Nelson Road Lindfield

Ecologically Sustainable Design Report

Castle Hill No. 3 Pty Ltd

Prepared by:

SLR Consulting Australia

SLR Project No.: 610.032785.00000

28 May 2025

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Revision Record`

Revision	Date	Prepared By	Checked By	Authorised By
1	28 May 2025	Prameena Karunairaj	Anthony Marklund	Dr Neihad Al-Khalidy

Basis of Report

This report has been prepared by SLR Consulting Australia (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Castle Hill No. 3 Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

Executive Summary

SLR Consulting Australia Pty Ltd (SLR) has been engaged by Castle Hill No.3 Pty Ltd to provide a qualitative Ecologically Sustainable Design (ESD) assessment for the proposed development at 1-5 Nelson Road, Lindfield. The proposal includes development of a new residential flat building comprising of approximately 167 residential apartments (inclusive of affordable housing apartments) and basement car parking.

The project will respond to the ESD requirements outlined in the Planning Secretary's Environmental Assessment Requirements – Housing as shown below:

15. Ecologically Sustainable Development (ESD)	ESD Report
• Identify how ESD principles (as defined in section 193 of the EP&A Regulation) are incorporated in the design and ongoing operation of the development.	BASIX Certificate
• Where relevant, provide an assessment of the development against the standards for non-residential development set out in Chapter 3 of *State Environmental Planning Policy (Sustainable Buildings) 2022*.	

In line with the above, the following ESD measures are proposed to be included in the design:

- Thermal mass - Concrete slab construction is proposed for all floors throughout the development - concrete has amongst the highest thermal mass capacity of a range of common building products. The proposed development's external walls, structural internal walls, and slabs should be predominantly high thermal mass materials.
- LED energy-efficient lighting for all spaces;
- Centralised energy-efficient gas fired boiler hot water system;
- Ducted 1-phase ducted air-conditioning system of EER 3.0-3.5 rating for all living areas and bedrooms in the dwelling units for heating and cooling requirements;
- Dishwasher units to be installed within each residential dwelling. The dishwasher units are to have an energy efficiency rating of at least 4 stars;
- Clothes dryer units to be installed within each residential dwelling. The clothes dryer units are to have an energy efficiency rating of at least 2 stars;
- Provision of gas cooktop and electric oven;
- Water efficient bathroom and kitchen fittings;
    - All residential kitchen and bathroom taps are 5-star;
    - All shower heads are 4.0 Stars (>4.5 but <=6 L/min);
    - All residential toilet flushing systems are 4-star;
    - All dishwashers are 4-star;
- Light efficiency measures in the lobby using motion sensors;
- Low levels of volatile organic compounds (VOC) paints and floor coverings and low formaldehyde wood products where possible;
- 71% of the living rooms and private open spaces of the proposed apartments will receive a minimum of 2 hours direct sunlight between 9.00 AM and 3.00 PM at mid-

winter. The above percentage equates to 119 apartments out of 167 apartments have solar access to the living room.

- 62% of the proposed residential units will be naturally cross ventilated across the first 9 levels of the development. This amounts to 100 apartments in the first 9 levels.
- Landscaped areas are within the residential development throughout the designated communal areas. Proposed planting provides added cooling during the summer months through the leaf transpiration process and is also useful for wind amelioration;
- Plant species within the development would be predominantly indigenous species that can tolerate low water to reduce maintenance requirements; and
- SLR recommends the installation of a solar PV system.
    - A 50 kW PV solar system is recommended to minimise greenhouse gas emission.
    - A 50 kW PV solar system will offset approximately 71 MWh/year of energy usage.
    - The estimated greenhouse gas CO2 emission saving is approximately 83,363 kgCO2/annum
- The proposed residential development will enjoy a high level of thermal comfort gaining an average 7 NatHERS star rating.
- The development will also achieve BASIX targets by achieving targeted points in Water and Energy.

The report body contains recommendations regarding other ESD features, such as a mechanical ventilation system, domestic hot water, other appliances, and operational waste.

These features will help achieve significant reductions in energy and water required by the development both in building and operation, in addition to ensuring that the residential units are pleasant spaces to reside.

It is recommended that the proposed ESD initiatives continue to be developed and implemented throughout this project.

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1.0 Introduction

SLR Consulting Pty Ltd (SLR) has been engaged by Castle Hill No. 3 Pty Ltd to provide a qualitative Ecologically Sustainable Design (ESD) assessment, including energy efficiency, for the proposed development at 1-5 Nelson Road Lindfield. The ESD report has been prepared in a standard form considering the following aspects of the development.

- Identify how ESD principles will be incorporated in the design and ongoing operation of the development.
- Demonstrate how the development will meet or exceed the relevant industry recognised building sustainability and environmental performance standards.

