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Sustainability Management Plan

Rutledge St, Queanbeyan NSW

Prepared For:
The Village Building Co.

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1. Summary

The proposed development at Rutledge St, Queanbeyan NSW sets high benchmark for sustainable design. This document outlines the sustainable initiatives embedding within the building design:

- Enhance the internal environment.
- Reduce the buildings consumption of energy and fossil fuels.
- Reduce waste to landfill
- Protect ecological value and optimise resource use.

This report outlines the project's commitment to sustainable development principles with respect to ESD in alignment to the Queanbeyan-Palerang Regional Council goals.

This report outlines the project's commitment to sustainable development principles with respect to ESD in alignment to the Queanbeyan-Palerang Regional Council ESD Planning Schemes and policies.

2. Introduction

This report has been updated to make note of changes regarding the net zero emission strategy.

In alignment to the Queanbeyan-Palerang Regional Council requirements, BSE has been engaged by The Village Building Co to report on Sustainable Development Principle requirements for the proposed residential development at Rutledge St, Queanbeyan NSW.

To facilitate the creation of sustainable urban communities, the project focuses on the following key principles: -

- Creating, maintaining, and promoting a liveable community
- Generating benefit to the economy
- Protecting ecological value and optimising use or resources
- Promoting excellence in planning and design

This report will demonstrate how the proposed development protects, manages and enhances natural systems and promotes the efficient use of materials, water and energy to minimise impacts on the environment. It will illustrate the project's compliance with the criteria noted and will focus on the specific measures that contribute to sustainable development principles. Specifically covering the following 10 key sustainability criteria: -

Table 1: Environmental Categories

Categories	
Management	Transport
Water	Waste
Energy	Urban Ecology
Stormwater	Innovation
IEQ	

2.1. Building Description

The Rutledge development located on the corner of Crawford st and Rutledge st, Queanbeyan NSW 2620 is a shop top housing development proposed by The Village Building Co.

The site is located to the south-eastern side of a key block within the Queanbeyan CBD separated by an access lane and basement portal (shown as one site).

The site is well positioned adjacent to the new Council building and Q Theatre. Rutledge and Crawford Streets are known for the leafy tree and the site benefits from this on two sides. It includes two heritage listed buildings, The Fire station and Dutton's Cottage. Envisaged as a new landmark within the Queanbeyan CBD and will add to the activation of this emerging precinct.

The two buildings are expected to occupy a land size of approx. 5,000sqm when excluding the existing laneway and ramp area.

Figure 1: Proposed Site Plan, 6 Rutledge Street. 10-12 Rutledge Street and Part 257 Crawford Street Queanbeyan NSW.

3. Environmental Categories and Proposed Schemes

Significant measures have been undertaken to ensure that this development responsibly impacts upon the local environment and addresses environmental, social and economic sustainability aspects for the buildings' occupants, users and the wider community.

The environmental vision, principles, goals, and strategies for Rutledge Street development are described as follows: -

Vision	**Creating a sustainable urban community**			
Principles	**Creating, maintaining, and promoting a liveable community**	**Generating benefit to the economy**	**Protecting ecological value and optimising use or resources**	**Promoting excellence in planning and design**
Goals	A community that is diverse, safe and healthy, has access to services, jobs and learning, that fosters active local participation and is a pleasant place to live, work and visit while integrating with and enhancing the value of existing neighbourhoods.	Economic benefit is maximised by facilitating the release of urban land, incorporating lifecycle costs including operational savings, long term employment opportunities, and creating partnering opportunities and long-term value.	Protect, manage and enhance natural systems, habitats and biodiversity, and promote the innovative and efficient use and management of materials, water and energy to minimise impacts on the climate.	Develop a modern resilient and adaptable urban form that promotes connectivity, safety and accessibility whilst recognising existing local values and aspirations.
Strategies	• High quality of life. • High levels of community participation. • Healthy and safe communities. • Respect existing communities.	• Public benefit. • Lifecycle costs. • Partnerships.	• Climate impact. • Water. • Energy and transport. • Materials and waste. • Habitats and biodiversity. • Pollution.	• Community and place. • Responsive urban form. • Quality public realm. • Infrastructure. • Connectivity, safety and accessibility. • Engagement and partnerships.

3.1. Establishing Agreed Sustainable Design Outcomes

This report sets clear sustainable outcomes and prioritises how the proposed development protects, manages and enhances natural systems and promotes the efficient use of materials, water and energy to minimise impacts on the environment. It will illustrate the project's compliance with the criteria noted and will focus on the specific measures that contribute to sustainable development principles.

