SJOG Richmond Hospital

Ecologically Sustainable Development Report

Prepared for: St John of God c/- STH

Attention: Brent Railton

Date: 26/11/2020

Prepared by: Joseph Caparrotta

Ref: 301343762

Stantec Australia Pty Ltd
Level 6, Building B, 207 Pacific Highway, St Leonards NSW 2065
Tel: +61 2 8484 7000 Web: www.stantec.com

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Revision

Revision	Date	Comment	Prepared By	Approved By
1	26/11/2020	SSDA Preliminary Issue	JOC	JOC

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1. Executive Summary

This Ecological Sustainable Development Report has been prepared on behalf of St John of God Health Care c/- Silver Thomas Hanley for the proposed upgrade of St John of God Hospital, located at 177 Grose Vale Road, North Richmond, NSW 2754.

This report provides an overview of the proposed Ecologically Sustainable Development (ESD) principles and sustainability initiatives to be included within the project and is intended to form the basis of the ESD response as part of the Environmental Impact Statement (EIS) for the upcoming State Significant Development Application.

Information contained within this report has been prepared with consideration for:

- Secretary's Environmental Assessment Requirements (SEARs) for the proposed development;
- Hawkesbury City Council Development Control Plan 2002;
- Hawkesbury Local Environment Plan 2012;
- NCC 2019 Section J; and

The building will be designed to a level that the building could be benchmarked to achieve a 4 Star Green Star rating.

In coordination with the above, the project will implement several sustainable design principles and includes initiatives designed to mitigate the environmental impact of the following:

- Energy – including improved energy efficiency across the buildings and its associated sources.
- Water Efficiency – including reduced potable water demand and improved stormwater quality.
- Materiality – considering the whole of life impact of materials and considering their retention and selection to minimise harm to the environment, including efficiency and construction.
- Quality – Building high quality, high performing buildings to increase its service life, in turn alleviating redevelopment

The following sections detail the development's specific sustainable design response in more detail.

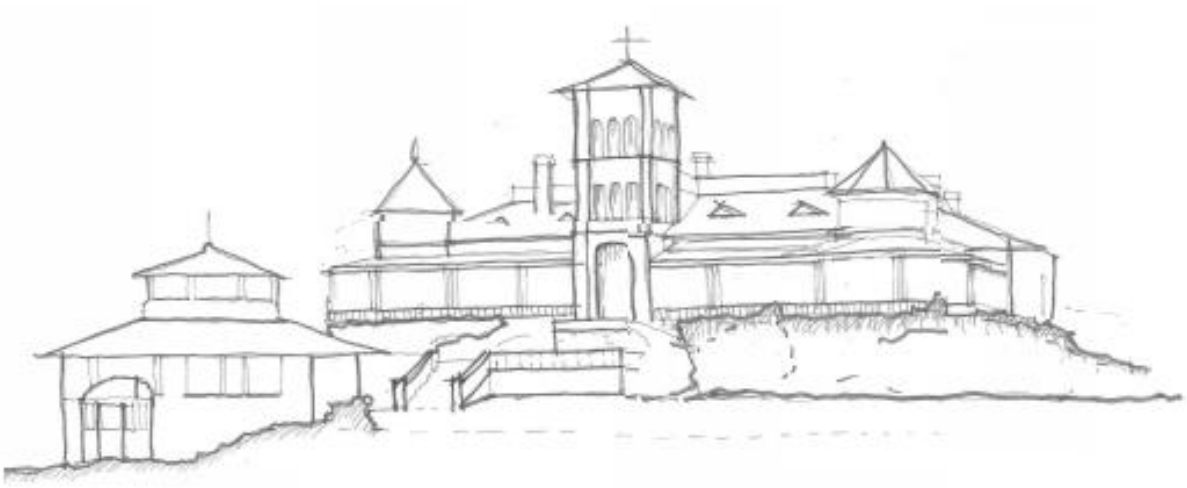


Figure 1 – St John of God Hospital Richmond, illustration – STH Draft SD Report

2. Introduction

This report supports a State Significant Development (SSD) Development Application (DA) for the expansion and redevelopment of St John of God (SJG) Richmond Hospital, which is submitted to the Department of Planning, Industry and Environment (DPIE) pursuant to Part 4 of the *Environmental Planning and Assessment Act 1979* (the Act). St John of God Health Care (SJGHC) is the proponent of the SSD DA.

2.1 Background

SJG Richmond Hospital has a contract with The Australian Government Department of Veterans' Affairs to deliver care to veterans with Trauma and Stressors Related Disorders. SJG Richmond Hospital's current physical environment now fails to support contemporary models of clinical care; is, for the most part, past its expected lifespan; and is significantly out of step with both patient expectations and competitor standards of a mental health clinic care environment.

Consequently, SJGHC has proposed a complete redevelopment of the site. The redevelopment will involve rebuilding the inpatient areas and remodelling selected existing buildings to accommodate outpatient and other selected services.

Further to the historical buildings, Richmond Hill is of significant Aboriginal heritage. The site was once an Aboriginal meeting ground and in 1795 many Burruberongal people were killed there as part of a series of confrontations between Europeans and the local people.

2.2 Site Description

The site is located at 177 Grose Vale Road, North Richmond, within Richmond LGA and approximately 15km north of Penrith City centre. It is flanked by the Hawkesbury river to the east and surrounded by pastureland and sporadic residential living. Located on Richmond Hill,

Existing development on the site includes "Belmont House" with two wings and decommissioned operating theatres, 24 bed accommodation for Post Traumatic Stress Disorder Patients (PTSD) and a 10-bed transition accommodation, "the Lodge", and three accommodations for patient family short stay accommodation.

The site at 177 Grose Vale Road comprises 2 lots, lot 11 and lot 12. The proposed redevelopment is located on lot 11 which has total area of approximately 97,700m^2.

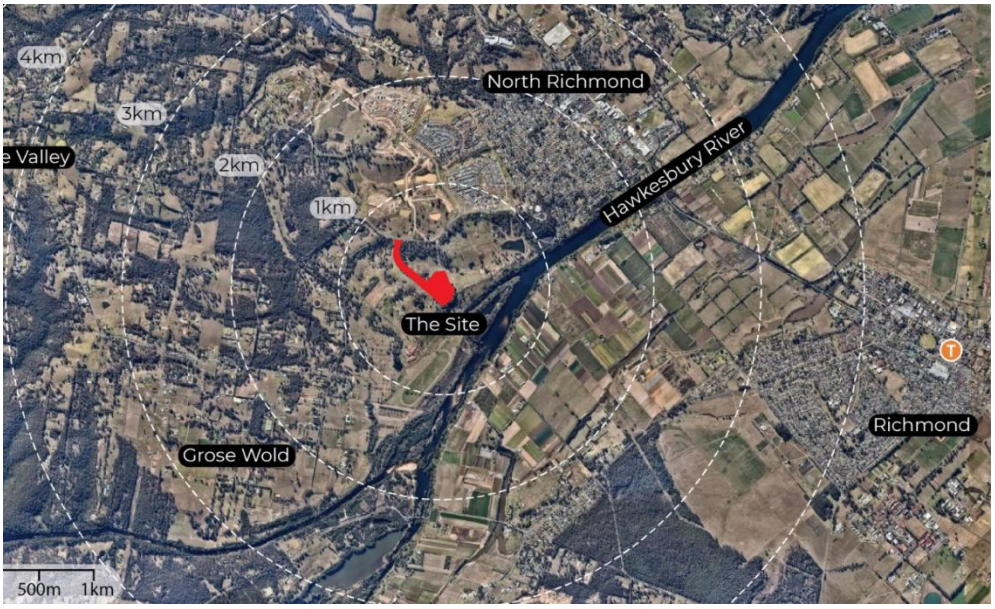


Figure 2 - Site Context, *Source: https://www.planningportal.nsw.gov.au/major-projects/project/25876*

