Tweed Valley Hospital Development **19/09/2019**

Ecologically Sustainable Design (ESD) Report

Prepared for

Lendlease

Issue 02

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Revision Information

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Client	Lendlease
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Revision Schedule

Revision	Date	Issue Name	Authorised
Draft 00	09/08/2019	Draft Issue for Review	Alan Davis
Draft 01	14/08/2019	Draft Issue for Review	Alan Davis
Issue 00	16/08/2019	Stage 2 SSDA Submission	Alan Davis
Issue 01	12/09/2019	Stage 2 SSDA Submission	Alan Davis
Issue 02	19/09/2019	Stage 2 SSDA Submission	Alan Davis

Contents

1 Introduction

LCI has been engaged to provide an Ecologically Sustainable Development (ESD) Report as part of the Stage 2 State Significant Development Application (SSDA) for the proposed new Tweed Valley Hospital development on 771 Cudgen Road, Cudgen, NSW (legally described as Lot 11 DP 1246853). This report will form part of the documentation required to meet the Secretary's Environmental Assessment Requirements (SEARs*; see Section 1.3*) for this SSDA, SSD-10353, 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 new Tweed Valley Hospital development, as stipulated under the 'Ecologically Sustainable Development' section in SEARs for SSD-10353.

In summary, the requirements from the following items are consolidated with respect to developing an ESD framework:

- Details of the requirements under policies listed:
  a) NSW Energy Efficiency Action Plan 2013
  b) NSW Government Resource Efficiency Policy (GREP)
  c) NSW Climate Change Policy Framework
  d) NSW and ACT Government Regional Climate Modelling (NARCLiM) climate change projections
- 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
- 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 in accordance with *Environmentally Sustainable Design Report* prepared by Steensen Varming Pty Ltd, dated 16 August 2018. This is based on a materiality assessment and includes waste reduction design measures, future proofing, use of sustainable and low-carbon materials, energy and water efficient design, and technology for the use of renewable energy.
- Details of preliminary considerations of building performance in support of climate change mitigation, including consideration of an equivalent 4 star Green Star Design & As Built v1.2 pathway
- Details of how the design of the development is responsive to the CSIRO projected impacts of climate change
- Details of water conservation, including practical opportunities to implement water sensitive urban design principles
- Details of energy efficiency, including practical opportunities to minimise energy consumption from non-renewable sources and to implement effective energy efficiency measures

1.1 Project Overview

The Tweed Valley Hospital is a significant, new state-of-the-art hospital on a greenfield site committed by the NSW Government with a total project budget of $534 million. A major referral hospital that will provide the health services required to meet the needs of the growing population of the Tweed-Byron region, it will work in conjunction with other hospitals and community health centres across the region. The health services will include:

- Comprehensive cancer services, including radiation oncology, and other specialised services, such as cardiac catheterisation
- Expanded critical care services, including an expanded Emergency Department, intensive care services and helipad
- Expanded operating theatres and surgical services, additional capacity of in-patient medical and surgical beds, and maternity, birthing and paediatric services

- Rehabilitation services and integrated care for our ageing community
- Expanded ambulatory care services, including community health and outpatient services with outreach support of people with chronic and complex conditions
- Expanded renal services to address the increasing incidence of chronic kidney disease in the Tweed Valley
- Mental health services working with service partners to deliver more community-based care

1.2 Project Background

The development is being conducted in stages in accordance with the following planning applications:

- **Stage 1** – A concept development application and detailed proposal for Stage 1 (early and enabling works comprising site preparation, bulk earthworks to establish site levels, stormwater works, clearance of vegetation, utility augmentation, revegetation of part of the wetland area, construction of internal roads and retaining walls)
- **Stage 2** – detailed design, construction and operation of the Tweed Valley Hospital (Project Application)

Development consent was granted for the Concept Proposal and detailed approval to carry out the Stage 1 early works and enabling works (SSD 9575) by the Minister for Planning on 11 June 2019.

This consent permitted the early and enabling works, and established planning and development framework through which to assess the subsequent Stage 2 application. Specifically, State Significant Development Consent SSD 9575 encompassed:

1. A Concept Proposal, comprising:
    - The maximum building envelope for a nine-storey hospital with helipad and plant rooms on the rooftop
    - The maximum building envelope for a building for support services (health hub)
    - The maximum gross floor area of 65,000 square metres for the hospital and the health hub building on the site
    - The site layout, internal roads, site access arrangements and car parking provisions
    - A landscape masterplan, concept public domain treatments and stormwater strategy
    - Tweed Coast Road and Cudgen Road intersection upgrade works
2. Concurrent Stage 1 early and enabling works, comprising:
    - Site preparation and bulk earthworks to establish site levels
    - Identification of the construction compound with temporary car parking areas, laydowns and internal roads
    - New vehicular access points from Cudgen Road
    - Improvements to the roundabout at the intersection of Turnock Street and Cudgen Road
    - Utility augmentation and connection of permanent services for the future hospital
    - Construction of retaining walls
    - Stormwater drainage works and soil and water management measures
    - Site remediation works
    - Piling works associated with the future hospital

This report relates to the Stage 2 application and considers the detailed design, construction and operation of the new Tweed Valley Hospital pursuant to the approved Concept Proposal.

Any subsequent stages after Stage 2 for potential future expansion would be subject to a separate application(s) as required. Details of this are currently unknown and would be developed as required.

1.3 SEARs

The Department of Planning and Environment have issued Secretary's Environmental Assessment Requirements (SEARs) to the applicant for the preparation of an Environmental Impact Statement (EIS) for the proposed development. This report has been prepared having regard to the SEARs, as detailed below.

SEAR 2 | Policies

Relevant planning provisions, goals and strategic planning objectives are addressed in the followings:

- NSW Energy Efficiency Action Plan 2013 – ***See Section 3.1.1***
- NSW Resources Efficiency Policy (GREP) – ***See Section 3.1.2***
- NSW Climate Change Policy Framework – ***See Section 3.1.3***

- In addition, NSW Health Infrastructure Engineering Services Guideline – ***See Section 2.4***

SEAR 8 | Ecologically Sustainable Development (ESD)

- Detail how ESD principles (as defined in clause 7(4) of 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 3.2.***
- Address ESD in accordance with the conditions imposed under SSD 9575 (see below extract).

