Nepean Stage 2 Hospital Development

11/11/2021

ESD SSDA SEARs Report

Prepared for

Health Infrastructure

Revision 02

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Revision Information

Project	Nepean Stage 2 Hospital Redevelopment
Title	ESD SSDA SEARs Report
Client	Health Infrastructure
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Revision Schedule

Revision	Date	Issue Name	Authorised
00	27/07/2021	Draft for Review	Garry Luu
01	13/08/2021	Issued for SSDA	Garry Luu
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Contents

Executive Summary

Health Infrastructure NSW (HI) is the applicant for the proposed Stage 2 Redevelopment of Nepean Hospital in Penrith Local Government Area (LGA).

The proposal is State Significant Development (SSD) for the purposes of the Environmental Planning and Assessment Act 1979 (EP&A Act) and clause 14(a) of Schedule 1 of the State Environmental Planning Policy (State and Regional Development) 2011 (SEPP SRD) as it involves development for the purposes of a hospital with a capital investment value in excess of $30 million.

The Stage 2 Redevelopment seeks to deliver significantly enhanced acute services, as well as a new campus main entry and drop-off area. It complements the recent Stage 1 Redevelopment (SSD 8766) approved in February 2019 and due for completion by early 2022.

The proposed Stage 2 Tower will be located west of, and connected to, the Stage 1 Tower. Portions of the North Block (north section) will be demolished with the remaining sections of the North Block (to the south of the Stage 2 Tower) to remain operational.

Departments to be provided in the Stage 2 Tower include:

- Front of House, including retail;
- Education and Training Centre;
- Transit Lounge;
- Medical Imaging;
- Interventional Radiology;
- Intensive Care Unit and Close Observation Unit;
- In-Centre Dialysis and Renal Inpatient Unit;
- Paediatric In-patient Unit;
- Plant areas;
- Clinical Support areas; and
- Kitchen.

The Stage 2 Redevelopment project scope includes:

- The Stage 2 Tower, being predominantly a 7-storey building, with roof plant;
- Demolition of parts of the existing North Block and other satellite buildings directly within the Stage 2 Tower footprint (excluding other buildings already approved under the Stage 1 SSD consent);
- Demolition of the Total Asset Management (TAM) facility;
- Reconfiguration of the loading dock area and back of house functions;
- Landscaping and other associated at-grade works within the Stage 2 Tower's immediate vicinity; and
- Barber Avenue upgrade and access road to the Stage 2 Tower's forecourt, port cochere, and front of house area.

The Stage 2 Redevelopment's SEARs was issued by the Department of Planning, Industry and Environment on 22 April 2021.

In preparing this report, the following SEARs General Requirements, Key Issues, and Agency's Advice letters have been addressed. The table below sets out the reference or location of these matters within this report.

General Requirement or Key Issue or Agency Advice	Reference / Location within this report
Identify how ESD principles (as defined in clause 7(4) of Schedule 2 of the Regulation) would be incorporated in the design and ongoing operation phases of the development.	Details of how best practice ESD principles, as defined by Part 7(4) Schedule 2 of the Environmental Planning and Assessment Regulation 2000, will be incorporated in the design and ongoing operation phases of the development. See **Section 3.1**.
Identify proposed measures to minimise consumption of resources, water (including water sensitive urban design) and energy.	Details of how the proposed measures minimise consumption of resources, water (including water sensitive urban design) and energy. See **Section 3.2**.
Identify how the future development would be designed to consider and reflect national best practice sustainable building principles to improve environmental performance and reduce ecological impact. This should be based on a materiality assessment and include waste reduction design measures, future proofing, use of sustainable and low-carbon materials, energy and water efficient design (including water sensitive urban design) and technology and use of renewable energy.	Details of how the future development will be designed to consider and reflect national best practice sustainable building principles to improve environmental performance and reduce ecological impact. See **Section 3.3** & **Appendix A – HI ESD Evaluation Tool**
Provide an assessment against an accredited ESD rating system or an equivalent program of ESD performance. This should include a minimum rating scheme target level.	Details of an assessment against the HI ESD Evaluation tool as required by HINSW DGN 058 Ecological Sustainable Design. See **Section 3.3** & **Appendix A – HI ESD Evaluation Tool**
Provide a statement regarding how the design of the development is responsive to the NARCliM projected impacts of climate change. Relevant Policies and Guidelines: • NSW and ACT Government Regional Climate Modelling (NARCliM) climate change projections.	Details of how the design of the development is responsive to the NSW and ACT Government Regional Climate Modelling (NARCLiM) climate change projections. See **Section 3.4**
Provide an Integrated Water Management Plan detailing any proposed alternative water supplies, proposed end uses of potable and non-potable water, and water sensitive urban design.	Details of water conservation strategies, including practical opportunities to implement water sensitive urban design principles. See **Section 3.5**

1 Introduction

LCI has been engaged to provide an Ecologically Sustainable Development (ESD) SEARs Report as part of the State Significant Development Application (SSDA) for the proposed Nepean Hospital Redevelopment Stage 2 on Derby Street, Kingswood, NSW. This report will form part of the documentation required to meet the Secretary's Environmental Assessment Requirements (SEARs*; see Section* ***Error! Reference source not found.***) for this SSDA, SSD-16928008, which is submitted to the Minister for Planning pursuant to Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The report identifies and responds to relevant government policy and/or targets pertinent to the Nepean Hospital Redevelopment Stage 2, as stipulated under the 'Ecologically Sustainable Development' section in SEARs for SSD-16928008.

1.1 Project Background

The Nepean Hospital Campus sits east of the Penrith Central Business District. The extent of the campus is defined by the Great Western Highway and Barber Avenue to the north, Somerset Street to the east, Derby Street to the south and Parker Street to the west. Whilst not located on the campus property, the existing Nepean Private Hospital is located immediately (adjacent) to the north/west of the campus and is physically linked back to the Nepean Hospital via a link bridge.

The campus is composed of a series of buildings linked by bridges, pathways and external covered paths with the majority of acute services located central to the campus. The existing buildings vary in scale from one storey to six storeys. Currently, West Block and South Block are the highest buildings on the site at 6 storeys. Other buildings making up the acute hospital core vary in height from 2 to 4 storeys. The outlying buildings over the eastern portion of the campus are all single storey in height.

The proposed site Stage 1 and Stage 2 Towers is located in the east of the campus, just to the north of the existing East Block and North Block.

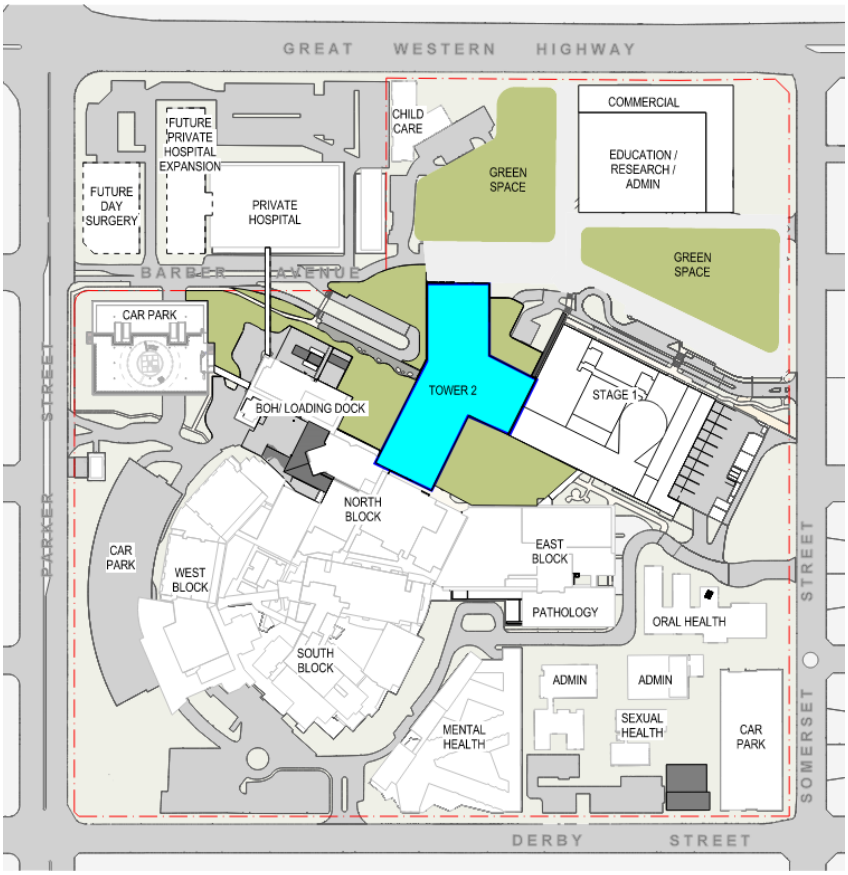


Figure 1: Architectural site plan showing Tower 2 on the Nepean Hospital Campus (by BVN Architects)

2 General Design Principles

2.1 Site Description

Nepean Hospital is located in Kingswood, a suburb located in the west of metropolitan Sydney, slightly east of the Penrith central business district. The campus is defined by the Great Western Highway and Barber Ave to the north, Somerset Street to the east, Darby Street to the south and Parker Street to the west. The site is a rough square, aligned 15° to the east. The project area is located on the east of the Nepean Hospital Campus. The location of the site is shown in Figure 2, whilst the Stage 2 site boundaries and existing site surrounding features are shown in Figure 3.