2.3 Overview of the Proposed Development

The SSD DA seeks approval for:

- Retention of key buildings including Xavier Building, Admin Building, Belmont House
- Construction of:
  - four pavilions and support areas.
  - café, dining and food services
  - A wellness centre
- Landscaping including the provision of a terrace and open green space

Figure 3 - Site Aerial, Source: Nearmap

2.4 Secretary's Environmental Assessment Requirements

DPIE has issued Secretary's Environmental Assessment Requirements (SEARs) for the proposed development. This report has been prepared having regard to the relevant SEARs as follows:

SEAR	Comment / Reference
8. Ecologically Sustainable Development (ESD)	
Detail how ESD principles (as defined in clause 7(4) of Schedule 2 of the Regulation) will be incorporated in the design and ongoing operation phases of the development.	Refer to Section 4.1 of this report.
Include a framework for 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. 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.	Refer to Section 4.2 of this report.
Include preliminary consideration of building performance and mitigation of climate change, including consideration of Green Star Performance.	Refer to Section 4.2 & Section 4.4 of this report.
Include an assessment against an accredited ESD rating system or an equivalent program of ESD performance. This should include a minimum rating scheme target level.	Refer to Section 4.2 & Section 4.3 of this report.
Provide a statement regarding how the design of the future development is responsive to the CSIRO projected impacts of climate change, specifically: • **hotter days and more frequent heatwave events.** • **extended drought periods.** • **more extreme rainfall events.** • **gustier wind conditions.** • **how these will inform landscape design, material selection and social equity aspects (respite/shelter areas).**	Refer to Section 4.4 of this report.

2.5 Summary of Mitigation Measures

Based on the findings and recommendations of this report, the following measures are suggested to mitigate the identified impacts of the development:

Mitigation Measure
Implement initiatives outlined in Sections 4.3, 4.4 and 4.5 of this report.

2.6 Sustainable Design Initiatives

In pursuit of the ESD design principles, the SJG development will pursue ecological sustainability with drivers from:

- Secretary's Environmental Assessment Requirements (SEARs) for the proposed development;
- Hawkesbury Development Control Plan 2002
- Hawkesbury Local Environment Plan 2012;
- NCC 2019 Section J; and

3. Project Drivers

The following section presents an overview of the applicable drivers for this project.

3.1 SEARS Requirements

DPIE has issued Secretary's Environmental Assessment Requirements (SEARs) for the proposed development. This report has been prepared having regard to the relevant SEARs as follows:

- Detail how **ESD principles** (as defined in clause 7(4) of Schedule 2 of the Regulation) will be incorporated in the design and ongoing operation phases of the development.
- Include a framework for 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. 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.
- Include preliminary consideration of building performance and mitigation of climate change, including **consideration of Green Star Performance**. Include an assessment against an accredited ESD rating system or an equivalent program of ESD performance. This should include a minimum rating scheme target level.
- Provide a statement regarding how the design of the future development is responsive to the CSIRO projected **impacts of climate change**, specifically:
  - hotter days and more frequent heatwave events
  - extended drought periods
  - more extreme rainfall events
  - gustier wind conditions
  - how these will inform landscape design, material selection and social equity aspects (respite/shelter areas).

3.2 NSW Environmental Planning and Assessment Regulation 2000

A requirement of the SEARs is to address ESD principles (as defined in clause 7(4) of Schedule 2 of the Environmental Planning and Assessment Regulation 2000) that will be incorporated in the design and ongoing operation phases of the development.

Schedule 2 7(4) of the Environmental Planning and Assessment Regulation 2000 states:

"The principles of ecologically sustainable development are as follows:

a) 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,

b) 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,

c) conservation of biological diversity and ecological integrity, namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration,

d) 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,

(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."

3.3 Hawkesbury Development Control Plan (DCP) 2002

The Hawkesbury Development Control Plan 2002 has specific objectives around ecologically sustainable design. These objectives are listed in Section 1.4 and include:

b) To promote economically, socially and environmentally sustainable development within the City of Hawkesbury;

h) To promote the Ecologically Sustainable Development (ESD) principles including water sensitive urban design, climate responsive building design, energy efficiency, and selection/use of recycled materials.

3.4 Hawkesbury Local Environmental Plan (LEP) 2012

The Hawkesbury Local Environment Plan has a loose focus around the following ESD aims:

- Protect and enhance the natural environment in Hawkesbury and to encourage ecologically sustainable development.

3.5 NCC Section J – Energy Efficiency

The project will be required to demonstrate compliance with the new provisions outlined within NCC Section J 2019. NCC 2019 method represents a significant overhaul of the previous version of the NCC (2016) with significant amendments to Section J – energy efficiency provisions.

Section J outlines minimum performance requirements including,

- Maximum greenhouse gas emissions (GHG) levels;
- Minimum thermal envelope performance for building elements such as walls, floors, roof and external glazing;
- Treatment of thermal bridging across construction systems;
- Minimum performance requirements for building sealing;
- Maximum lighting power densities for internal lighting design;
- Minimum performance levels for building air-conditioning and ventilation systems;
- Minimum requirements for energy and water metering;
- Minimum requirements for energy and water data collection; and
- Minimum access for maintenance requirements.

The proposed new performance standards for Section J (2019) will increase the thermal performance requirements for code compliant façade designs, meaning consideration must be shown for exposed glazing included within the façade design.

4. Project Design Response

The following sections document the project's response to the ESD requirements outlined in the sections above. It is noted that several the ESD requirements are duplicated within the applicable drivers for this project and the responses below may apply to multiple requirements.

4.1 Principles of Ecologically Sustainable Design

In response to the expected SEARs requirements, the principles of ecologically sustainable development (as documented within the Environmental Planning and Assessment Regulation 2000 are defined within Section 2.3 above. The following provides a direct response to the specific principles a) through d) as follows:

The Precautionary Principle:

There are no threats of serious or irreversible environmental damage as a result of upgrading the SJG Richmond Hospital. The proposed new buildings are to be located on a previously developed sites within an established urban area. As the proposed development is not a greenfield project, the risk of creating environmental damage often associated with building on a greenfield site is considered low. No threatened or endangered species are located on the land due to the previous development of the site.

