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ECOLOGICALLY SUSTAINABLE DESIGN (ESD) REPORT

614-632 High Street, Penrith NSW 2750

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1. Introduction

Efficient Living has been engaged to prepare an Ecologically Sustainable Design (ESD) report to accompany the Development Application (DA) for the proposed development at 614-632 High Street, Penrith NSW 2750. The development is required to demonstrate objectives and controls outlined within the following Sections contained within Penrith Development Control Plan (DCP) 2014:

- E11: Penrith City Centre & Section C 1.2.2. Built Form: Energy Efficiency and Conservation.

The proposed development will also comply with NCC 2019 Section J.

The following table outlines the ESD controls within the applicable DCP, also highlighting sections within the report demonstrating compliance with the environmental controls outlined below. The purpose of controls within the DCP is to ensure all objectives are satisfied, therefore only a response to the controls has been provided.

Penrith DCP Section E11, 11.5 – Sustainable Development	Design Response
Objectives: a) *To restrict the reflection of sunlight from buildings to surrounding areas and buildings* **Controls:** 1) New buildings and facades should not result in glare that causes discomfort or threatens safety of pedestrians or drivers; 2) Visible light reflectivity from building materials used on the facades of new buildings should not exceed 20%; 3) Subject to the extent and nature of glazing and reflective materials used, a Reflectivity Report that analyses potential solar glare from the proposed development on pedestrians and motorists may be required.	Please see Section 3.1.
Objectives: a) *To encourage the design of developments based on a 'whole of building' approach;* b) *To reduce the occurrence of 'sick building' syndrome on occupants;* c) *To ensure that community safety and crime prevention measures are incorporated in the design of the development, including the public domain.* **Controls:** 1. Demonstrate how the passive and active environmental design features of the building design and proposed construction achieves ESD criteria and the 'whole of building' approach. Elements include, but not limited to: a) Adaptability of buildings and floor levels within buildings to accommodate a range of uses over time; b) Occupant comfort and amenity; c) Fulfilling the Ecospecifier's Assessment criteria; and d) Incorporation of safety and crime prevention measures in the design of buildings and public domain as well as the siting of activities in the building. 2. Development proposals may require referral to the NSW Police for crime prevention and safety considerations, in accordance with the community safety protocol.	Please see Sections 3.2, 4.1, 4.2, 4.3, 4.4 & 7.
Objectives: a) *To encourage the selection and use of construction materials with low environmental impact over the lifecycle of the building.* b) *To reduce the health problems associated with the solvent content of finishes and fittings.* c) *To reduce the health problems associated with the high formaldehyde emission from composite wood products* **Controls:**	Please see Sections 4.2, 6 & 7.