Figure 2: Local site context

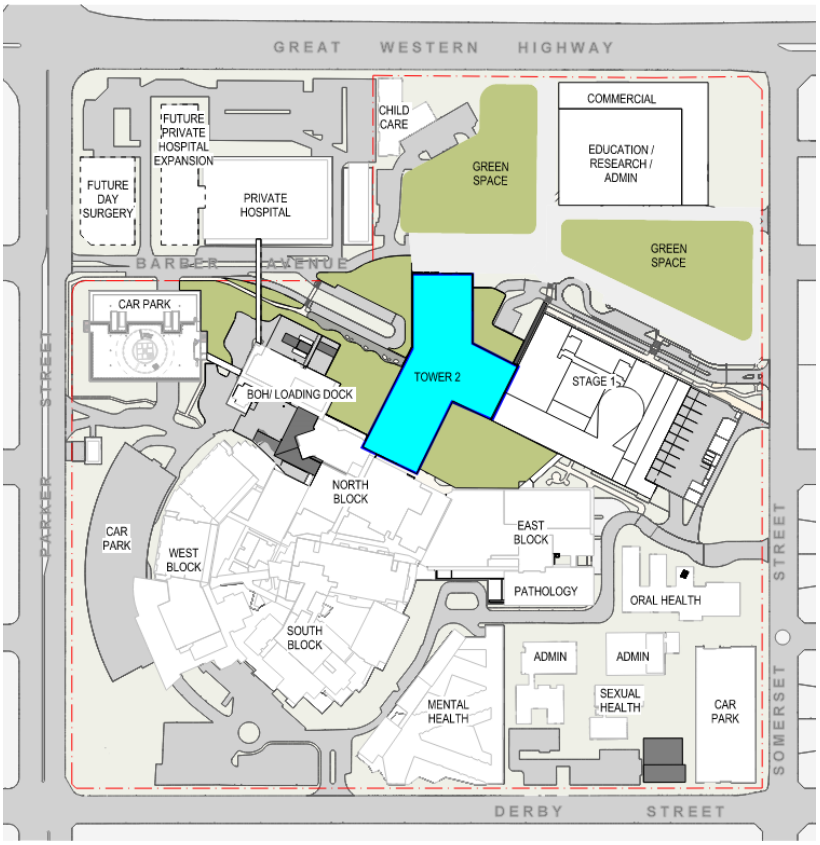


Figure 3: Proposed Location of Tower 2

2.2 Site Climate

The site is located in a humid subtropical climate, characterised by its long hot summers and cool short winters with cold nights, with maximum annual temperatures averaging 31.2°C and minimum annual temperatures averaging 8.3°C. Based on the BOM weather data for Penrith, the annual precipitation is just over 700mm, as shown in Figure 4.

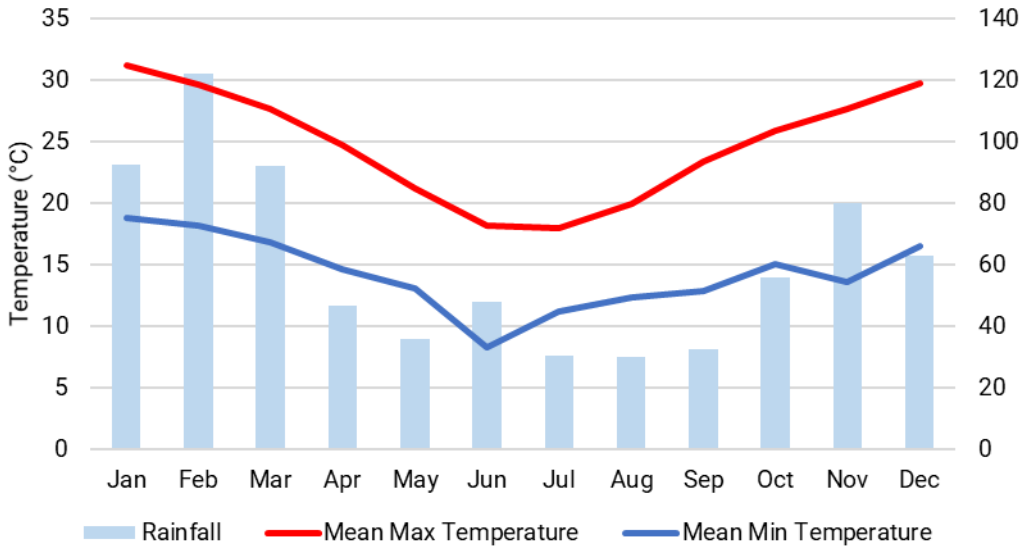


Figure 4: Penrith Climate

2.3 Passive Sustainable Design Principles

As per BVN Architectural Drawing Package, the project has adopted passive design principles that respond to the local climate and local sun path; reducing the building's demand for active building-services systems to provide thermal comfort and artificial lighting and reducing peak energy demand and annual energy consumption.

Passive Cooling and Heating

Passive cooling and heating is a design principle in which the building design elements, such as the orientation, window-to-wall ratio (WWR), façade performance and extent of external shading, are optimised to improve thermal comfort and reduce building's reliance on mechanical systems; supporting a reduced peak energy demand and annual energy consumption.

According to the sun path diagram for the site:

(1) the morning and the afternoon sun during the summer solstice will deliver direct, high solar radiation through the unprotected west facade causing thermal discomfort and increased cooling load. The morning sun in the east will be obstructed by Tower 1; and
(2) the low sun during the winter solstice can deliver direct, high solar radiation through the north façade, providing a free source of heating.

Figure 5: Sun Path for Nepean Hospital

To take advantage of the sun path, the project will investigate:

- low window to wall ratio on the exposed west façade to reduce direct solar radiation from entering the building on summer afternoons.
- high window to wall ratio on north-facing facades with shading devices to maximise winter solar access while limiting summer direct solar ingress
- Limiting overall window to wall ratio to less than 25%.

- vertical shading devices for west-facing windows in order to reduce summer afternoon sunlight to minimise unwanted gains and to control glare
- oriented the building form (after a balancing activity of various factors such as site environmental setbacks, daylight and external view availability) to avoid excessive direct solar radiation by minimising the façade area facing the afternoon West sun during Summer, and to maximise the façade area facing the low sun during Winter to reduce heating loads.

Improving Access to Natural Daylight

The building will be designed to maximise the amount of daylight access to the various functional zones, which contributes to a fostered sense of normality and wellbeing and enhances user comfort levels. Solar access also helps reduce stress levels, and generally improves the efficiency and productivity of staff, wellbeing of visitors and has shown to aid in increasing patient recovery times. Measures to improve solar access that have been considered include:

- Narrow floor plate to increase perimeter zones, allowing more natural daylight access where achievable within the clinical planning constraints;
- Location of all wards on the building perimeter to maximise patient access to daylight through windows;
- Courtyards and key public spaces receive a good amount of direct sunlight; and
- Planning for glazed apertures as end conditions to major circulation routes provide light into corridors.

Improving Access to External Views & Glare Reduction

The patient rooms and bed space shall be orientated to capitalise on the available views from the site, allowing the patients access to views, daylight, and nature where possible. A daylight and views analysis may be done to confirm the levels of access for the perimeter patient zones. Glare management will be addressed in part by optimising the window to wall ratio and the performance characteristics of the glazing, complimented by adjustable room blinds that can cater for individual comfort.

2.4 NSW Health Infrastructure Engineering Services Guidelines

The Engineering Services Guidelines (NSW HI ESG) provide a performance-based guide for the development of design and specification documentation for healthcare facilities.

The guidance document states that integrated, built environment sustainability must be considered, including appropriate designs for energy and water, and the use of appropriate materials. In addition, the indoor environment must consider air quality, ventilation, daylight and other factors that influence thermal, visual, acoustic and psychological comfort. The basic design principles also include the following guidance and project responses detailed in Table 1 below. The design strategies adapted from the ESG requirements are cross-referenced in Section 3 (Project responses to SEARs, see in particular, Section 3.2.) due to the similarity in its requirements.

Table 1. NSW HI ESG Requirements related to ESD

ESG Requirements	Project Response
General	
• Proposed designs should include: passive sustainable design strategies, such as daylighting, demand management, gravity systems, energy and water efficiency, and conservation techniques; use of non-toxic, environmentally sound materials and finishes, and consider life cycle sustainability and maintenance implications • All new facilities will target a Green Star Health Care 4-star equivalence rating, this has been and will continue to be considered as aspirational within the context of project location, scope and budgetary allowances; no documentation or certification is required	Passive sustainable design strategies, including passive cooling and heating, daylighting and access to views, as discussed above in *Section 2.3,* shall be implemented. Energy and water efficiency strategies, and sustainable material considerations are discussed in respective sections of this report. As per the "*Design Guidance Note No. 058 - ESD*" and the NSW Government Resource Efficiency Policy which supplements the NSW HI ESG, the project team has developed a Green Star Design & As Built v1.3 5 Star equivalency pathway in 'Appendix A – HI ESD Evaluation Tool' to reflect an equivalent 5 Star Green Star Design & As-Built v1.3 pathway. The elevated rating compared to requirement stipulated in the HI ESG requirements is due to the location of Nepean Hospital within metropolitan Sydney
Energy	
• All new standalone buildings will have a mandatory requirement of delivering a 10% improvement on national construction code (NCC) Section J. • Engineering design should be applied to reduce energy wastage and carbon dioxide emissions arising from the operation of the hospital, whilst maintaining clinical and functional standards. • Energy efficient design should consider: a. An enterprise-level energy management program integrated with other functions b. Integrated performance monitoring and controls c. The incorporation of variable speed pumps d. Efficient insulation of hot and warm water distribution pipework e. Consideration of opportunities for energy and heat recovery f. Appropriate system zoning and time control	The project shall be designed to deliver a 10% or more improvement on the NCC 2019 Section J. Strategies to meet the above target, and measures to demonstrate energy efficient design, reduction of energy wastage and the subsequent carbon dioxide emissions, are further referenced in *Section 3.2.*
Water	
• The design of the water systems should include consideration of: a. Potential use of gravity systems b. Water (potable, grey, black) recycling options c. Options for maximising water conservation d. Appropriate metering and monitoring e. Opportunities for re-use of fire test water f. Rainwater harvesting to reduce potable water consumption g. Installation of high efficiency fixtures, such as those covered by the High Water Efficiency Labelling and Standards scheme h. Efficiency irrigation systems	Water efficiency measures to reduce potable water consumptions are targeted for the project and are further referenced in *Section 3.2.*

ESG Requirements	Project Response
Materials	
• Consideration should be given to materials of low embodied energy content, high recycled content or that are highly recyclable • Designers should consider the quantities of materials and investigate opportunities for alternative design solutions that may reduce material use (e.g. mass concrete versus post-tension designs) • Material selection should focus on: a. Use of locally sourced materials b. Selection of low embodied energy materials c. Specification of products and materials that are either reused or contain high recycled content d. Promoting the specification of recyclable manufactured materials and fittings e. Giving preference to materials manufactured using renewable energy sources f. Designing to minimise material use and improve material efficiency • As a minimum, the below design options should be considered in the material selection process: a. Use of structural steel products composed of recycled content b. Use of recycled concrete c. Minimisation of PVC products d. Specification of low VOC materials e. Giving preference to reused timber, legally sourced timber, and timber sourced from forests whose conservation values are not degraded f. Designing to material sizes and common packaging quantities to avoid off-cut wastage and unnecessary consumption.	The project team shall take into consideration the sustainable strategies regarding materiality, waste reduction design measures, future proofing, and use of sustainable and low-carbon materials, as outlined in *Section 3.2.* Specification of materials or means to reduce waste will be confirmed in the detailed design.