The proposed development is proposed to carry out predominantly the same use as the current building(s) on the site. Therefore, no serious or irreversible environmental damage is expected due to the operation of the proposed building. Supporting design such as stormwater management, sediment & erosion control, environmental management plan during construction shall all be implemented to ensure the precautionary principle for the proposed development is supported.

Inter-generational equity:

The proposed development conserves inter-generational equity through minimising the consumption of resources whilst providing both an education facility and workplace which will ensure the health and well-being of students, staff and visitors into the future. The project will ensure a lower demand for resources than a standard practice development by introducing several best practice energy and water conservation measures. These initiatives will conserve more resources for future generations, instead of their immediate consumption by the current generation.

As the site is already developed, the existing environment condition is unlikely to be significantly altered. The proposed development shall include new landscaping which will maintain pockets of planted environment like those currently present on the site.

All waste streams will be dealt with in ecologically safe methods; wastewater and stormwater will be plumbed to the sewers or stormwater drains as required by law. In addition, wastewater will be lower for this development compared with a standard practice development as low-flow fixtures and fittings will be used to reduce water consumption throughout the building. Existing services infrastructure upgrades will be documented & included within the project where relevant and connect to the existing major services infrastructure currently serving the site.

Conservation of biological diversity and ecological integrity:

There is limited biological diversity on the current site due to the property being previously developed. As such, the proposed upgrade will have very limited impact on the current level of biological diversity and ecological integrity.

The project will target an improvement in the conservation of resources in comparison to standard development practices. This means that the proposed development is likely to have a smaller gross biological and ecological footprint than other similar projects.

Energy conservation measures will reduce the project's demand for electricity and gas, which will slow or reduce the need for new energy infrastructure in the broader energy markets. This indirectly reduces the land required for new infrastructure, and the pollution caused by electricity generation.

Improved valuation, pricing and incentive mechanisms:

This project will integrate several initiatives which aim to minimise pollution and other undesirable environmental outcomes. Contractors will be requested to provide and abide by an Environmental Management Plan and Environmental Management System which are in accordance with NSW Environmental Management Systems Guidelines or a similar standard. This places a value on environmentally responsible building practices and places a form of "polluter pays" onto the contractors to ensure they are held responsible for the environmental management of the building site as they complete their work.

The Head Contractor shall be required to target 90% recycling of construction waste. This may have a greater financial cost to the project, however it provides a more accurate reflection of the full life cycle costs of the materials which were on the site, and the waste from the new materials as a result of the construction. The increased cost of recycling construction materials will also incentivise the purchase of less materials, thereby reducing over-ordering and material wastage.

The costs of producing the following pollution: sewage, landfill waste, and CO_2 emissions are partially borne by the project team and accounted for in the project's sustainability initiatives. The project has voluntarily elected to:

- improve water consumption efficiency, thereby paying to reduce production of sewage;
- reduce energy consumption, which means solutions to reducing CO_2 emissions will be paid to be investigated during the design phase;
- recycle waste streams in the construction and operation of the project, which will cost more than standard practice where all material waste is directed to landfill.

4.2 Best Practice Sustainable Development Framework – "Green Star Design & As Built"

The SEARs calls for the identification of a framework which reflects 'national best practice sustainable building principles' as a minimum performance requirement. **The project will be designed to a level that will enable the building to be benchmarked against an equivalent 4 Star Green Star building.**

Widely considered as the benchmark environmental assessment tool within the Australian Property Industry, Green Star is an independent accreditation framework which delivers sustainable built outcomes throughout the project lifecycle. Green Star is a credits-based star rating system ranging from one through to six stars.

Green Star assesses the environmental performance of projects in design, construction and operation via the following category frameworks:

- Management
- Indoor Environment Quality
- Energy
- Transport
- Water
- Materials
- Land use & Ecology
- Emissions; and
- Innovation

The evaluation tool most suited to this project is the "Green Star Design & As Built v1.3" tool. This tool has been developed for new buildings and major refurbishments and aligns with the project's NCC 2019 Section J requirement.

A provisional Green Star analysis and matrix demonstrating the projects ability to achieve the minimum 4 Star Green Star performance outcome is included in **Appendix A** of this report. Note, the provisional list of initiatives will be subject to further amendment during project detailed design phase following development approval.

4.3 ESD Opportunities & Initiatives

The following section identifies ESD opportunities and initiatives for consideration on the project. The initiatives are in response to the guidelines outlined in the following project requirements:

- Hawkesbury DCP and LEP

4.3.1 Energy Efficiency

A variety of energy efficiency measures are applicable to the proposed hospital and its individual buildings. These energy efficiency measures shall form the part of the final design and operation of the spaces. The final strategy will always be a combination of sustainability, operational feasibility, architectural intent and site-specific appropriateness.

The energy efficiency strategy follows the hierarchy pyramid below. Best practice energy conservation dictates that in the first instance demand is reduced. This has a much greater benefit to the overall long-term sustainability of the site compared to efficiency measures or renewables/offsets. As such, the focus will be on the elements that provide the greatest return on investment.

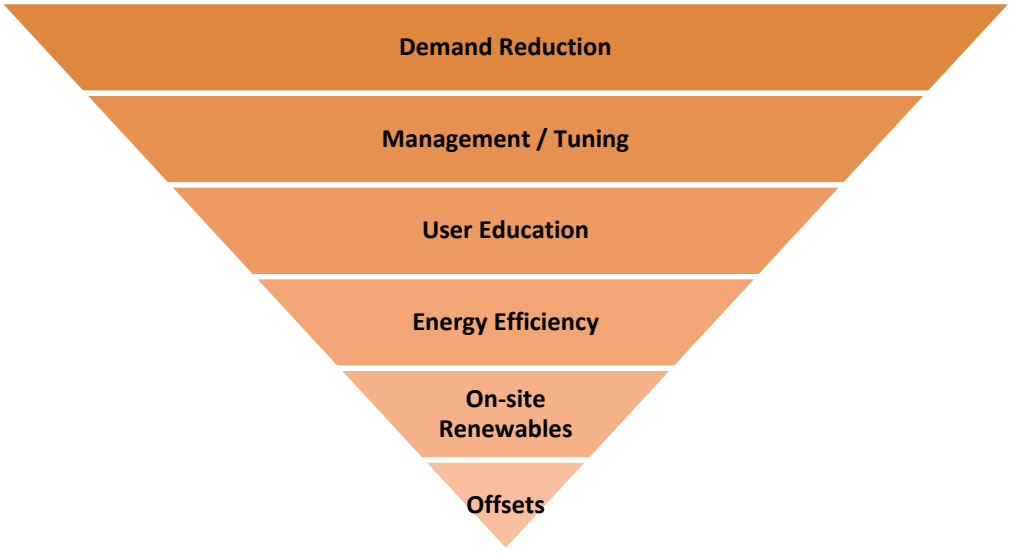


Figure 4: Energy efficiency strategy hierarchy

Passive thermal design

- Use of high performance glazing selections to meet stringent NCC 2019 Section J requirements. All sides of the windows have a protruding border acting as an architectural feature but also shading to prevent excess solar radiation gain to reduce heat load and its associated impact on mechanical systems and energy use. Refer to Section 4.5 for further details on the project's response to NCC 2019 Section J.
- Covered outdoor areas with low thermal mass, keeping accessible outdoor air cool. This allows more natural ventilation to be harnessed in the mixed mode ventilation
- Insulation to exposed floors, external walls and roofs for thermal efficiency and prevention of heat loss in winter