The initiatives suggested throughout this report have been included as opportunities for the project team to adopt ESD initiatives that provide both direct and indirect benefits to the proposed development.

1.1 Objectives

The principal objective of this Energy Efficiency and Ecologically Sustainable Design Report is to identify all potential energy saving opportunities that may be realised during the operational phase of the project, including a description of likely energy consumption levels and options for alternative energy sources such as green power in accordance with the ESD controls. In addition, this report also aims to provide an overview of recommendations on potential ESD initiatives that can be implemented.

1.2 Site Description

The development site is situated at Lindfield which is within the Ku-ring-gai Council.

It is bounded by mixed suburban development. The proposed development will be bounded by Nelson Road on the West and residential development surrounding all three sides. The site location and surrounds are shown in the below figure.

Figure 1 Site Location

1.3 Development Description

The development consists of approximately 167 apartments which includes 17% of total proposed GFA to be dedicated as affordable housing utilising the TOD provisions of SEPP (Housing) 2021 Chapter 5 and Infill affordable housing provisions of SEPP (Housing) 2021 Chapter 2.

The proposed development includes 2 levels of basement and 9 above ground levels including ground level.

Figure 2 Ground Level

Figure 3 Level 5

2.0 Ecologically Sustainable Design

The concept of Ecologically Sustainable Development (ESD) was outlined in “Our Common Future”, the report of the 1987 United Nations World Commission on the Environment and Development (the Brundtland Commission). It defined Sustainable Development as,

“Development that meets the needs of the present without compromising the ability of future generation to meet their own needs”.

This concept was adopted within Australia in 1990 when the Council of Australian Governments endorsed a National Strategy for Ecologically Sustainable Development. The Commonwealth Government suggested the following definition for ESD in Australia:

“Using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased”.

Put simply, ESD is development which aims to meet the needs of Australians today, while conserving our ecosystems for the benefit of future generations. To do this, it is necessary to develop ways of using those environmental resources which form the basis of our economy in a way which maintains and, where possible, improves their range, variety and quality.

The National Strategy for Ecologically Sustainable Development notes that there is no identifiable point where it can be said that ESD has been achieved. The strategy further states that there are two main features which distinguish an ecologically sustainable approach to development:

- We need to consider, in an integrated way, the wider economic, social and environmental implications of our decisions and actions for Australia, the international community and the biosphere; and
- We need to take a long-term rather than short-term view when taking those decisions and actions.

Ultimately ESD should lead to changes in our patterns of resource use, including improvements in the quality of our air, land and water, and in the development of new, environmentally friendly products and processes.

National Strategy for ESD Objectives and Guiding Principles are elaborated below.

The National Strategy for ESD sets its core objectives as:

- To enhance individual and community well-being and welfare by following a path of economic development that safeguards the welfare of future generations.
- To provide for equity within and between generations.
- To protect biological diversity and maintain essential ecological processes and life-support systems.

The Guiding Principles of the National Strategy for ESD are documented as:

- Decision making processes should effectively integrate both long and short-term economic, environmental, social and equity considerations.
- Where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.
- The global dimension of environmental impacts of actions and policies should be recognised and considered.

- The need to develop a strong, growing and diversified economy which can enhance the capacity for environmental protection should be recognised.
- The need to maintain and enhance international competitiveness in an environmentally sound manner should be recognised.
- Cost effective and flexible policy instruments should be adopted, such as improved valuation, pricing and incentive mechanisms.
- Decisions and actions should provide for broad community involvement on issues which affect them.

These guiding principles and core objectives need to be considered as a package. No objective or principle should predominate over the others. A balanced approach is required that considers all these objectives and principles to pursue the goal of ESD.

2.1 Specific Requirements for Compliance

Specifications for environmental design measures required for the proposed site are detailed below:

2.1.1 Mandatory ESD Measures for Consideration

- BASIX Certification.
- Planning Secretary's Environmental Assessment Requirements – Housing

15. Ecologically Sustainable Development (ESD) • Identify how ESD principles (as defined in section 193 of the EP&A Regulation) are incorporated in the design and ongoing operation of the development. • Where relevant, provide an assessment of the development against the standards for non-residential development set out in Chapter 3 of *State Environmental Planning Policy (Sustainable Buildings) 2022*.	ESD Report BASIX Certificate

- Ku-ring-gai Development Control Plan 2024 which in turn requires compliance with SEPP (Housing) 2021 and Apartment Design Guide Requirements. In particular, Part 7 Section C – Residential Flat Buildings – Building Design and Sustainability requirements.

The following section elaborate how the above requirements are captured in the design and how the project responds to these controls.

