SUSTAINABILITY REPORT

Laundy Tavern – Jordan Springs

LOT 3989 Lakeside Parade & Jubilee Drive, Jordan Springs, NSW 2747

PREPARED FOR

FDC
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Forest Lodge NSW 2037
Tel: 02 8117 5000

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Sustainability Report

Date	Revision	Issue	Prepared By	Approved By
30.06.2020	1	Issued for DA	B. Park	I. Van Eerden
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Executive Summary

The intent of this report is to outline the sustainability strategy adopted for the new Laundy Tavern Pub at LOT 3989, Lakeside Parade & Jubilee Drive, Jordan Springs, and demonstrate compliance with sustainability objectives set out by Penrith City Council. This report has been prepared on the basis of the plans prepared by FDC to satisfy the DCP requirements of Penrith City Council.

Laundy Tavern Jordan Springs development will be targeting the following key sustainability objectives:

- Minimised production of greenhouse gas emissions and optimised energy efficiency.
- Minimised mains potable water use.
- Minimised waste going to landfill and improved waste collection efficiency.
- Minimised effects of urban heat island effect, and
- On-site renewable energy generation.

These outcomes will be achieved through demonstrating compliance through the following actions.

- Building Code of Australia – exceeding the minimum compliance requirements of Section J Energy Efficiency
- Incorporating energy efficient heating, ventilation and air conditioning systems, including natural ventilation to indoor space where it is achievable.
- The use of water efficient building services including rainwater collection and fire system reuse (where appropriate)
- The minimisation of the projects impact on Stormwater flow entering the municipal systems and
- Looking to ensure that the project maintains the site's ecology and biodiversity.

Based on the above, the design initiatives outlined in this Sustainability Report provides a framework for the development to show how it exceed the minimum benchmarks of the Penrith City Council's Development Control Plan (DCP) requirements.

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1. Introduction

1.1 General

The intent of this report is to outline the sustainability strategy and demonstrate the sustainability initiatives being considered as part of the development of the Laundy Tavern Jordan Springs at Lot 3989, Lakeside Parade & Jubilee Drive, Jordan Springs.

This report has been developed in accordance with the Penrith City Council's Development Control Plan (DCP) 2014 Volume One and aims to align the development design with the objectives outlined in C1.2.2 – Built Form – Energy Efficiency and Conservation and C3.1.5 – The Water Cycle/Water Conservation for Commercial Premises. The sustainability initiatives listed in the subsequent sections of this Sustainability Report have been suggested as pragmatic and cost-effective solutions for the project and are being actively considered as part of the detailed design of the project.

1.2 Building Characteristics

Laundy Tavern Jordan Springs development incorporates the renewal of a site located on Lakeside Parade Road to be built as a principle of social gathering and accommodate beverage and restaurant facilities. The project will provide high quality outdoor dining area with proximity to the Jordan Springs Lake, activating the surrounding areas as well as that of Penrith LGA. The proposed development is located on South-side of Jordan Springs Lake, encapsulated by Lakeside Parade Road and Jubilee Drive in Jordan Springs.

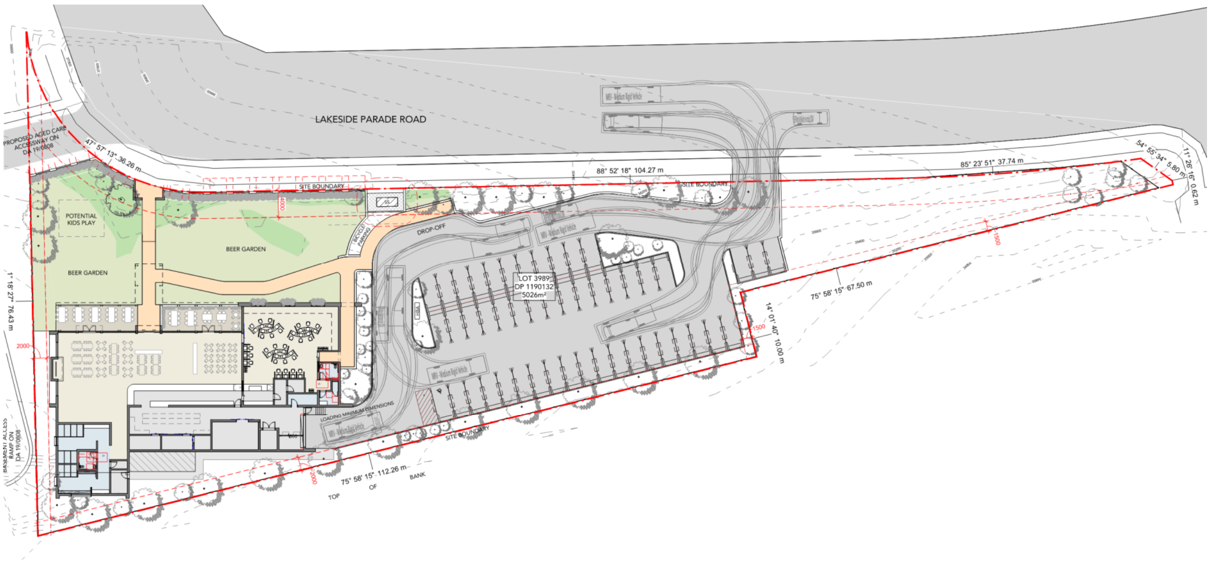


Figure 1 –Site Plan of the Proposed Development at LOT 3989 Lakeside Parade & Jubilee Drive, Jordan Springs Designed by Team2 Architects

1.3 Limitations of the report

Due care and skill have been exercised in the preparation of this report.