Responds to: NCC2019 Section J, Green Star Design & As Built – Energy, Hawkesbury DCP 1.4 (b) (h)

Lighting

Lighting energy consumption typically makes up 40% of a hospital's total energy demand (*Baseline Energy Consumption and Greenhouse Gas Emissions, 2012*). Reducing the demand of lighting will therefore contribute a significant impact on the overall hospital's energy demand.

- LED lights, which have longer lifespans, consume less energy and produce a higher quality light than their counterparts, reducing overall building energy demand.
- Lighting controls including timers and occupancy sensors

Responds to: Green Star Design & As Built – Visual Comfort, Energy, Hawkesbury DCP 1.4 (h)

Heating, Ventilation and Air Conditioning Systems

HVAC typically makes up the largest portion of energy usage in a hospital at up to 50%. The following strategies can be implemented to new mechanical selections to minimise this overall demand:

- High performance HVAC systems with a focus on energy efficiency to be selected
- Air Cooled System to significantly reduce water consumption throughout the life of the project.
- Mixed mode system with natural ventilation integration will reduce the overall energy consumption of the building.

Responds to: Green Star Design & As Built – Energy, Water. Hawkesbury DCP 1.4 (h)

Renewable Energy

On-site solar photovoltaic systems will allow the project's electricity demand to be reduced significantly. The project is to install a 40kW on-site solar photovoltaic system to offset energy demands. The generation peak of a solar PV system coincides nicely with the electricity use of a typical hospital and is therefore perfectly suited.

Responds to: Green Star Design & As Built – Energy, Hawkesbury DCP 1.4 (h)

4.3.2 Indoor Environment Quality

Consideration of the indoor environment quality will improve the overall aesthetic and encourage learning for students.

Indoor Air Quality

- Low-VOC paints, sealants, adhesives, carpets, to limit emissions of dangerous volatile components and minimise health impacts of students and staff
- Selection of engineered wood products with low formaldehyde levels in accordance with industry best practice standards

Responds to: Green Star Design & As Built – Indoor Air Quality, Hawkesbury LEP

Lighting Comfort & Daylight

- Orientation of bedrooms, common areas and congregation spaces to achieve high levels of natural daylight and glazing to allow visual connection to outdoors
- Passive lighting design optimised by having these primary spaces along the perimeter of the building harnessing maximum amount of natural daylight.
- Glare control through the use of fixed external shading devices and low VLT glass
- Design of electric lighting to achieve uniform lighting levels and allow for comfortable lighting conditions avoiding high levels of change in lighting conditions.

Responds to: Green Star Design & As Built – Indoor Air Quality, Hawkesbury DCP 1.4 (h)

4.3.3 Water

Given the current drought in Australia, potable water is a precious resource and the project is seeking to minimise the use of this water as far as possible. The initiatives to be implemented include:

- High WELS rated water fittings including taps, WCs, showers and urinals in line with GBCA Green Star Design and As-Built V1.3 4-star rating.
- On-site rainwater harvesting & reuse for landscape irrigation will reduce the site discharge levels and reduce the demand on potable water. Consideration of the extent of rainwater reuse should be made in the next design phase
- Landscape design shall focus on the inclusion of local, indigenous species with drought tolerant capability and use of sub-soil landscape irrigation systems
- On-site stormwater management in accordance with EPA/WSUD best practice guidelines

Responds to: Hawkesbury DCP 1.4 (b) (h), Green Star Design & As Built – Potable Water, Emissions. Hawkesbury LEP ESD.

4.3.4 Materials

The production of materials uses large amounts of raw materials including water and energy, as well as needing to be transported long distances to the development site. The following initiatives should be considered to minimise this impact:

- Materials and products which include reused content, environmental product declarations, third party sustainability certifications or product stewardship programs
- Locally sourced materials
- Best practice PVC plastics in formwork, piping, blinds, cables and conduits. PVC generally has a reputation for damaging the environment in their production, both upstream and downstream of the manufacturing process and the use of Best Practice PVC will minimise these impacts; and
- A target of 90% of construction and demolition waste will be diverted from landfill.

Responds to: Green Star Design & As Built – Materials, Hawkesbury DCP 1.4 (h)

4.4 Projected Impacts of Climate Change

In response to the expected SEARs requirements, an assessment of project risks associated with the predicted impacts of Climate Change has been undertaken for the proposed development. The assessment has been undertaken to ensure the project design allows for suitable provisions for the predicted impact of climate change scenarios.

The project design team has conducted a site-specific analysis of the likely scenarios which represent the most significant projected impacts of climate change. The assessment is summarised within the table below inclusive of specific categories as defined within expected SEARs.

The assessment has been undertaken in accordance with CSIRO and Australian Bureau of Meteorology data.

The table below summarises the projected impacts of climate change across two scenarios (RCP4.5 and RCP8.5*): the near future 2020-2039 (referred to 2030) and far future 2080-2099 (referred to 2090). These projections are generalised for the 'East Coast (South) Cluster' region as defined by the CSIRO and BOM (2015) and is taken as the most representative of the proposed site's future climate-change enhanced conditions in Sydney.

*Representative Conservation Pathway – 4.5 represents normalised emission levels. 8.5 represents worst case scenario based upon 2005 emissions trends.