3.0 ESD Initiatives Considered for the Proposed Development

In order to achieve a structured integrated approach to ESD, a series of indicators and strategic goals have been identified at the outset to be communicated to the design team. SLR Consulting's role, as the project's ESD consultant, has been to apply these principles to all aspects of the development ensuring a best possible ESD outcome.

ESD indicators identified for the proposed Concept Plan are:

- Passive design features
- Landscaping
- Building construction
- Active energy efficiency
- Water
- Transport
- Indoor environmental quality
- Operational waste management
- Renewable energy options

The ESD initiatives to be committed for the proposed development will be outlined in the following sections below.

3.1 Passive Design Features

Passive energy efficiency refers to the choice of building materials, the placement of external facades and fenestration to effectively utilise solar energy for heating when required, and minimise solar gains when appropriate, thus 'passively' reducing the artificial heating and cooling requirements of the building. While high cooling and heating loads are typical in summer and winter months respectively, a good balance of heating and cooling load reduction techniques is required to facilitate a development with efficient passive design.

3.1.1 Site Analysis and Layout

A key objective should be to optimise site conditions and minimise energy consumed for cooling and heating loads through proper selection of building orientation and internal layout. The following points are noted with respect to the siting of the proposed development.

- As opposed to new developments on the outer fringes of the city which require significant investment in new roads, sewerage, lighting and power the proposed development site will have immediate access to all of these at very little additional regional infrastructure investment;
- The proposed development provides a large number of units with access to daylighting;
- The proposed development provides good design to promote natural ventilation;
- The proposed development provides a relatively large landscaped area and communal open space, with several smaller communal landscaped spaces also integrated into the design;

3.1.2 Solar Access

One of the objectives of energy conservation is to minimise the heating and cooling requirements of buildings. Sunlight should preferably be able to penetrate the building in winter and be excluded from the building in summer. The form dictated by the site has been designed to maximise the solar access of residential units by:

- Maximising solar exposure of every residential apartment. The height and units' layouts will allow excellent solar exposure from at least 2 directions to the majority of the apartments throughout the day, year-round.
- Ensuring that primary facade glazing is attached to all "living zone" rooms for all apartments (i.e. living room, bedrooms etc). With proper attention to design details (e.g. glazing seals), these rooms can act as highly efficient solar collectors especially during winter months.
- Incorporating deep balconies to reduce summer thermal loads on the residential units.

The State Environmental Planning Policy (SEPP) 65 supported by the Apartment Design Guide - Part 04 is relevant to the assessment of the daylight access into residential components of the project. The above guide states that:

- Living rooms and private open spaces of at least 70% of apartments in a building receive a minimum of 2 hours direct sunlight between 9 am and 3 pm at mid-winter in the Sydney Metropolitan Area and in the Newcastle and Wollongong local government areas.
- In all other areas, living rooms and private open spaces of at least 70% of the apartments in a building receive a minimum of 3 hours direct sunlight between 9 am and 3 pm at mid-winter.
- A maximum of 15% of apartments in a building receive no direct sunlight between 9 am and 3 pm at mid-winter.

The development has been assessed by the project Architect DKO for solar access to the site between 9.00 am and 3.00 pm on the winter solstice. The following conclusions have been reached from the solar access study:

- 71% of the living rooms and private open spaces of the proposed apartments will receive a minimum of 2 hours direct sunlight between 9.00 AM and 3.00 PM at mid-winter. The above percentage equates to 119 apartments out of 167 apartments have solar access to the living room.

3.1.3 Natural Ventilation

In relation to key characteristics of the Sydney Region Wind Climate relevant to the wind impact assessment of the proposed development, we note that Sydney is affected by two primary wind seasons:

- Summer winds occur mainly from the northeast, southeast and south. While northeast winds are the more common prevailing winds (occurring typically as offshore land-sea breezes), southeast and south winds generally provide the strongest gusts during summer.
- Winter/Early spring winds occur mainly from the west and the south west quadrant (southwest to northwest), provide the strongest winds during winter and in fact for the whole year.

Wind-induced natural ventilation works on the straightforward principle of differential pressure. If a building envelope has multiple openings and there exists a pressure difference between those openings, e.g. the wind pressure at one opening is greater than the pressure at the other openings; airflow will be pushed through the building in the direction positive to negative.

The resulting amount of airflow through the building envelope will be a function of the magnitude of the pressure differential, size of the various building openings and degree of "blockage" in between.

3.1.3.1 Residential Apartments

The most important role of natural ventilation in the context of the residential apartments is to remove accumulated heat gain during periods of overheating. In this case, ventilation is intended to achieve predicted rates of volumetric air change. Also important during the summer months is the role of ventilation in directly improving the perception of thermal comfort by occupants of a space. This is achieved when moving air aids the evaporation of perspiration by passing over the skin. If there is some air movement, most people will tolerate somewhat higher temperatures.