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 Northrop for detailed advice, which will consider that party's particular requirements.

2. Building Code Compliance – Section J

As part of the buildings sustainability assessment Northrop Consulting Engineers has conducted a Deemed-to-Satisfy (DTS) assessment of the building fabric in accordance with Section J of the National Construction Code (NCC) 2019. the following section provides an outline of the minimum compliance requirements for the building fabric as outlined in Part J1 of the code.

The table below outlines compliance requirements for J1.0 to J1.6:

Table 1: Insulation and Glazing System requirements for the building fabric

Building Fabrics	Required Minimum Thermal Performance
Roof	R3.2; Solar Absorptance (SA) ≤ 0.45
External Walls	R1.0
Partition Walls to Non-Conditioned Space	R1.0
Floors (Slab-on-ground, exposed & semi-exposed)	R2.0
All Windows	U-value: 5.2 SHGC: 0.31

The proposed compliant fabric solution must take the impacts of thermal bridging into account. Should the requirements listed above be deemed unfeasible, it is recommended that the project team should proceed with a JV3 performance-based solution during the detailed design phase. This approach is more flexible as it offers a holistic assessment of the building performance, rather than individual components.

2.1 Building Description

The Laundy Tavern Jordan Springs is classified as Class 6 and 9b – retail and assembly building. For the purposes of Section J – Part J1 Class 6 and 9b was considered for the assessment of the building fabric encapsulating conditioned spaces throughout the development. This proposed development is located at Lot 3989, Lakeside Parade & Jubilee Drive, Jordan Springs, NSW 2747, which belongs to climate zone 6 as shown in Figure 1 below.

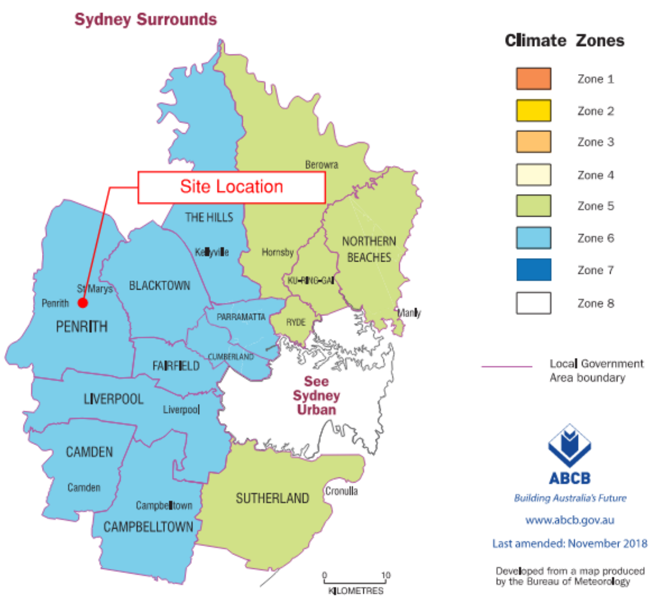


Figure 2 - Climate Zone Map of Jordan Springs Site

2.2 J1 Building Fabric

Building fabric thermal insulation requirements apply to the building fabric enclosing habitable and conditioned spaces forming part of the thermal boundary of the site (building envelope). This is demonstrated in the thermal boundary markup attached in Appendix B of this report.

Below entails the thermal performance requirements of each components of the building fabric applicable to Laundy Tavern Jordan Springs development, which are assessed against Parts J1.3 to J1.6.

J1.3 Roof and Ceiling Construction

Roof or ceiling construction must achieve a total system R-Value of R3.2 with solar absorptance value of no more than 0.45.

J1.5 Walls and Glazing

The total system U-Value the wall-glazing construction of Laundy Tavern Jordan Springs must not be greater than U2.0 as per J1.5 clause (a)(i).

The table below outlines the thermal performance requirements of the external walls, partition walls and the glazing system required to achieve the specified maximum of U2.0.

Table 1 - Required Code Compliant Thermal Performance of the Wall-Glazing System

Wall-Glazing Component	Required Thermal Performance
External Wall	R1.0 (See Note Below)
Partition Wall	R1.0 (See Note Below)
All Windows	U-Value: 5.2 SHGC: 0.31

Note: The total system R-Value of the external and partition walls reflect thermal performances inclusive of the thermal bridging effect caused by building support structures. As such the build-up must achieve the stipulated R-Values with the effects of thermal bridging taken into account. External walls should include a non-combustible thermal break within metal elements and ensure that the noted performance can be achievable.

J1.6 Floors

All floors, including slab-on-ground and floors to non-conditioned spaces must achieve a total system R-Value of 2.0. For Laundy Tavern Jordan Springs development, no additional ground floor insulation is required as sufficient thermal performance is achieved by the solid ground floor and the soil. (See Appendix C – Total System R-Value Calculation for Solid Ground Floors)

3. Sustainability Initiatives

Further to the minimum code compliance assessment of the development, the project team have also looked at potential additional design strategies to improve the environmental performance of the development. In line with the Penrith City Council's Cooling the City Strategy, strategies to mitigate the effects of urban heat island effect (UHI) have been developed addressing the councils concerns regarding the financial, environmental and the social impacts of this issue on the Penrith Local Government Area (LGA).