Climate Variable	Climate Projections (change relative to 1986 – 2005 baseline)			
	2030		2090	
	RCP4.5	RCP8.5	RCP4.5	RCP8.5
Mean temperature change (°C)	0.9 (0.6 to 1.1)	1.0 (0.7 to 1.3)	1.8 (1.3 to 2.5)	3.7 (2.9 to 4.6)
Extreme temperature (days per year over 35°C)	7.21	7.82	11.12	19.84
	Substantial increase in intensity and frequency of extreme temperature days			
Mean annual rainfall change (%)	-3 (-10 to 6)	-1 (-11 to 6)	-2 (-16 to 9)	-3 (-20 to 16)
Extreme rainfall	Extreme rainfall events to increase in intensity			
Drought	Time spent in drought conditions to increase			
Bushfire weather (Number of severe fire danger days; FFDA > 50)	Severity of fire-weather climate to increase			
Solar radiation (%)	0.5 (-0.5 to 1.9)	0.8 (-0.7 to 2.7)	1.5 (-0.3 to 3.7)	1.3 (-1.2 to 3.4)
Relative humidity (%, absolute)	-0.5 (-1.6 to 0.8)	-0.6 (-1.4 to 0.9)	-1.0 (-3.1 to 0.3)	-1.5 (-3.8 to 1.3)
Wind Speed (%)	-1.1 (-2.9 to 0.5)	-0.5 (-2.3 to 1.9)	-1.0 (-4.2 to 0.2)	-1.1 (-6.9 to 4.2)
Sea level rise (m)	0.13 (0.09 to 0.18)	0.14 (0.10 to 0.19)	0.47 (0.30 to 0.65)	0.66 (0.45 to 0.88)

Table 1: Summary of Climate Change Projects (CSIRO, 2015)

4.4.1 Summary of major impacts assessment:

Mean & Extreme Temperature

With very high confidence, air temperatures are projected to increase due to continued substantial warming from a mean warming of around 0.4 to 1.3°C by 2030 relative to the climate of 1986-2005 with minor difference between RCPs up to 1.3 to 2.5°C under RCP4.5 and 2.7 to 4.7°C under RCP8.5 by 2090 (CSIRO and BOM, 2015). This projection is in line with the current rising trend of local mean temperatures which has resulted in Year 2019 being Australia's warmest year on record (Bureau of Meteorology, 2020b).

Because of rising temperatures, peak temperature events will become more frequent whereby the number of days above 35°C are expected to double under RCP4.5 and nearly triple under RCP8.5 by 2090 (CSIRO and BOM, 2015).

In response to the above, the project design seeks to ensure the passive thermal design elements are fundamentally sound ensuring that average daily temperature and peak extreme temperature days are managed as best as possible. External shading, glazing design, HVAC and natural ventilation shall all be fundamentally proven to ensure the proposed project design responds appropriately to the projected risks of climate change.

Drought & Bushfire weather

The frequency and duration of harsher fire-weather climate and drought events could possibly increase under RCP8.5 but will be heavily dictated by the amount of rainfall events (CSIRO and BOM, 2015). With Year 2019 being Australia's driest year on record since 1900 (Bureau of Meteorology, 2020b), droughts & bushfire events are anticipated to become more frequent, even under RCP4.5, based on the amount of annual rainfalls received over the recent years as described in Section 3.2.

In response to the above, the project is seeking to reduce the amount of potable water use within the development to minimise stress on potable water supplies. The project will also be using a waterless heat rejection system to further reduce consumption.

Extreme rainfall and storms

Heavy rainfall events are expected to intensify, however, the magnitude of change and the time when any change may be evident against natural variability cannot be reliably estimated (CSIRO and BOM, 2015).

Wind speeds along the East Coast South region is expected to remain the same under all RCPs by 2030 and may decrease during the winter period by 2090 under RCP8.5. According to global and regional studies, tropical cyclones are foreseen to become less frequent but with increases in the proportion of the most intense storms (CSIRO and BOM, 2015).

The project seeks to provide rainwater collection to assist in reducing rainwater runoff from the site to minimise impacts on existing infrastructure and reduce the possibility of flooding. In addition, the project's WSUD system will be designed to cope with extreme rainfall events.

4.5 NCC 2019 Section J

The project is subject to the new provisions outlined within NCC Section J 2019.

The proposed new performance standards for NCC Section J will increase the thermal performance requirements for code compliant façade designs, meaning consideration must be shown for exposed glazing included within the façade design. Glazing thermal performance, solar control, visible light transmittance and inclusion of appropriate shading features within the design response must be considered in accordance with the increased performance requirements of NCC Section J 2019.

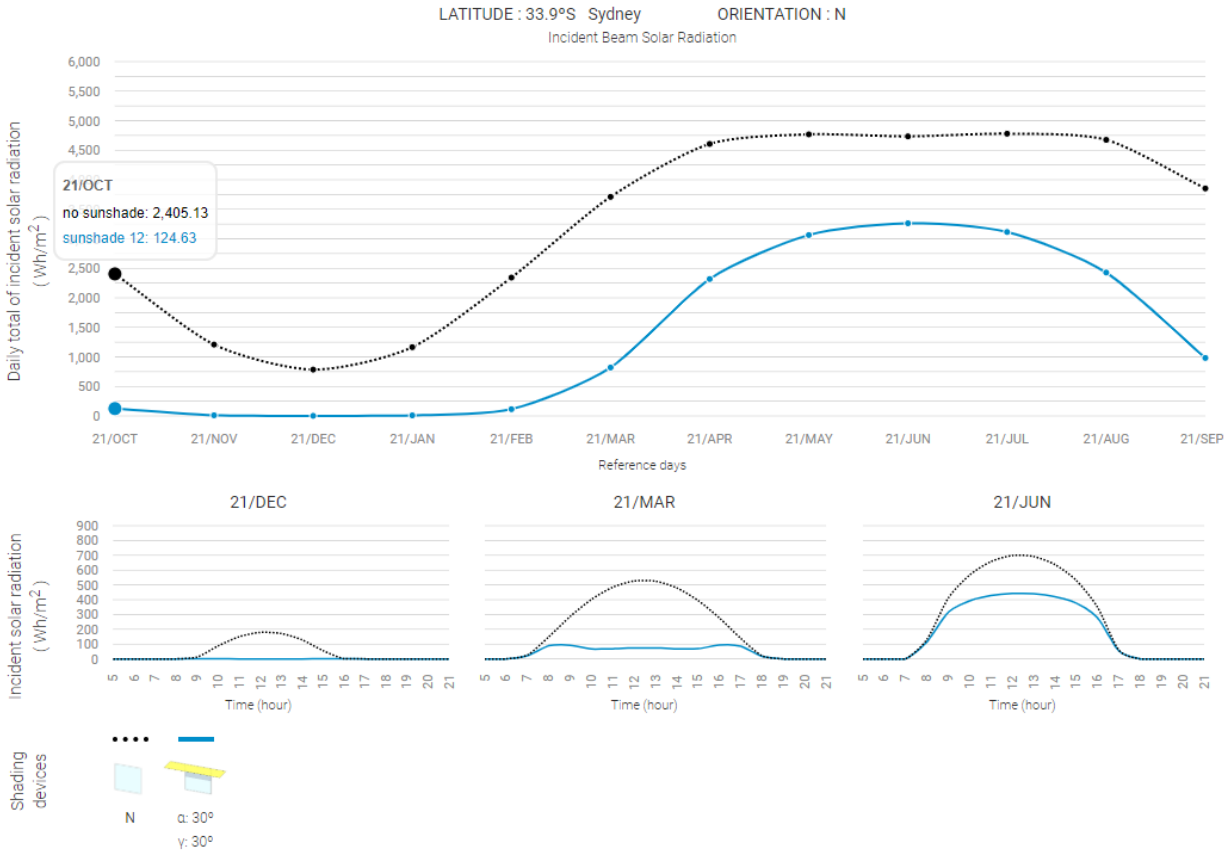
The proposed development will seek to optimise energy efficiency & thermal performance to comply with Section J 2019 via design external façade design elements which improve the building passive thermal performance (i.e. fixed external shading, insulated façade elements, etc.).