1. Materials with low embodied energy properties and/or materials that have been salvaged/ recycled are to be selected for the construction and fit out of the development; 2. Avoid using high environmental/high impact materials, such as volatile organic compounds (VOC's) and hydrofluoro-carbons (HCFC's) as these materials can become volatile at room temperature contributing to poor indoor air quality and affecting the health of occupants.	
Penrith DCP Section C1: Site Planning & Design Principles	**Design Response**
B. General Objectives: b), v) utilising, where possible, sustainable materials that minimise impacts on the environment, maintenance and waste.	Please see Sections 3.2, 3.4, 4.2, 6 & 7.
c) To ensure that non-residential buildings (and their future uses) are designed to incorporate design and sustainable excellence by: i) being accredited under the Australian Buildings Greenhouse Ratings certification system, now part of the National Australian Built Environment Rating System (NABERS) and/or Green Star certification system, whichever is applicable; and ii) ensuring that energy and water consumption is minimized.	To be addressed during design development.
Penrith DCP Section C1: 1.2. Design Principles	**Design Response**
1.2.1. a) Non-residential developments, including mixed-use developments, with a construction cost of $1 million or more are to demonstrate a commitment to achieving no less than 4 stars under Green Star or 4.5 stars under the Australian Building Greenhouse Rating system, now part of the National Australian Built Environment Rating System (NABERS).	To be addressed during design development.
1.2.2. a) The selection criteria for construction materials, including internal fit-out work, should include detailed documentation of their energy efficiency properties.	To be addressed during design development.
b) Buildings should be designed on passive solar design principles which: i) Respond to orientation to maximise the northerly aspect and solar access in the cooler periods; ii) Reduce overheating in summer and promote solar gain in winter; and iii) Ensure there is adequate cross flow of air by utilising natural ventilation, resulting in a reduction in the use of mechanical ventilation and/or air-conditioning systems.	Please see Sections 3.2, 4.1 & 4.3.
c) The future use and occupants of the building should be considered in the design and location of building services/equipment to ensure that: i) The thermal comfort of occupants is optimised through zoning sections of the floor area to *(typo in DCP)* ii) of building services is provided enable individual control of heating and cooling *(typo in DCP)*; iii) Lighting systems and fittings have reduced energy consumption that are also appropriate for the use/activity located in that part of the building; iv) The equipment or service will be used and its future use will not affect other elements of sustainability; and v) Sub-metering to individual tenancies within the development to enable individual monitoring of consumption performance.	Please see Sections 3.1, 3.2, 3.3, 3.4 & 3.5.
d) Common and service areas in the building should incorporate energy and water efficiency/conservation measures in their design and location.	Please see Sections 3.3, 3.4 & 3.5.

2. Building Description

2.1. The Site

The development is located at 614-632 High Street, Penrith NSW 2750 and is a mixed-use building comprising a part 7 and part 46 storey building of mixed residential and commercial components, comprising residential apartments, retail & commercial tenancies, serviced apartments and various communal spaces throughout the site.

Figure 1: Rendered images of the proposed development

2.2. Sources of Information

- 190620_DRP 2 Presentation HR & 190822_DRP 3 Presentation HR;
- Architectural drawings DA001 (P7), DA100 - DA102 (P7), DA200 – DA220 (P7), DA300 – DA308 (P7) DA400 – DA408 (P7);
- Penrith DCP 2014 Part C1;
- Penrith DCP 2014 Volume 1;
- Waste Management Plan, Dickens Solutions, November 2019.

2.3. Aim of Report

This report identifies the design initiatives being considered that have the potential to reduce the environmental impact of the proposed development at 614-632 High Street, Penrith, in line with applicable DCP objectives and controls.

3. Energy

3.1. Façade

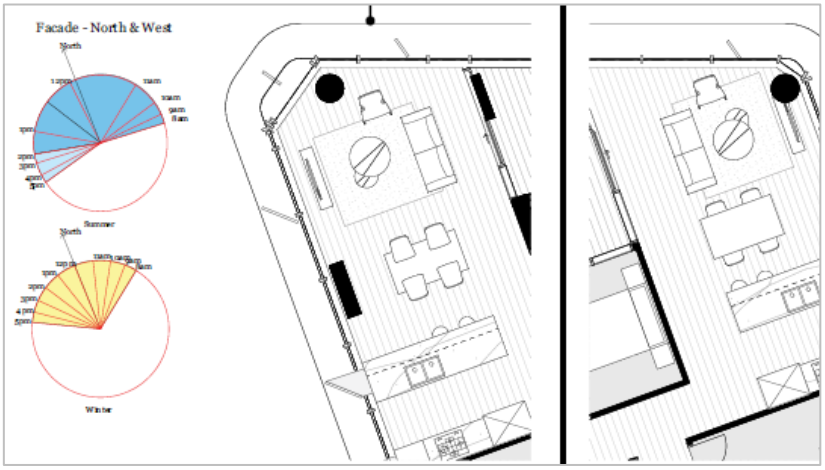
A preliminary assessment will soon be carried out in accordance with Section J of NCC to determine the thermal performance of the façade. A DTS glazing calculator will be carried out initially, with the results feeding in to the feasibility of a JV3 Alternate Solution for the development.