> **Ecologically Sustainable Development** (*Extract from Development Consent – SSD 9575*)
>
> B15. The Stage 2 application must include a framework detailing 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 in accordance with Environmentally Sustainable Design Report prepared by Steensen Varming Pty Ltd dated 16 August 2018. 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 – ***See Section 3.3***
>
> B16. The Stage 2 application must include preliminary consideration of building performance and mitigation of climate change, including consideration of Green Star performance – ***See Section 3.4***
>
> B17. The Stage 2 application must provide a statement regarding how the design of the future development is responsive to the CSIRO projected impacts of climate change, specifically:
> a) hotter days and more frequent heatwave events;
> b) extended drought periods;
> c) more extreme rainfall events;
> d) gustier wind conditions; and
> e) how these will inform landscape design, material selection and social equity aspects (respite/shelter areas).
> ***See Section 3.5***
>
> B18. The future development application is required to address the implementation of water sensitive urban design principles (WSUD) in accordance with the best practise guidelines (such as Water by Design 2014) and energy conservation and efficiency measures, including but not limited to:
> a) rainwater harvesting and re-use;
> b) water efficient fixtures;
> c) installation of rooftop solar photovoltaic arrays for on-Site electricity generation;
> d) storage of surplus energy generated by rooftop solar photovoltaic arrays;
> e) use of electric vehicles for dedicated on Site transport tasks (where possible); and
> f) energy efficient electrical equipment, fittings and fixtures.
> ***See Sections 3.3 and 3.6.***

- Address ESD in reference to NSW and ACT Government Regional Climate Modelling (NARCLiM) climate change projections – ***See Section 3.4***

2 General Design Principles

2.1 Site Description

The site is located off Cudgen Road between Tweed Coast Road and Kingscliff on rural land situated on the border of Kingscliff. The project is located on a portion of 771 Cudgen Road, legally described as Lot 11 DP 1246853. The immediate surrounding environment of the hospital site includes Kingscliff TAFE (Tertiary Education) and agricultural holdings to the south, Kingscliff Hill suburb to the east, environmental area to the north and agricultural lands including Cudgen Town beyond Tweed Coast Road to the west.

The site comprises a developable "plateau" accessible along the dominant length of the Cudgen Road title boundary interface with multiple potential site entrance opportunities. In addition, the site is predominantly located on an elevated level avoiding the flood prone parts of the region. Furthermore, the site possesses notable surrounding views accessible from site, including coastline views to the north east and south east, adjacent environmental area to the north, which together provide therapeutic value of contact with nature.

The locational context of the Site is shown in Figure 1, whilst the site boundaries and existing site surrounding features are shown in Figure 2.