3 Assessment Requirements and Project Responses

3.1 SEAR 6 | Ecologically Sustainable Development (ESD)

Clause 7(4) of Schedule 2

The ESD principles that are to be incorporated into the proposed development must be aligned with Clause 7(4) – Schedule 2 – Environmental Planning & Assessment Regulation (2000).

3.1.1 The Precautionary Principle

Namely, that if 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. In the application of the precautionary principle, public and private decisions should be guided by:

(i) Careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment; and
(ii) An assessment of the risk-weighted consequences of various options.

PROJECT RESPONSE

The proposed redevelopment is situated on a previously developed site. The project site within the Nepean Hospital Campus consists of several outlying standalone buildings, housing support services including doctors' accommodation, aged care IPU, rehabilitation IPU, anaesthetist's offices and asset management office. These will be demolished as part of the enabling works for Tower 2. Thus, the redevelopment will not have an adverse environmental impact, thereby alleviating concern of serious or irreversible environmental damage. Proactive measures to further minimise environmental degradation will be included within the design, construction and operational phases of the proposed development. Much of these will be captured by the design and construction measures adopted to ensure the building is designed and constructed to the standards of an equivalent 5 Star Green Star building. During the design and construction phases, the main contractor will implement an independently certified Environmental Management System (EMS), which demonstrates formalised systematic and methodical approach to planning, implementing and auditing. Throughout the building's operation, adherence to procedures that account for environmental risk and mitigation measures will be met.

3.1.2 Inter-Generational Equity

Namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.

PROJECT RESPONSE

To uphold inter-generational equity, the proposed development minimises the consumption of energy and water resources whilst reducing waste. The ESD principles incorporated into the proposed development facilitates the conservation of energy and water resources through energy and water efficiency measures. Further, the location of the proposed building on predeveloped land removes the need for virgin natural areas to be repurposed, hence the health, diversity and productivity of the environment is maintained.

Energy consumption will be designed to achieve a minimum 10% improvement above National Construction Code requirements. The reduction in water use will be established through high WELS rated water fixtures and fittings, unless otherwise required for clinical purposes. Rainwater collection is also being considered for use in landscape irrigation. The reclamation of fire testing water is also under consideration by the project team. Waste generated during the construction and operational phases will be diverted from landfill to be recycled. An Environmental Management System (EMS) will be established and adhered to throughout construction. Operational waste streams will be separated to maximise recycling. Reducing energy, water and waste ensures that the health, diversity and productivity of the environment is maintained for the benefit of future generations.

3.1.3 Conservation of Biological Diversity and Ecological Integrity

Namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration.

PROJECT RESPONSE

The location of the project on previously developed land reduces the need to adopt pristine natural environment for the expansion of health services. Further, this significantly reduces the chance that the redevelopment works will negatively impact native flora and fauna. Nevertheless, the project team will take all steps to minimise impact on any native vegetation that is located on site. A flora and fauna assessment will be carried out as part of the environmental impact statement and will provide more detail on the biodiversity requirements of the area. However, the probability of negative impact is low, as any native vegetation that can be found on site will likely be planted as part of earlier development works and not be part of old-growth, especially given that the development state of the Nepean Hospital campus.

The project's ESD principles to reduce energy, water and waste consumption will have an indirect impact to conserve biodiversity and ecological integrity to the surrounding area. By minimising demand on energy, water and material resources, the need for land-clearing and the pollution generated from utility infrastructure to support the surrounding area will be minimised.

3.1.4 Improved Valuation, Pricing and Incentive Mechanisms

Namely, that environmental factors should be included in the valuation of assets and services, such as:

(i) polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement;
(ii) the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste; and
(iii) environmental goals, having been established, should be pursued in the most cost-effective way by establishing incentive structures, including market mechanisms that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.

PROJECT RESPONSE

The valuation of the project's assets and services consider environmental factors through the implementation of various ESD initiatives. An Environmental Management System will be in place throughout the construction to ensure that excessive pollution and waste are minimised, and to establish recycling and landfill waste streams during construction and operational phases. This creates a system where pollution is managed and controlled and creates an incentive to reduce pollution and waste. Environmental goals of the project are pursued in the most cost-effective way by first reducing demand via passive design measures through the design of the building form and fabric before active design measures such as more efficient building systems are considered.

3.2 Improving Environmental Performance and Reducing Ecological Impact

The project shall be designed to achieve a minimum 10% improvement on NCC 2019 Section J, reducing the operational energy of the development and enhancing the thermal comfort of the occupied spaces. Each of the services have strategies to improve the environmental performance, as detailed in the following sections. The ecological impact will be monitored through a flora and fauna assessment of the site to provide more detail on the native species and any biodiversity requirements or risk to be managed and mitigated.

PASSIVE COOLING AND HEATING DESIGN

The design shall adopt passive cooling and heating design principles to reduce the building's reliance on the mechanical HVAC system to reduce energy consumption. Those considered include:

- orientation and form of the building suited for the sun path to avoid direct solar radiation in summer and to benefit from free source of heating during winter;

- implementation of external shading to limit solar penetration in summer but optimise passive heating in winter;
- optimising window to wall ratio (WWR) and the use of a high-performance façade with improved thermal resistance.

More detail on passive cooling and heating design is described above in *Section 2.3*.

MECHANICAL SERVICES

The building services will be designed to achieve a high level of energy efficiency to achieve a 10% or more improvement on NCC 2019-Section J. The following mechanical strategies will be considered for implementation, subject to detailed design of the project:

- All mechanical equipment to be efficient, subject to mechanical designer's life cycle cost analysis.
- A series counterflow configuration of chilled water plant equipment.
- Centralised mechanical plant configuration, which allowing for diversity and improves energy efficiency
- Ductwork/pipework systems to be designed to reduce system pressure losses and reduce fan and pump motor power
- A Building Management Control System (BMCS) to be installed with automatic intelligent controls to optimise plant efficiency, and monitor and record energy consumptions to reduce energy wastage
- Airlocks at the entrances to be provided to avoid conditioned air from escaping the building, reducing energy wastage
- Where applicable, refrigerants to be specified that have low ozone depletion potential, and low global warming potential
- Medical imaging equipment to be cooled by water-cooled or air-cooled chilled water system in order to reduce water consumption for process cooling.
- High efficiency condensing type gas-fired boilers for heating hot water generation.
- Variable air volume air distribution system for conditioned air distribution for non-critical areas.
- Variable speed fans and outside air economy cycle for air handling systems.

ELECTRICAL SERVICES

The project team will work to implement electrical services that assist energy efficient design. The following electrical strategies will be considered for implementation, subject to detailed design of the project:

- Robust, long-life LED lighting with automatic lighting control system to reduce energy wastage – lighting control strategies may include implementation of area dimming, time clock, daylight sensors or PIDs, subject to room function
- External artificial lighting to be designed to exceed minimum energy efficiency requirements and, where possible, specified with LED luminaires with photocell and manual override control
- Electrical equipment to be specified to be energy efficient to reduce building electricity consumption, unless otherwise required for clinical purposes
- Major energy uses to be sub-metered by end use, and function area / department
- Where appropriate, reliance on internal artificial lighting to be reduced by consideration of the façade design, i.e. the application of daylight dimming controls. *Section 2.3* above discusses design strategies used to improve daylight to the building form.

HYDRAULICS SERVICES

The project team will consider hydraulics services that assist water efficient design. The following hydraulics strategies will be considered for implementation, subject to detailed design of the project:

- Potable water using fixtures to be high efficiency rated by WELS as outlined below, unless otherwise required for clinical purposes. Specification of fittings to be confirmed in the detailed design.
  - Showerheads ≥ 3 stars (either: >6.0 but ≤7.5 l/min, >4.5 but ≤6.0 l/min)
  - Toilets ≥ 5 stars
  - Urinals ≥ 6 stars
  - Dishwashers ≥ 6 stars
  - Taps and flow controllers ≥ 6 stars

- Rainwater capture and reuse strategy to reduce potable water consumption – the project team to investigate the application of a rainwater harvesting and reuse system that captures rainwater from the roof areas to reuse for irrigation.
- Potable water sub-metering to be connected to the BMCS to reduce wastage through identifying leaks or poor operational performance. Sub-meters for each department will be considered.
- Fire test water for recycling back into the fire services storage tank in Tower 1 to be investigated.
- Isolation valves or shutoff points for sprinkler system on each floor will be investigated to enable floor by floor testing.
- Gravity drainage to be considered to reduce pumping energy.

CIVIL ENGINEERING SERVICES

The project team will implement design strategies to cater for water sensitive urban design principles (WSUD), with the aim of reducing pollutants and not effecting the increase in natural annual average load of nutrients and sediments. Further details are provided in *Section 2.4* and in Bonacci's *SSDA Design Report*.

SUSTAINABLE MATERIALS AND REDUCING WASTE

The project team will take into consideration the sustainable strategies outlined below regarding materiality, waste reduction design measures, future proofing, and use of sustainable and low-carbon materials. Specification of materials or means to reduce waste will be considered and confirmed in the detailed design.

- Specifying low VOC emitting materials to improve indoor air quality
- Specifying engineered wood products with low or no formaldehyde limits
- Applying low carbon construction principles and learnings in relation to:
  - specifying green concrete steel and timber (such as Portland cement replacement, captured/reclaimed water for mix water, and recycled aggregates; steel manufactured from energy-reducing processes; and sourcing reused timbers);
  - minimising mass or volume of materials; and
  - implementing sound procurement practices.
- A life cycle assessment may be carried out in order to estimate reductions in carbon emissions from material selections and structural design of the building.
- Pipe material selection based on current best practice such that:
  - PVC-u to be specified based on the GBCA guidelines.
  - Polyethylene material to be specified for pressure water and gas services, as Polyethylene is recyclable and has significantly lower environmental impact than the alternative ductile iron material.
  - Pipe bedding materials to be specified to be locally sourced, where practical.
- Selecting permanent formworks, flooring, blinds and cables with no PVC or PVC products that comply to GBCA's best practice guidelines for PVC.
- Specification of structural and reinforcing steel manufactured from processes that consume less energy than industry normal.
- Prioritising locally sourced materials.
- Specifying salvaged and/or recycled materials.
- Specifying materials sourced with cradle to cradle credentials.
- Reuse of materials on the site to limit waste, e.g. excavated bulk soil used in the formation of landscaped landforms for playgrounds around hospital.
- Efficient selection of materials to limit off-cut wastage during construction.
- Promotion of off-site prefabrication to limit construction waste impacts.

ON-SITE RENEWABLE ENERGY

A photovoltaic system of approximately 190 kW will be designed for the roof to generate electricity from solar energy.

