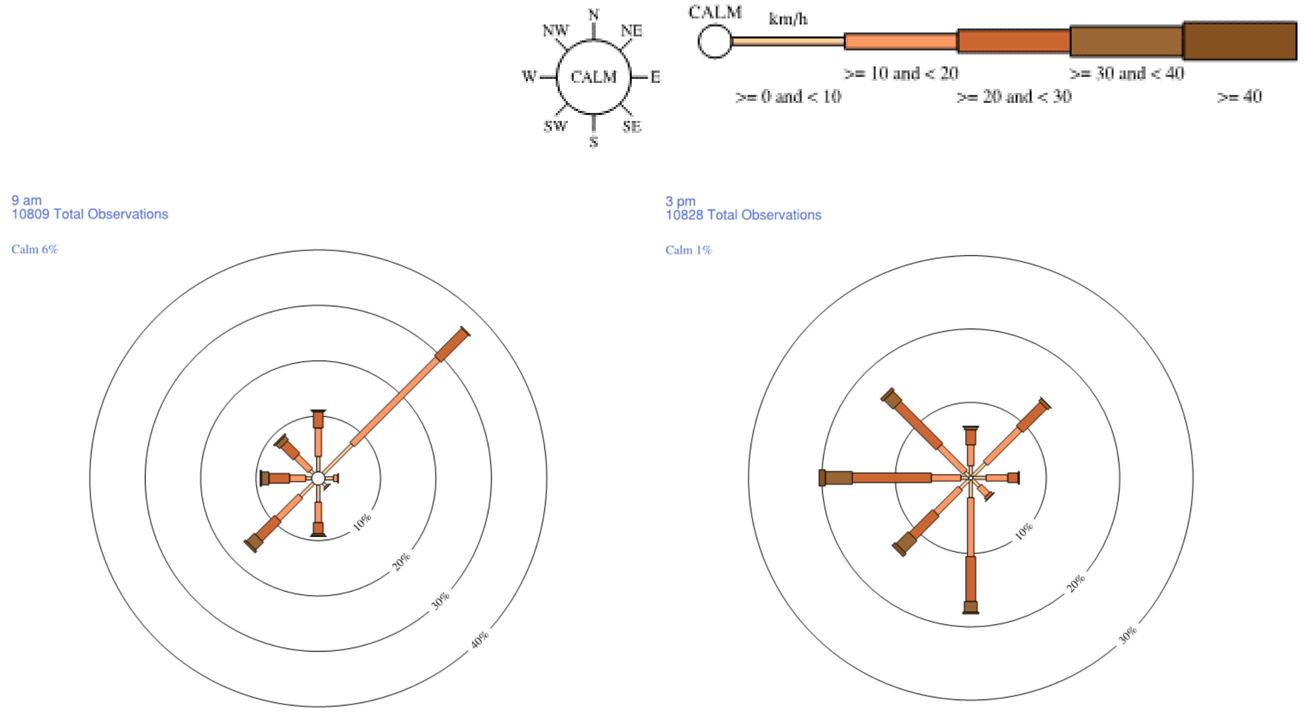
Mean annual rainfall is 529.5mm. The month with maximum average rainfall is November (66.3 mm), which has an average of nearly 11.5 rainfall days. Lowest average rainfall typically occurs in May (26.9 mm) with average of less than 10.9 days bringing rainfall.

Wind Direction and Speeds



Average monthly wind speeds for morning and afternoon

Reviewing data on wind speeds in the morning and afternoon informs of the natural ventilation potential of the site. Wind speed of 1.5 m/s provides a cooling sensation of up to 3°C. Airtightness of the building fabric should be a design consideration, noting decent wind speed in the both morning and afternoon throughout the year.



Wind rose for 9am and 3pm

The wind speeds in Jindabyne may offer a good possibility for natural ventilation during summer.