The following objective framework in the Penrith City Council's DCP requirements were applied to set guidance in the formulation of the design initiatives proposed in the report:

- To ensure that development is designed on a 'whole of building' approach by:
    - Encouraging passive solar building design
    - Allowing reasonable daylight access to all developments and the public domain
    - Reducing the necessity for, or improve the control of, mechanical heating and cooling
    - Reducing the energy consumed by installed
    - Improving the indoor environmental quality of occupants
    - Minimising greenhouse gas emissions
- To reduce consumption of potable water for all development types within the City
- To use harvested rainwater, treated urban stormwater or treated wastewater for non-potable substitution where appropriate.
- Utilising, where possible, sustainable materials that minimise impacts on the environment, maintenance, and waste

3.1 Passive Design

Passive design is a key element when designing low energy buildings. Passive design reduces the need for auxiliary heating or cooling by taking advantage of varying climate to achieve thermal comfort. The following initiatives will play a significant role in ensuring that the building's annual energy performance is lower than the set thresholds.

Key considerations include thermal performance of the building fabric, glazing selection and extent, external shading, daylight direction devices, surface properties and possible natural ventilation openings.

3.1.1 Building Insulation

Climatic conditions influence the appropriate level and type of insulation, as it acts as a barrier to heat flow and is essential for retaining thermally comfortable indoor temperature. In line with the National Construction Code 2019 Volume One, the proposed development is deemed to meet the best practice (minimum code) requirements of the wall-glazing construction to provide the appropriate insulation level across the building envelop.

3.1.2 Roof Solar Reflectance Index (SRI)

Solar Reflectance Index (SRI) is a numerical value used to denote the roof's ability to reflect incident energy from the sun away from the building. It is determined from two parameters of the roof – solar reflectance, which represents the extent to which a surface reflects sunlight, and thermal emittance, which quantifies the ability of a surface to release absorbed thermal energy. Higher SRI therefore correlates to the ability to reflect heat away from the surface with minimal absorption, which is often observed in lighter-coloured roof materials.

The development proposes a light-coloured roofing material with solar absorptance of below 0.45, which largely involves higher SRI yielding roof materials. This helps to comply with part J1 of the National Construction Code 2019, but also helps to mitigate the effects of the urban island effect by reflecting the energy from the sun away from the building, rather than absorbing and re-emitting it back to the atmosphere.

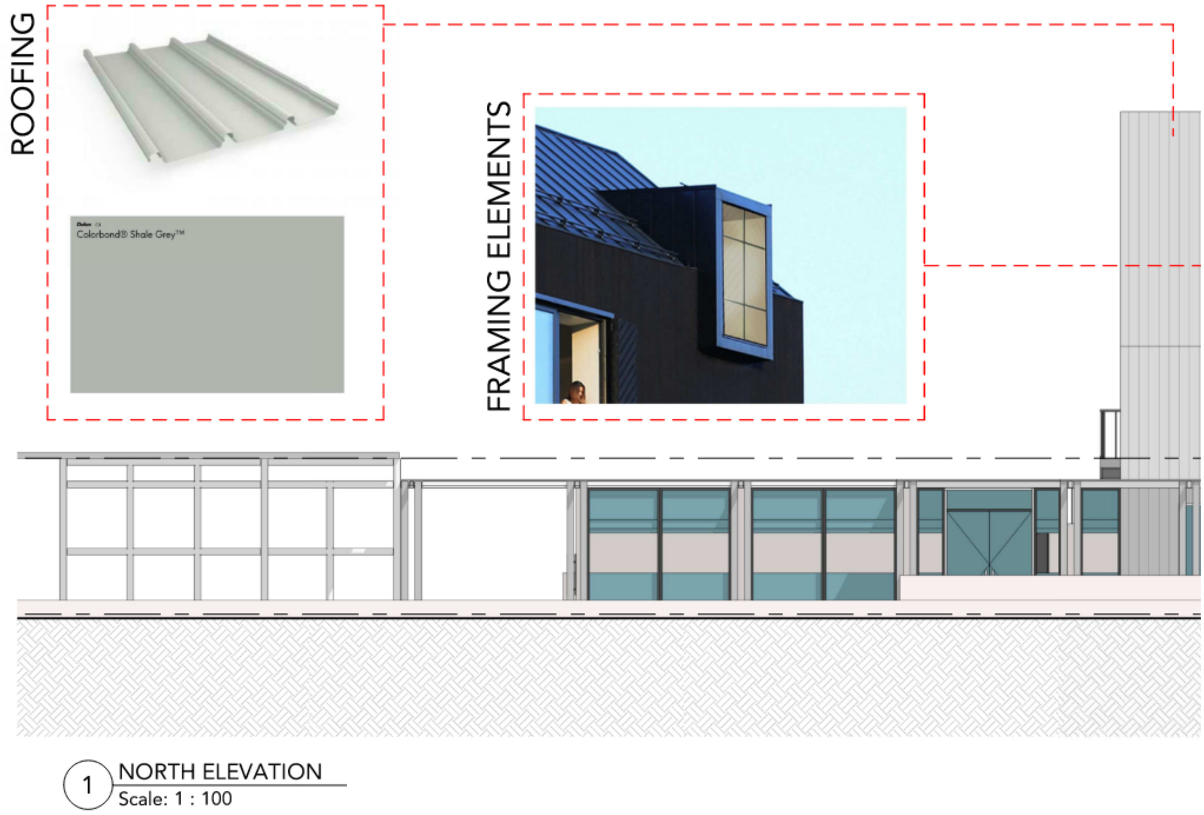


Figure 3 Roof specification for Laundy Tavern Jordan Springs Development

3.1.3 Natural Ventilation

The building is designed for good use of naturally ventilated spaces. This is demonstrated by the fully openable, well-shaded windows and doors on the Western façade of the building across both floors. Increasing the natural ventilation of the space is a method used to passively cool and ventilate the space without using mechanical air conditioning systems and thus an effective way to minimise energy consumption in the building.