3.3 Preliminary Consideration of Building Environmental Performance & Ecological Impact Reduction

Preliminary consideration of building performance for the proposed development is reflected by applying passive sustainable design principles (see Section 2.3) and achieving the minimum performance requirements stipulated under NCC 2019 Section J. Further, the building design addresses mitigation of climate change by improving the building's energy efficiency via adopting energy conservation strategies in building services design, as detailed in Section 3.2. Finally, the building's sustainable design and management practices are further supplemented by implementation of the design practices stipulated within the 5 Star Green Star Design & As Built v1.3 equivalency pathway.

3.3.1 NCC 2019 Section J Requirements

The National Construction Code (NCC): Building Code of Australia (BCA) 2019 Section J Energy Efficiency sets minimum energy performance requirements for all new developments, including the performance of building fabric and building sealing, glazing thermal performance, heating, air conditioning and ventilation systems, artificial lighting and power, and heating water supplies. The project will be targeting an improvement in performance of at least 10% over NCC 2019 Section J DTS requirements, as mandated by the HI ESG requirements. Thus, the project will comply with NCC 2019 Section J. A JV3 Analysis will be carried out by Arup.

3.3.2 Health Infrastructure NSW Design Guide Note 58 Ecological Sustainable Design and Evaluation Tool

The Health Infrastructure (HI) NSW Design Guide Note (DGN) no. 058 Ecological Sustainable Design has been developed by HINSW and outlines the requirements for Ecological Sustainable Design. The HINSW DGN 058 requires the use of the HI ESD Evaluation tool (developed by Health Infrastructure) and utilises numerous Green Building rating schemes and allows projects to target and award sustainability initiatives that offer value to the project. The HI ESD Evaluation tool primarily focuses on sustainability initiatives from the Green Building Council of Australia's Design and As-built tools, as this tool has been specifically developed for the Australian Construction Industry. The HI ESD Evaluation tool uses the same scoring system to demonstrate equivalency with the best practice sustainable design.

The HI ESD Evaluation tool indicates credits that are considered standard practice, high priority and lower priority. The purpose of this identification is to focus team on firstly targeting sustainability initiatives that are valuable to healthcare facilities, and deliver on key sustainability issues, such as occupant and staff wellness, energy and water reduction and waste minimisation.

The HI ESD Evaluation tool (See Appendix A – HI ESD Evaluation Tool) has been implemented by the project team which outlines the relevant initiatives considered to the project. The pathway reflects the requirement of a minimum 60 points to be achieved. Typically, buffer points are allocated to ensure a targeted performance is maintained as emerging design and construction constraints may prevent points from being achieved. This represent a pathway that will be tested and refined as the project progresses through its design and construction phases.

The following section provides more detail about the Green Star rating system.

3.3.3 Green Star Design & As Built v1.3

Green Star is a voluntary scheme administered by the national, not-for-profit organisation, Green Building Council of Australia (GBCA). The Green Star suite of tools provides an environmental sustainability rating of a building's performance. The tools are performance based and assess the environmental attributes of new and refurbished buildings in every state across Australia. The Green Star rating system is scaled to a star level from 0 to 6 stars.

Figure 6: Green Star rating scale

Nepean Hospital Redevelopment Stage 2 will not be targeting official Green Star certification, rather it will follow the aims and requirements of specific credits to achieve the standards of a 5 Star Green Star Design and As-built v1.3 rating as required by the HI DGN 058 Ecological Sustainable Design. The alignment of Green Star principles will be peer reviewed by a third party to ensure compliance with the targeted star rating.

3.4 Design for Climate Change Resilience

Nepean Hospital Redevelopment Stage 2 will be designed to future-proof itself from the potential impacts of climate change.

NARCLiM Climate Change Projections

The NSW Office of Environment and Heritage, now part of the NSW Department of Planning, Industry and Environment, has developed the NSW and ACT Government Regional Climate Modelling (NARCLiM) climate change projections to provide a dataset for detailed near future (2020-2039) and far future (2060-2079) projections. Generally, it determines that there will be:

1. more hot days and fewer cold nights;
2. an increase the number of heatwave events;
3. more hot days above 35°C; particularly in Spring and Summer;
4. an increase in rainfall in Summer and Autumn and a decrease in Winter and Spring; and
5. a change in rainfall patterns that will affect drought and flooding events.

CSIRO Climate Future Projections

In addition, the Intergovernmental Panel on Climate Change (IPCC) published four greenhouse gas (GHG) concentration trajectories known as Representative Concentration Pathways (RCPs) which are used by CSIRO for climate projection modelling at a regional scale within Australia. The four RCPs and its definitions include:

- **RCP 2.6** – Emissions peak 2010-2010, decline substantially – 1.0°C of Global Warming Mean and likely temperature range of 0.3°C – 1.7°C
- **RCP 4.5** – Emissions peak around 2040, then decline – 1.8°C of Global Warming Mean and likely temperature range of 1.1°C – 2.6°C

- **RCP 6.0** – Emissions peak around 2060, then decline – 2.2°C of Global Warming Mean and likely temperature range of 1.4°C – 3.1°C
- **RCP 8.5** – Emissions continue to rise throughout the 21st century – 3.7°C of Global Warming Mean and likely temperature range of 2.6°C – 4.8°C

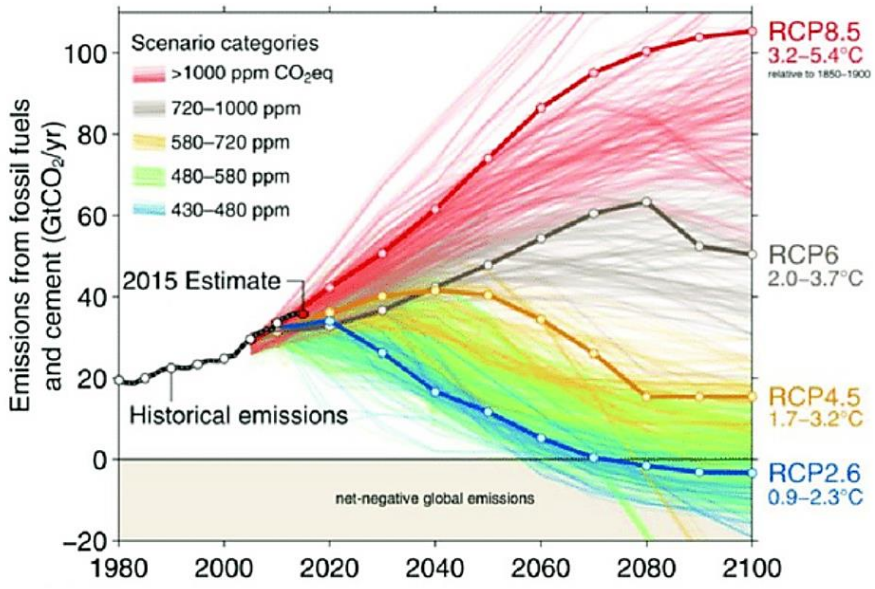


Figure 7: Climate Change Projections

To provide practical and realistic design advice, the use of climate projection data from the medium range scenarios, RCP 4.5, is considered for the 2030 climate projections. The RCP 8.5 scenario is considered an extreme worst-case scenario and has been considered for the 2070 climate projections. Projections for mild and extreme climate prediction scenarios based on the NARCliM and ACCESS1-0 climate models are summarised in Table 2.

Table 2. Climate prediction matrices for RCP 4.5 and RCP 8.5 at Penrith

Impact Category	2030 (RCP 4.5)		2070 (RCP 8.5)	
	ACCESS1-0	NARCLiM	ACCESS1-0	NARCLiM
Temperature	+1 (0.5 -1.25)	+0.7°C	+3 (1.9 – 3.9)	+1.9°C
Days above 35°C	+7.21 (6.6 -7.97)	+8.7	14.4 (11.53 – 20.07)	+26.4
Nights less than 2°C	-	-5.9	-	-17.3
Rainfall	-7.5 (-15 to +15%)	+0.4% (-5.7 to +11.8%)	-2.5 (-20 to +25%)	+6.5% (-4.9 to +13.9%)
Humidity	-0.25 (-5 to 0.25%)	-	-0.25 (-7.5 to +5%)	-
Wind Speed	-1 (-5 to 2%)	-	-1 (-6 to 4%)	-
Evapotranspiration	+2.5 (+1 to +7%)	-	+10 (+5 to +15%)	-
Fire	-	+0.7	-	+2

Climate Adaptation Plan

The projections summarised above will have an impact on operational costs and occupancy comfort and safety. The project team has developed a Climate Adaptation Plan (CAP), which analyses mild and extreme climate

prediction models in the near and far future to assess the site-specific climate risks and proposes mitigation measures to address these risks through design and governance.

Table 3 summarises the key project responses outlined in the CAP that address the various changes in the projected climate conditions to mitigate the potential impacts of future climate change. These measures should allow the project to meet the difficulties predicted by the CSIRO's climate change projections while maintaining occupancy comfort and operational efficiency.

Table 3: Climate change projections and response initiatives for Nepean Hospital Redevelopment Stage 2

Climate Change Projections	Project Responses
Increased average temperature and duration of heatwaves	**Mechanical System Provision** The climate futures matrix in Table 2 predicts that under both climate scenarios RCP for 2030, it is highly likely that higher maximum daily temperatures will be experienced. To reasonably future proof the building, the mechanical design has considered a suitable peak temperature to calculate the required cooling load of the building. The cooling plant will be sized based on AIRAH critical summer outdoor temperature and comfort summer outdoor temperatures. Sizing of plant rooms according to a summer outdoor temperature increase of 1.9°C to fit larger plant installed in the future will be considered. The risk of cooling equipment derating has also been considered, but this is unlikely to be an issue as the summer design indoor temperature of 24°C is expected to only be marginally exceeded. The heat rejection equipment will be arranged to maximise their effectiveness. **Architectural Design** An increase in hot days will increase the risk of heat island effect. Mitigation measures considered to address this include increasing vegetation cover and the application of low emissivity coatings to hard surfaces. Increase in hotter ambient temperature is combated via use of high-performance façade with reduced WWR to improve overall thermal resistance, minimising radiation penetrating the building, which affects energy consumption and thermal comfort. In addition, external shadings are to be implemented to further reduce direct solar radiation. **Electrical System Provisions** Increases in temperatures may cause blackouts or brownouts as electrical equipment servicing the hospital and the surrounding areas as the temperatures may exceed the rated operating temperatures of these systems. Mitigation measures for this include the provision of generators to support life safety and business-critical essential loads, the provision of a centralised UPS to supply critical loads such as ICT equipment, and the use of natural ventilation to ventilate the substation room, with intake fans to maintain positive pressure within the room. Transformers with relatively higher design temperatures will be considered, which would reduce the magnitude of derating if this is exceeded.
Increased flood risk	The increase in flood risk may result in the flooding of low-level comms equipment during extreme events. The stormwater system is designed for a 100-year flood. Pumps and pumpout pits will be considered. These mitigation measures will also reduce the risk of flooding of ground levels which will impact pedestrian access. Sufficient overland flow paths are also provided to allow for flows that exceed the capacity of the pit and pipe system. The flood study undertaken for Penrith City Council (College, Orth and Werrington Creeks Catchment Overland Flow Flood Study) assessed the impact of Climate Change. For the upper bound climate change increase (notional 30% increase in rainfall intensity), mapping in the Flood Study indicated that there is approximately a 10mm increase in the 1% AEP flood level in the region of Nepean Hospital. This is considered to be a negligible increase that can be accommodated in the provided overland flow paths.