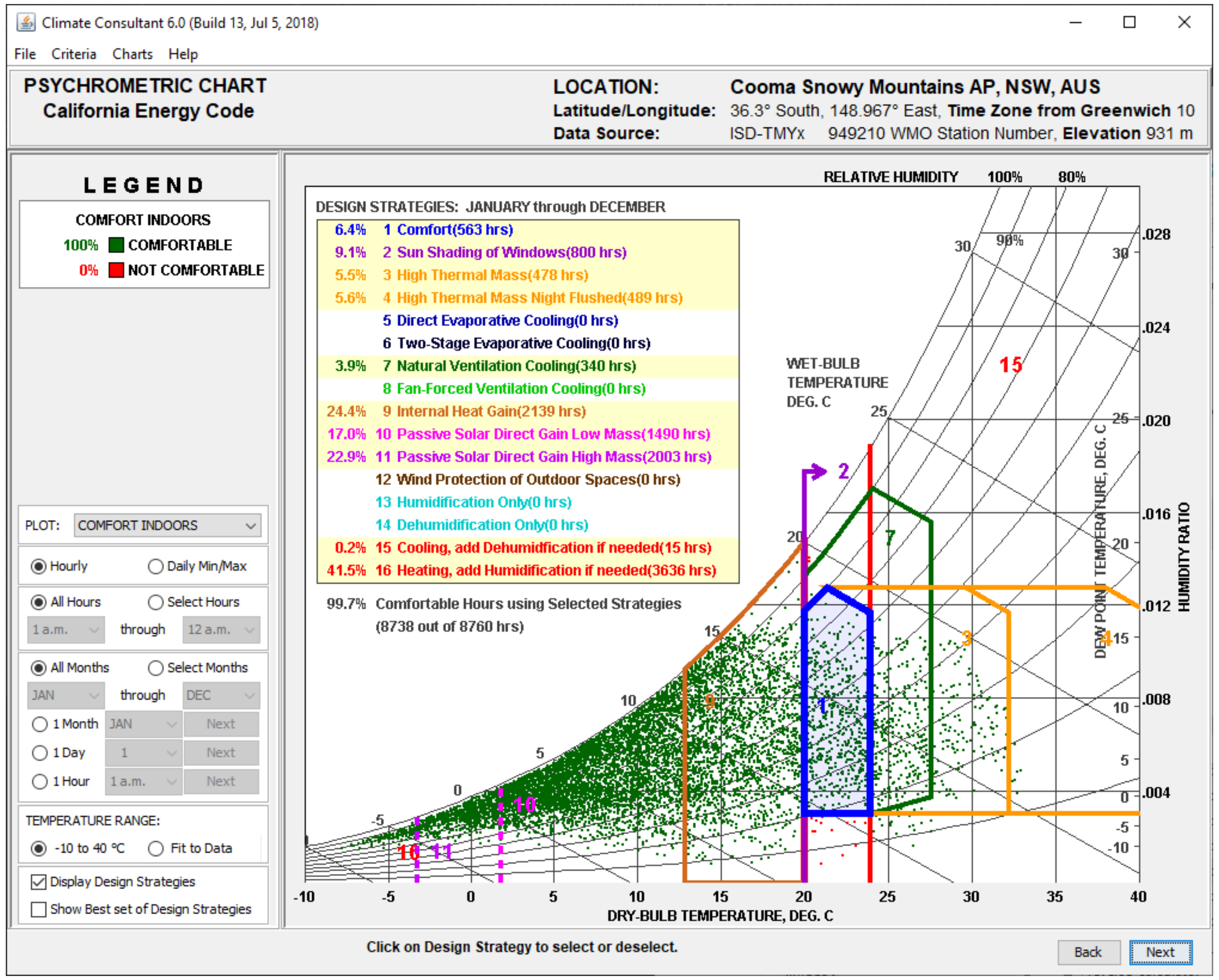
4.1.3 CLIMATE CHANGE SCENARIO PLANNING

Buildings today are simulated using historical weather data. With the uncertainty in the climatic conditions that we are witnessing in recent times, JHA believes that the buildings and developments planned today should not only be simulated/assessed with historical climatic conditions, but they should also be subject to the predicted climate change conditions. For substantial projects where built assets are designed for the next 40+ years, climate change scenario planning can be of paramount importance.