3.2. Management

In recognising activities that ensure the proposed development is designed, procured, built and handed over in a responsible manner. The following sustainable development principles will be incorporated: -

- Early involvement of qualified ESD professional to ensure appropriate sustainable design principles and strategies are considered from the preliminary design stage.
- Early commitment to environmental targets
- Regular tuning of building services
- Sensible use of building services, such as heating and cooling devices
- Implementation of individual tenant utility metering for electricity, and water consumption.

3.3. Indoor Environment Quality

The aims of this project are to achieve a healthy indoor environment quality for the wellbeing of building occupants, including the provision of fresh air intake, cross ventilation, and natural daylight.

- To reduce reliance on mechanical heating, ventilation, cooling and lighting systems
- To achieve a high level of comfort and amenity.
- To reduce indoor air pollutants by reducing the material use and encouraging use of materials with low toxic chemicals.
- To minimise noise levels and noise transfer within and between buildings and associated external areas.

3.3.1. Natural Ventilation

Cross ventilation and single sided ventilation has been allowed for as a breeze path between two ventilation openings either within the room or from one room to another. Ventilation openings located either in opposite or adjacent external walls or an external wall are to implement the following strategies: -

- Size of ventilation openings to be greater than 2% of total floor area or 1m^2, whichever is greater.
- The opening is the maximum allowable clear open area for the window.
- If on adjacent walls, ventilation openings must be at least 3m apart at their closest point to ensure the space has reasonable ventilation throughout the room.

3.3.1. External Shading and Orientation

The building will be designed to include large balconies or extended slab edge as a means to provide extensive use of overhangs around the building, to shade against hot summer sun. All east, west and north facing glazing will be designed with appropriate external shading.

3.3.2. Amenity and Indoor pollutants

- Use of low VOC materials for paints, sealants, adhesives
- No use of PVC
- Formaldehyde Minimisation Low-formaldehyde composite wood products will be specified throughout, complying with E1, E0, Super E0 or lower emission limits. This requirement applies to any of the following when installed internally. Particleboard, plywood, veneer MDF of decorative overlaid wood panels.

3.4. Energy Performance

Faced with ever increasing fuel costs, be it gas or electricity, the importance of reducing a buildings annual energy consumption from the onset is ever present. A potentially minimal increase to the building's capital cost can be compensated by the buildings reduced ongoing operational costs. Reduced annual energy consumption also aligns with reduced annual greenhouse gas emissions, as can be quantified in tonnes of carbon dioxide.

There are various means by which a buildings annual energy consumption can be reduced, be it via passive improvements to the developments building fabric, or via the installation of highly efficient mechanical plant.

As part of the ongoing design process, the design team proactively works to innovate and optimise the building's design both via passive building fabric optimisations and highly efficient mechanical design solutions.

This ensures final design provides an optimal balance of insulation, glazing performance, energy efficient lighting and mechanically enhanced design solution.

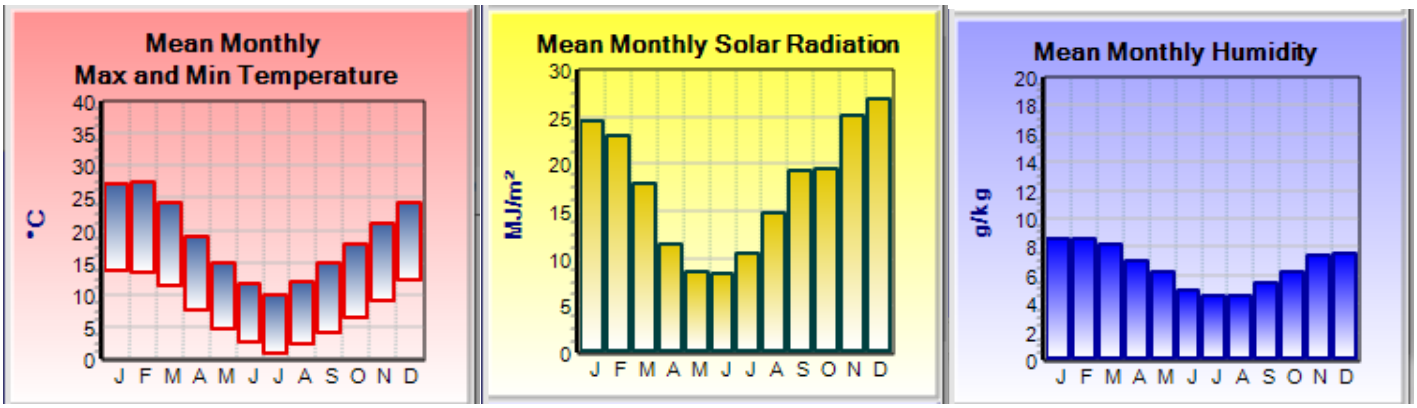
3.4.1. Passive Design Strategy

The buildings envelope will be subject to extensive interrogation in the pursuit of an energy efficient solution, whilst also dovetailing with the wider requirements it is subject to, such as acoustics.