Climate Change Projections	Project Responses
More extreme rainfall events	Extreme rainfall events run the risk of the drainage systems being overloaded. One mitigation measure considered is to size rainwater gutters and downpipes for an equivalent one in 100-year storm to cater for additional rainfall intensity in 2070. Rainwater outlets, gutters, and downpipes are proposed to be periodically inspected and cleared to ensure the system operates at maximum capacity.
Increased bushfires	Higher temperatures will increase the likelihood and intensity of bushfires. The smoke generated by bushfires will cause a health risk for building occupants, and may also trigger false fire alarms. To minimise the risk of poor indoor air quality as a result of the smoke, smart detectors will be considered for the smoke detection systems. These would automatically adjust the sensitivity of smoke detectors and their obscuration limits to account for overall changes in air conditions, which would reduce the chance of false alarms. To reduce frequency of filter replacement due to capture of bushfire smoke particles, operational procedures during bushfires will be considered, including the replacement of fresh air intake filters with temporary construction coarse filters. Regular checks of filters with replacement as needed will be considered in order to ensure that the filters do not get blocked. High efficiency filters of MERV 15 and above will be considered for air handling systems to improve filtration efficiency.

3.5 Implementation of Water Conservation and Water Sensitive Urban Design Principles

The project shall implement a water management plan that incorporates water conservation and water sensitive urban design principles. The project will consider the use of low consumption sanitary fixtures with high WELS ratings, including taps, urinals, toilets, showers and dishwashers. Further, rainwater will be captured and reused for landscape irrigation in order to further reduce the project's impact on water resources. This feature will be integrated with the OSD tank in the stormwater system and is documented in Bonacci's Civil Design Report. Separate water meters for each department will also be considered with linkage to the BMCS in order to enable monitoring of water consumption, which will assist with determining areas of high water use during operation. The fire safety system is also served by a central plant in Tower 1, which may recapture fire systems testing water.

The project shall implement water sensitive urban design (WSUD) measures in accordance with the Civil Design Report by Bonacci. The stormwater system will be designed such that the post-development stormwater flows will be less than predevelopment stormwater flows. An underground on-site detention tank will be considered to cater for additional flows from the proposed building relative to the previous development case. Stormwater drainage will be upgraded to cater for expected stormwater flows in order to avoid disruptions to hospital operations due to stormwater issues. Stormwater quality will also be managed to reduce stormwater pollutant levels to targets set by Penrith City Council's WSUD Policy for gross pollutants, total suspended solids (TSS), total phosphorous (TP) and total nitrogen (TN). Water Sensitive Urban Design measures will be incorporated in accordance with best practice where possible. Water quality treatment measures considered for the site include a combination of rainwater tank, pit baskets and stormwater filter cartridges. Outflows from the OSD will also be passed through a stormwater filter to maintain stormwater quality. Stormwater quality has been modelled using computer software, which will be revised with any updates to the stormwater system design.

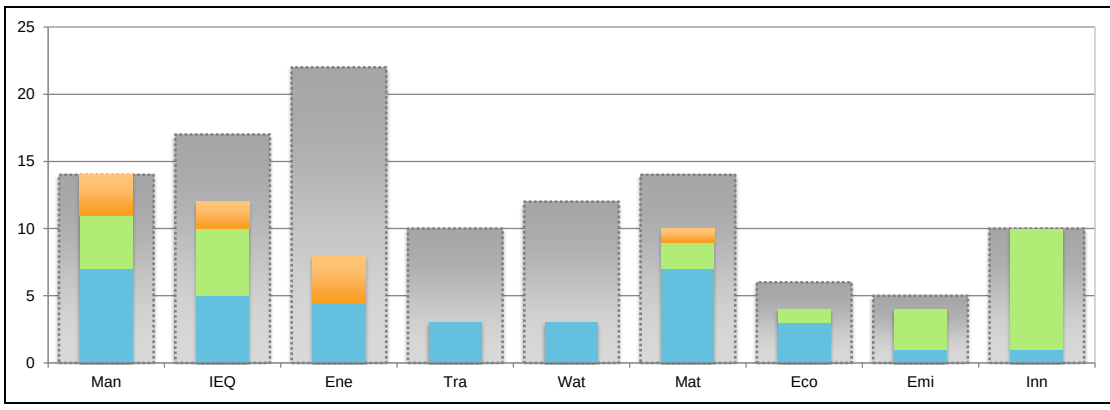
4 Conclusion

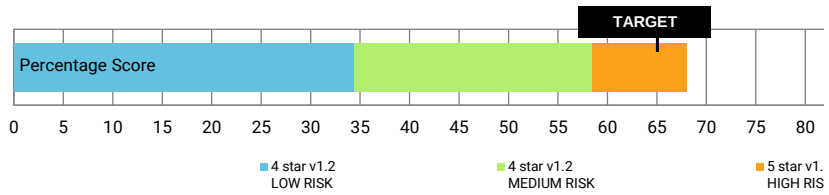
This report details responses to the Department of Planning, Industry and Environment's SEARs for the preparation of an Environmental Impact Statement (EIS) for the proposed redevelopment. The report demonstrates that a myriad of ESD initiatives have been incorporated within the current project design, complies to the NSW HI ESG and Design Guidance Note 058 - ESD, and all the policy requirements under SEAR 6.

Further, the project team has implemented the HI ESD Evaluation tool to demonstrate an equivalent 5-Star Green Star Design & As-Built v1.3 pathway (See Appendix A – HI ESD Evaluation Tool) outlining the relevant initiatives considered to the project. This represent a preliminary pathway that will be tested and refined as the project progresses through its design and construction phases.