We recommend undertaking climate change scenario planning for 2020, 2050 and 2080 in order to determine strategies required to meet the then comfort conditions, as well as future-proof the development.

4.2 CLIMATE RESPONSIVE BUILDING DESIGN

A NCC Section J report using JV3 verification method is recommended to optimise the thermal specifications of the building fabrics during detailed design.



Psychrometric chart detailing potential of various design techniques to improve thermal comfort

With the implementation of the following strategies, comfortable conditions can be improved for Jindabyne's climate. The following is a very high level analysis to determine balance point temperature, in order to reduce the system size.

- Design walls and roofs with good insulation to minimise heat loss;
- The building fabric should be air tight to minimise air leakages;
- High performance glazing and window shading device to minimise heat loss;
- Appropriate sun shading of windows combined with high thermal mass and night flushing has the potential to mitigate need for mechanical cooling; and
- Passive solar gains on to thermal mass has potential to significantly reduce heating demand.

4.2.1 SITING, ORIENTATION AND BUILDING FORM

Siting is already established within the design of this project. Siting buildings properly, appropriately orientating them and using climatically responsive building form all play a vital role in creating low energy architecture. The siting of the buildings should account for the solar access, prevailing winds, noise consideration and views. Likewise, the orientation of the buildings should aid in minimising the solar heat gain in summer. A compact floor plate building of the same floor area as compared to an articulated building has lower floor to wall area ratio, which is effective in reducing the solar heat gain in summer months. In addition, a building with smaller wall area effectively encloses the same floor area with less building façade area, thereby offering a smaller environmental footprint as well as a lower construction cost.

4.2.2 BUILDING ENVELOPE

Building envelope comprises external walls (including glazing), floors and the roofs (including skylights) of the building. There is a constant thermodynamic interaction between the internal space and the external environment through building envelope. The building envelope impact on the heat load of the building and therefore impact the size of the cooling/heating system to maintain thermally comfortable conditions within the building. Whilst the National Construction Code dictates the minimum thermal performance required from the building envelope, it should be noted that the requirements are the bare minimum R-value required for that climate type. These values could be optimised to achieve better thermal performance from all elements of the building envelope. This optimisation of the thermal performance of the building envelope is a key ESD initiative.

The building fabric will be designed to meet or exceed the NCC 2019 Volume One Section J requirements for building envelope. Thermal breaks will be incorporated into walls, floors and roofs where appropriate to ensure a continuous thermal barrier on the building envelope, reducing the flow of thermal energy via conductive materials. The installation of the insulation material should with the consideration of minimising the impact of thermal bridging.

A preliminary Section J assessment for Jindabyne Police Station has been carried out to ensure compliance with sustainability targets is achievable. The indicative building fabric requirement under the Deemed-to-Satisfy (DTS) pathway for the police station (class 5) and accommodation (class 3) to achieve compliance with NCC 2019 Section J are provided below:

Area		Indicative Thermal Performance Requirements*	Comments
Class 5 – Police Station	Roof/Exposed Ceiling Envelope	Total R-Value of 4.1 (upwards) (Solar absorptance of the upper surface of a roof must be not more than 0.45)	*The impacts of the thermal bridge must be included in the total construction R-value calculation. NCC 2019 total R-value of 1.4 for walls is anticipated to be equivalent to the NCC 2016 total R-value of 2.8 once the impacts of the thermal bridge have been taken into consideration.*
	External Envelope Walls	Total R-Value of 1.4	
	Internal Envelope Walls	Total R-Value of 1.4	
	Envelope Floors	Total R-value of 2.0 (downwards)	
Class 3 – Accommodation	Roof/Exposed Ceiling Envelope	Total R-Value of 4.1 (upwards) (Solar absorptance of the upper surface of a roof must be not more than 0.45)	
	External Envelope Walls	Total R-Value of 2.8	
	Internal Envelope Walls	Total R-Value of 2.8	
	Envelope Floors	Total R-value of 2.0 (downwards)	

* This is the preliminary review for NCC 2019 Volume One Section J Part J1 Building Fabric compliance and is subject to change pending the outcomes of detailed Section J assessment under the performance pathway JV3 during detail design.