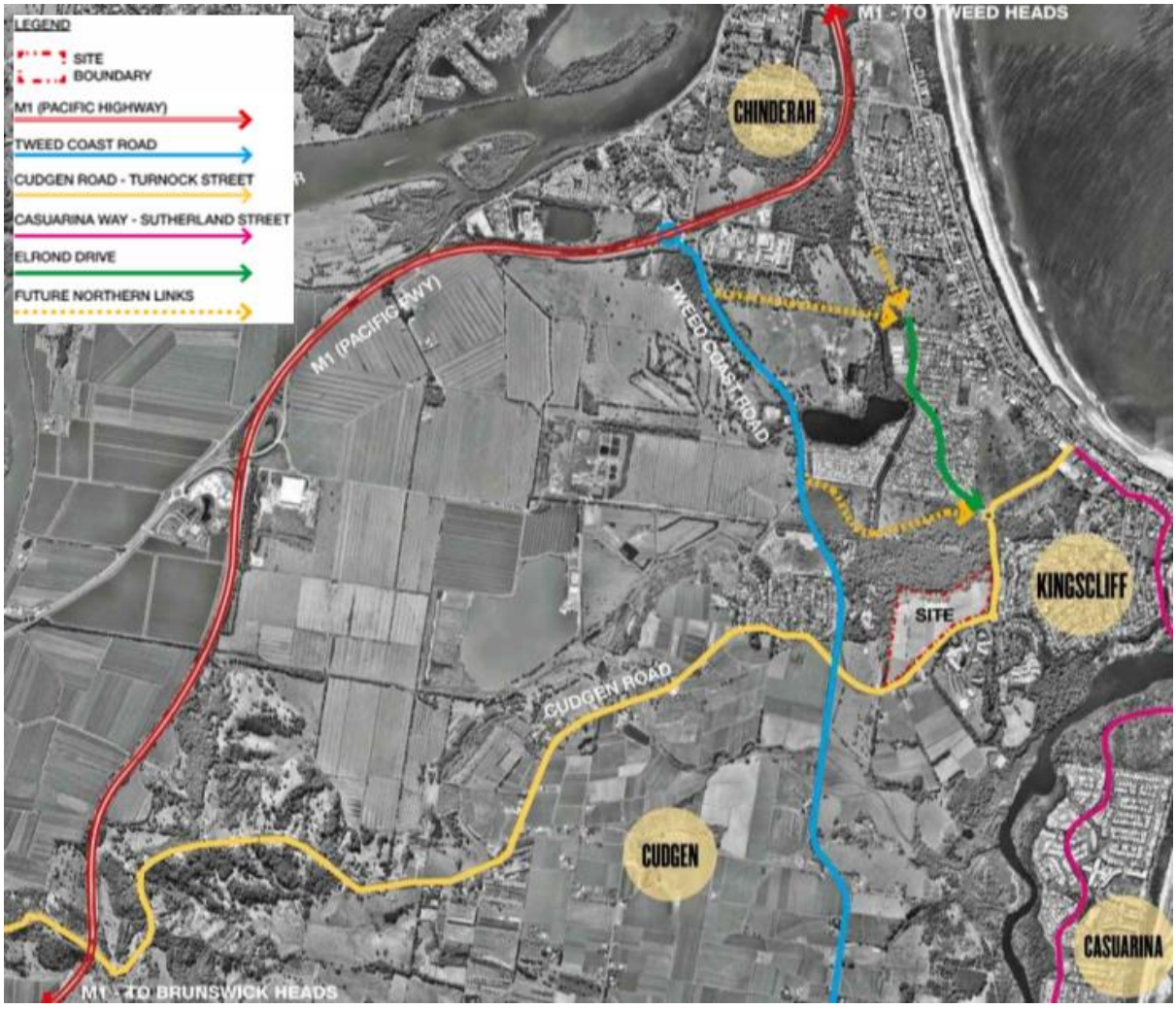


Figure 1: Regional site context

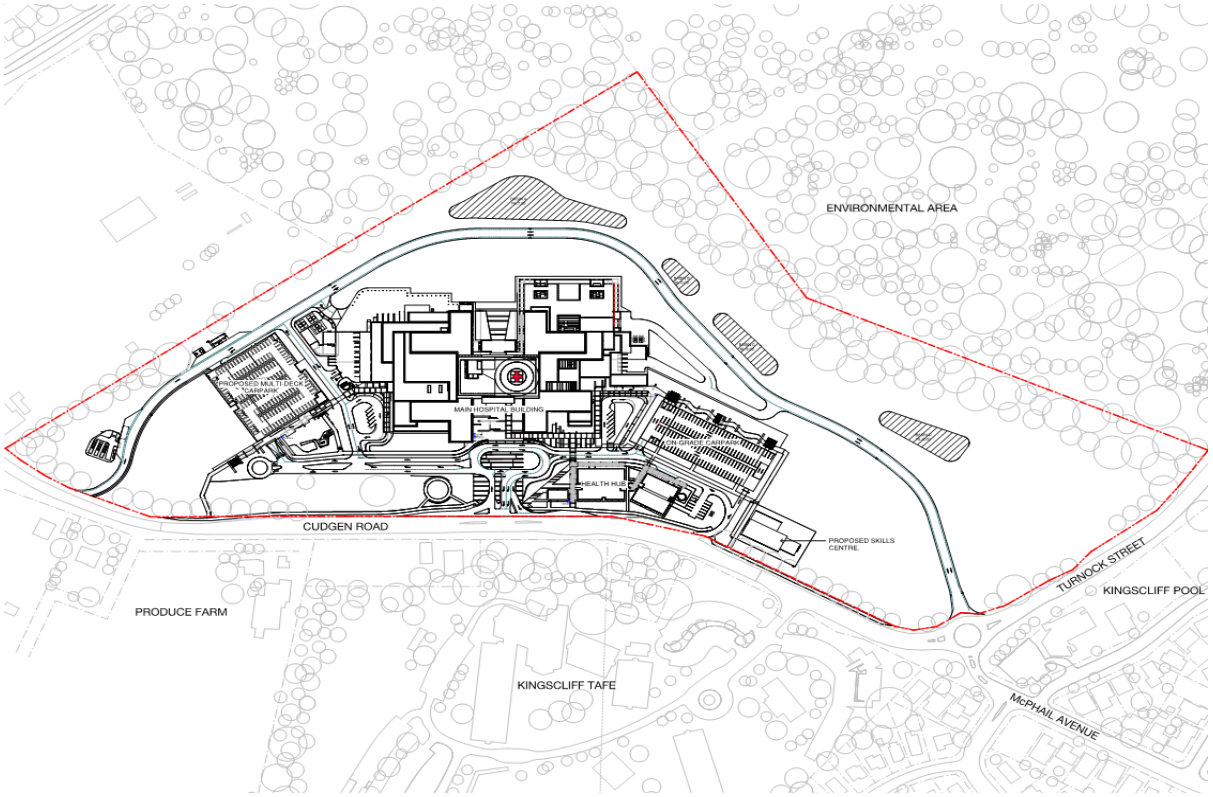


Figure 2: Site area and local context

2.2 Site Climate

The site is in a coastal subtropical climate with minimum annual temperatures ranging from 10°C to 20°C, and maximum annual temperatures ranging from 20°C to 28°C. Based on the data from the BOM Coolangatta Weather Station, the predominant summer winds blow from the south in the morning and then to the east with north easterly sea cool breezes. Morning winds tend to be light to moderate; with afternoon winds ranging from gentle to strong. The site receives its main winter (cold front) winds from the south west.

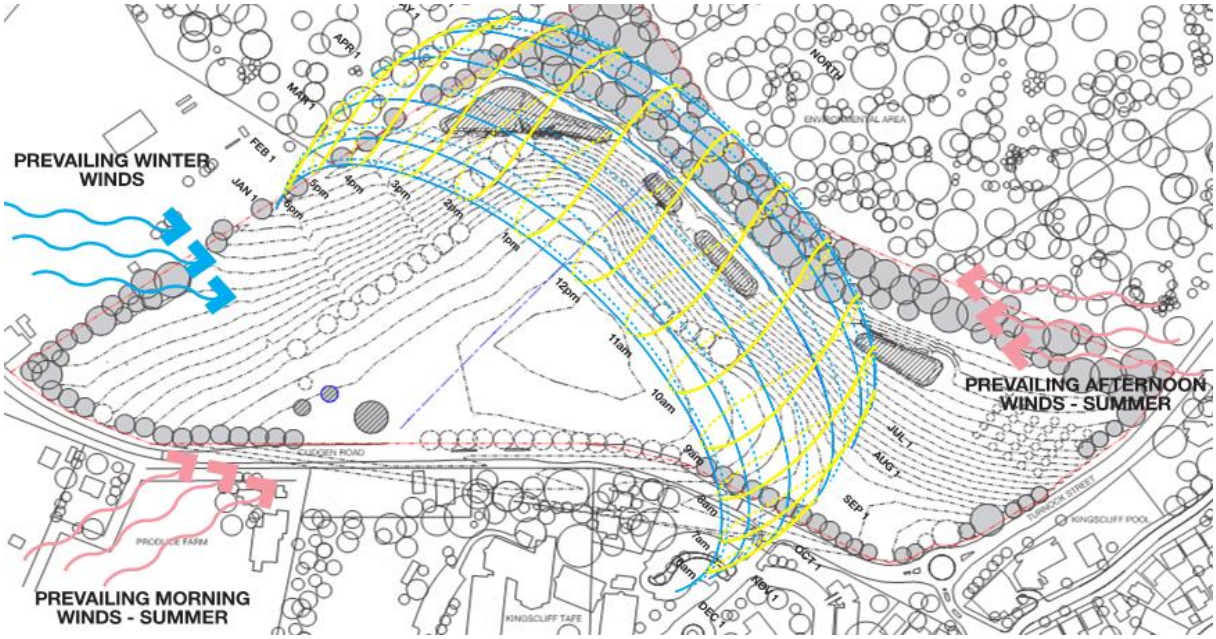


Figure 3: Site climate diagram

2.3 Passive Sustainable Design Principles

As per STH | Bates Smart's Architectural Drawing Package, and the Architectural and Urban Design, 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 afternoon sun during the Summer solstice can deliver direct, high solar radiation through the unprotected East and West facade causing thermal discomfort and increased cooling load; 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.

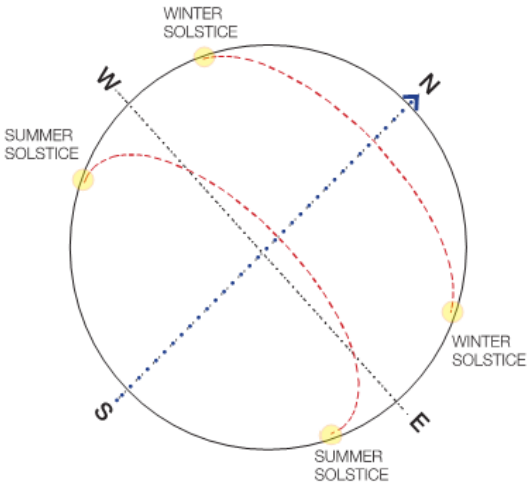


Figure 4: Sun path diagram for Tweed Valley Hospital

To take advantage of the sun path, the project has:

- applied vertical external shadings to the building to prevent early and afternoon solar radiation from directly transferring into the building;
- maintained a WWR of 25% to the in-patient unit (IPU) rooms;
- positioned the glazed South-East main entrance and staff workplace levels such that it is recessed within the building form, avoiding direct solar radiation from the morning and afternoon sun from the East and the West, respectively; and
- 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 early East and afternoon West sun during Summer, and to maximise the façade area facing the low sun during Winter to reduce heating loads (see below Figure 5).