Heat build-up within apartments through daytime summer temperatures can be quickly purged with the availability of suitable breeze at the site.

The ADG encourages cross ventilation to be assisted by the building design. Building design should enable ventilation to be controlled, where comfort levels are maintained for the occupants during the summer and winter extremes. Locations of windows and openings within the apartment are to be suitably in line, where possible, with each other on opposite sides of the room. It is recommended that building openings be designed such that cross-ventilation is maximised, to minimise heat gain in summer.

Ventilation of building is achieved by permanent openings, windows, doors or other devices which have an aggregate opening or openable size of not less than 5% of the floor area of the ventilated room. The provision of ceiling fans for use in summer months is also encouraged.

In winter it is important to close off heated areas that need warming. The opportunity to open and close balcony doors will allow adequate control to moderate the impact of any higher than comfortable winds. It is recommended that the following initiatives are also incorporated to minimise heat leakage from the building:

- Design detailing of the glazing interface to the window framing system and the provision of adequate sealing in accordance with the National Construction Code (NCC).
- Doors leading to hallways, stairwells and non-common use areas provided with draught excluders to limit heat losses during winter months.
- Doors located throughout the development in general-use areas, such as access ways to/from the building, fitted with door closers where it is deemed that their opening will have an adverse effect on heat loss during winter.

ADG specifies the following rules of thumb:

- At least 60% of apartments are naturally cross ventilated in the first nine storeys of the building. Apartments at ten storeys or greater are deemed to be cross ventilated only if any enclosure of the balconies at these levels allows adequate natural ventilation and cannot be fully enclosed.
- Building depth, which support natural ventilation typically range from 10 to 18 meters.

- Developments, which seek to vary from the minimum standards, must demonstrate how natural ventilation can be satisfactorily achieved, particularly in relation to habitable rooms.

The development has been assessed in a ventilation study of the proposed plan to confirm that the design complies with relevant ADG requirements. The following is achieved:

- 62% of the proposed residential units will be naturally cross ventilated across the first 9 levels of the development. This amounts to 100 apartments in the first 9 levels.

3.2 Landscaping

The following points are noted with respect to the landscaping of the proposed development:

- The proposed landscape plan (refer below figure) shows trees around perimeters as on the ground level. The use of trees and perimeter planting for shading is very effective in reducing the reflection of heat and light onto the building from surrounding paved areas. Planting also provides added cooling during the summer months through the leaf transpiration process.
- Most of the trees provided to the perimeter of the site will be evergreen trees, providing year-round wind, heat and solar mitigation.

Figure 4 Landscaping in Ground Level

3.3 Building Construction

3.3.1 Building Massing

The proposed development will have a compact form requiring less heating and cooling than low-rise buildings that would tend to sprawl out over a site. Apartments will “share” heat with their adjacent neighbours and so gain and lose less heat to the external environment.

3.3.2 Building Materials

3.3.2.1 Walls

It is recommended that external walls are Precast Concrete Panel or Aluminium Panel with plasterboard with R2.0 acoustic insulation where required. The use of this wall system will reduce the insulation required due to the inherent R value of the wall system. The insulation required will be determined by the NCC and Section J calculations.

It is recommended intra-tenancy walls are to be lightweight plasterboard on stud construction or Shaftliner Party Wall with plasterboard with acoustic insulation where required. This is advantageous from a building life-cycle perspective, as it maximises the adaptive reuse potential when a building reaches the end of its intended use.

This will be further confirmed as the design progresses.

3.3.2.2 Roof

It is proposed to use concrete roof with plasterboard ceiling construction for all apartments throughout the building. R3.0 insulation is to be provided to roof areas exposed to open air. The insulation required will be determined by the NCC and Section J calculations. Waterproofing membrane will also be provided as part of the roof.

This will be further confirmed as the design progresses.

3.3.2.3 Glazing

Performance Glazing such as high-performance glazing is recommended for most units, this will reduce the solar heat gain mostly on the western and eastern facades where low angle solar rays penetrate beneath shading devices. The glazing required will be determined by the NCC and Section J calculations.

This will be further confirmed as the design progresses.

3.3.2.4 Floor and Thermal Mass

Concrete slab construction is to be used for all floors throughout the development in accordance with BASIX and NCC Section J requirements. Concrete has amongst the highest thermal mass capacity among a range of common building products, as presented in the below table.

Generally, denser materials have higher mass which has the ability to store heat energy and then release it slowly to the room. This storage effectively smoothens out daily temperature variations within conditioned spaces, with corresponding reductions in both heating and cooling loads. Insulation is to be provided to floor areas exposed to open air.