Insulation reduces heat flow and consequent heat loss in winter and heat gain in summer. This minimises the heating and cooling load demand on the air conditioning systems.

4.2.3 GLAZING

Glazing is a major source of unwanted heat gain in the summer and can cause significant heat loss in the winter due to its low insulation performance. It is thus recommended that windows will be high performance glazing systems. Performance glazing substantially reduces heat transmission.

Thermal performance wise, glazing and skylights are the weakest elements of the building fabric. For example, an uninsulated brick veneer wall has an R-value of R0.56, which is over 3 times the single glazed window's R-value of 0.17. This means that a single glazed window's rate of heat transfer is over 3 times the quantity per unit area as compared to that of an uninsulated brick veneer wall. The rate of heat transfer for a single glazed window increases to 14 times that of a brick veneer wall after addition of R2 insulation. Specifying IGU (Insulating Glazed Unit, or double glazed windows) with U-value of 3.5 (R-value 0.28) helps to some extent by reducing the rate of heat transfer to around 8-9 times that of an R2 insulated brick veneer wall. Where appropriate, the development team should consider using glazing sparingly.

Area		Indicative Thermal Performance Requirements*	Comments
Class 5 – Police Station	Glazing	Total U-value of 7.0 & Total SHGC of 0.55	Single glazed tinted
	Skylight	Total U-value of 3.9 & Total SHGC of 0.29	Double glazed tinted
Class 3 – Accommodation	Glazing	Total U-value of 5.6 & Total SHGC of 0.32	Single glazed tinted

* This is the preliminary review for NCC 2019 Volume One Section J Part J1 Building Fabric compliance and is subject to change pending the outcomes of detailed Section J assessment under the performance pathway JV3 during detail design.

4.2.4 SHADING

Shading is incredibly valuable for all glazed elements (windows and skylights) as it prevents the direct component of solar radiation from impacting on the glazing and thereby minimises the solar load on the building. To minimise solar gain, particular to glazing that is exposed to morning or afternoon summer sun, consideration should be made to providing external shades to the north, east and west façade. The proposed shading design will also assist the building to achieve compliance with Section J requirements.

Solar access can enhance indoor environmental quality through access to daylighting and reduce lighting energy consumption. However, excessive solar access and hence, direct solar radiation heat can increase HVAC energy demand and can also cause thermal discomfort. Passive solar heating principle which aims to prevent solar heat gain in the summer and harvest it in the winter for free source of heating, and Passive cooling principle which prevents heat from entering the building during the summer months, are strategies which can conveniently take advantage of the site specific solar access for optimised indoor environmental quality and reduction of HVAC energy demand through use of tailored shadings.

The proposed building has been designed to maximise daylighting and views with consideration on glare control. The large portion of windows are shaded by shading devices, roof eaves and balconies/access paths to the floor above that will reduce the amount of incident summer solar radiation.

These passive design features allow for enriched daylighting and greater access to external views for occupants. Additional daylighting reduces the reliance on artificial light and benefits alertness, mood and productivity. External views provide a connection to nature and the adjacent market place and also help to create an environment encouraging healthy living.

4.2.5 NATURAL VENTILATION

Adequate natural air movement makes an important contribution in creating a comfortable indoor environment and reducing the need for mechanical ventilation by carrying accumulated heat out and replacing it with cooler external air. This is important during the summer months where heat build-up within spaces can be quickly removed with the availability of suitable breeze at the site.

5. INDOOR ENVIRONMENTAL QUALITY, HEALTH & WELLBEING

5.1 INDOOR AIR

Filtration media and CO2 censors could be utilised to maintain a high quality indoor air environment. In addition to focusing on the amount of fresh air in each space, it is extremely important to specify non-toxic finishes, furniture and flooring for any surface located within the building.