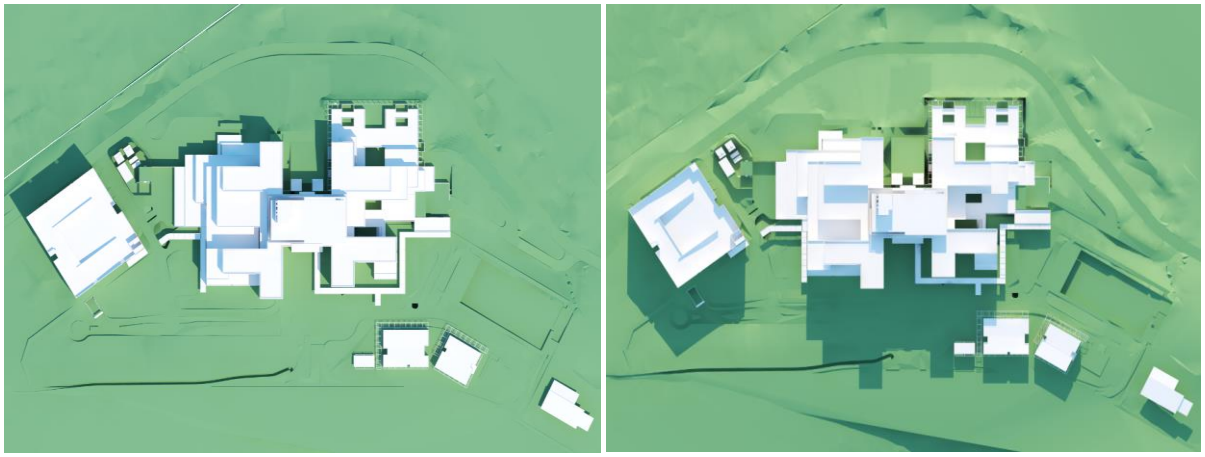


Figure 5: Summer shadow diagram 9am, 15 December (Left), Winter shadow diagram 3pm, 15 July (Right)

Improving Access to Natural Daylight

The building has been designed to maximise the amount of daylight access to the various functional zones, which contributes to 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 the building users.

Measures taken to improve solar access include:

- Incorporating internal courtyards within deep plan zones where achievable within the clinical planning constraints
- IPU floor plates are based on a shallow two grid arrangement, allowing light penetration to central corridor spaces
- Window-wall façade adopted where serving open plan, co-shared administration workplace, enhancing Grade A and B amenity
- Courtyards and key public spaces receive a good amount of direct sunlight, achieving more than 2 hours of direct light on its base surface
- Planning for glazed apertures as end conditions to major circulation routes provide light into corridors
- The main north-south civic spine is designed as double height to allow deep solar access

Improving Access to External Views & Glare Reduction

The typical L-shade IPU layout is designed to position patient rooms and bed space orientation to capitalise on the available 360° resplendent views from the site. A study conducted by the architects, STH | Bates Smart, revealed that 44% of IPU achieved unimpeded distant views, with approximately 51% achieving oblique distant views, with a minimal 5% experiencing no distant views.

Further measures taken to improve external views include:

- Major circulation corridors within IPU's have end-of-corridor windows providing daylight and views
- Family waiting rooms located off the east and west IPU linking corridors are located on axis overlooking the Green Spine. Distant views to the east (north east) are towards the coastline and ocean, while views to the west (south west) are towards Wollumbin National Park (Mount Warning) and Mount Jerusalem National Park.
- Staff co-share workplace within the central building zone provides open plan office space, having a functional demand for greater glazing percentages to improve daylight access, consequently, also providing good visual access to landscape and the outdoors.

Glare management will be addressed in part within 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 for the ESG requirements are cross-referenced in *Section 3* (Project responses to SEARs, see in particular, *Section 3.3*.) 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 "*HI ESD Guideline 2019 – Final*" which supplements the NSW HI ESG, the project team has developed an ESD matrix (or framework) in *Appendix A* – ESD Matrix' to reflect an equivalent 4 star Green Star Design & As-Built v1.2 pathway.
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 2016-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 3.3.*
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 3.3.*

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 3.3.* Specification of materials or means to reduce waste will be confirmed in the detailed design.

3 Assessment Requirements and Project Responses

3.1 SEAR 2 | Policies

The following section details the policy requirements/targets relevant to the ecologically sustainable design of the new Tweed Valley Hospital development. These will be reflected in the ESD Matrix developed to capture the requirements.

3.1.1 NSW Energy Efficiency Action Plan

The NSW Energy Efficiency Action Plan (NSW EEAP) was developed in 2013 to contend with current and future increases in energy costs in NSW. The plan includes targets and actions to:

- Realise annual energy savings of 16,000GWh by 2020
- Support 220,000 low income households to reduce energy use by up to 20% by 2014
- Deliver high standard building retrofit programs so 50% of NSW commercial floor space achieves a 4 star NABERS Energy and Water rating by 2020

PROJECT RESPONSE

NSW EEAP is not applicable to the project as it is not a residential or a commercial office development. The project is nevertheless committed to achieve high level of energy efficiency.

3.1.2 NSW Government Resources Efficiency Policy (GREP)

The NSW Government Resources Efficiency Policy (NSW GREP) outlines specific requirements for the EEAP. The GREP aims to reduce the operating costs of the NSW Government through efficient use of resources; particularly energy consumption, water consumption and waste management. The measures and project responses within the GREP that are relevant to the Tweed Valley Hospital development are provided in Table 2.

Table 2: GREP elements relevant to the Tweed Valley Hospital design

GREP Measure	Description	Project Response
Energy		
E3: Minimum standards for new electrical appliances and equipment	All new electrical equipment purchased by the government must meet minimum energy efficiency ratings.	Selection of electrical equipment will meet minimum energy efficiency ratings to comply with NCC. Where applicable, the project shall consider purchasing equipment recognised as high efficiency from the likes of ENERGY STAR® accreditation or being above-average efficiency of Greenhouse and Energy Minimum Standards (GEMS) registered products. Final equipment selection will be addressed during detailed design.
E4: Minimum standards for new buildings	New buildings must be designed and built so that energy consumption is predicted to be at least 10% lower than if built to minimum compliance with National Construction Code requirements.	Passive sustainable design strategies (*Section 2.3*), mechanical HVAC systems and lighting design with its controls will be designed to achieve a high level of energy efficiency. Strategies to reduce energy consumption are further detailed in *Section 3.3*. This measure will be addressed during detailed design.
Water		
W3: Minimum standards for new water-using appliances	All new water-using appliances, shower heads, taps and toilets purchased by agencies must achieve specified levels of water efficiency.	The hospital is committed to achieving a high level of water efficiency. Strategies to reduce water consumption are further detailed in *Section 3.3*.