Table 1 Indicative Thermal Mass Values of Various Materials

Material	Thickness (mm)	Thermal Mass ($kJ/m^2.K$)
Dolerite (Rock / Stone)	200	433
10-31 Solid Brick	190	410
Concrete	100	221
Concrete block	90	194
10.01 regular brick	90	151
Clay brick (3.5 kg solid + 0.5 kg mortar)	110	142
Aerated concrete block	100	50
Fibre cement sheet (compressed)	18	32
Wood flooring (hardwood)	19	25
Weatherboard (softwood)	15	16
Fibre cement sheet	6	8
Plasterboard	10	8
Glass	3	6
Expanded polystyrene (EPS-class SL)	50	1.8
Cork	6	1.6
Rockwool (batts)	50	1.5
Fibreglass (batts)	50	0.5
Air	50	0.5

3.3.3 Building Sealing

The purpose of sealing is to ensure that additional heating and cooling loads will not be introduced through building leakage.

A seal to restrict air infiltration must be fitted to each edge of an external door, operable external window or the like when serving a conditioned space in the proposed development. The seal may be a foam or rubber compressible strip, fibrous seal or the like.

The bathroom/toilet and laundry exhaust fans in the proposed development must be fitted with a sealing device such as a self-closing damper or the like.

3.4 Active Energy Efficiency

Active energy efficiency is achieved by putting in place energy efficient electrical items such as air-conditions systems, artificial lighting to reduce the energy usage of the building.

3.4.1 Mechanical Ventilation and Air Conditioning

Where mechanical ventilation is required, the use of energy efficiency measures will be fully explored during detailed design. These measures include linking mechanical ventilation to manual switching where allowable under the NCC and using individual fans rather than a common ducted ventilation system with constant operation. These initiatives will provide significant savings in energy use and associated operational energy costs of the development.

Single phase ducted air conditioning of EER 3.0-3.5 is recommended for residential spaces.

3.4.2 Domestic Hot Water

Centralised energy efficient bulk-metered gas fired boiler hot water system is recommended for water heating within the proposed development.

3.4.3 Green Power Initiative

It is recommended that a certain percentage (approximately 10%) of “Greenpower” should be made available to residents, providing the opportunity to contribute to a reduction in total greenhouse gas emissions produced by the proposed development. Greenpower is produced from environmentally friendly renewable energy sources such as solar, wind, water and biomass.

When a Greenpower product is selected by the owner, the energy supplier commits to buying a certain amount of electricity from approved new renewable energy sources. The financial accounts of Greenpower suppliers are audited independently. This makes a clear distinction between the services provided by standard energy suppliers and the more sustainable service offered through Greenpower options.

The National Greenpower website[1] states that “Australian households generate almost one-fifth of Australia's greenhouse pollution through everyday activities such as transport and household energy use”. The average household in Australia emits over seven to eight tonnes of greenhouse pollution each year through energy use alone. This is because most households source their electricity from burning coal and other fossil fuels. By choosing accredited Greenpower, up to 100% of a household's energy usage can be generated from renewable sources.

3.4.4 Lighting

3.4.4.1 Natural Lighting

The proposed development maximises daylighting opportunities on at least 2 directions in most units, therefore minimising the use of artificial lighting.

3.4.4.2 Artificial Lighting

Household lighting energy use in Australia is increasing due to the construction of larger homes and the installation of more light fittings per home. It is estimated that most homes could readily reduce the amount of energy they use for lighting by 50% or more.

Lighting installations require a design that properly considers the conservation of scarce energy resources. Sustainable lighting design ensures that illuminance is not excessive, that the switching arrangements are such that unnecessary illumination may be turned off and that the illumination is provided in an efficient manner.

There are additional energy losses associated with inefficient lamps and lighting losses associated with luminaries. Consequently, a lighting design which uses the most efficient lamp types and the least number of luminaries for a given design illuminance will be more efficient and usually have a lower capital cost.

[1] http://www.greenpower.gov.au

It is likely that the lighting to be used within the development will incorporate LED lamps and compact fluorescents. It is recommended that the following lighting features be incorporated into the development to minimise energy consumption due to lighting:

- Maximise use of compact fluorescents or LED and minimise or where possible eliminate the use of halogen down lights, as compact fluorescents are much more efficient than halogen lighting.
- Light switches to be located at room exits to encourage switching lights off when leaving a room. Separate switches to be installed for special purpose lighting.
- Lighting to the carpark and common hallways will be controlled by daylight sensors, motion sensors and time clocks, to minimise unnecessary use of artificial lighting.

SLR recommends a maximum average lighting power density of 4 W/m2 for the proposed development.