3.1.4 Natural lighting – Light Shelving

Effective use of daylight in buildings has been shown to reduce building energy consumption and improve the occupants' sense of well-being. The controlled transmission of natural light into a building will reduce the reliance on artificial lighting for much of the year, whilst still achieving acceptable illumination.

While the current design of the envelope aims to open the buildings to more natural light where possible, this can also be maximised utilising high reflectance finishes and light shelving.

Figure 4 Example of natural light shelving

3.1.5 Optimised Shading

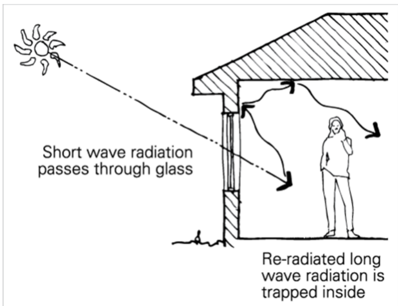


Figure 5 shading prevents the entry of solar radiation in summer but should allow warmth to enter in winter

Direct solar radiation entering a building can act as a heater in winter, however, it can drastically increase air-conditioning loads throughout summer. As such optimised shading will allow the entry of warmth in winter and block this in summer.

The placement of the shading devices should be focused on the North, West and Easterly facades to reduce unwanted heat gain resulting from the high angle sun in the Summer months. The development proposes an extensive shading in the West where most of the glazing is located, thereby mitigating the effects of heating in warmer months.

Adjustable vertical shade sails on the Western deck are also proposed to resolve the potential problems of direct solar heat gain and glare from the afternoon sun.

3.1.6 Thermal Mass

High thermal mass can be used for heating and cooling as brings a delay on reaching the maximum and minimum temperature on daily bases which provides temperature stability and enhances the thermal comfort.

Heating with thermal mass happens through storing solar heat during the day and releasing it at night, while cooling through thermal mass can happen through allowing night breeze to cool the high thermal mass and it will release that coolness during daytime when it is mostly needed.

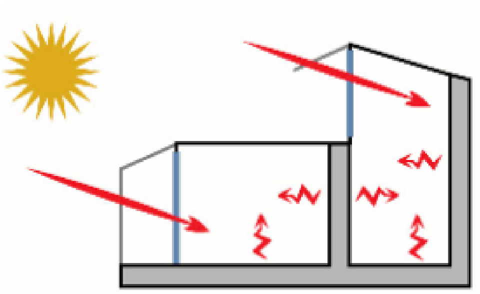


Figure 3: using thermal mass to store solar heat. (house-energy.com)

Appropriate use of thermal mass is recommended for this development as it is located inland within Climate Zone 6, whereby high temperature swings between the day and night is expected throughout the year. Using exposed pre-cast panels on walls, and slab-on-ground can be an effective way of utilising thermal mass to dampen the unwanted temperature fluctuations.

3.1.7 Thermal Bridging Elimination

Heat will flow the easiest path from the heated space to the outside - the path with the least resistance. Several components in the building envelope usually act as a thermal bridge, a conduit for heat to leak through the walls, roofs, floors and windows internally and externally.

This results in additional energy consumed by the HVAC system to compensate for heat gains and losses and achieve comfort. Thermal Bridging could account for up to 10% of total energy consumption.

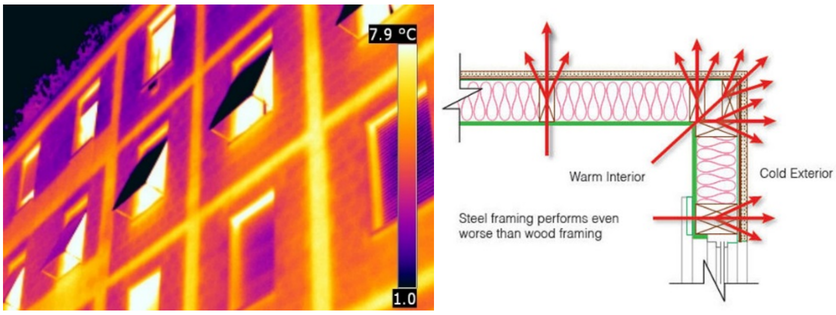


Figure 6 Typical thermal bridge heat losses

Thermal separation eliminating thermal bridging is recommended for the following components;

- Utilising, where possible, sustainable materials that minimise impacts on the environment, maintenance and waste
- Foundation wall transitions;
- Metal panel wall support connections;
- Parapet conditions;
- Roof to wall transitions;
- Window wall transitions;
- Window frames; an
- Curtain wall support connections;

It is noted that thermal bridging is required to be addressed in some elements as part of NCC2019. Good attention to detail within the building structure will help to minimise the impact of thermal bridging on the buildings HVAC systems.

3.1.8 Building Sealing

Air leaks is usually present in two scenarios, direct and indirect.

- Direct leaks are the most obvious, such as undercuts that allow outside air to come directly under the sill or around the frame.
- Indirect leaks are more difficult to identify but represent most of the air leakage in a typical building. Indirect leaks occur where air penetrates the exterior at one location and the interior at another.

Extensive building sealing should be applied to eliminate all heat losses in the space. This is recommended to be undertaken on the interior and exterior of the building during construction works, using expanding foam or the like.

Figure 7 interior and exterior building sealing

3.2 Energy Efficiency

3.2.1 Energy Efficient Air-Conditioning

Though the utilisation of HVAC system zoning and higher energy efficiency ratio (EER), a higher performing, energy efficient system can be employed to condition the occupied space effectively and accommodate significant variation in occupant loads across the day. Active control systems will work to maintain the space at the outer limits of the thermal dead band accounting for predicted demand increases with restaurant opening hours.