GREP Measure	Description	Project Response
Clean Air		
A2: Low-VOC surface coatings	All surface coatings will comply with the Australian Paint Approval Scheme (APAS) where fit for purpose.	The hospital is committed to achieving excellent indoor environmental quality. This measure is addressed in *Section 3.3*.

3.1.3 NSW Climate Change Policy Framework

The NSW Climate Change Policy Framework (NSW CCPF) aims to maximise the economic, social and environmental wellbeing in the context of changing climate, and current and emerging international and national policy settings and action to address climate change. The framework sets out an aspirational objective to achieve net-zero emissions by 2050, which, in the context of new development, translates to a requirement to deliver energy efficient buildings.

PROJECT RESPONSE

This development is being designed in accordance with a wide range of ESD goals that pertain to the design and operational stages. The project will ensure that the building is energy efficient with a strong focus on electrical and mechanical strategies that are resilient against the potential impacts of climate change. The climate projections defined by the NSW and ACT Government Regional Climate Modelling (NARCLiM), and the CSIRO have been considered. For further details, see *Section 3.5*.

3.2 SEAR 8 | 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).

3.2.1 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 development will be constructed on a previous farmland. This will not have an adverse environmental impact and therefore alleviates concern of serious or irreversible environmental damage. Proactive measures to prevent environmental degradation will be included within the design, construction and operational phases of the proposed development. 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.

3.2.2 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.

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. 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 recycled waste. Reducing energy, water and waste ensures that the health, diversity and productivity of the environment is maintained for the benefit of future generations.

Further, according to Appendix Z. Social and Economic Impact Assessment Report submitted as part of the project's Environmental Impact Statement (EIS) for SSD9575, not only will the new hospital provide improved health services in the region, aspirations for the project include to provision for increased education, training and research facilities – the Northern NSW Local Health District is preparing an education, training and research strategy for the site. The presence of TAFE across the road from the site also presents opportunities for the future clustering of research and education institutions, with potential for establishing a health and education precinct in the future – possibly with the ability to attract a university presence.

3.2.3 Conservation of Biological Diversity and Ecological Integrity

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

PROJECT RESPONSE

The Appendix I Biodiversity Development Assessment Report (October 2018) submitted as part of the project's Environmental Impact Statement (EIS) for SSD9575 revealed that the project has been located on the site to avoid direct impacts upon Endangered Ecological Communities (EECs), and that the project has been developed to avoid and minimise impact of the development on biodiversity, resulting in a negligible impact. In addition, an assessment of prescribed impacts on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities revealed that the operation of the project based on an approved Construction Environmental Management Plan (CEMP) will result in a net improvement in the quality of the stormwater discharged from the site, rendering a positive impact on balance to the water aspects that sustain threatened species and ecological communities.

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

3.2.4 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.

3.3 B15 | Improving Environmental Performance and Reducing Ecological Impact

The project has been designed to adopt national best practice sustainable building principles, as per the Environmentally Sustainable Design Report prepared by Steensen Varming Pty Ltd (16 August 2018), referred to as the "Stage 1 ESD Report", to improve environmental performance and to reduce ecological impact. Section 4.1 within the Stage 1 ESD Report details a list of concept proposal initiatives for each discipline in the project.

This section draws on relevant strategies from the Stage 1 ESD Report and further elaborates on these strategies for the Stage 2 SSDA to demonstrate consideration of materiality, waste reduction design measures, future proofing, use of sustainable and low-carbon materials, and energy and water efficient design (including water sensitive urban design).

PASSIVE COOLING AND HEATING DESIGN

The design shall adopt passive cooling and heating design principles to reduce the building's reliance on mechanical HVAC system and artificial lighting; acting to reduce energy consumption. These 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; limiting window to wall ratio (WWR) and the use of a high-performance prefabricated 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 2016-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 life cycle costing analysis outcomes
- All area served by variable air volume systems to be provided with economy cycle and associated motorised economy cycle volume control dampers for outside air when ambient conditions are suitable to reduce operating cost and optimise ventilation
- Mechanical system to consist of a centralised plant configuration, which allows for diversity and improves energy efficiency
- Ductwork/pipework systems to be designed to reduce system pressure losses and reduce fan and pump motor power
- Variable speed drives (VSDs) to be provided for cooling tower fans
- Variable speed pumps to be provided for space heating hot water generators
- 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
- Air-cooled, heat recovery VRF (variable refrigerant flow) systems to be provided for the Health Hub
- 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

ELECTRICAL SERVICES

The project team will work to implement electrical services that assist energy efficient design, as detailed below, 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 implement the hydraulics services that assist water efficient design as detailed below, 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 – 3stars
  - Toilets and urinals – 4 stars
  - Washing machines – 4stars
  - Dishwashers – 4 stars
  - Taps and flow controllers – 4.5 stars
- Drainage capture and reuse strategy to be implemented to reduce potable water consumption – the project team to investigate the application of a rainwater harvesting and ruse system that captures rainwater from the roof areas, condensate discharge from air handling units (AHUs) and fan coil units (FCUs), and from Reverse Osmosis (RO) systems, to reuse for irrigation and cooling tower make-up water purposes
- Potable water sub-metering to be connected to the BMCS to reduce wastage through identifying leaks or poor operational performance. Sub-meters to be installed at:
  - Cold water inlet to each domestic hot water unit plant, and Renal and Central Sterile Services Department (CSSD) Reverse Osmosis (RO) plants
  - Cold water supply to each floor/major department, kitchen, retail tenancy, make-up water to re-used rainwater system, cooling tower make-up water
  - Hot water supply to each floor/major department (supply & return) and kitchen
- Gravity drainage systems to be investigated for sewer and trade waste
- Fire test water for recycling back into the fire services storage tank to be investigated
- High efficiency, gas-fired domestic hot water plant to be specified

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 (including Total Suspended Solids, Phosphorous, Nitrogen and Gross Pollutants) and not effecting the increase in natural annual average load of nutrients and sediments. Further details are provided in *Section 3.6*, summarising the Stormwater Management Plan by Robert Bird Group.