Appendix A – HI ESD Evaluation Tool

HI ESD Evaluation Tool - Nepean Hospital Stage 2 Redevelopment



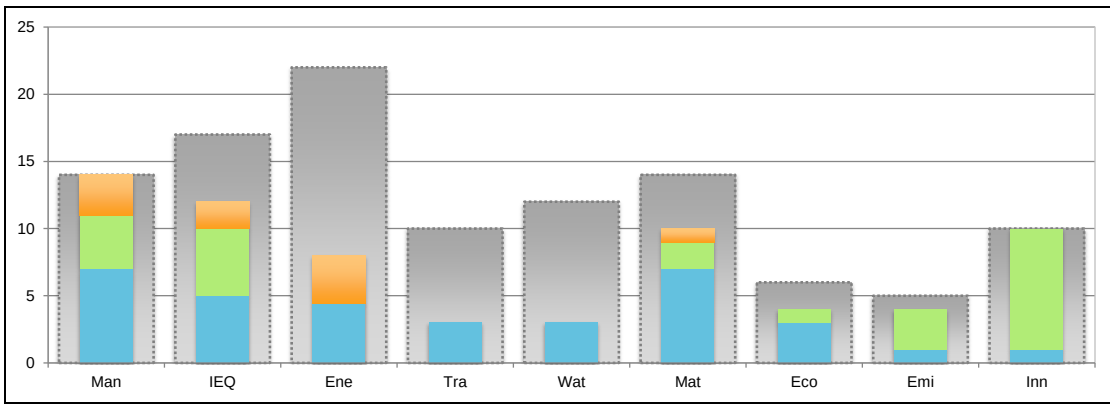


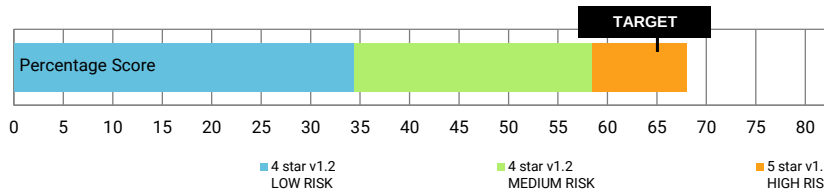
TOTAL TARGETED	68.0

4 Star: 45 to 59 Points, **5 Star:** 60 to 74 Points, **6 Star:** 75+ Points

Credit Title	Aim of Credit	Credit Code	Criteria Title	Credit Requirements Summary *For full criteria refer to Green Star Design and As Built v1.1 and v1.3 Submission Guidelines*	Points Available	4 star v1.2 LOW RISK	4 star v1.2 MEDIUM RISK	5 star v1.2 HIGH RISK	Notes
MANAGEMENT									
Accredited Professional	To recognise the appointment and active involvement of a Green Star Accredited Professional in order to ensure that the rating tool is applied effectively and as intended.	1.1	Accredited Professional	Contractual engagement of GSAP at all stages of the project from schematic design through to practical completion and certification	1	1			
Commissioning and Tuning	To encourage and recognise commissioning, handover and tuning initiatives that ensure all building services operate to their full potential.	2.0	Environmental Performance Targets	Minimum Credit Requirement: Documented targets for the environmental performance of the project to be set through a design intent report or an owner's project requirements document	Credit Minimum	Will Comply			
		2.1	Services & Maintainability Review	Comprehensive services and maintainability review of the project led by the head contractor or owner's representative (e.g. ICA) during the design stage and prior to construction	1	1			
		2.2	Building Commissioning	Comprehensive pre-commissioning and commissioning activities are performed for all building services according to AIRAH/CIBSE codes for all services or ASHRAE for mechanical services only. Air permeability test to be carried out in accordance with AS/NZS ISO 9972:2015.	1			1	
		2.3	Building Systems Tuning	Tuning process in place requiring, as a minimum, quarterly adjustments and measurements for the first 12 months after occupancy and review of building system manufacturer warranties. Tuning process requires analysis of monitoring system data and assessment of occupant feedback on building conditions.	1	1			
		2.4	Independent Commissioning Agent (ICA)	Engagement of an ICA to advise, monitor, and verify the commissioning and tuning of all building systems	1			1	HI/LHD confirmation of ICA engagement required
Adaptation and Resilience	To encourage and recognise projects that are resilient to the impacts of a changing climate and natural disasters.	3.1	Climate Adaption Plan	Implementation of a Climate Adaption Plan according to AS5334:2013 or ISO31000-2009 & AGO, Climate Change Risks and Impacts	2		2		CAP responses required (only mech received)
Building Information	To recognise the development and provision of building information that facilitates understanding of a building's systems, operation and maintenance requirements, and environmental targets to enable the optimised performance.	4.1	Building Operations & Maintenance Information	Produce comprehensive Building Operation and Maintenance information made available to Facilities Management team. Relevant and current building user information is developed and made avaialble to all relvant stakeholders.	1		1		
Commitment to Performance	To recognise practices that encourage building owners, building occupants and facilities management teams to set targets and monitor environmental performance in a collaborative way.	5.1	Environmental Building Performance	Commitment to set performance targets for 80% of the Gross Floor Area (GFA) to measure, and report on at least two environmental building performance metrics such as GHG emissions, potable water usage, operational waste etc. OR achieve certified operational performance ratings in accordance with Green Star.	1	1			
		5.2	End of Life Waste Performance	Commitment to reduce demolition waste at the end of life of an interior fit out or base building component for at least 80% of the GFA	1			1	HI/LHD commitment to long term fitouts required
Metering and Monitoring	To recognise the implementation of effective energy and water metering and monitoring systems.	6.0	Metering	Minimum Credit Requirement: Provide accessible metering to all energy and water consumption covering common and major uses and sources for distinct uses or floors (whichever is smaller). Energy items >100kVA must be individually metered. Meters are to be commissioned and validated as per NABERS protocol.	Credit Minimum	Will Comply			
		6.1	Monitoring Systems	Implementation of a monitoring strategy in accordance with a recognised standard (e.g. CIBSE TM39 Building Energy Metering), capable of capturing and processing data from all energy and water meters, and accurately and clearly presenting data consumption trends.	1	1			
Responsible Construction Practices	To reward responsible construction practices that manage environmental impacts, enhance staff health and wellbeing, and improve sustainability knowledge on site.	7.0	Environmental Management Plan (EMP)	Minimum Credit Requirement: Engaged Contractor must implement a project specific EMP meeting requirements of the NSW Environmental Management System Guidelines.	Credit Minimum	Complies			
		7.1	Formalised Environmental Management System	Engaged Contractor to have a Formalised Environmental Management System with evidence of independent auditing & system compliance to ISO 14001.	1	1			
		7.2	High Quality Staff Support	Promote positive mental and physical health outcomes of site activities and culture of site workers through programs and solution on-site. Enhance site workers' knopwledge on sustainable practices through on-site, off-site, online education programs	1	1			
Operational Waste	To recognise projects that implement waste management plans that facilitate the re-use, upcycling, or conversion of waste into energy, and stewardship of items to reduce the quantity of outgoing waste.	8A	Performance Pathway: Specialist Plan	Engagement of a qualified waste auditor/professional specialist to prepare and implement an Operational Waste Management Plan (OWMP) for the project in accordance with best practice approaches. Requirements of the OWMP must be reflected in the development waste facilities provided.	1		1		HI/LHD confirmation required.
		8B	Prescriptive Pathway: Facilities	Provide occupant waste storage containers for separation of all applicable waste streams, have a dedicated waste storage area for collection of all waste sized to handle all waste streams that is provided to meet best practice access requirements.	-				
				Category Total	**14**	**7**	**4**	**3**	

HI ESD Evaluation Tool - Nepean Hospital Stage 2 Redevelopment





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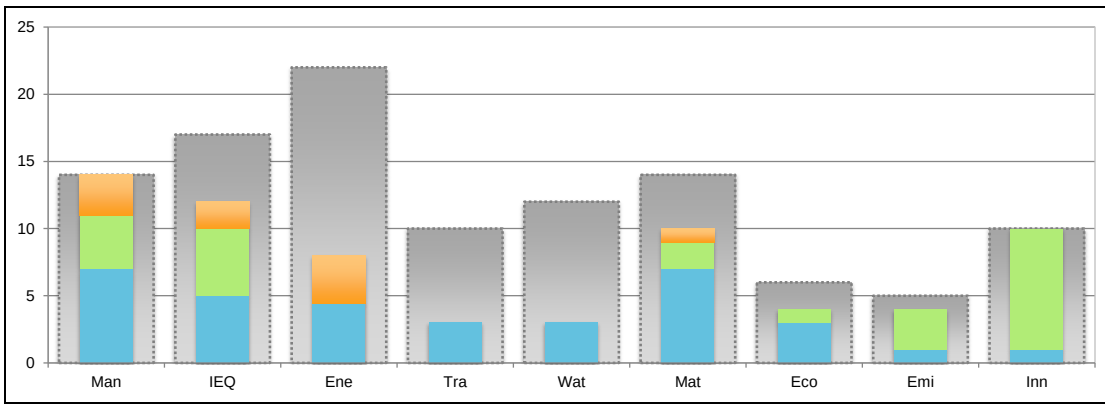
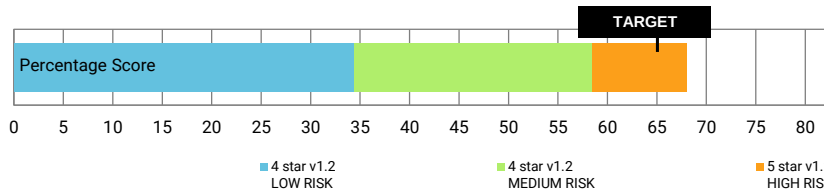
INDOOR ENVIRONMENT QUALITY									
Indoor Air Quality	To recognise projects that provide high indoor air quality to occupants.	9.1	Ventilation System Attributes	Mechanical ventilation systems are to be: - designed in accordance with ASHRAE Standard 62.1:2013 regarding separation of outdoor air intakes & pollution sources to minimise entry of pollutants; - designed with provision of access for maintenance and cleaning to both sides of all moisture and debris-catching components; and - cleaned prior to occupation and use, covering all new and existing ductwork.	1	1			
		9.2	Provision of Outdoor Air	For mechanically ventilated or mix mode spaces, outdoor air is provided at a rate 50%(1 point) /100% (2 points) greater than the minimum required by AS1668.2-2012, or CO2 concentrations are maintained below 800ppm/700ppm through a CO2 monitoring & control system For naturally ventilated spaces 2 points are awarded where the requirements if AS 1668.4-2012 are met.	2				unlikely. Removed
		9.3	Exhaust OR Elimination of Pollutants	Provide exhaust systems in accordance with AS1668.2-2012 to remove pollutants from printing and photocopy equipment, cooking processes and equipment, and vehicle exhaust AND/OR remove the source of these pollutants.	1		1		HI/LHD input required to confirm purchase of low-emission photocopiers/printers
Acoustic Comfort	To reward projects that provide appropriate and comfortable acoustic conditions for occupants.	10.1	Internal Noise Levels	Internal noise levels in the nominated area considering all internal & external noise sources are to be no more than 5dB(A) above the "satisfactory" sound levels listed in AS/NZS 2107:2016	1		1		
		10.2	Reverberation	The reverberation time in the nominated area must be below the maximum stated in AS/NZS 2107:2016	1		1		
		10.3	Acoustic Separation	The partition between the nominated enclosed (typically occupied) spaces should be constructed to achieve a weighted sound reduction index (Rw) of at least 45 OR the sound insulation between enclosed spaces complies with DW + LAeqT > 75	1		1		
Lighting Comfort	To encourage and recognise well-lit spaces that provide a high degree of comfort to users.	11.0	Minimum Lighting Comfort	Minimum Credit Requirement: All lights in the nominated area are installed with ballasts (flicker free) and have a minimum Colour Rendering Index (CRI) of 80	Credit Minimum	Will Comply			
		11.1	General Illuminance & Glare Reduction	Maintained illuminance meets the recommended levels of AS1680.2, and lighting glare is eliminated.	1	1			
		11.2	Surface Illuminance	A combination of lighting and surfaces in the nominated area improve uniformity of lighting to give visual interest. Over 95% of nominated area's ceiling to have an surface reflectance value >0.75 and a lighting system to provide an average surface illuminance of at least 30% of the lighting levels on the working plane.	1				
		11.3	Localised Lighting Control	Occupants have the ability to control the lighting in their immediate environment including on/off switching and adjusting lighting levels.	1		1		
Visual Comfort	To recognise the delivery of well-lit spaces that provide high levels of visual comfort to building occupants.	12.0	Glare Reduction	Minimum Credit Requirement: Demonstrate that glare from sunlight through the viewing facades in the nominated area is reduced through a combination of blinds, screens, fixed devices, or other means. Where the functional requirements of an are require the exclusion of daylight and views, these areas may be excluded.	Credit Minimum	Will Comply			
		12.1	Daylight	At least 40% or 60% of the nominated area must demonstrate a daylight factor (DF) of 2%.	2			1	High risk due to size of windows.
		12.2	Views	At least 60% of the nominated area has a clear line of sight to an external view or a high quality internal view. Floor area within 8m from a compliant window, atrium or view can be considered to meet the criteria.	1			1	High risk due to location of many offices & clinical support deep within building.
Indoor Pollutants	To recognise projects that safeguard occupant health through the reduction in internal air pollutant levels.	13.1	Paints, Adhesives, Sealants & Carpets	At least 95% of all internally applied paints, adhesives, sealants and carpets meet the stipulated 'T-VOC limits'	1	1			
		13.2	Engineered Wood Products	Engineered Wood Products: At least 95% of all engineered wood products meet the stipulated formaldehyde limits	1	1			
Thermal Comfort	To recognise projects that achieve high levels of thermal comfort.	14.1	Thermal Comfort	For mechanically ventilated spaces, Predicted Mean Vote (PMV) levels of ± 1.0 must be achieved	1	1			
		14.2	Advanced Thermal Comfort	For mechanically ventilated spaces, Predicted Mean Vote (PMV) levels of ± 0.5 must be achieved	1			tbc	
				Category Total	**17**	**5**	**5**	**2**	
ENERGY									
Greenhouse Gas Emissions | 15E GHG Emissions Reduction - Modelled Performance	To encourage the reduction of greenhouse gas (GHG) emissions associated with the use of energy in building operations.	15E.0	Conditional Requirement	v1.3 Conditional Requirement - Proposed Building achieves 10% improvement on NCC 2019-Section J Reference Building (Benchmark Building)	Conditional	Will Comply			
		15E.1	Intermediate Building Improvement	Intermediate Building improvement over Reference Building v1.3 (NCC 2019-Section J, Part J1) - sliding scale 0-20%	4	1.0			
		15E.2	Proposed Building Improvement	Proposed Building improvement over Benchmark Building v1.3 (NCC 2019-Section J, Part, J1, J2, J5-J6) - sliding scale 10-100%	16	2.4			
		15E.3	Off-Site Renewables	Commit to procuring 100% off-site renewable electricity for a minimum period of ten years.				3.6	LHD/HI input required
		15E.4	District Services	Rewards buildings that connect to low-carbon energt sources at a utility-scale					
Peak Electricity Demand Reduction	To encourage the reduction of peak demand load on the electricity network infrastructure.	16A	Prescriptive Pathway: On-site Energy Generation	The use of on-site electricity generation systems reduces the total peak electricity demand by at least 15% (1 point)	-				
		16B	Modelled Performance Pathway: Reference Building	Improvement in Proposed Building Peak Electricity Demand over Reference Building Peak Electricity Demand v1.3 - sliding scale 10-30%	2	1.0			
				Category Total	**22**	**4.4**	**0**	**4**	