In Queanbeyan, BOM data demonstrates four distinct seasons, with summer and winter months significantly exceeding human comfort range.

However, it is well understood of the significant climate variation within NCC climate zones. In climate zone 6, different sites can experience dominant cooling or heating requirements.

To better understand the proposed sites local environmental conditions, analyse was taken with NatHERs simulation, and the more defined climate files.



With hot and very hot summers that experience moderate humidity and mild to cool winters with low humidity. Queanbeyan provides design opportunities to passively reduce mechanical needs for cooling in summer and heating in winter.

Thus the development offers cost-effective opportunities to use passive solar heating where solar access is available. Areas of the development that do not have solar access, lightweight solutions have been proposed so that the building thermal envelope can respond quickly and efficiently to minimal heating. Cross ventilation for cooling. These design additions will bn appropriately incorporated at detailed design stages to support energy-efficient outcomes.

The façade is the largest area of the buildings envelope that is subject to external climatic conditions. Therefore, its building fabric profile needs to be composed according to the conditions of the local climatic variables.

Furthermore, where conditioned spaces are adjacent to unconditioned spaces, particularly ones with a highly variable internal dry bulb temperature, the design team will address the heat transfer between these spaces through the application of insulation. This increases the wall and floors thermal resistivity, thus reducing heat transfer via conductivity when internal temperatures differences between the spaces are considerable.

3.4.1. Energy Efficiency Initiatives

Reductions in electricity consumption and demand has an impact upon greenhouse gas emissions and energy production capacity as well as other emissions associated with energy generation. In minimising the load on Queanbeyan municipal electricity demand and dependence on diminishing non-renewable energy sources, the following sustainable development principles will be incorporated: -

- Building electrification [no gas – post implementation of net zero emission plan; gas install to GF tenancies only (e.g. commercial kitchens)]
- Electric induction cooktops and electric oven (residential units only)
- Metering will be provided to each tenant to inform the users on their use and management of electricity.
- Highly efficient Heating and cooling systems (EER or COP)
- Highly efficient electric hot water heating systems
- All lifts to have gearless traction with VVVF motor
- Residential units to have minimum single phase, reverse cycle air conditioning to living areas, and at least 1 bedroom.
- Heating and cooling within units to have minimum efficiency of 3.5 stars for cooling and heating and Day/Night zoning.

Base Building Mechanical performance requirements are to comply with the following: -

- 70% fan efficiency.
- High efficiency pumps.
- High efficiency ventilation fans.
- Fan efficiencies to be > 0.025W/l.s.Pa.
- Motor efficiencies to exceed High Efficiency levels listed in AS/NZS 1359.5-2004.
- Fan / motors to be selected to maximise total system efficiency and minimise absorbed power.
- Pump / motors to be selected to maximise total system efficiency and minimise absorbed power.
- Lighting control to employ night setback strategy whereby minimum security and emergency lighting is maintained.
- VSDs to be employed on all fans over 1000L/s.

3.4.2. Reduce Building Loads

Internal loads will be reduced via the following

- PV installation to available roof to offset base building energy
- LED lighting throughout.
- Smart switch occupancy control (i.e. kill all lights when occupant is out).
- Occupancy PIR on common area lighting.

- Mandate energy efficient appliances:
    1. Dishwasher 4 stars min. (energy rating).

3.4.3. Thermal Performance

- Thermal performance – Aspire to improve 25% better than NCC 2019 (glazing, insulation, roof reflectivity)
- High efficiency packaged units with swirl diffusers to maximise air mixing.

3.4.4. Hot Water Provision

- Energy efficient instantaneous electric systems provided to all units.

3.4.5. Common Use Energy

- Common lighting occupancy control and set back/night time.

3.5. Water Resources

Water is central to every community, powering industries, economies, improving our quality of life, and nurturing our natural environment.