- Extensive research has been carried out to determine optimum shading projections and angles in order to reduce solar gains and subsequently energy consumption for the development;
- A high-performance glazing system will be installed, with Solar Heat Gain Coefficient's (SHGC) optimised to minimise solar heat gains without compromising daylight amenity for internal occupants;
- The reflectivity of façade materials will not exceed 20% in order to comply with DCP requirements.

3.2. Passive Design Principles

The development will consist of passive design strategies that respond to a range of environmental conditions the building is exposed to. These elements of passive design result in improved internal environmental quality, whilst minimising the impacts on the building and its services associated with increased occurrence of extreme temperatures due to climatic warming. Aspects of passive design principles implemented in design include:

- Sky gardens, outdoor kitchens and communal open spaces provided throughout the development, encouraging occupants to spend more time outdoors, decreasing reliance on Heating, Ventilation & Air Conditioning (HVAC) and lighting;
- Car park situated above ground, well ventilated to reduce the need for mechanical ventilation, however shaded to reduce wind disruption;
- Heavy thermal mass, reducing building peak loads and annual energy consumption;
- Dense placement of vertical shading structures which mitigate solar loads, as well as reduce afternoon glare during early morning (Eastern orientation), or later hours of the afternoon (Western orientation);
- Slab edge extensions to provide shading from solar radiation during summer;
- Use of green roofs, reducing solar loads on conditioned spaces, whilst improving local air quality and providing a space for the community to enjoy;
- Positioning, curvature and location of structures to reduce the disruption associated with gusty wind conditions throughout the development, further increasing the liveability of outdoor areas.



Screenshot from DRP 3 Presentation, showing horizontal slab extension and careful location of vertical shading devices.

These features help reduce internal solar gains and afternoon glare, whilst improving thermal comfort of internal occupants.

The above initiatives show passive design strategies incorporated in-to design will reduce the need for mechanical ventilation during favourable ambient weather conditions. During times of extreme hot or cold, high performing windows, well insulated facades and accurate location of shading structures will ensure high energy performance when HVAC is in operation whilst maintaining internal comfort for building occupants.

3.3. Air Conditioning

Due to the stage of design an HVAC strategy is not available at this stage however will be refined during design development. To improve energy efficiency of HVAC systems, the following design features are being considered:

- Serviced apartment rooms that are equipped with HVAC interlock, disabling the system when doors and windows are open;
- HVAC systems that disable when rooms are unoccupied;
- Efficient system components;
- Economy cycles where feasible;
- VSD's on carpark ventilation with CO control to allow natural ventilation to be maximised, reducing fan energy consumption;
- Plant location considered to aid energy efficient operation of equipment;
- Refrigerants with reduced global warming potential;
- Efficient service provision for common areas;
- A BMS which raises alarms when anomalies are identified by the system;
- Optimised HVAC zoning that considers façade orientation and internal loads.

Systems will be designed to ensure compliance with all regulatory requirements.

3.4. Lighting

Lighting can use over 20% of a buildings electricity consumption, therefore efficient luminaires and lighting control systems are critical in order to optimise a buildings energy efficiency. The following measures are being implemented in design:

- LED lighting incorporated throughout development;
- Lighting with low/no mercury content;
- Daylight & occupant control in commercial office spaces;
- Disabled lighting to serviced apartments when unoccupied;
- Vertical light shelves to maximise daylight penetration, reducing the need for artificial lighting.

The use of efficient lighting and control systems also reduces the demand on HVAC systems, also improving thermal comfort through a reduction of radiant heat exposure to building occupants.

3.5. Sub-metering

Sub-metering strategies will be put in place to ensure major commercial energy end uses and individual commercial and residential tenancies are separately metered, providing greater visibility on energy consumption trends over time. This allows anomalies in consumption to be identified, investigated and resolved resulting in improved energy performance. Sub-metering can also be used to raise alarms should:

- Excessive consumption be identified in central plant;
- Meter readings of child to parent meters be inconsistent, highlighting the need to calibrate/service meters.