Volatile Organic Compounds (VOCs) and Formaldehyde are known carcinogens. Therefore, it is of utmost importance to specify materials (adhesives, sealants, paints, coatings, flooring) and furniture that does not contain VOCs or Formaldehyde. Typically covering 80% of a building's surfaces, paints are made up of a variety of ingredients, some of which are more benign than others. Possibly the most harmful chemical found in paints are Volatile Organic Compounds (VOCs), which are carbon-containing solvents that vaporise into the air readily as paint dries. These VOCs help make paint easier to spread as well as more durable, but often have negative effects on the health of building occupants. Some exposure to such products can cause headaches, dizziness and nausea, while higher exposure levels can have more serious consequences, such as kidney damage and even cancer. Studies that show that an individual gets 70% of the toxins in the body through absorption from the air inhaled within buildings. Some VOCs also form ground level ozone by releasing odoriferous chemicals that lead to 'urban smog'. This leads to environmental repercussions, with the paint industry responsible for up to 16% of all VOC emissions in Australia. Composite wood such as MDF should be selected on the basis of no urea-formaldehyde content.

5.2 THERMAL COMFORT

The thermal comfort in a space is affected by the surface temperatures of objects. Even when the air temperature is within the comfortable range, radiant heat from a hot object, such as a window that is in direct sun, can cause discomfort.

East and west facing façades that are exposed to direct sunlight for significant periods of the day can increase the mean radiant temperature of the internal space, which is one of the parameters that govern thermal comfort. External shades are one of the most effective methods to reduce mean radiant temperature in perimeter zone next to the glazing.

As discussed in Climate-Responsive Building Design, maximum comfort and functionality is achieved when external shades are provided to complement internal blinds. Selection of internal surface finishes will be important as they will dictate the interaction between the other surfaces as well as the occupants.

6. ENERGY

The energy performance of the building services will impact on the building's ability to achieve a 4.5 star NABERS Energy rating. Please see NABER Checklist attached as Appendix B for minimum recommendations to achieve the targeted NABERS Energy rating of 4.5 star.

6.1 AIR CONDITIONING

VRF (variable refrigerant flow) heat recovery system is recommended to serve centre zones and perimeter zones respectively. The condensers will be located in dedicated plantrooms. This system provides simultaneous operation of cooling and heating to each individual room and also substantially improves energy efficiency by recycling waste heat. The normal economic (service) life for the above VRF heat recovery type air conditioning unit is 15 to 20 years according to the data provided by AIRAH Technical Handbook and manufacturer's advice.

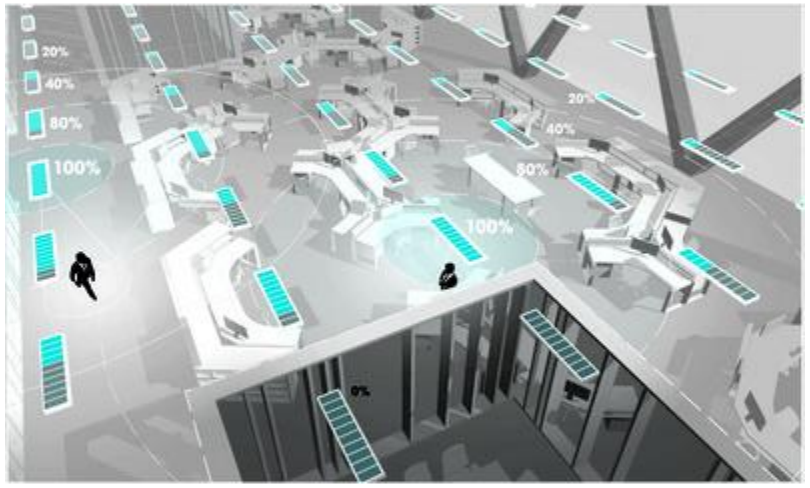
The advantages of this option compared to the alternative air cooled split reverse cycle system are:

- Lower electricity cost due to higher energy efficiency and heat recovery technology
- Lower maintenance cost due to less equipment to maintain
- Lower life cycle cost
- Less spatial requirement for outdoor condensers due to smaller footprint and weight
- The system can provide heating & cooling simultaneously. It is more suitable to serve multiple zones and more flexible to adjust to tenant fitout plan.