Reducing the demand for water through efficient design can also reduce building owners' operational costs.

In Queanbeyan the temperate climate is becoming warmer and drier due to anthropogenic climate change.

In minimising the load on Queanbeyan municipal water, sewer and stormwater infrastructure, the following sustainable development principles will be incorporated: -

- The use of low water demanding plant selection and efficient irrigation.
- Native planting landscaping to use endemic and native species and those known to do well in the local area. Which will not require irrigation after establishment.
- 6-star WELS rated taps to bathrooms and 4.5-star WELS rated toilets
- If a Dishwashing Machine is to be provided to apartments, it is to be 6 Star WELS rated.

Based on the BSE's potable water calculations, incorporating the above efficient fixtures and fittings indicates a reduction of annual potable water use of 40% for the combined building in comparison to typical buildings of this nature: -

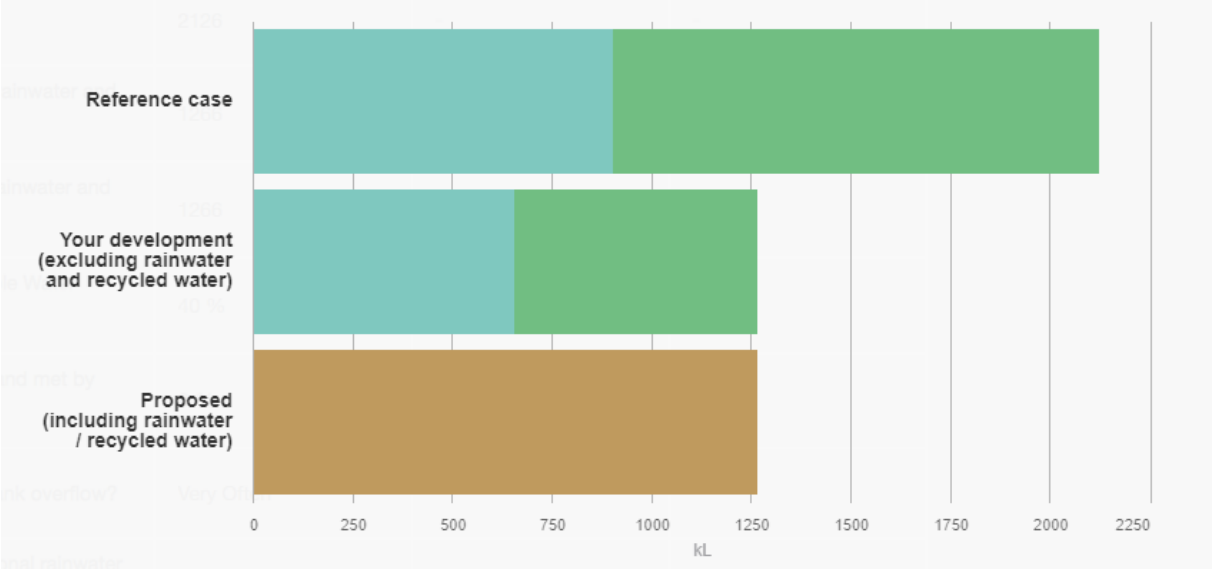


Figure 2: Summary of Calculated Potable Water Savings

3.5.1. Reduction of dead leg on hot water piping

Dead-legs in piping for hot water will be reduced through careful design. This aids to reduce the risk of legionella.

3.6. Sustainable Building Materials

3.6.1. Sustainable Construction Materials

The production and use of building materials has placed pressure on natural resources as they are exploited by the production industry. Energy is used to extract, produce and transport building materials, which causes pollution and if poorly selected the material ends up as waste, to become landfill or incinerated. In minimising the use of these material, the following sustainable development principles will be incorporated: -

The development aims to reduce the amount of construction materials required via the following:

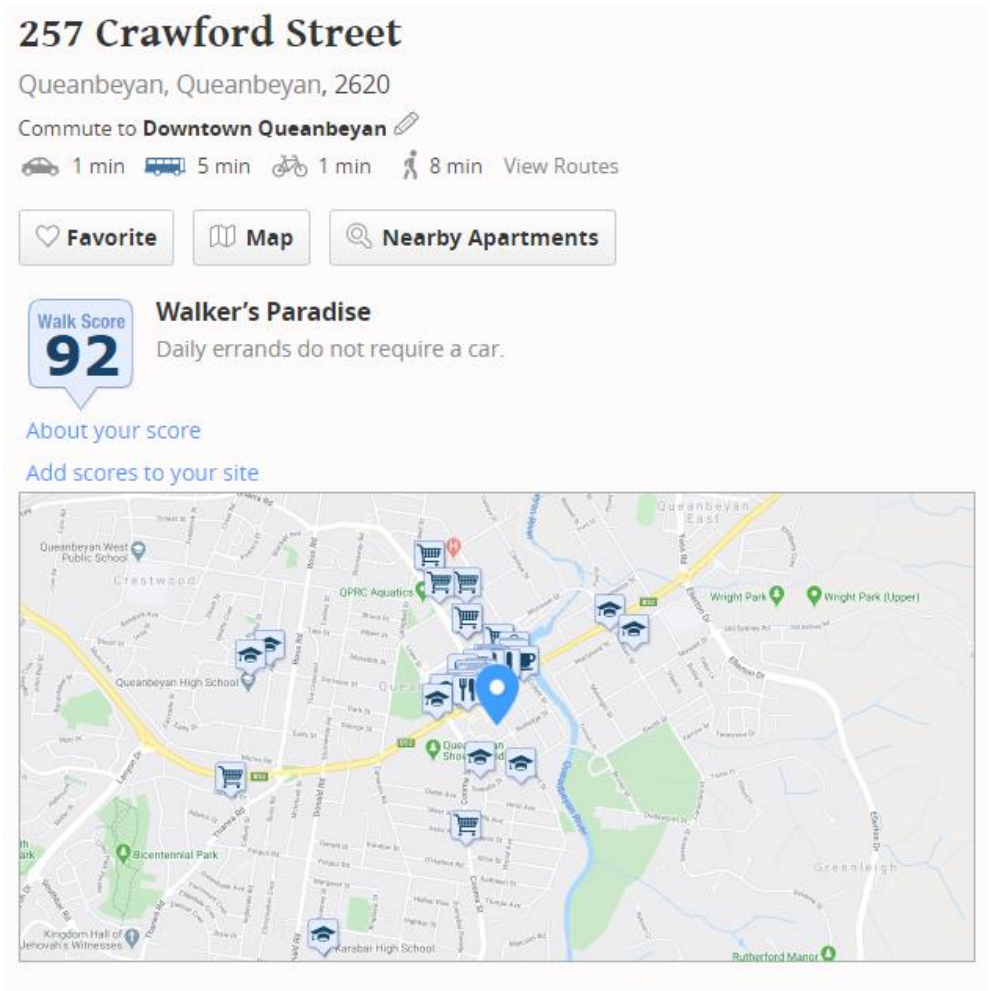
- Timber and composite timber products used in the building and construction works will be sourced from either or a combination of post-consumer re-used timber; or Forest Stewardship Council (FSC) certified Timber as appropriate for the project.
- PVC products or products containing PVC will meet the Best Practice Guidelines for PVC in the built environment.
- Thermal insulants and refrigerants will avoid the use of ozone-depleting substances in both manufacture and composition.
- Wall, ceiling, carpet and floor finishes, and adhesives and sealants will be low Volatile Organic Compounds emitting (EN 13419).
- Composite wood products used will be low emission formaldehyde (rated E0).
- Non-allergenic materials will be selected for furnishings.
- Steel will be sourced from responsible steel makers that utilise high recycled content
- Concrete when appropriate will be incorporate Fly-ash additive and other supplementary cementitious material in lieu of Portland cement.

3.7. Transport

Due to Queanbeyan's growing population, alternative transport options have been investigated to assist in reducing air pollution and road congestions, whilst also promoting an active and healthy lifestyle.

With the sites high walkscore, BSE recommends the following for the carparks provided:-

- Ready to charge EV charging points
- Electrical infrastructure and a load management plan prepared to allow for future installation of EV charging. Mix of EV chargers assumed (e.g., 7kW v 22 kW) to be detailed.
- A dedicated, safe, unobstructed route from the electrical supply point which allows for the future provision of all necessary electrical cabling without the need for substantial builders work in connection to the electrical cabling installation.
- As part of the Sustainable Transport Plan, the project team must outline how spatial and electrical barriers to the roll out of future provisions have been considered and addressed.



3.8. Waste Management

3.8.1. Waste management

The overall objectives of this development are to:

- Ensure term reusability of building materials
- Ensure sufficient space is allocated for future change/options in waste management needs, green waste facilities.
- Promote waste minimisation, reuse and recycling during the design, construction and maintenance of apartment block.