3.4.5 Appliances

For BASIX compliance, the below measures for energy performance in appliances could include:

- 4-star energy efficient dishwashers;
- 2-star energy efficient clothes dryer;
- A gas cooktop and an electric oven to be installed within each residential dwelling.
- Single phase ducted air-conditioning of EER 3.0-3.5 rating.

3.5 Water

Australians use more than one million litres of freshwater per person each year (source: Green Building Council of Australia 2006).

In addition to increased water use efficiency, new developments can reduce potable water demand by residents, and visitors through the provision of an on-site alternative water supply. There are three principal forms of alternative water supply:

- Reticulation of reclaimed water to the site
- Rainwater/stormwater storage and reuse
- Grey water storage and reuse.

It is recommended that the above types of alternate water supply be explored for use in landscape irrigation and fire services, reducing the demand for potable water.

A rainwater/stormwater tank has been proposed in the design. This water will be used for irrigation of landscape. The rainwater tank sizing will be developed as the design progresses.

3.5.1 Water Efficiency

The minimum sustainable standard for water efficient water fixtures and fittings is 3 star. To achieve greater than the standard level, following water efficient fixtures and fittings are recommended for the proposed site:

- All residential kitchen and bathroom taps are 5-star;
- All shower heads are 4.0 Stars (>4.5 but <=6 L/min);

- All residential toilet flushing systems are 4-star;
- All dishwashers are 4-star;

Implementation of the above recommendations will assist in reducing the water consumption.

3.5.2 Landscape Irrigation

Based on international best practice guidelines, it is generally recommended that either 90% of the water requirement for landscape irrigation is sourced from on-site rainwater collection or recycled water. Alternatively, best practice would also be achieved with the installation of a water efficient irrigation system comprising subsoil drip systems and automatic timers with rainwater or soil moisture sensor control override.

The landscape design should focus on using native coastal and other drought resistant species that rely primarily on rainwater for their water needs. The following is recommended to be incorporated into the development to minimise water consumption for landscape irrigation.

- Native coastal and other drought resistant species that rely primarily on rainwater for their water needs where appropriate and possible;
- Indigenous species are currently proposed to comprise over 30% of the provided landscaping.

3.6 Transport

When designing a sustainable development, it is important to minimise the use of individual motorised transport where possible and thus enhance energy savings and environmental impact through reduced fossil fuel consumption and improved regional air quality. This can be achieved by encouraging the use of energy efficient public transport that is immediately at hand, reducing car parking facilities, and providing adequate bike storage facilities to minimise the requirement for individual motorised transport. The development includes many walkways and connections between the development and the surrounding streets as shown in the below figure.

Figure 5 Public Transport Infrastructure around the Project Site

Sufficient recreational opportunities are easily accessible to occupants, eliminating the requirement for long-distance motorised transport for most recreational activities. This would be a positive feature of the development with regards to sustainability as this clearly avoids greenhouse gas emissions that would otherwise have been produced if residents had to travel long distances for recreational activities.

Developments that are within close proximity of good transport nodes with frequent service should be encouraged. The proposed building is located near mass transit and will allow more people to take public transportation to keep their automobiles off the road.

The proposed development is located near mass transit (Lindfield Train Station). The proposed development will encourage occupants and users of the development to use public transportation and minimise automobile use.

3.6.1 Provision of Car Parking

Transport emissions are one of the largest contributors of greenhouse gas emissions in Australia.

The project is committed to equip 10% of total car spaces with EV charging stations and allocating these charging stations to visitor as well as occupants to encourage maximum uptake. In addition, the project is committed to providing provision for future installation of EV chargers in 100% of charging spaces.

3.6.2 Facilitation of Pedestrian and Non-motorised Transport

When designing a sustainable development, it is important to minimise the use of individual motorised transport where possible and thus enhance energy savings and reduce environmental impact through reduced fossil fuel consumption and improved regional air

quality. This can be achieved by encouraging all users of the development to make use of the energy efficient public transport that is immediately at hand.

Bike storage facilities are proposed to be installed in the proposed development, which will also help to minimise the requirement for individual motorised transport.

3.7 Indoor Environmental Quality

Achieving enhanced Indoor Environment Quality (IEQ) ensures that the building and building services are designed and managed to benefit the health and well-being of building occupants and visitors.

3.7.1 Asbestos

It is recommended that Asbestos identification and removal procedures be included in the site Environmental Management Plan (EMP) where required.

3.7.2 Internal Noise Levels

Internal noise levels are a significant factor in determining occupant and customer satisfaction and well-being. The aim of controlling internal noise levels is to encourage and recognise buildings that are designed to maintain internal noise levels at an appropriate level.