6.2 LIGHTING & CONTROLS

Lighting accounts for a significant amount of energy usage in a building. Good practice lighting design generally includes for energy efficient fluorescent and LED lighting. LED lighting is becoming a popular choice of light fitting and offers good energy savings.

The use of occupancy sensors to activate lighting and daylight sensing are good ways to further reduce energy consumption associated with lighting. Daylight sensors located in communal areas with banks of lighting and/or dimmable ballasts can be used effectively to ensure lighting is only turned on when required.



Lighting Design – Occupancy Sensor

Lighting design usually allows for occupancy sensors to be installed in rooms/areas used intermittently such as back of house areas, corridors and toilets. The use of occupancy sensors could potentially be expanded to wards and common areas. When selecting occupancy sensors, consider a microwave sensor over an infrared sensor, as a microwave sensor is significantly more effective in picking up the smallest of the movements as against the latter.

Occupancy and daylighting sensors to all areas should be considered as this is a low cost and easy to implement item.

6.3 ENERGY EFFICIENT APPLIANCES AND EQUIPMENT

Energy consumption shall be reduced by installing energy efficient appliances. Appliances with higher energy stars will provide a return in saving energy and decrease greenhouse gas emission. Where is provided, the appliance shall be selected within 1 star of the highest energy Efficiency rating available on the market.

Energy Star – Energy Rating Label

6.4 PHOTOVOLTAICS (Optional)

Onsite generation of renewable energy is an increasingly popular means for buildings to reduce its greenhouse gas emissions. PV solar panels are a popular choice because they are simple to install, operate and maintain.

Of the technologies available, mono- and poly-crystalline silicon panels are the most common; it is a proven technology and provides better efficiency than thin film products. Thin film modules are less efficient at converting sunlight into electricity but they are also less expensive. Thin film modules may be an option when the aim is to clad a large area.

PV Panels should be mounted facing north to maximise yearly output. Mounting the panels directly on a flat roof will reduce electricity output by approximately 10%. When mounted flat, soiling of the module surface may become an issue as velocity of rain runoff becomes insufficient to clean the module surface. Should the proposed roof profile be relatively flat, it is recommended that panels be mounted on tilt frames to maximise power generation and to ensure the slope is sufficient to allow modules to self-clean. Also consideration should be given to the weight of the panels and framing structure on the building's roof structure.

The price of electricity is likely to continue increasing in the future. On the other hand, the cost of installing a PV system has gradually decreased over recent years as the industry expands. If these trends continue, the cost effectiveness of installing a PV system will continue to improve. One of the great advantages of PV is that the solar availability and electricity demand closely correlate.

The payback period of PV can be improved by using the PV modules to replace another building material. For example, the PV modules can form an awning, which can be an architectural feature of the building and replace part of the costs of awning materials.

7. WATER

The water efficiency of the building services will impact on the building's ability to achieve a 4.0 star NABERS Water rating. Please see NABER Checklist attached as Appendix B for minimum recommendations to achieve the targeted NABERS Water rating of 4.0 star.