4. Indoor Environmental Quality

4.1. Thermal Comfort

It is important the thermal comfort of occupants is not compromised when implementing energy efficiency measures in design. The following measures have been introduced to design for the proposed development at 614-632 High Street, Penrith NSW 2750 to ensure a high level of internal thermal comfort is maintained:

- HVAC systems adequately sized to cope with seasonal peaks;
- High thermal mass throughout the residential and commercial spaces, reducing demand on HVAC systems during times of peak loads;
- Vertical shading devices minimising direct solar loads;
- A variety of well-designed community spaces have been embedded to design, allowing residents and commercial/retail employees to enjoy comfortable outdoor spaces, reducing the need to spend time in air conditioned spaces;
- Blinds/curtains to eliminate solar loads and glare during late afternoon hours.

4.2. Air Quality

The following measures are being considered to improve internal air quality:

- Paints that contain low VOC levels, in line with Green Star D&AB requirements;
- Wood products that contain low formaldehyde levels, in line with Green Star D&AB requirements;
- Openable doors to highly shaded residential balconies, which can be opened at favourable times throughout the year provide a well ventilated internal living environment;
- Greenery incorporated throughout development, improving local air quality, also providing relief from extreme heat conditions.

The development did explore the opportunity to increase outdoor air levels beyond code compliance. There are a number of features embedded in design which improve the air quality throughout the development, therefore the additional energy associated with an increase in outdoor air supply to conditioned spaces was deemed unfeasible for the development.

4.3. Daylight

The following measures will be explored to improve internal daylight levels:

- Vertical shading devices that act as light shelves, whilst reducing the need to install heavily tinted glazing to building facades;
- Residential and commercial buildings have been carefully positioned to maximise solar access in the cooler periods;
- Light internal colour schemes to maximise daylight penetration;
- Lighting controls to dim down when favourable daylight levels are present.

4.4. Noise

An assessment of project acoustic requirements will be carried out for the development in accordance with Australian Standard AS2107:2016, considering external noise intrusion, noise separation between spaces, as well as noise from building services.

A good level of acoustic amenity will be embedded in design in order to ensure a comfortable internal environment, reducing negative impacts associated with noise pollution.

5. Water

Water is becoming an increasingly scarce resource in Australia, therefore new buildings should aim to reduce water demand by incorporating efficient fixtures, fittings and white goods. These water saving initiatives reduce the pressure on the local infrastructure and protect the development from future water shortages resulting from climate change.

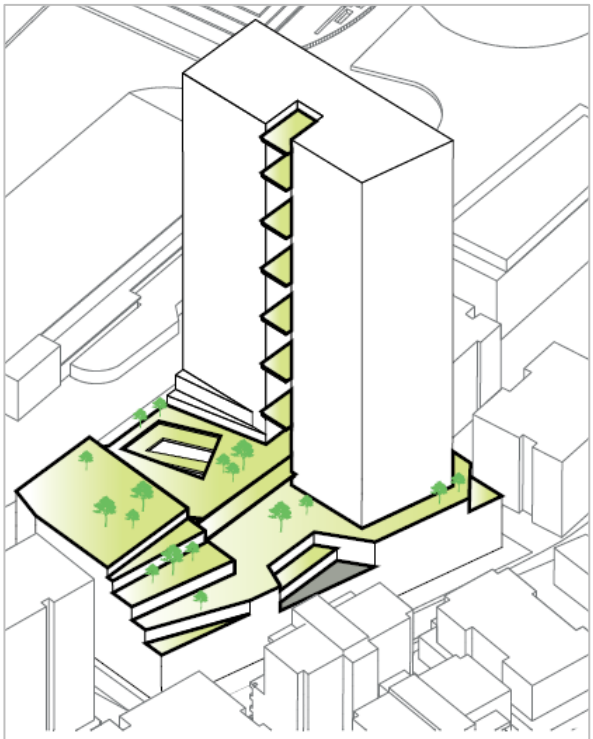
5.1. Fixtures and Fittings

The development will consider reducing water consumption by installing fixtures and fittings in line with Green Star Design & As Built requirements:

Fixture Type	WELS Rating
Taps	4
Urinals	4
Toilet	4
Shower	3
Dishwashers	4.5
Washing Machines	4

5.2. Landscape & Irrigation

A variety of outdoor areas will be provided for use of precinct occupants, therefore WSUD initiatives will be embedded in to design that reduce the strain on natural resources which is often seen when providing liveable outdoor spaces.