In addition to the above, thermal comfort modelling will be included to demonstrate compliance with the new NCC 2019 code, with a minimum performance of -1.0 < PMV <1.0 in each mechanically conditioned zone. The design of the building fabric will demonstrate compliance with this clause through dynamic modelling of the building against a reference case.

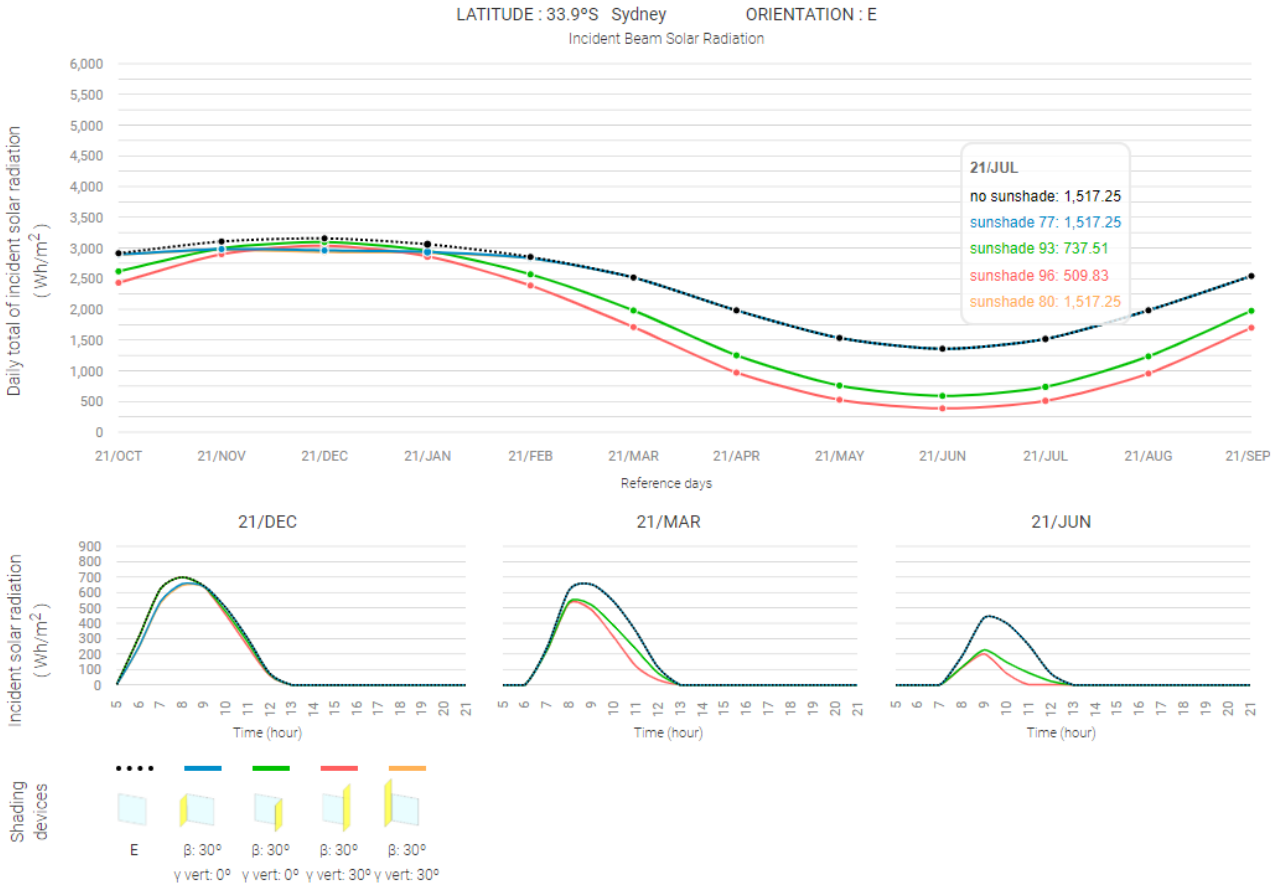
Shading

The proposed design is inclusive of externally recessed windows on all facades. This recess acts as a shading device to prevent solar radiation gain within the space to minimise cooling loads on the HVAC system. The proposed shading will have a significant impact on the overall energy performance of the building in association with the predicted climatic changes as documented within Section 4.4 above.

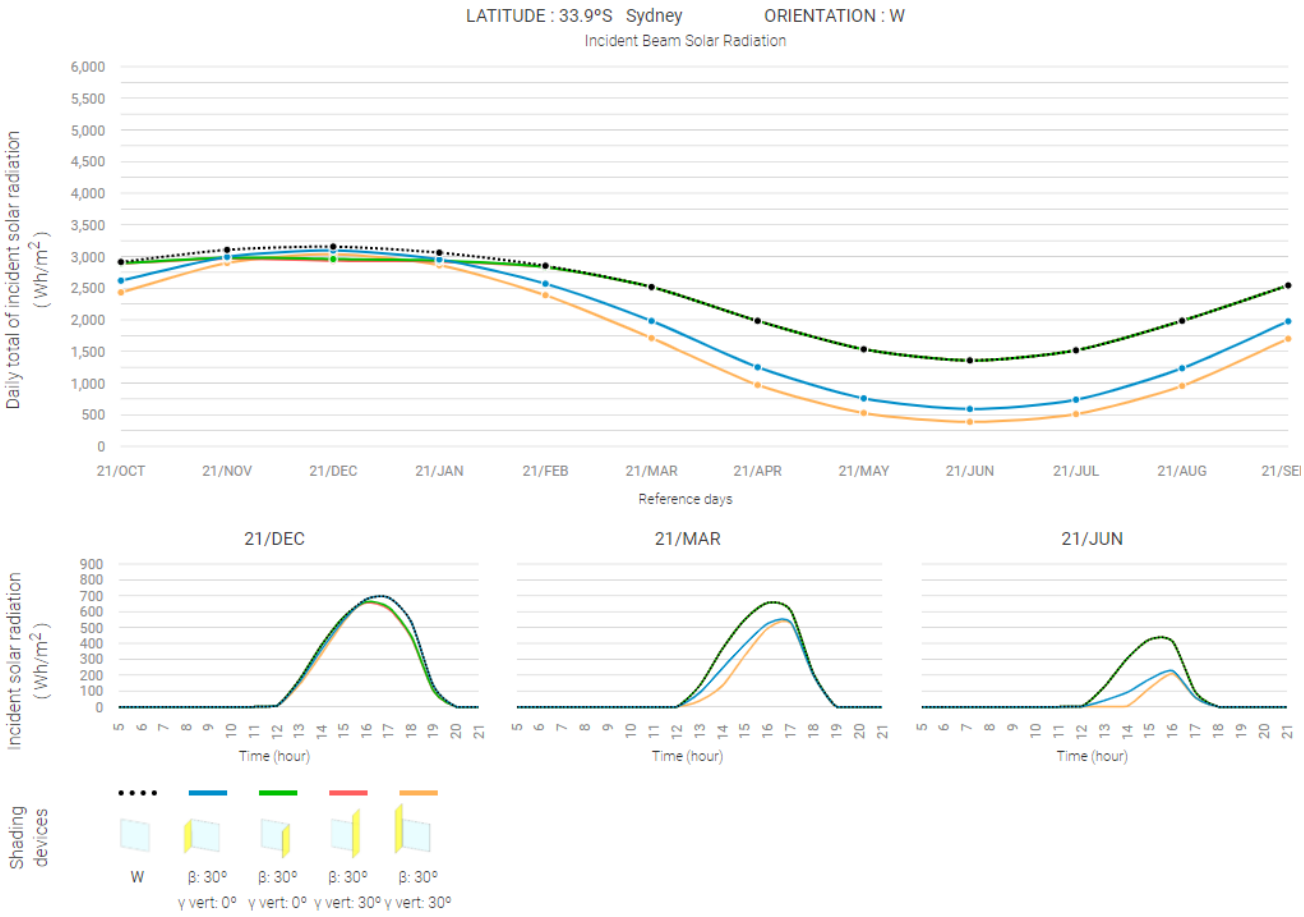
- Horizontal sunshades to the northern elevation:
  Direct solar incidence on the northern windows are observed as the blue profile. This represents an ideal shading orientation for the northern facade with a significant reduction in direct solar radiation in spring to summer and a slight reduction in autumn to winter.