7.1 WATER EFFICIENT FITTINGS & FIXTURES

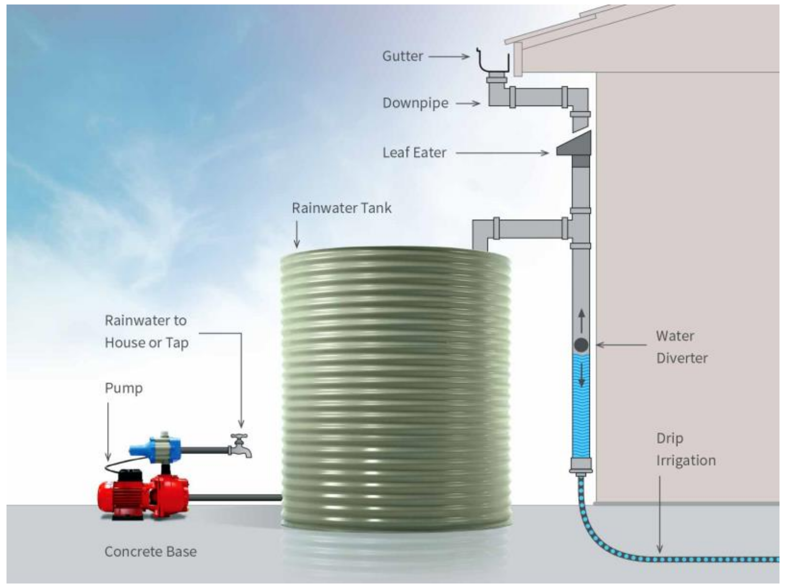
Water consumption shall be reduced by incorporating water efficient fixtures and fittings in accordance with the Australian Government's Water Efficiency Labelling Scheme (WELS). The fixtures and fittings are to have the following minimum WELS Rating. In addition, flow restrictors or taps with timed flows can be used to minimise water usage.

Water Fittings / fixtures	Minimum WELS Rating	Highest Available Rating
Showerheads rating	4 (flow rate >6.0 but <= 7.5 L/min)	4 (flow rate >4.5 but <= 6.0 L/min)
Taps rating	5	6
Toilet rating	5	6
Urinals rating	5	6

WELS - Water Rating Label

7.2 ALTERNATIVE WATER SOURCE

Rainwater is proposed to be captured to irrigate landscaping and provide for toilet flushing. Stormwater may also be captured to supplement this. With the consideration of rainfall intensity and demand, there is also the opportunity to use the recycled water for HVAC system heat rejection. Drip irrigation with moisture sensor override installed will allow further reduce water consumption. The captured water will be used for landscape irrigation and toilets/urinals flushing purpose.



Example – Rainwater Tank

APPENDIX A – SUMMARY OF ESD OPPORTUNITIES

ESD OPPORTUNITIES SUMMARY & PRELIMINARY COST ESTIMATES					
Category	**Item**	**Description**	**Cost**	**Recommendation**	**Relevant Provisions**
Climate Specific Opportunities	4.2.1 Siting, Orientation and Building Form	**Building Form**: A compact floor plate building compared to a rectangular building renders effective reduction of solar heat gain in summer.	N/A – proper siting, orientation and building form do not increase costs.	N/A – already established in the design	N/A
	4.2.2 Building Envelope	**Total R-value:** optimising R-value that would improve thermal performance.	**Total R-value:** Little to no cost increase. Only issue is that the thicker building elements with greater R values.	Opportunity	**BCA Section J1.3 Roof and ceiling construction** - sets out minimum total R-Value that a roof/ceiling must achieve. **BCA Section J1.5 Walls** - sets out minimum total R-Value that a wall must achieve. **BCA Section J1.6 Floors** - Sets out minimum total R-value that a floor must achieve.
	4.2.3 Glazing	**High thermal performance glazing** to be added to increase the thermal performance where deemed necessary.	N/A – required.	Mandatory minimum glazing compliance	**BCA Section J compliance.**
	4.2.4 Shading	**Shading** by means of external window shading devices such as horizontal/vertical fins, fixed canopies, eaves or shading hood.	N/A – part of current design.	N/A – already established in the design	N/A
Indoor Environmental Quality, Health & Wellbeing	5.1. Indoor Air	**Materials** w/o VOCs or Formaldehyde (adhesives, sealants, paints, coatings and flooring etc.)	Require little to no cost increase	Opportunity; Strongly Recommended	**BCA** - No specific limitations re VOC and/or Formaldehyde levels. However, **Section F4.5(b)** states that the rooms must be ventilated with mechanical ventilation or AC system complying **AS 1668.2** which states: "This standard sets out design requirements for mechanical air-handling systems...based on the need to control ... VOCs." - necessitating VOC level control.
	5.2 Thermal Comfort	**Internal blinds & surface finishing (**e.g. Glare Control Blinds)	Simple roller blinds approx from **~ $50;** Venetian blinds approx **$70 ~ $150**, etc.	Opportunity	N/A
Energy	6.1 Photovoltaic (PV)	Installation of PV Panels	**PV installed**: Approx $2.00/W Payback period is between 5 to 10 years.	Opportunity	N/A
	6.2 Lighting & Controls	LED lights	LED Light Bulbs **$25 ~ $40 per bulb**. Dependent on electrical layout of the buildings	Opportunity; Strongly Recommended	**BCA Section J6 "Artificial Lighting and Power"** sets out maximum illumination power density to be considered.
	6.3 Appliance	Installation of high energy efficient appliance and equipment	Higher cost but return can come from decreased energy usage.	Opportunity	N/A
Water	7.1. Water Efficient Fittings & Fixtures	Installation of low water use fittings and fixtures	Require little to no cost increase	Opportunity	Council's requirement on water reuse measures
	7.2 Rainwater Collection	Propose rainwater collection for irrigation and toilet flushing purpose	Require additional design inputs, cost is subject the size of the tanks, typically ~$1,000 - $1,500 per 5000L	Opportunity	Council's requirement on water reuse measures