3.2.1 HVAC System Controls

While other HVAC systems operate on a more rigid full-on or full-off schedule, variable air-conditioning systems, such as a Variable Refrigerant Flow (VRF) systems deliver refrigerant at variable rates and exact amounts to spaces that need it, meeting the heating and cooling needs of the building with increased precision and efficiency.

The use of an effective controls system with an efficient air-conditioning system will allow the adjustment of the heating and cooling requirements of each space and allow the system to operate at reduced speeds, saving energy. The use of smaller systems coupled with controls sensors in each space means that differ space requirements can be accommodated with areas avoiding over cooling or heating.

3.2.1 Heat Recovery

Heat recovery is the process of reclaiming the energy contained in return air from being discharged and using it to pre-condition fresh outside air to deliver heating to spaces where needed.

The process results in reduction of energy consumed in conditioning outside air as well as maintaining a better indoor environment quality by providing opportunities for larger fresh air supply rates.

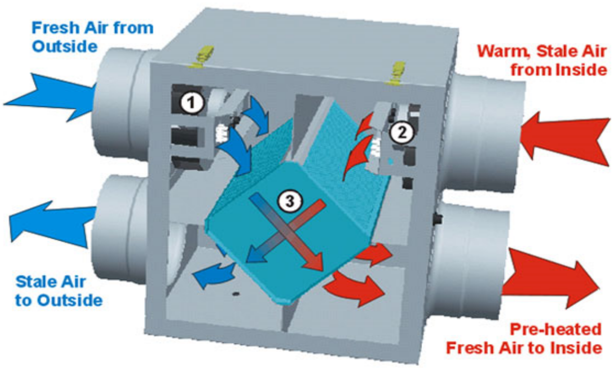


Figure 8 Heat Recovery ventilator

3.2.2 Energy efficient appliances

Minimum Energy Performance Standards (MEPS) specify the minimum level of energy performance that appliances, lighting and electrical equipment must meet or exceed before they can be offered for sale or used for commercial purposes.

MEPS are mandatory for a range of products in Australia and New Zealand. These products must be registered through an online database and meet a number of legal requirements before they can be sold in either of these countries.

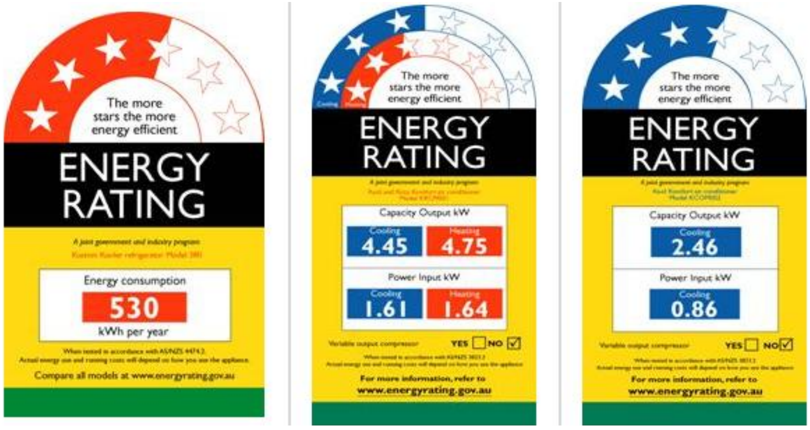


Figure 9 Typical Energy rating labels

MEPS should be specified for the following;

- Domestic hot water units – minimum 5 Stars; and
- White goods – Minimum 5 stars.

3.2.3 Energy Efficient Lighting

The LED lighting technology today offers a range of suitable applications that maximises efficiency. LED Lamps offer a number of advantages over other lighting technologies being energy efficient, cost effective and robust. While LED lighting is more capital intensive, the life expectancy and energy efficiency of the fitting result in an attractive payback.

Figure 10 Sample LED light fittings

3.2.4 Fire Stairs - Occupancy Sensors & Dimming Control

Emergency luminaires within the fire stairs can be fitted with self-contained high-performance stand-by/emergency multi-function LED type luminaires, controlled with integral motion sensors.

Luminaries operate on two separate circuits. When the fire stairs are unoccupied, the light goes on stand-by mode circuit, delivering around 20% of its brightness. When movement is detected within 8m, the light's second circuit is switched ON, delivering full lumen output for an adjustable set period of time, up to 15 minutes.

Figure 11 Emergency lights in standby & occupancy modes

3.2.5 Electrical Demand Reductions

Staggering the activation of major plant equipment will reduce peak electrical demand by avoiding fans, pumps and compressors ramping up simultaneously. This will reduce peak demand on the grid and reduce energy demand costs.

3.2.6 Energy, Water and Gas Metering

Metering should be provided to allow each area of the building to monitor their energy and water usage. This will allow building users to set targets for consumption and monitor energy improvements resulting from behavioural or equipment changes.

Effective energy and water monitoring systems will also provide building users with information to better analyse their energy consumption identifying underperforming systems and enabling them to compare performance at different sites. Through providing this data the project will make energy consumption visible and assist with energy reporting.

Figure 12 Metering will assist with building management and reporting

3.3 On-site Renewable Energy Generation

3.3.1 Photovoltaic (PV)

With decreasing capital and installation costs, photovoltaic arrays can provide on-site generation with a competitive pay back rate. Photovoltaic arrays are also flexible and modular which allows them to be integrated as a secondary function of a space.

Figure 13 PV on roof structure

The performance of photovoltaic energy generation will be assessed later as its detailed design progress throughout the project.