- Vertical sunshades to the east elevation:
  Direct solar incidence on the eastern windows are observed as the different coloured profiles. The blue profile represents a vertical the fin to the left of the window when looking east through the window. This profile represents an ideal location on the eastern facade with a marginal reduction in direct solar radiation in summer, and nil reduction in winter.



- Vertical sunshades to the west elevation:
  Direct solar incidence on the western windows are observed as the different coloured profiles. The green profile represents a vertical the fin to the right of the window when looking west through the window. This profile represents an ideal location on the western facade with a marginal reduction in direct solar radiation in summer, and nil reduction in winter.



Performance Requirements

NCC Section J – energy efficiency provisions will apply to the design & construction of the development with the intent to ensure the built form and associated building services demonstrate a level of energy efficiency performance.

The proposed building fabric will likely require the following values in order to comply with Section J Deemed-to-Satisfy requirements:

Table 1 - New Built fabric thermal performance requirements.

Building Envelope Element	Minimum Effective Total R-value	Solar Absorptance
All New Built Roof	**R_T 3.2**	0.45 or less
External Walls	**For Class 9a – Wards Areas = R_T 1.4** **For Class 9b Area = R_T 1.0 – 1.4** **For Class 5 Area = R_T 1.0 – 1.4**	0.60 average or less
Internal Walls	**R_T = 1.4**	NA
Ground Floor Slab on ground	**No minimum requirement**	NA

Final details with regards to the above shall be defined within the detailed design issue report following development application approval. A detailed NCC Section JV3 report shall be provided in association with the project detailed design demonstrating compliance with the provisions of the NCC Section J energy efficiency.

5. Summary

Ecologically Sustainable Design is a driving consideration in the development of the proposed St John of God Hospital located at 177 Grose Vale Rd, North Richmond, NSW, 2754. As described within the report above, the project will incorporate several ESD and environmentally conscious initiatives in both design and operation aimed at ensuring the principles of sustainable development are both demonstrated and achieved in accordance with the project drivers.

The development's commitment to reducing the overall environmental impact is evident of the holistic approach taken to long-term sustainability. Documented initiatives cover a range of categories including:

- Secretary's Environmental Assessment Requirements (SEARs) for the proposed development;
- Hawkesbury Development Control Plan 2002;
- Hawkesbury Local Environment Plan 2012; and
- NCC 2019 Section J;

The building will be designed to a level that the building could be benchmarked to achieve a 4 Star Green Star rating.

We trust this Ecologically Sustainable Development report provides enough overview of the project commitment to environmentally sustainable design and the sustainability vision for the proposed St John of God Richmond Hospital project.

Appendix A Preliminary Green Star Credit Schedule

Green Star - Design & As Built Scorecard

Project:	SJG Richmond Hospital	
Targeted Rating:	4 Star - Best Practice	26.11.2020

Core Points Available	Total Score Targeted
98	50

NA	CATEGORY / CREDIT	AIM OF THE CREDIT / SELECTION	CODE	CREDIT CRITERIA	POINTS AVAILABLE	POINTS TARGETED
	Management				14	
	Green Star 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	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	-	Complies
			2.1	Services and Maintainability Review	1	1
			2.2	Building Commissioning	1	
			2.3	Building Systems Tuning	1	1
			2.4	Independent Commissioning Agent	1	
	Adaptation and Resilience	To encourage and recognise projects that are resilient to the impacts of a changing climate and natural disasters.	3.1	Implementation of a Climate Adaptation Plan	2	2
	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 Information	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		1	1
		5.2	End of Life Waste Performance	A. Contractual Agreements	1	1
Metering and Monitoring	To recognise the implementation of effective energy and water metering and monitoring systems.	6.0	Metering		-	Complies
		6.1	Monitoring Systems		1	
Responsible Construction Practices	To reward projects that use best practice formal environmental management procedures during construction.	7.0	Environmental Management Plan		-	Complies
		7.1	Environmental Management System		1	1
		7.2	High Quality Staff Support		1	1
Operational Waste	A. Performance Pathway	8A	Performance Pathway: Specialist Plan		1	1
Total					**14**	**11**

Indoor Environment Quality					**17**	
☐	**Indoor Air Quality**	To recognise projects that provide	9.1	Ventilation System Attributes		1	
☐			9.2	Provision of Outdoor Air	☐ A. Comparison to Industry Standards ☑ B. Performance Based Approach	2	1