HI ESD Evaluation Tool - Nepean Hospital Stage 2 Redevelopment





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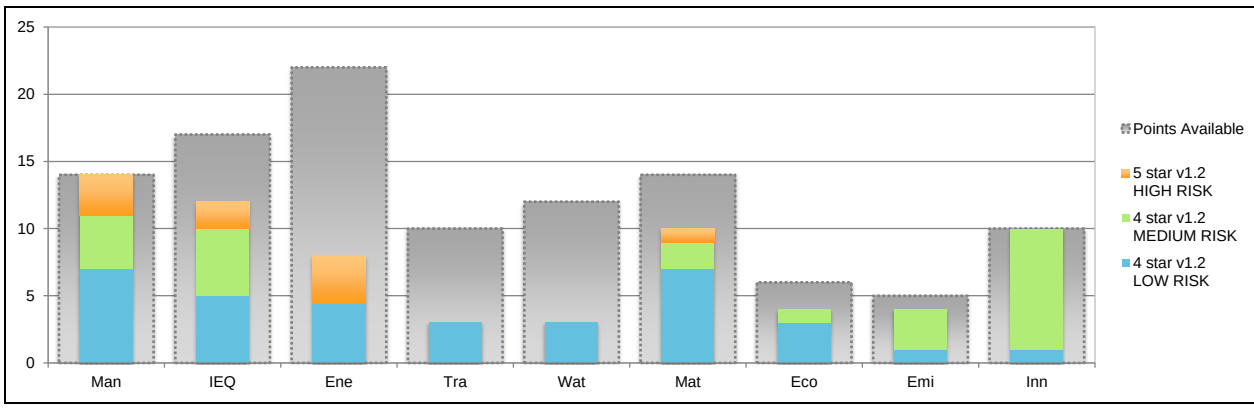
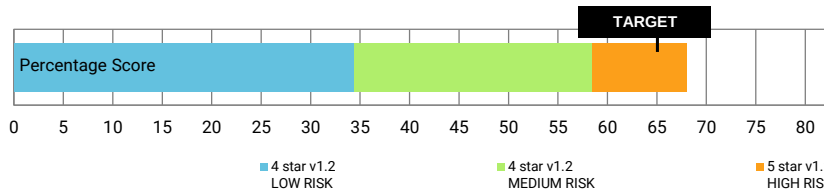
TRANSPORT									
Sustainable Transport	To reward projects that implement design and operational measures that reduce the carbon emissions arising from occupant travel to and from the project, when compared to a benchmark building. This also promotes the health and fitness of commuters, and the increased liveability of the location.	17A	Performance Pathway	Up to 10 points are awarded where the proposed transport solutions on site decrease emissions from transport, decrease mental and social impacts of commuting, and encourage uptake of healthier active transport options based on comparison to a Reference Building.	10	3			
		17B.1	Prescriptive Pathway	B.1 Access by Public Transport (up to 3 points) - Points are awarded based on the accessibility of the site by public transport	-				
		17B.2		B.2 Reduced Car Parking Provision (1 point) - Reduction of car parking spaces for the proposed building compared to maximum rates allowed	-				
		17B.3		B.3 Low Emission Vehicle Infrastructure (1 point) - 15% of parking is for fuel efficient vehicles and a maximum of 5% for motorcycle parking OR dedicated car share spaces and vehicles are provided at the rate of 1 per 70 building occupants	-				
		17B.4		B.4 Active Transport Facilities (1 point) - Provision of bicycle parking (occupants and visitor) and associated facilities (showers & lockers)	-				
		17B.5		B.5 Walkable Neighbourhoods (1 point) - At least 8 amenities are within 400m of the development; OR achieve a walk score of at least 80	-				
				Category Total	**10**	**3**	**0**	**0**	
WATER									
Potable Water	To encourage building design that minimises potable water consumption in operations.	18A	Performance Pathway	Up to 12 points are awarded for predicted reduction in potable water use across all building uses when compared to a Reference Building.	12	0			
		18B.1	Prescriptive Pathway	B.1 Sanitary Fixture Efficiency (1 point) - WELS Ratings of 6 Star for Taps/Urinals, 5 Star for Toilets, 3 Star (≤6l/min) for Showers.	-	1			
		18B.2	Prescriptive Pathway	B.2 Rainwater Reuse (1 point) - Rainwater collection & on-site reuse system incorporating a tank sized to 10L/m2.	-				
		18B.3	Prescriptive Pathway	B.3 Heat Rejection (2 points) - No water consumption used for heat rejection equipment.	-				
		18B.4	Prescriptive Pathway	B.4 Landscape Irrigation (1 point) - Drip irrigation system with moisture sensor override is used OR no potable water is used for irrigation.	-	1			
		18B.5	Prescriptive Pathway	B.5 Fire System Test Water (1 point) - No water is expelled for system testing OR 80% of test water is captured & reused on-site	-	1			
				Category Total	**12**	**3**	**0**	**0**	
MATERIALS									
Life Cycle Impacts	Conduct a whole building life cycle assessment (LCA) for the project building and a reference building that demonstrates the reduction of environmental impacts. Points are awarded based on the extent of environmental impact reduction achieved against nominated environmental impacts categories.	19A.1	Comparative Life Cycle Assessment	Up to 6 points are awarded based on the extent of environmental impact reduction achieved under six environmental impacts categories compared against a Reference Building using a Life Cycle Assessment (LCA) (sliding scale 0 to 6 points for 30%-130% impact reduction)	6	3	1		LHD/HI confirmation to carry out LCA required.
		19A.2	Additional Life Cycle Impact Reporting	An additional point is awarded where the LCA is used to inform building design process or as-built outcome	4	1			as above
		19B.1	Concrete	*Portland Cement Reduction* - Portland cement content is reduced by 30% OR 40% across all concrete used in the project against a reference case (1 OR 2 points) *Water Reduction* - Mix water for all concrete used contains at least 50% captured or reclaimed water (0.5 points) *Aggregates Reduction* - At least 40% of coarse aggregate in the concrete is crushed slag aggregate or another alternative material, OR at least 25% of fine aggregate sand in the concrete are manufactured sand or other alternative material (0.5 points)	3				
		19B.2	Steel	Steel Framed Building - *Reduced Mass of Steel Framing* - Reduce the mass of steel framing used by one of the following options (1 point): - Using high strength steel that meet specific strength grades for usage type; OR - Reduce mass of steel by 5% when compared to a suitable reference building. Concrete Framed Building - *Reduced Use of Steel Reinforcement* - Reduce the mass of steel reinforcement used by at least 5% when compared to a standard practice building (1 point)	1				
		19B.3	Building Reuse	*Façade Reuse* - At least 50% OR 80% of the building facade is retained (1 OR 2 points) *Structure Reuse* - At least 30% OR 60% of the existing major structure is retained (1 OR 2 points)	4				
		19B.4	Structural Timber	Minimum Requirement: All structural timber is responsibly sourced. Points are awarded where the building is constructed from structural timber - 30 / 70 / 90% of the building's GFA = 1 / 2 / 3 points.	3				
Responsible Building Materials	To reward projects that include building materials that are responsibly sourced or have a sustainable supply chain.	20.1	Structural and Reinforcing Steel	95% of the building steel is sourced from a Responsible Steel Maker; and - *For steel framed buildings:* at least 60% of the fabricated structural steelwork is supplied by a steel fabricator accredited to the Australian Steel Institute; OR - *For concrete framed buildings* : at least 60% of all reinforcing bar and mesh is produced using energy-reducing processes	1	1			
		20.2	Timber Products	At least 95% (by cost) of all timber used is certified by a forest certification scheme OR is from a reused source	1	1			
		20.3	Permanent Formwork, Pipes, Flooring, Blinds & Cables	At least 90% (by cost) of all permanent formwork, cables, pipes, flooring and blinds do not contain PVC and have an Environmental Product Declaration (EPD) OR meet Best Practice Guidelines for PVC	1	1			
Sustainable Products	To encourage sustainability and transparency in product specification.	21	Product Transparency	Points are awarded via the Product Transparency & Sustainability Calculator where the Product Sustainability Value (PSV) achieves a percentage of the Product Contract Value (PCV) - 3 / 6 / 9% = 1 / 2 / 3 points. PSV is contributed to for products that; have reused content, have recycled content, are environmentally certified or have stewardship programs.	3			1	
Construction and Demolition Waste	To reward projects that reduce construction waste going to landfill by reusing or recycling building materials.	22.0	Reporting Accuracy	Waste contractors and waste processing facilities serving the project demonstrate compliance	Credit Minimum		Will Comply		
		22A	Fixed Benchmark	Minimising the total amount of waste sent to landfill when compated against a typical building					
		22B	Percentage Benchmark	Percentage Benchmark: 90% of the waste generated during construction and demolition has been diverted from landfill	1		1		
				Category Total	**14**	**7**	**2**	**1**	