APPENDIX B – NABERS ENERGY AND WATER CHECKLIST

Architectural	Likely	Not Likely
Site Orientation - Site to be orientated north south where possible, to limit extent of eastern and western façade to minimise summer heat gain. - Consider locating amenities / back of house areas on eastern and western elevations.	☑ (to degree necessary)	
Shading - Horizontal shading to be considered to northern elevations to reduce heat gain in summer, but maximise solar gain in winter months. - Shading strategies include a combination of external shading devices and eave shadings.	☑	
Glazing - Maximise natural daylight through glazing to southern elevation. - Window to wall ratio of no more than 60%. - Consider higher performing glazing (with low solar heat gain co-efficient) to eastern and western facades. - Consider natural ventilation where security and acoustics are not an issue.	☑	
Fabric Performance - 10% improvement on wall and roof insulation values over minimum Section J requirements.	☑	
Mechanical		
Air Conditioning - High efficiency VRF heat recovery air conditioning systems. - 100% outdoor air economy cycle if suitable for climate zone. - Ensure appropriate controls are employed to minimise energy consumption e.g. out of hours use or unoccupied spaces system shutdown. - Where areas are unoccupied consider potential to relax internal temperatures / design conditions. - Where natural ventilation is proposed, consider interlocking operation of AC units to shut off when windows are open (security and acoustic issues will need to be considered).	☑	
Ventilation Systems - Consider heat recovery on exhaust systems to precool / preheat outside air. - CO2 sensors for high occupancy spaces; fans with variable speed drives to ramp up and down. - Consider high efficiency filters to reduce outside air rates. - Amenity exhaust systems to be interlocked with lighting PIR to deactivate when unoccupied. - Car parking areas (where natural ventilation cannot be utilised), carbon monoxide (CO) monitoring provided to control the ventilation system.	☑	
Controls - Centralised controller to monitor and control all services (e.g. air conditioning, fans, external lighting, energy consumption etc).	☑	
Electrical		
Lighting and Lighting Control - High efficiency LED lighting to be used throughout. - PIR lighting control to amenities and back of house areas. - Consider daylight sensing to office areas. - Consider Localised task lighting to work areas to reduce space Lux levels. - External lighting control via photo electric cell and time scheduling (consideration will need to be made with regards to security requirements).	☑	

Energy Generation - Consider the use of photovoltaic systems to power back of house and circulation areas as a minimum.	☑	
Hydraulic		
Hot Water Generation - Consider an energy-efficient hot water system such as heat pump or instantaneous gas hot water system.	☑	
Fittings & Fixtures - Consider high WELS rated fittings and Fixtures.	☑	
Alternative Water - Rainwater to be captured and reused for irrigation.	☑	
Commissioning		
- All building services systems will require appropriate commissioning, ensuring systems are operating and controlled as required.	☑	