3.7.3 Carbon Dioxide Monitoring and Control

Elevated carbon dioxide (CO2) levels are indicative of inadequate ventilation, affecting the quality of air within an enclosed occupied space, and the health of the occupants. CO2 monitoring systems can detect elevated concentrations of CO2 and automatically adjust ventilation supply rates before indoor air quality becomes problematic.

SLR Consulting recommends incorporating a CO2 monitoring system to the basement area where appropriate to satisfy NCC requirements.

3.7.4 Paints and Floor Coverings

SLR recommends the use of paints and floor coverings with low levels of volatile organic compounds (VOC) and low formaldehyde wood products where possible.

3.8 Operational Waste Management

An Operational Waste and Recycling Management Plan is a minimum requirement to meet sustainable building design best practice. The Waste and Recycling Management Plan includes:

- Separate waste and recycling streams;
- Transfer of material to common storage area;
- Communal storage areas;
- Frequency of collection; and
- Signage and educational initiatives for occupants.

A Waste Management Plan is recommended to track all waste going offsite to show that 90% of all construction waste is re-used or recycled.

3.9 Renewable Energy Options

As the worldwide demand for fuel increases, alternative and renewable energy sources are emerging as economical and sustainable. Alternative renewable energy sources are becoming more attractive options because of increased global demand for fuels, environmental responsibility, affordability and new local, state and federal government legislations.

SLR recommends the installation of a solar PV system;

- A 50 kW PV solar system is recommended to minimise greenhouse gas emission.
- A 50 kW PV solar system will offset approximately 71 MWh/year of energy usage.
- The estimated greenhouse gas CO2 emission saving is approximately 83,363 kgCO2/annum

4.0 Conclusion

SLR Consulting Australia Pty Ltd (SLR) has been engaged by Castle Hill No.3 Pty Ltd to provide a qualitative Ecologically Sustainable Design (ESD) assessment for the proposed development at 1-5 Nelson Road, Lindfield. The proposal includes development of a new residential flat building comprising of approximately 167 residential apartments (inclusive of affordable housing apartments) and basement car parking.

The project will respond to the ESD requirements outlined in the Planning Secretary's Environmental Assessment Requirements – Housing as shown below:

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• Where relevant, provide an assessment of the development against the standards for non-residential development set out in Chapter 3 of *State Environmental Planning Policy (Sustainable Buildings) 2022*.	

In line with the above, the following ESD measures are proposed to be included in the design:

- Thermal mass - Concrete slab construction is proposed for all floors throughout the development - concrete has amongst the highest thermal mass capacity of a range of common building products. The proposed development's external walls, structural internal walls, and slabs should be predominantly high thermal mass materials.
- LED energy-efficient lighting for all spaces;
- Centralised energy-efficient gas fired boiler hot water system;
- Ducted 1-phase ducted air-conditioning system of EER 3.0-3.5 rating for all living areas and bedrooms in the dwelling units for heating and cooling requirements;
- Dishwasher units to be installed within each residential dwelling. The dishwasher units are to have an energy efficiency rating of at least 4 stars;
- Clothes dryer units to be installed within each residential dwelling. The clothes dryer units are to have an energy efficiency rating of at least 2 stars;
- Provision of gas cooktop and electric oven;
- Water efficient bathroom and kitchen fittings;
    - All residential kitchen and bathroom taps are 5-star;
    - All shower heads are 4.0 Stars (>4.5 but <=6 L/min);
    - All residential toilet flushing systems are 4-star;
    - All dishwashers are 4-star;
- Light efficiency measures in the lobby using motion sensors;
- Low levels of volatile organic compounds (VOC) paints and floor coverings and low formaldehyde wood products where possible;
- 71% of the living rooms and private open spaces of the proposed apartments will receive a minimum of 2 hours direct sunlight between 9.00 AM and 3.00 PM at mid-

winter. The above percentage equates to 119 apartments out of 167 apartments have solar access to the living room.

- 62% of the proposed residential units will be naturally cross ventilated across the first 9 levels of the development. This amounts to 100 apartments in the first 9 levels.
- Landscaped areas are within the residential development throughout the designated communal areas. Proposed planting provides added cooling during the summer months through the leaf transpiration process and is also useful for wind amelioration;
- Plant species within the development would be predominantly indigenous species that can tolerate low water to reduce maintenance requirements; and
- SLR recommends the installation of a solar PV system.
    - A 50 kW PV solar system is recommended to minimise greenhouse gas emission.
    - A 50 kW PV solar system will offset approximately 71 MWh/year of energy usage.
    - The estimated greenhouse gas CO2 emission saving is approximately 83,363 kgCO2/annum
- The proposed residential development will enjoy a high level of thermal comfort gaining an average 7 NatHERS star rating.
- The development will also achieve BASIX targets by achieving targeted points in Water and Energy.

The report body contains recommendations regarding other ESD features, such as a mechanical ventilation system, domestic hot water, other appliances, and operational waste.