3.8.2. Operational waste management

BSE understand that Queanbeyan City Council is working to minimise waste by decoupling material consumption from building construction, demolition, refurbishment and operations. Minimising and recycling this waste can have significant social, economic and environmental benefits. In reliving the pressure on local landfills and natural resources, the following sustainable development principles will be incorporated as part of the buildings operational procedures: -

- Dedicated waste storage areas will be separated for commercial waste and residential waste.

3.9. Urban Ecology

As a brownfield site, the proposed development provides opportunity to provide landscaping unique to the Queanbeyan natural landscape which has been displaced and degraded from urban sprawl. Protecting and restoring the natural ecosystems will ensure the long-term ecological sustainability of Queanbeyan's biodiversity. In retaining Queanbeyan's unique natural landscape, the following sustainable development principles will be incorporated: -

- Landscaping design will be predominately low water use and native planting (more than 70%).
- Pesticides, herbicides and chemical fertilisers will be minimised.
- Environmentally sustainable landscapes and natural habitats will be incorporated where appropriate
- Where appropriate external surfaces with direct exposure to sunlight will have high solar reflectivity to minimise the urban heat island effect.

4. Innovation and ESD Excellence

The proposed development at Rutledge Street, Queanbeyan NSW aims to achieve innovative practices, processes and strategies by demonstrating initiatives that are far beyond industry Best Practices.

This way, the project will lead the local communities' ambitions, and form part of a pivotal opportunity as Queanbeyan-Palerang Regional Council's (QPRC) implements it's Community Climate Change Action Plan acting as a pioneer to the communities market transformation to a sustainable economy.

As such the project aims to achieve the following innovative goals:

- Using a technology or process that is considered innovative
- Implementing an initiative that substantially contributes to the broader market transformation towards a climate or nature positive development
- Implement initiatives that aims to challenge buildings to be exceptional in their achievements.

This will be achieved through the following targets:-

- Perform a Climate Change Risk and Adaptation Assessment
- Gas to GF tenancies initially, then phased out in line with State target of net zero by 2050 and SBT, Paris Agreement
- Building designed with no gas infrastructure to residential apartments, units to be fully electric
- The building exceeds the current NatHERS and BASIX requirements achieving a minimum 6 Stars NatHERs rating for each sole-occupancy unit and a weighted-area average of no less than 7 Stars.

4.1. Building Electrification Strategy

The Village Building Co. has a strong project commitment to sustainable development principles and as such aligns to Australia's electrification principals to be fossil free, by implementing a Net Zero Emission Decarbonisation Plan.

The building will initially incorporate Gas Infrastructure to the ground floor tenancies only. However, as part of the developments commitment to sustainability a Net Zero Emission decarbonisation plan, will be implemented to ensure the projects carbon emissions align to Science Based Targets (SBT) and the governments and local councils 2050 carbon neutral plans.

A vital part of accounting for the future, is understanding the global market and where Australia is moving as a country. As sch The Village Building Co. is future proofing the development for:-

1. Australia's infrastructure potential for load control
2. Prepare for Australia's renewable energy overhaul which will drive municipal electrical prices down

Load Control

Given battery prices dropping substantially, load control factor is a future environmental and key energy efficiency asset to buildings and Australian communities. Capabilities with be developed for both communities and single developments to flexibly moderate loads through battery systems, and this is substantiated through the building's electrification.

Renewable Energy Overhaul

Renewable energy is cheaper and continues to become cheaper while gas is expected to become more and more expensive until at least 2025. Detailed life cycle cost assessments for buildings currently support the minimisation of gas based on Australia's projections as supported by AEMO and case studies/assessments of electrified buildings of similar NLA.

Appendix A – BASIX and NCC 2022 Compliance Summary

BSE has been engaged to review the proposed development of the Shop Top Housing residential development located on 22-380 Rutledge St. Queanbeyan NSW 2620 against:-

- Section J (NCC 2022)
- BASIX

The building development was reviewed against the National Construction Code Energy Efficiency requirements and subset codes/standards.

Residential Apartments

BERS Pro Plus 4.4 has been used to determine the buildings compliance against the energy efficiency regulatory requirements for the development that also forms part of the BASIX assessment for the development.

Being at early design stages, a number of recommendations have been provided. These recommendations must be incorporated into the project drawings at a later date in order to satisfy the sustainability provisions.

Common Areas

Common areas form part of the BASIX assessment however will not be eligible to JP1 performance requirements. As all class 2 common areas do not require mechanical air conditioning set-points for the purposes of occupant thermal comfort.