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 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 life cycle assessment 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;
  - implementing sound procurement practices; and

  to support verification of the points targeted within the Green Star Scorecard following a Life Cycle Assessment pathway
- 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
- 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
- Provision of flexible floor plates to reduce the construction waste associated with future refurbishments

3.4 B16 | Preliminary Consideration of Building Performance & Climate Change Mitigation

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 2016-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 3.3*. Finally, the building's sustainable design and management practices are further supplemented by consideration of the design practices stipulated in the Green Star Design & As Built v 1.2 rating tool.

3.4.1 NCC 2016-Section J Requirements

The National Construction Code (NCC): Building Code of Australia (BCA) 2016 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 demonstrate NCC 2016-Section J compliance by complying with the Deemed-to-satisfy (DTS) provisions stipulated and/or via an Alternative Solution – JV3 Verification Method approach.

Note that the project falls under NCC 2016 on the basis that the Stage 2 SSDA approval will be received prior to formal commencement date of NCC 2019 (1 May 2020).

3.4.2 Green Star Design & As Built v1.2

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.

The project team has developed an ESD matrix (or framework) in *Appendix A* – ESD Matrix to reflect an equivalent 4 star Green Star Design & As-Built v1.2 pathway, which requires a minimum of 45 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.

An equivalent 4 star Green Star Design & As Built v1.2 Scorecard (See *Appendix B* – Green Star Design & As Built v 1.2 Scorecard) outlines 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.

3.5 B17 | Design for Climate Change Resilience

The new Tweed Valley Hospital will be designed to future-proof itself from the potential impacts of climate change.

NARCLiM Climate Change Projections

The NSW Office of Heritage and Environment, 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

The series of climate futures matrices representing the combination of time periods and greenhouse gas scenarios and classified by the combined changes of the climate variables identified above are provided in Table 3.

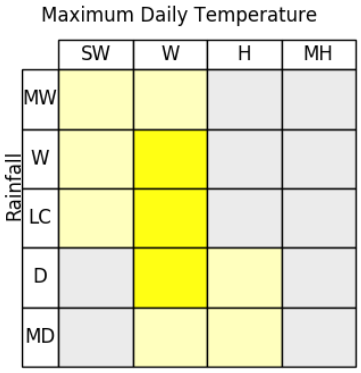
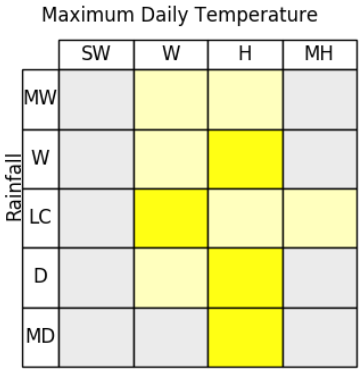
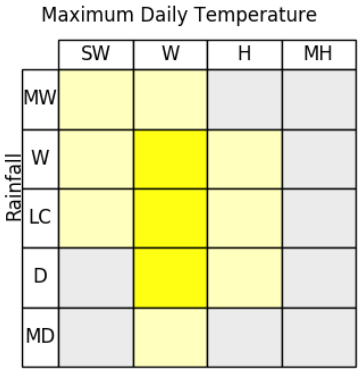
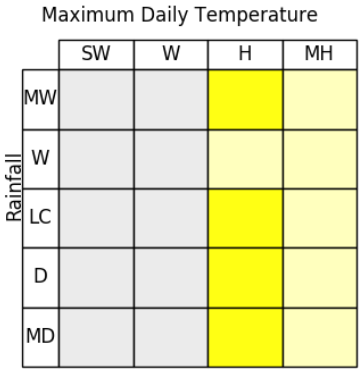
PROJECT RESPONSE (*See Table 4*)

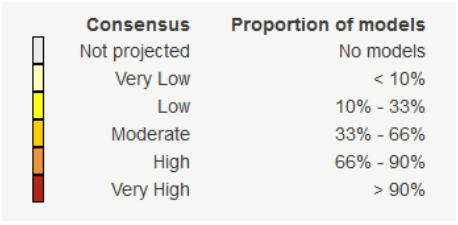
To provide practical and realistic design advice, the use of climate projection data from the medium range scenarios, RCP 4.5, is considered for the 2030 climate projections. The RCP 8.5 scenario is considered an extreme worst-case scenario and has been considered for the 2070 climate projections.

The projections will have an impact on operational costs and occupancy comfort and safety. Hotter days with more heatwave events will particularly affect patients and the operation of building services equipment. This will also require higher capacity and operational costs for mechanical services to maintain occupancy comfort. Increased drought events will require provisions to supplement shortages in potable water. Stronger and reinforced façade components will be required to withstand increased rainfall.

The design initiatives in Table 4 aim to mitigate the effect 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 futures matrices for RCP 4.5 and RCP 8.5 at East Coast

<table>
<tr><th colspan="2" rowspan="2">East Coast Climate Futures</th><th colspan="2">Year</th></tr>
<tr><th>Summer 2030</th><th>Summer 2070</th></tr>
<tr><td rowspan="3">Emissions Scenarios</td><td>RCP 4.5</td><td> 
</td><td> 
</td></tr>
<tr><td>RCP 8.5</td><td> 
</td><td> 
</td></tr>
<tr><td colspan="2">Keys</td><td>Maximum Daily Temperature
SW Slightly Warmer < 0.50
W Warmer 0.50 to 1.50
H Hotter 1.50 to 3.00
MH Much Hotter > 3.00

Rainfall
MW Much Wetter > 15.00
W Wetter 5.00 to 15.00
LC Little Change -5.00 to 5.00
D Drier -15.00 to -5.00
MD Much Drier < -15.00</td><td> 
</td></tr>
</table>

Source: CSIRO and Bureau of Meteorology, Climate Change in Australia website (http://www.climatechangeinaustralia.gov.au)

Table 4: Climate change projections and response initiatives for the Tweed Valley Hospital

Climate Change Projections	Project Responses
Hotter days and more frequent heatwave events	**Mechanical System Provision** In addition to selecting the External Ambient conditions in line with the requirements of the ESG, an extra 1°C (dry bulb) temperature has been added to the external ambient conditions to calculate the required cooling load of the building as a measure of accounting for 2030 RCP4.5 projections. The cooling load is satisfied by the chillers, cooling towers, chilled water pumps, condenser water pumps, pipework and air side systems, and, as such, all the aforementioned equipment associated with cooling accounts for the requirement of RCP 4.5. Further, the increase in temperatures as per 2070 RCP8.5 projections will be met as the main HVAC equipment that will satisfy the cooling demand will be replaced in approximately 25-30 years. Spatial provision is enabled through the equipment selection process which inherently provides for larger equipment typically in the range of 4-8% than that of the design requirement. However, it is also noted that equipment produced in 25-30 years will be of a much higher efficiency then that currently produced and, as such, will require a smaller footprint to satisfy the same load as that of its current day equivalent. Selecting external ambient conditions now to account for the provisions of RCP8.5 projections would be counter intuitive, as the main equipment items which satisfy the cooling demand will be oversized and will not operate with the desired efficiency. **Architectural Design** Increase in hotter ambient temperature is combated via use of prefabricated 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, vertical external shading is to be implemented to further reduce direct solar radiation.