	Indoor Air Quality	high air quality to occupants.			☐ C. Natural Ventilation		
☐			9.3	Exhaust or Elimination of Pollutants	☑ A. Removing the Source of Pollutants ☑ B. Exhausting the Pollutants Directly to	1	1
☐	**Acoustic Comfort**	To reward projects that provide appropriate and comfortable acoustic conditions for occupants.	10.1	Internal Noise Levels		1	1
☐			10.2	Reverberation		1	1
☐			10.3	Acoustic Separation	A. Sound Reduction	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		-	Complies
☐			11.1 General Illuminance and Glare Reduction	11.1.1 General Illuminance	☑ A. Non Residential Spaces ☐ B. Residential Spaces	1	1
				11.1.2 Glare Reduction	☑ A. Prescriptive Method 1 ☐ B. Prescriptive Method 2 ☐ C. Performance Method		
☐			11.2	Surface Illuminance	☐ A. Prescriptive Method ☐ B. Performance Method ☐ C. Residential Spaces (Prescriptive Me	1	
☐			11.3	Localised Lighting Control		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	☑ A. Fixed Shading Devices ☐ B. Blinds or Screens ☐ C. Daylight Glare Model	-	Does not comply
☐			12.1	Daylight	☐ A. Prescriptive Methodology ☑ B. Compliance Using Daylight Factor ☐ C. Compliance Using Daylight Autonon	2	1
☐			12.2	Views		1	1
	Indoor Pollutants	To recognise projects that safeguard occupant health through the reduction in internal air pollutant levels.	13.1 Paints, Adhesives, Sealants and Carpets	13.1.1 Paints, Adhesives and Sealants	☐ A. Product Certification ☑ B. Laboratory Testing ☐ C. No Paints, Adhesives or Sealants	1	1
☐				13.1.2 Carpets	☑ A. Product Certification ☐ B. Laboratory Testing ☐ C. No Carpets		
☐			13.2	Engineered Wood Products	☑ A. Product Certification ☐ B. Laboratory Testing	1	1

☐	**Thermal Comfort**	To encourage and recognise projects that achieve high levels of thermal comfort.	14.1	Thermal Comfort	☐ A. Naturally Ventilated Spaces ☑ B. Mechanically Ventilated Spaces ☐ C. Residential Spaces	1	1
☐			14.2	Advanced Thermal Comfort	☐ A. Naturally Ventilated Spaces ☐ B. Mechanically Ventilated Spaces ☐ C. Residential Spaces	1	
	Total					**17**	**11**

Energy				**22**	
Greenhouse Gas Emissions	E. Reference Building Pathway	15E.0	Conditional Requirement: Reference Building Pathway ☐	-	Complies
		15E.1	GHG Emissions Reduction: Building Fabric	4	2
		15E.2	GHG Emissions Reduction	16	4
		15E.3	Off-Site Renewables	8	
		15E.4	District Services	7	
		15E.5 Additional Prescriptive Measures	15E.5.1 Transition Plan	1	
			15E.5.2 Fuel Switching	2	
			15E.5.3 On-Site Storage	1	
Peak Electricity Demand Reduction	B. Performance Pathway	16B	Modelled Performance Pathway: Reference Building	2	1
Total				**22**	**7**

Transport					
				9	
Sustainable Transport	B. Prescriptive Pathway	17A	Performance Pathway	0	0
☑ Total				6	0

Water					
				12	
Potable Water	A. Performance Pathway	18A	Potable Water - Performance Pathway	12	6
☐ Total				12	6

Materials						
					14	
Life Cycle Impacts	A. Performance Pathway - Life Cycle Assessment	19A.1	Comparative Life Cycle Assessment		6	2
		19A.2	Additional Reporting	☑ A. Additional Life Cycle Impact Reporting ☐ B. Material Selection Improvement ☐ C. Construction Process Improvement ☐ D. LCA Design Review	4	1
☐ Responsible Building Materials	To reward projects that include materials that are responsibly sourced or have a sustainable supply chain.	20.1	Structural and Reinforcing Steel	20.1.0 Responsible Steel Maker	-	Complies
				B. Energy-Reducing Processes in Steel Reinforcement Production	1	1
☐		20.2	Timber	☐ A. Certified Timber ☐ B. Reused Timber	1	
☐		20.3	Permanent Formwork, Pipes, Flooring, Blinds and Cables	B. Best Practice Guidelines for PVC	1	1

Sustainable Products	To encourage sustainability and transparency in product specification.	21.1	Product Transparency and Su	☐ A. Reused Products ☐ B. Recycled Content Products ☑ C. Environmental Product Declarations ☑ D. Third Party Certification ☐ E. Stewardship Programs	3	
Construction and Demolition Waste	B. Percentage Benchmark	22.0	Reporting Accuracy	A. Compliance Verification Summary	-	Complies
		22B	Percentage Benchmark		1	1
Total					**14**	**6**

Land Use & Ecology					**5**	
Ecological Value	To reward projects that improve the ecological value of their site.	23.0	Endangered, Threatened or V	A. EPBC	-	Complies
		23.1	Ecological Value		3	
Sustainable Sites	To reward projects that choose to develop sites that have limited ecological value, re-use previously developed land and remediate contaminate land.	24.0	Conditional Requirement		-	Complies
		24.1	Reuse of Land	A. Previously Developed Land	1	1
☑		24.2	Contamination and Hazardous	☐ A. Site Contamination ☐ B. Hazardous Materials	0	1
Heat Island Effect	To encourage and recognise projects that reduce the contribution of the project site to the heat island effect.	25.1	Heat Island Effect Reduction		1	1
Total					**5**	**3**

Emissions					5	
Stormwater	To reward projects that minimise peak stormwater flows and reduce pollutants entering public sewer infrastructure.	26.1	Stormwater Peak Discharge		1	1
		26.2	Stormwater Pollution Targets		1	1
Light Pollution	To reward projects that minimise light pollution.	27.0	Light Pollution to Neighbouring Bodies		-	Complies
		27.1	Light Pollution to Night Sky	A. Control of Upward Light Output Ratio (ULOR)	1	1
Microbial Control	To recognise projects that implement systems to minimise the impacts associated with harmful microbes in building systems.	28	Legionella Impacts from Cooli	B. Waterless Heat Rejection Systems	1	1
Refrigerant Impacts	To encourage operational practices that minimise the environmental impacts of refrigeration equipment.	29.1	Refrigerants Impacts	A. Calculating TSDEI	1	
Total					**5**	**4**

Innovation					10	
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	Innovative Technology or Process			1
Market Transformation	The project has undertaken a sustainability initiative that substantially contributes to the broader market transformation towards sustainable development in Australia or in the world.	30B	Market Transformation			

Improving on Green Star Benchmarks	The project has achieved full points in a Green Star credit and demonstrates a substantial improvement on the benchmark required to achieve full points.	30C	Improving on Green Star Benchmarks	10	
Innovation Challenge	Where the project addresses an sustainability issue not included within any of the Credits in the existing Green Star rating tools.	30D	Innovation Challenge		
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 this Green Star rating tools.	30E	Global Sustainability		
Total				**10**	**1**

TOTALS	**AVAILABLE**	**TARGETED**
CORE POINTS	**98**	**48.0**
CATEGORY PERCENTAGE SCORE		**49.0**
INNOVATION POINTS	**10**	**1.0**
TOTAL SCORE TARGETED		**50.0**

Design with
community in mind

Level 6, Building B
207 Pacific Highway
St Leonards NSW 2065
Tel +61 +61 2 8484 7000

For more information please visit
www.stantec.com

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