3.3.2 Solar Hot water

Solar thermal domestic hot water generation consists of solar hot water package system complete with gas fired / electrical continuous flow boost. Solar hot water could provide 20-50% of the hot water demand.

The actual contribution from solar would need to be determined based on demand profiles, storage size and collector efficiency. The feasibility of solar hot water will be further assessed at the detailed design stage.

Figure 14 Solar hot water system

3.4 Water Efficiency

3.4.1 Water efficient fixtures and fittings

Water Efficient fixtures and fitting will reduce the water consumption of the site. As an indication, the following should be targeted:

- Wash hand basin taps 6 star WELS
- General taps 6 star WELS
- Toilets dual flush 4 star WELS
- Urinals 0.8 L per flush 6 star WELS
- Shower heads 7-9 L per minutes 3WELS
- Rainwater collection and ruse for Landscape irrigation and toilet flushing
- Fire testing water re-diverted to storage tank.

3.4.2 Water Harvesting and Reuse

Roof collection and tank storage – the collected water should be sufficient for the provision of irrigation to the planter boxes, as well as being used for sanitary fixtures. Water harvesting opportunities will be examined further as part of the projects detailed design.

3.5 Indoor Environment Quality

The idea of improving indoor environment quality is to ensure that building occupants are comfortable within a space and reduce exposure to internal pollutants. Through the provision of sufficient outside air, sufficient lighting levels and good visual access to outside the project should achieve good indoor environment quality. However additional initiatives for consideration include the selection of,

- Low VOC paints, flooring, sealants and adhesives; and
- Formaldehyde free engineered wood products.

3.6 Other Potential Initiatives

3.6.1 Construction and demolition waste

Building materials account for approximately half of all materials used and about half the solid waste generated worldwide incurring significant environmental impacts at each process interval. It is proposed that at least 90% of construction and demolition waste is to be recycled, to reduce the carbon footprint of the site. This commitment should be incorporated into the head contractors' Environmental Management Plan for the site. Reclamation of high value building materials should be considered first preference. Where reclamation is not viable, materials such as asphalt, bricks, timber, plastics (including PVC) and concrete should be recycled accordingly.

3.6.2 Locally sourced products and services

Locally sourcing products and services for use in the design and construction of the development would help to keep transport and distribution impacts to a minimum. It will also help to support local employment and improve economic resilience of the Jordan Springs' manufacturing industry. Manufacturer location for materials and services should adhered to the following restrictions:

- 20% of more of the materials construction budget should come from within 500km of the construction site
- An additional 30% of the materials construction budget should come from within 1000km of the construction site or closer.

- An additional 25% of the materials construction budget should come from within 5000km of the construction site.
- 25% of materials may be sourced from any location.
- Consultants should come from within 2500km of the project location.

Utilising local manufacturing and suppliers should also help to minimise lead time for products, build positive relationships and make supply chain auditing easier. Overall, the sourcing of locally sourced products should be explored and implemented where economically feasible.

3.6.3 Dual waste segregation

Providing waste storage areas located centrally within the building to dispose of multiple waste streams will improve the waste outcomes for the development. The use of source separation of waste will drastically improve environmental outcomes as post collections segregation takes longer, costs more and increases cross contamination. Overall, the separation of general waste and comingled recycling at a minimum will reduce waste disposal costs for the development and therefore help to minimise waste levies payable. Furthermore, and for example, source separation for Paper and Cardboard with an on-site compactor to process paper-based recycling, will likely result in a notable operational cost savings because this resource stream attracts either low cost, nil charge or pay-back for its collection.

3.6.4 Waste compactors

Waste compaction is being considered for the development as a way to reduce the number of traffic movements on site, reduce vermin and rodents and improve cleanliness and sanitation on site.

The Elephants Foot compaction systems offer several options which have the potential to reduce waste services costs up to 75 percent. This would allow the reduction in size of waste rooms, help to minimise the number of collections that are required by the waste contractor and should reduce the waste disposal costs and therefore help to minimise costs to the residents and operators.

3.6.5 Urban heat island effect mitigation

3.6.5.1 Solar Reflectance

As previously discussed in Section 3.1.2, selection of roof colour has minimal impact on the architectural aesthetic or cost for the development however can have a substantial influence on the overall impact of the site in terms of heat island effect.

A provision of at least 75% of all external façade, pavement and roof surfaces follow the Solar Reflectance Index (SRI) guideline:

- For roof pitched <15°– a three-year SRI >64; or
- For roof pitched >15°– a three-year SRI >34.

The use of pale coloured roofs and facades will have marginal cost implications and would assist in the propagation of daylight through areas that are shadowed by adjacent buildings.

4. Conclusion

The inclusion of the initiatives outlined within this report will ensure that the Laundy Tavern Jordan Springs project delivers a development that not only meets the needs of its occupants but also those of the surrounding environment and more broadly Penrith City Council and the local government areas of Penrith.

The proposed development will present significantly improved sustainability outcomes for its occupants when compared to traditional developments of this type through the additional energy efficiency and incorporation of sustainability initiatives embedded into the building design to achieve sound environmental performance. The consideration given to the environment within the development is highlighted through the following;

- Minimised production of greenhouse gas emissions and optimised energy efficiency;
- Minimised mains potable water use;
- Minimised waste going to landfill and improved waste collection efficiency; and
- Minimised effects of urban heat island effect
- On-site renewable energy generation

As such the commitment to targeting significant sustainability outcomes and strict energy, water and storm-water management measures work to address the council requirements for these considerations as well as improving the overall social, economic and environmental welfare of Penrith's local government areas.