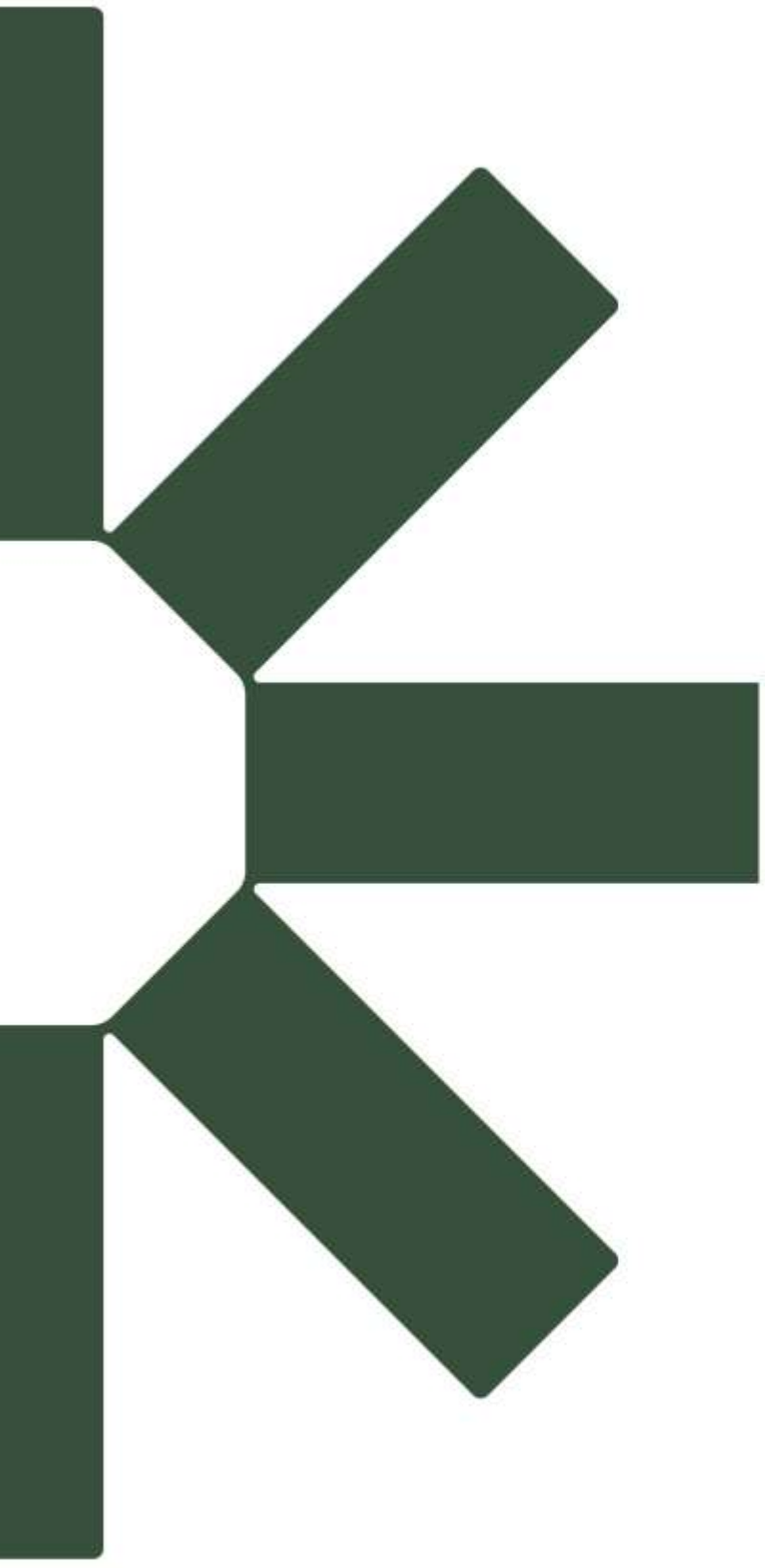
These features will help achieve significant reductions in energy and water required by the development both in building and operation, in addition to ensuring that the residential units are pleasant spaces to reside.

It is recommended that the proposed ESD initiatives continue to be developed and implemented throughout this project.

5.0 Feedback

At SLR, we are committed to delivering professional quality service to our clients. We are constantly looking for ways to improve the quality of our deliverables and our service to our clients. Client feedback is a valuable tool in helping us prioritise services and resources according to our client needs.

To achieve this, your feedback on the team's performance, deliverables and service are valuable and SLR welcome all feedback via https://www.slrconsulting.com/en/feedback. We recognise the value of your time and we will make a $10 donation to our Charity Partner - Lifeline, for every completed form.



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