The BASIX assessment demonstrates the proposed development complies with all independent efficiency categories: Water, Thermal Comfort and Energy.

The development achieves the minumum 40% BASIX Water Target, Thermal Comfort heating and cooling capacities (Pass), and the minimum 10% BASIX Energy Target.

Subject to satisfaction of the provisions outlined in this report, the proposed development will comply with the requirements of BASIX, NatHERS and Section J of NCC 2022 for all residential units.

The residential apartments were modelled as per Kasparek architects drawing issue C [28/10/2022], and in accordance with NatHERS protocols and procedures.

For projects in New South Whales, the *BASIX standards* is to be assessed in complementary to the National Construction Code 2022, as part of the Sustainable Buildings State Environmental Planning Policy (SEPP).

Building Thermal Envelope – Residential

The residential units were modelled using the construction details outlined in the below table.

Summary of Building Fabric Proposed to Comply with Energy Efficiency Requirements

Roof	Concrete slab with waterproofing membrane (light colour, solar absorptance = 0.30) with R4.5 bulk insulation and 10mm plasterboard. Roof space assumed unventilated, with no cavity. **All unit balconies (Roofs/ceiling of a apartment that also forms a trafficable balcony above)** R2.50 soffit insulation to underside of exposed slab.
Walls (Internal and External)	All building fabric wall elements have been modelled in accordance with client discussion. Architect to include and provide drawings detailing the insulation and material type/thickness details that correspond to the NatHERs modelling. Summary of typical wall types modelled are as follows:- **External Lightweight Walls [EW1]** 6mm FC (or similar) / 90mm Stud with R2.50 bulk insulation batts / Plasterboard **External Heavyweight Wall [EW2]** 140mm Blockwork (or similar) / 90mm Stud with R2.50 bulk insulation / Plasterboard **Walls between units – Party Walls (Blockwork) [BW1]** Plasterboard / R0.6 bulk insulation / 190mm Concrete Block / R0.6 bulk insulation / Plasterboard **Partition walls within units (Single Stud)** Plasterboard / Air Cavity / Plasterboard
Colour	External wall colours were typically modelled as medium / dark [Solar Absaoptance = 0.50]
Spandrel Systems	No Spandrel Panels were identified based on current architectural drawings.
External Glazing	The following whole of window performance values (Glazing and Frame) are to be met: - **<u>All Residential Units</u>** **Fixed Panels: -** Total system U-Value $\leq$ 4.30 Total system SHGC $\leq$ 0.53 **Sliding doors (2, 3 and 4 panels): -** Total system U-Value $\leq$ 4.30

	Total system SHGC ≤ 0.53 **Awning frame: -** Total system U-Value ≤ 4.30 Total system SHGC ≤ 0.47 Aluminium double glazed high solar gain; low-e clear glazing system expected to achieve the above listed performance requirements for residential units
Floors	**Bedrooms and WIR's** 200mm concrete slab with carpet floor covering and rubber underlay. **Bathrooms and Laundry** 200mm concrete slab with tiles floor covering. **Kitchen/Living Rooms, Corridors and MPR / Study spaces** 200mm concrete slab with floating timber
Suspended Floors	**Additional insulation treatment has been proposed to all suspended floors:-** R2.00 rigid soffit insulation proposed to all suspended floor areas. **[F1]**
Ceiling Fans	No Ceiling fans (min 1200mm diameter) have been modelled.
Downlights	Sealed (airtight) LED downlights are to be incorporated for all downlight fittings within the residential apartments. This prevents egress of air from the ceiling cavity to the occupied space.
Exhaust fans	All apartment exhaust fans have been modelled as sealed. This requires sealing around all penetrations and draughts. Including but not limited to, caulking the gap between the fan and the ceiling / drywall. As well as sealing holes in the fan housing. This prevents the movement of air between the ventilated space and surrounding conditioned zones.
Openable Windows	Windows have been modelled in accordance with architectural drawings. Window restrictors have been incorporated to all applicable awning windows.

Results - Residential

The following table provides a summary of the NatHERS result for the proposed Residential Units.