Appendix A – NCC 2019 DTS Glazing Calculator

NCC 2019 Wall-Glazing Calculator v3.0

Wall and glazing energy efficiency in Class 2-9 buildings - Method 2 of Specification J1.5a, NCC 2019

Building name and description	Classification	Climate Zone
Laundry Tavern - Jordan Springs	Other	6

Calculated Area-Weighted U-Value	1.99	Calculated Representative Air-Conditioning Energy Value	53.1
Allowable Area-Weighted U-Value	2.00	Allowable Representative Air-Conditioning Energy Value	53.1
Building total U-Value allowance met	100%	**Building total SHGC allowance met**	100%
Check Values: Visible	**Wall Element Requirements**: Met	**Display Glazing Element Requirements**	-

Use of this calculator does not guarantee compliance with the NCC. The disclaimer and a version update check are available at the bottom of the pag

Building Check-Values

	Area (m²) Walls	Glazing	Sub-total	Display	Glazing Percentage (non display)
North	94.2	98.5	192.6	0.0	51%
East	74.2	10.7	84.9	0.0	13%
South	78.4	2.7	81.1	0.0	3%
West	118.7	26.7	145.5	0.0	18%
Internal	86.6	0.0	86.6	0.0	0%
Total	**452.1**	**138.6**	**590.7**	**0.0**	**23%**

Element Limits

Wall U-Value*	1.00
Display Glazing U-Value	5.8
Display Glazing Solar Admittance	0.81

*The wall u-value limit will update based on building class and glazing %

Element Description					U-Value		SHGC and Shading					Element Check-Values				
ID	Description (optional)	Element Type	Facing Sector	Area (m²)	U-Value	U-Value Element share of allowance used	SHGC	Glazing Height (m)	Shading Height (m)	Shading Projection (m)	SHGC Element share of allowance used	Rounded G/H	Rounded P/H	Shading Factor	Solar Admittance	AC Energy Value
1	North External	Wall	North	94.19	1.00	8% of building total					Not counted	0	0	1	0	0
2	East External	Wall	East	74.20	1.00	6% of building total					Not counted	0	0	1	0	0
3	South External	Wall	South	78.43	1.00	7% of building total					Not counted	0	0	1	0	0
4	West External	Wall	West	118.74	1.00	10% of building total					Not counted	0	0	1	0	0
5	Internal Partition	Wall	Internal	86.55	1.00	7% of building total					Not counted	0	0	1	0	0
6						Not counted					Not counted	0	0	1	0	0
7	North_Shading 1	Glazing	North	33.30	5.20	15% of building total	0.31	3.2	3.2	0.97	30% of building total	0	0.3	0.72	0.2232	15.7546613
8	North_Shading 2	Glazing	North	20.64	5.20	9% of building total	0.31	3	3	1.01	18% of building total	0	0.3	0.72	0.2232	9.76462502
9	North_Shading 3	Glazing	North	12.90	5.20	6% of building total	0.31	3.85	3.85	1.01	13% of building total	0	0.2	0.8	0.248	6.7809896
10	North_No Shading	Glazing	North	31.63	5.20	14% of building total	0.31				39% of building total	0	0	1	0.31	20.78395
11						Not counted					Not counted	0	0	1	0	0
12	East_Shading 1	Glazing	East	3.48	5.20	2% of building total	0.31	3.5	3.5	3	0% of building total	0	0.8	0.41	0.1271	0
13	East_Shading 2	Glazing	East	7.20	5.20	3% of building total	0.31	3.5	3.5	10.2	0% of building total	0	2.9	0.35	0.1085	0
14						Not counted					Not counted	0	0	1	0	0
15	South_Shading	Glazing	South	2.70	5.20	1% of building total	0.31	0.9	0.9	0.3	0% of building total	0	0.3	0.82	0.2542	0
16						Not counted					Not counted	0	0	1	0	0
17	West_Shading	Glazing	West	7.02	5.20	3% of building total	0.31	2.7	2.7	0.3	0% of building total	0	0.1	0.9	0.279	0
18	West_No Shading	Glazing	West	19.70	5.20	9% of building total	0.31				0% of building total	0	0	1	0.31	0
19						Not counted					Not counted	0	0	1	0	0
20						Not counted					Not counted	0	0	1	0	0
21						Not counted					Not counted	0	0	1	0	0
22						Not counted					Not counted	0	0	1	0	0
23						Not counted					Not counted	0	0	1	0	0
24						Not counted					Not counted	0	0	1	0	0
25						Not counted					Not counted	0	0	1	0	0
26						Not counted					Not counted	0	0	1	0	0
27						Not counted					Not counted	0	0	1	0	0
28						Not counted					Not counted	0	0	1	0	0
29						Not counted					Not counted	0	0	1	0	0
30						Not counted					Not counted	0	0	1	0	0
31						Not counted					Not counted	0	0	1	0	0
32						Not counted					Not counted	0	0	1	0	0
33						Not counted					Not counted	0	0	1	0	0
34						Not counted					Not counted	0	0	1	0	0
35						Not counted					Not counted	0	0	1	0	0
36						Not counted					Not counted	0	0	1	0	0
37						Not counted					Not counted	0	0	1	0	0
38						Not counted					Not counted	0	0	1	0	0
39						Not counted					Not counted	0	0	1	0	0
40						Not counted					Not counted	0	0	1	0	0
41						Not counted					Not counted	0	0	1	0	0
42						Not counted					Not counted	0	0	1	0	0
43						Not counted					Not counted	0	0	1	0	0
44						Not counted					Not counted	0	0	1	0	0
45						Not counted					Not counted	0	0	1	0	0
46						Not counted					Not counted	0	0	1	0	0
47						Not counted					Not counted	0	0	1	0	0
48						Not counted					Not counted	0	0	1	0	0
49						Not counted					Not counted	0	0	1	0	0
50						Not counted					Not counted	0	0	1	0	0

Disclaimer:

This calculator has been developed to assist in developing a better understanding of the glazing energy efficiency parameters of NCC 2019. While the author believes that the calculator, if used correctly, is likely to produce accurate results, it is provided "as is" and without any representation or warranty of any kind, including that it is fit for any purpose or of merchantable quality, or functions as intended or at all. Your use of this calculator is entirely at your own risk and the author accepts no liability of any kind.