Extended drought periods	The current hydraulic services design implements a drainage capture and reuse strategy to reduce potable water consumption that will assist in combating extended drought periods. The design incorporates a rainwater harvesting and reuses system that captures rainwater from the roof areas, condensate discharge from air handling units (AHUs) and fan coil units (FCUs), and from Reverse Osmosis (RO) systems, to reuse for irrigation and cooling tower make-up water purposes. In addition, strategies that assist water efficient design include, subject to detailed design of the project:
	
	• Potable water using fixtures to be high efficiency and WELS rated as detailed below, unless otherwise required for clinical purposes. Specification of fittings will be confirmed in the detailed design.
	  - Showerheads – 3stars
	  - Dishwashers, Washing machines, Toilets and urinals – 4 stars
	  - Taps and flow controllers – 4.5 stars
	• Potable water sub-metering to be connected to the BMCS to reduce wastage through identifying leaks, or poor operational performances
	• Fire test water for recycling back into the fire services storage tank to be investigated
	• High efficiency, gas-fired domestic hot water plant to be specified

Climate Change Projections	Project Responses
More extreme rainfall events	The project responds to the potential effects of climate change – an increase in rainfall intensity – as demonstrated in the flood assessment that has been carried out for the project (*Appendix W of the Stage 1 EIS: Tweed Valley Hospital, Flooding and Coastal Hazards Assessment – BMT, October 2018*). The assessment concludes that the northern part of the site is within the Tweed River flood plain and is subject to regular inundation. The outlet pipes from the four proposed bio-detention basins are above the existing 1% AEP flood level (approx. RL 3.5m AHD). All roads, buildings and other infrastructure will be constructed above the PMF flood level (approx. RL 8.0m AHD).

3.6 B18 | Implementation of Water Sensitive Urban Design Principles

The project has implemented water sensitive urban design (WSUD) measures as per the Stormwater Management Plan by Robert Bird Group. Stormwater quality modelling was undertaken to demonstrate compliance with the following requirements:

- Guidelines for Development Adjoining Land managed by the NSW Office of Environment and Heritage – no increase in the natural annual average load of nutrients and sediment; and
- Table 6.1 Water Quality Objectives stipulated under Tweed Shire Council Development Design Specification D7 – Storm water quality, requiring minimum reductions of pollutants (including Total Suspended Solids, Total Phosphorous, Total Nitrogen and Gross Pollutants).

The report demonstrates that water quality control will be achieved through converting four existing sediment basins to bio-detention basins in combination with the use of proprietary pit filter baskets (Enviropods or similar) in all stormwater pits.

The bio-detention basins reduce the concentration of suspended solids (TSS), phosphorus (TP) and especially nitrogen (TN) via nutrient uptake and denitrification through the vegetated soil media filters allowing stormwater to pond on the vegetated surface and slowly infiltrate downwards through the soil media. The filtration will be provided by three sub-surface layers including filtration layer, transition layer and drainage layer. Treated water is then collected via subsoil perforated pipes before being discharged to downstream waterways.

Vegetation plays an important role in the efficiency of bio-retention and bio-detention systems. The surface will be densely planted, which retards and distributes the flows across the filter media. Below ground, the roots, which are highly biologically active, physically trap/take up the materials (both fine soils and soluble nutrients). The plant growth and death cycle also play an important role, maintaining the soil structure and hydraulic conductivity of the media.

Refer to the Stormwater Management Plan by Robert Bird Group in 'Appendix S Civil and Stormwater Reports' included in Stage 2 SSDA EIS Submission.

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 development. The report demonstrates that a myriad of ESD initiatives have been incorporated within the current project design, complies to the NSW HI ESG and ESD guidelines, an all the policy requirements under SEAR 2 and SEAR 8, including the requirements from the Stage 1 Development Consent – SSD 9575.

Further, the project team has developed an ESD Matrix (or framework) in *Appendix A* – ESD Matrix' to reflect an equivalent 4 star Green Star Design & As-Built v1.2 pathway. An equivalent 4 star Green Star Design & As Built v1.2 Scorecard (See *Appendix B* – Green Star Design & As Built v 1.2 Scorecard) outlines 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 – ESD Matrix

Main Contractor

Initiative	Green Star Credit	Details	Future Action
Services and Maintainability Review	2.1	- Implement a comprehensive services and maintainability review. The review will address: commissionability, controllability, maintainability, operability and safety aspects for the buildings systems.	To be conducted
Building Commissioning		- Implement a comprehensive pre-commissioning and commissioning requirements/activities documented for the building systems.	To be included within relevant specifications
Design to Climate Change Resilience	3.1	- Develop a project-specific Climate Adaptation Plan (CAP) and suggest potential solutions to be included into the building design in addressing the climate risks.	Addressed within the design
Building Information	4.1	- Develop an operations and maintenance information guide (O&M) made available for the facilities management team.	O&M guide to be developed
Responsible Construction Practices	7.0, 7.1 & 7.2	- **Environmental Management Plan** Develop and implement an Environmental Management Plan (EMP) to manage environmental performance, conditions and impacts arising from demolition, excavation and construction, addressing potential site-specific environmental impacts arising from the construction works. - **Environmental Management System** Implement a formalised systematic and methodological approach to planning, implement and auditing is in place during construction ensuring compliance to the above EMP. A formal Environmental Management System must be independently certified to a recognised standard. - **High Quality Staff Support** Promote site worker's positive mental and physical health outcomes of site activities and culture through programs and solutions on site. Also, enhance site work's knowledge on sustainable practices through education programs.	EMP/EMS to be developed LL to outline high quality staff support provisions
Operational Waste Management	8A	- Develop and implement an Operational Waste Management Plan (OWMP)	Refer to OWMP report developed by TTM Consulting; implemented in architectural spatial planning
Indoor Pollutants	13.1, 13.2	- **Low VOC Materials** Ensure 95% of all internally applied paints, adhesives, sealants and carpets have low Total VOC levels - **Engineered Wood Products** Ensure all engineering wood products have low formaldehyde emission levels.	To be included within relevant specifications
Sustainable Transport	17A.1	- Develop a Travel/Transport Plan by a transport professional.	Travel/Transport Plan to be developed