Requirement	Building East	Building West	Compliance Achieved
5 Star Minimum NatHERS Rating Required	5.40	5.40	YES
6 Star Average NatHERs Rating Required	7.39	7.37	YES

East Building	STAR RATING	COOLING LOAD (MJ/m2)	HEATING LOAD (MJ/m2)	TOTAL LOAD (MJ/m2)	COMMENTS
A	5.4	36.4	152.8	189.2	High Solar Gain, Low-e IGU glazing unit used for all units.
A.1	5.6	18.2	167.6	185.8	
B	8.1	5.0	67.4	72.5	
C	8.1	3.8	69.1	72.9	
E	7.1	7.9	109.4	117.3	
E.1	7.8	14.4	70.4	84.8	
F	7.5	21.3	76.2	97.5	
I	7.2	6.9	106.3	113.2	
Minimum					5.40 Stars (PASS)
Average					7.39 Stars (PASS)

West Building	STAR RATING	COOLING LOAD (MJ/m2)	HEATING LOAD (MJ/m2)	TOTAL LOAD (MJ/m2)	COMMENTS
A	5.4	36.4	152.8	189.2	High Solar Gain, Low-e IGU glazing unit used for all units.
A.1	5.6	18.2	167.6	185.8	
B	8.1	5.0	67.4	72.5	
C	8.1	3.8	69.1	72.9	
D	7.4	7.6	95.4	103.0	
E	7.1	7.9	109.4	117.3	
E.1	7.8	14.4	70.4	84.8	
F	7.5	21.3	76.2	97.5	
G	7.9	1.5	76.5	78.0	
G.1	9.3	1.8	21.8	23.7	
H	7.2	14.8	95.9	110.7	
I	7.2	6.9	106.3	113.2	
J	7.8	16.3	70.4	89.6	
Minimum					5.40 Stars (PASS)
Average					7.37 Stars (PASS)

Appendix B – Building Parametric Studies

As part of the preliminary design process, BSE has reviewed the buildings performance using three different glazing systems detailed below.

Aluminium Framed Single Glazed: High Solar Gain Low-E Glass						
	Product Test	**BERS Code**	**Glass U**	**Glass SHGC**	**System U**	**System SHGC**
Awning	1	ALM-001-03 A	3.7	0.72	5.4	0.49
Slider	1	ALM-002-03 A	3.7	0.72	5.4	0.58
Fixed	1	ALM-002-03 A	3.7	0.72	5.4	0.58

Aluminium Framed Single Glazed: Low Solar Gain Low-E Glass						
	Product Test	**BERS Code**	**Glass U**	**Glass SHGC**	**System U**	**System SHGC**
Awning	2	ALM-001-04 A	3.7	0.54	5.6	0.36
Slider	2	ALM-002-04 A	3.7	0.54	5.6	0.41
Fixed	2	ALM-002-04 A	3.7	0.54	5.6	0.41

Aluminium Framed Double Glazed (IGU): Air Fill Gap with High Solar Gain low-E – Clear Glass						
	Product Test	**BERS Code**	**Glass U**	**Glass SHGC**	**System U**	**System SHGC**
Awning	3	ALM-003-03 A	2.2	0.65	4.3	0.47
Slider	3	ALM-004-03 A	2.1	0.65	4.3	0.53
Fixed	3	ALM-004-03 A	2.1	0.65	4.3	0.53

Determining the Glazing System Performance Requirements

Preliminary energy modelling of typical units using the glazing systems detailed above, demonstrated the following:-

Compliance (by the decimal point) when using single glazing - high solar gain low-e (*Product Test 1).*

Non-compliance when using low solar gain low-e glass (*Product Test 2).*

Compliance, when using low solar gain low-e glass (*Product Test 3).*

Results demonstrate Product Test 1 and 3 achieve compliance for typical units against BASIX.

However using single glazing, this was by the decimal fraction. And any modification to the design may result in the building not complying to the 5 Star NatHERS minimum and 6 Star Average stipulation.

Furthermore, worse performing units underwent parametric studies to improve their current rating when using a single glazed low-e façade system

Evaluation of alternative compliance options have been completed for these apartments.

Parametric studies included:-

Further to above, a parametric study was completed of the worse case units, assess the environmental performance impacts of other performance variables in coalition to single glazed systems (*Product Test 1 glazing system)*, These units were:

'A' and 'A.1' on level 2 of the West and East building.

The specific design parameter investigated included:-

- Removal of fixed lower pane (beneath awning sash) on well-shaded walls
- External insulation to all concrete walls
- Variation of different insulation and construction types, such as composite insulation for lightweight walls.
- Variations to roof colours
- Adjustable shading to allow variable solar access in spring and autumn.
- Sealed and thermos-statically controlled ceiling spaces.

Preliminary results demonstrate increase in [+ 0.28 Stars] in comparison to single glazing without modification.