CONNECTION OF TOWER GREEN SPACES
TO PODIUM GREEN SPACES

Water reducing irrigation measure implemented include:

- Water Sensitive Urban Design (WSUD) principles have been realised into the landscape design;
- Irrigation systems will comprise of subsurface drip systems and automatic timers with rainwater/soil moisture sensor controls;
- Where possible, stormwater runoff (ongrade & podium) will be directed to the lawn and garden beds;
- Irrigation will be provided to all soft landscape areas and will be specified within later design packages;
- Native species will be incorporated throughout the development.

5.3. Storm Water Management

An on-site detention (OSD) tank strategy will be developed in accordance with local council requirements. The OSD tanks will incorporate flow control measures to ensure peak flows generated under proposed conditions do not exceed flows generated under pre-developed conditions, in accordance with regulatory requirements. The following features of the stormwater design assist in reducing the quantity, whilst improving the quality of site stormwater:

- Overflows from hardscaped areas will be filtered and temporarily detained in OSD systems before slowly releasing back to community storm water systems;
- Vegetated podium areas and open terraces will reduce peak rates of runoff and alleviate the pressure on storm drainage systems by the retention, diffusion and evapotranspiration of rainwater;
- Storm water runoff that is treated using appropriate devices and filtration systems to improve storm water quality.

6. Waste and Recycling

Dickens Solutions has been engaged to provide a Waste Management Plan for the proposed development which will therefore be addressing applicable DCP requirements. In summary, the following initiatives are provided for the construction and operational waste management throughout the development:

- Dual waste chutes (one for general waste, another for recyclable waste) will be provided for the residential development.
- Chutes will be designed to be easily cleaned, reducing build-up of bacteria and germs;
- Waste storage facilities provided have been demonstrated as adequate for the estimated waste generated, considering Penrith City Councils waste collection times;
- A licensed private waste and recycling collection contractor will provide all residential waste and recycling services to the development. The project consists of:
  - The clearing and levelling of the site;
  - The removal of all materials in accordance with this WMP;
  - The excavation of the site;
  - The construction of the buildings;
  - The provision of landscaping, driveways, concrete pathways and other elements associated with the development;
  - The on-going use of the building.
- All materials used in the construction of the building that are not required will be recycled, reused, or responsibly disposed of in accordance with the WMP;
- Green waste will be appropriately dealt with by the Owners Corporation.

7. Materials

The following initiatives are currently being considered. Further research will be carried out and initiatives to be pursued will be determine during design development.

- Major material components that have environmental performance declaration certificates (EPD's);
- Steel manufacturers that demonstrate a valid ISO 14001 Environmental Management System (EMS) is in place as well as membership of the World Steel Association's Climate Action Program (WSA CAP);
- Cement with reduced Portland cement content;
- Concrete produces with a reduction in water use (increased recycled water content);
- Timber that is PEFC or FCS certified;
- Construction waste recycled, reused or disposed of in accordance with the site WMP.

8. Transport

The following initiatives associated with a reduction in transport emissions are currently being considered:

- Dedicated parking spaces for electric and low emission Vehicles;
- Provisions for 150 bicycle racks have been provided for residents and employees of commercial/retail tenancies;
- The development is situated within 600m of Penrith Train Station, assisting with the reduction of emissions associated with commuting and leisure travel.

Further research will be carried out and initiatives to be pursued will be determined during design development.

9. Conclusion

There are numerous initiatives being considered in design that contributes to the sustainability and energy efficiency credentials of the proposed development at 614-632 High Street, Penrith NSW 2750. This report concludes that the proposed development will satisfy conditions contained within the Penrith DCP.