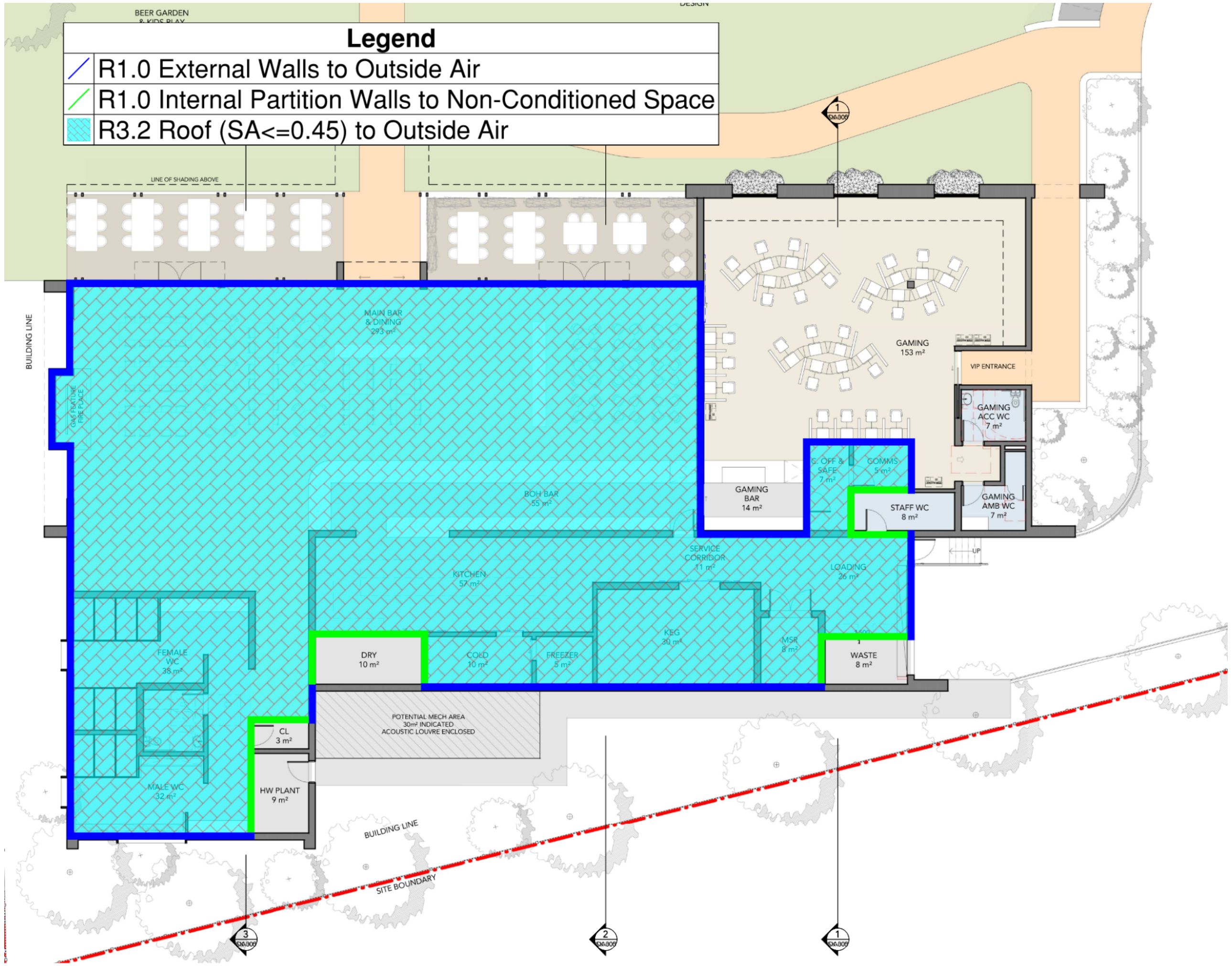
Made by Alex Zeller

Email alex.wallglazingcalculator@gmail.com with any suggestions for improvement

Check for version update

Appendix B – Thermal Boundary Markup

Ground Floor



Appendix C – Total System R-Value Calculation for Solid Ground Floors

Wall-Glazing Component	Required Thermal Performance
Conditioned Floor Perimeter 'P_f'	107.71m
Conditioned Floor Area 'A_f'	608.38m^2
Wall Thickness 'd_w'	0.3m
Soil Type in Contact with Floor	Silt
Soil Thermal Conductivity	1.5W/m.K
Floor Insulation (R_f = 0 if none) 'R_f'	No Additional Insulation Assumed
Perimeter to Area Ratio 'P_f/A_f'	0.18
Total Equivalent Thickness 'd_{ef}'	0.6m
Characteristic Dimension 'B''	11.3
Total System R-Value of Ground Floor	**R2.84**

Note: The total system R-Value calculation of the solid ground floor was carried out in line with the equations and methodologies outlined in Section 3.5 of CIBSE Guide A. Where a referenced document was unclear or ambiguous, the calculation took a conservative approach as not to overstate the result.