HI ESD Evaluation Tool - Nepean Hospital Stage 2 Redevelopment



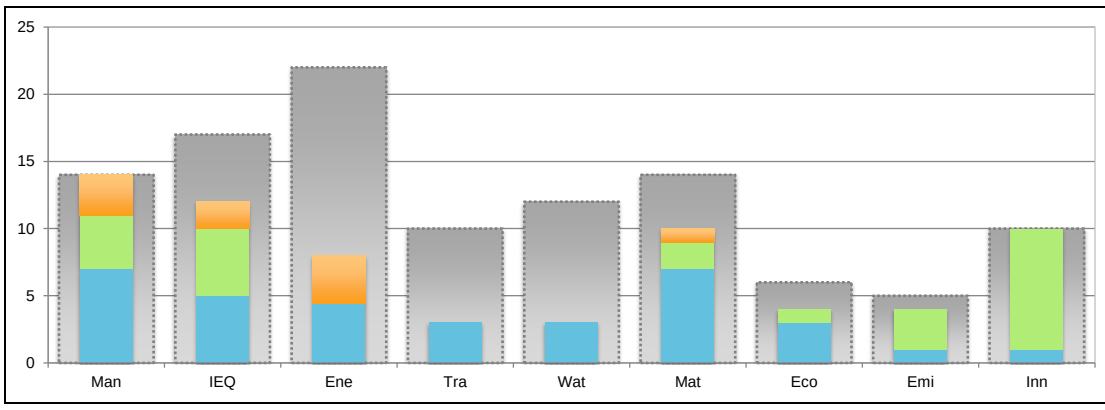


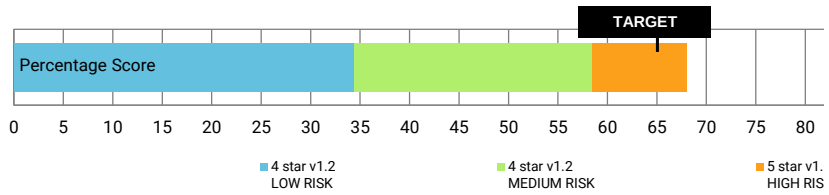
TOTAL TARGETED	68.0

4 Star: 45 to 59 Points, **5 Star:** 60 to 74 Points, **6 Star:** 75+ Points

Credit Title	Aim of Credit	Credit Code	Criteria Title	Credit Requirements Summary *For full criteria refer to Green Star Design and As Built v1.1 and v1.3 Submission Guidelines*	Points Available	4 star v1.2 LOW RISK	4 star v1.2 MEDIUM RISK	5 star v1.2 HIGH RISK	Notes
LAND USE & ECOLOGY									
Ecological Value	To reward projects that improve the ecological value of their site.	23.0	Endangered, Threatened or Vulnerable Species	Minimum Credit Requirement: Demonstrate no critically endangered, endangered, vulnerable species or ecological communities were present on the site at the time of purchase.	Credit Minimum	Will Comply			
		23.1	Ecological Value	Points are awarded based on the relative improvement of ecological value by 0.01/ 0.10 / 0.20 (1 / 2 / 3 points)	3	1			Calculator to be filled
Sustainable Sites	To reward projects that choose to develop sites that have limited ecological value, that reuse previously developed land, and that remediate contaminated land.	24.0	Sustainable Sites - Conditional Requirement	The site did not include old growth forest or wetland of 'High National Importance', or did not impact on 'Matters of National Significance'	Conditional	Will Comply			
		24.1	Reuse of Land	At least 75% of the site was previously developed land	1	1			
		24.2	Contamination and Hazardous Materials	Any significant site contamination is identified with remedial steps undertaken to decontaminate site prior to construction	1	1			
Heat Island Effect	To encourage and recognise projects that reduce the contribution of the project site to the 'heat island effect'.	25	Heat Island effect	At least 75% of the whole site area to comprise of one of a combination of: - Vegetation; - Green roofs; - Roofing material with high solar reflectance index (initial SRI>82 or 3yr SRI>64); - Water bodies; and - Hard-scaping elements shaded by overhanging vegetation or roof - Unshaded hard-scape with high SRI (initial SRI>39 or 3yr SRI>34).	1		1		Calculator to be filled
				Category Total	**6**	**3**	**1**	**0**	
EMISSIONS									
Stormwater	To reward projects that minimise peak storm water outflows from the site and reduce pollutants entering the public sewer infrastructure.	26.1	Stormwater Peak Discharge	Demonstrate a reduction in peak sewer discharge comparing pre-development to post-development discharge	1	1			
		26.2	Stormwater Pollution Targets	Stormwater discharged from the site must meet the following Pollution Reduction Targets: - Total Suspended Solids (TSS) - 80% - Gross Pollutants - 85% - Total Nitrogen (TN) - 30% - Total Phosphorus (TP) - 30% - Total Petroleum Hydrocarbons - 60% (Not applicable) - Free Oils - 90% (Not applicable)	1		1		
Light Pollution	To reward projects that minimise light pollution arising from external lighting.	27.0	Light Pollution Neighbouring Properties	Minimum Credit Requirement: Light Pollution to Neighbouring Properties: All outdoor lighting must comply with AS4282:1997	Credit Minimum		Will Comply		
		27.1	Light Pollution Night Sky	Light Pollution to Night Sky: No external luminaire has a Upward Light Output Ratio (ULOR) that exceeds 5%; OR External luminaries produces a maximum initial point illuminance value of no greater than 0.5 Lux to the site boundary and 0.1Lux to 4.5m beyond the site into the night sky	1		1		
Microbial Control	To recognise projects that implement systems to minimise the impacts associated with harmful microbes in building cooling systems.	28	Microbial control	Demonstrate the building is: - naturally ventilated; or - has waterless heat rejection systems; or - has water-based heat rejection systems that includes measures for Legionella control and Risk Management (1 point)	1				
Refrigerant Impacts	To encourage practices that minimise the environmental impacts of refrigeration equipment.	29	Refrigerants	1 Point is awarded for achieving 1 of the following: - The combined Total System Direct Environmental Impact (TSDEI) of the refrigerant is less than 15; - The combined TSDEI of the refrigerant is between 15 and 35, AND a leak detection system with automated recovery covering plant >50kWr; - All refrigerants used have a zero Ozone Depletion Potential (ODP); AND a Global Warming Potential (GWP) of 10 or less; OR - No refrigerants are used	1		1		
				Category Total	**5**	**1**	**3**	**0**	
				BASE TOTAL POINTS	***100***	**33.4**	**15.0**	**10**	

HI ESD Evaluation Tool - Nepean Hospital Stage 2 Redevelopment





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INNOVATION									
Innovative Technology or Process	The project meets the aims of an existing credit using a technology or process that is considered innovative in Australia or the world	30A			10				
			Heat rejection systems in equipment requiring process cooling	One (1) Innovation point is available where water use from process cooling in medical, laboratory, or industrial equipment, is at least 10% of the building's total water consumption. In such a case, an innovation point can be achieved if: -95% of the water requirement for once-through cooling of equipment requiring process cooling is sourced from non-potable water; OR -All equipment requiring process cooling uses cooling systems other than once-through cooling systems This innovation point is deemed 'Not Applicable' where the project does not contain equipment requiring process cooling					
			Passive Design	Projects that use of passive water treatment systems (such as vegetation to treat water passively) to achieve at least one point in the potable water calculator.					
		30A.1	Microbial Control in Hot Water Systems	A project team may claim an Innovation point where it is demonstrated that hot water systems have also been designed to manage the risk of microbial contamination. This may be done in association with operational practices that are to be implemented, as long as there are also design features that facilitate the achievement of the aim of the credit. Project teams must contact the Green Building Council of Australia prior to claiming this Innovation Challenge, as compliance requirements have to be developed in collaboration with the project team.		1			
		30A.2	On-site renewable energy	Up to two (2) points awarded for installation of on-site renewable energy sources.				tbc	PV feasibility TBC
		30A.3	Process Cooling Water	One (1) point awarded where water used to cool medical or laboratory equipment are either: - 95% of single-pass cooling water are sourced from non-potable water; or - are used in cooling systems other than single-pass cooling systems.			1		
Market Transformation	The project has undertaken a sustainability initiative that substantially contributes to the broader market transformation towards sustainable development in Australia or the world	30B							
		30C.1	Stormwater Pollution Targets	One (1) point is awarded where the project meets the following targets for stormwater pollutants: - Toal Suspended Solids = 80% - Gross Pollutants = 90% - Total Nitrogen = 45% - Total Phosphorus = 60% Two (2) points are awarded if: - Total Suspended Solids = 90% - Gross Pollutants = 95% - Total Nitrogen = 60% - Total Phosphorus = 70%			1		
		30C.2	Ultra Low VOC	One (1) point may be awarded where over 50% of paints (by volume) specified in the building have a maximum TVOC content of 5g/L. This must be verified by one of the approved paint test methods.			1		
		30C.3	Financial Transparency	Project to disclose costs associated with Green Star for both implementation and documentation. Cost breakdown per credit required.			1		
		30C.4	Mattresses	One (1) pont awarded where 95% of all mattresses that are to be supplied to the building meet the GreenGuard emission criteria for bedding.			1		LHD/HI input required on procurement
		30D.1	High Performance Site Offices	Site sheds to achieve 75% of the initiatives in the High Performance Site Office Checklist . Initiatives cover Energy, IEQ, Materials and Water.			1		
		30D.2	Occupant Engagement	One (1) points may be awarded where the following have proven to be performed: - pre occupancy survey on staff or occupants - post occupancy on significant proportion of occupants between 6-12 months after practical completion. The applicant must also commit to providing the results upon completion with the GBCA			1		LHD/HI input required
		30D.3	Reconciliation Action Plan (RAP)	Aboriginal Participation targets (APIC) and contributing to RAP targets.			1		
		30D.4	Incorporation of Indigenous Design	Follow four principles from Australian Indigenous Design Charter: Indigenous Led, Community Specific, Impact of Design, Shared Knowledge (Collaboration, Co-creation, Procurement)			1		new credit
		30D.5	Stakeholder Engagement	Utilise credit from Communities Rating Scheme					
Global Sustainability	Project teams may adopt an approved credit from a Global Green Building Rating tool that addresses a sustainability issue that is currently outside the scope of the Green Star Design & As-Built tool	30E							
				Category Total	**10**	**1**	**9**	**0**	

Environmental Category	Points Available	4 star v1.2 LOW RISK	4 star v1.2 MEDIUM RISK	5 star v1.2 HIGH RISK	Points Not Targeted
Management	14	7	4	3	0
IEQ	17	5	5	2	5
Energy	22	4.4	0.0	3.6	14
Transport	10	3	0	0	7
Water	12	3	0	0	9
Materials	14	7	2	1	4
Land Use & Ecology	6	3	1	0	2
Emissions	5	1	3	0	1
TOTAL POINTS	**100**	**33.4**	**15.0**	**10**	
SUB-TOTAL PERCENTAGE SCORE	**100**	**33.4**	**15.0**	**10**	
BASE TOTAL PERCENTAGE SCORE		***33.4***	***15.0***	***9.6***	
Innovation	10	**1**	**9**	**0**	0
TOTAL PERCENTAGE SCORE (Including Innovation)		***34.4***	***24.0***	***9.6***	
***4 Star** - 45 to 59.9 score | **5 Star** - 60 to 74.9 score | **6 Star** - 75+ score*					