Initiative	Green Star Credit	Details	Future Action
Materials with Lower Impact	19A.1	Apply life cycle assessment (LCA) principles and learnings in relation to: - specifying green concrete steel and timber (such as: concrete with Portland cement replacement, captured/reclaimed water used as 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, to support verification of the points targeted within the Life Cycle Assessment pathway	To be included within relevant specifications
Responsible Building Materials & Sustainable Products	20.1, 20.2, 20.3 & 21.1	- **Structural and Reinforcing Steel** Ensure at least 60% (by mass) of all reinforcing bar and mesh is produced using energy-reducing processed in its manufacture (measured by average mass by steel maker annually). - **Timber** Ensure all timber used in the building and construction works is either certified by a forest certification scheme that meets the GBCA's 'Essential' criteria for forest certification; Or is from a reused source. - **Permanent Formwork, Pipes, Flooring, Blinds and Cables** Ensure 90% (by cost) of all permanent formwork, pipes, flooring, blinds and cables do not contain PVC and have recognised product declaration; Or satisfy the Best practice guidelines for PVC (provide product accreditation certificate). - **Product Transparency & Sustainability** Ensure 3% of all materials used in the project satisfies as one of the below as defined by the GS DAB v1.2 technical manual: A. Reused products; B. Recycled Content Products C. Environmental Product Declarations D. Third-party Certification E. Stewardship Programs	To be included within relevant specifications
Endangered, Threatened or Vulnerable Species and Communities	23.0	- Demonstrate that no critically endangered, endangered or vulnerable species, or ecological communities were present on site at the date of site purchase or option contract.	Refer to SSDA Stage 1 EIS Appendix I – Biodiversity Development Assessment Report
Sustainable Site	24.2	- Ensure any contamination of hazardous materials on the site has been remediated in accordance with a best practice remediation strategy.	Remediation Action Plan to be developed
Innovation Challenges	30D	Demonstrate compliance to GS DAB v1.2 requirements for innovation challenges below: - High Performance Site Offices - Financial Transparency	To be undertaken

Owner's Representative

Initiative	Green Star Credit	Details	Future Action
Environmental Performance Targets	2.0	- Develop a design intent report or an Owner's Project Requirements (OPR) document outlining basic functions, operations and maintenance of the building systems - Include targets for energy and water consumption and budgets for all nominated building systems. - Include how energy, water and indoor environment quality (IEQ) are metered and monitored.	OPR defined based on extensive NSW Government/HI policies and guidelines

Architectural

Initiative	Green Star Credit	Details	Future Action
Visual Comfort	12.0	- Ensure the glare from sunlight through all viewing façade of nominated area are reduced through a combination of blinds, screens, fixed devices or other means - Selection of orientation appropriate window shade methods - Avoidance of direct sunlight on surfaces in the normal field of view - Avoiding the use of highly polished / reflective surfaces - Exploring options for incorporating deep eaves to provide shading - Optimising window to wall area	Captured in architectural design
Heat Island Effect	25.0	- Implement a heat island effect strategy to show 75% of the site area comprises building or landscape elements	Achieved since based on the overall project site configuration

Mechanical Services

Initiative	Green Star Credit	Details	Future Action
Metering & Monitoring Systems	6.0	- Ensure accessible metering is provided to monitor building energy uses from all mechanical services related systems.	Implemented in design
Ventilation System	9.1, 9.2 & 9.3	- Ensure entry of outdoor pollutants is mitigated in mechanical design; ensure system designed for ease of maintenance and cleaning; ensure that the system has been cleaned prior to occupation and use - Design mechanical system such that outdoor air provided is 50% greater than the minimum required by AS 1668:2012 or carbon dioxide concentrations are maintained below 800ppm - Ensure pollutants (those arising from printing equipment, cooking processes and equipment, and vehicle exhaust) are limited by exhausting the pollutants directly to the outside	Implemented in design

Initiative	Green Star Credit	Details	Future Action
Thermal Comfort	14.1 & 14.2	- Demonstrate 95% of the nominated area and 98% of the year achieves Predicted Mean Vote (PMV) levels between -0.5 and +0.5 inclusive	Implemented in design
Energy Conservation	15E.0 & 15E.1	- Ensure energy consumption of the building achieves a 10% improvement on the reference building (as defined by the deemed-to-satisfy – DTS – provisions in NCC 2016-Section J) - Achieve energy consumption reduction from improving on DTS building fabric provisions of the reference building - Achieve energy consumption reduction from improving on DTS building services provisions of the reference building	Section J reporting to demonstrate

Electrical Services

Initiative	Green Star Credit	Details	Future Action
Metering & Monitoring Systems	6.0	- Ensure accessible metering is provided to monitor building energy uses from all electrical services related systems - Provide monitoring system capable of capturing and processing input data (electricity, gas, water, etc.) from installed energy and water meters (lighting, HVAC, fans, water, etc.). The system must be capable of accurately and clearly presenting the metered data and include reports on consumption trends.	Implemented in design
Lighting Comfort	11.0 & 11.1	- Ensure lights provided in all areas of the hospital are in accordance with AS 1680 - Ensure that lights in the nominated area are flicker-free and accurately address perception of colour by light sources having a minimum Colour Rendering Index (CRI) of 80. An area can be excluded from the CRI requirement if an activity is not impeded by a lower CRI. - Demonstrate that 95% of the nominated area achieves best practice lighting levels for healthcare spaces stipulated under Table F1 of AS 1680.2.5	Implemented in design
External Light Design	27.0 & 27.1	- Ensure all external lighting (except emergency lightings) complies with AS 4282:1997 - Demonstrate light pollution to night sky is reduced by ensuring control of upward light output ratio (ULOR) is below 5% or by ensuring direct illuminance from external luminaires produces maximum illuminance no greater than 0.5 Lux to the site boundary, and 0.1 Lux to 4.5 metres beyond the site into the night sky, when modelled using a calculation plane set at the highest point of the building	Implemented in design

Hydraulic Services

Initiative	Green Star Credit	Details	Future Action
Metering & Monitoring Systems	6.0	- Ensure accessible metering is provided to monitor building water uses from all hydraulic services related systems - Sub-metering to be installed to reduce wastage through identifying leaks, or poor operational performance. Sub-meters to be installed in the following locations: a. Potable cold-water meter for each building b. Potable hot and cold-water meters for each building level c. Potable hot and cold-water meters for each major use department d. Potable water meters to major usage equipment (mechanical plant, hot water plant, RO water plant)	Implemented in design
Water Conservation	18A.1	- Demonstrate reduction of the building's predicted potable water consumption from use of water efficient sanitary fixtures, appliances, HVAC, and irrigation.	Implemented in design

Acoustic Services

Initiative	Green Star Credit	Details	Future Action
Acoustic Comfort	10.1, 10.2 & 10.3	- Ensure internal ambient noise levels are suitable for nominated areas, no more than 5dB(A) above the lower figure in the range recommended in Table 1 of AS 2107:2016 - Ensure the reverberation time in the nominated area is below the maximum stated in the 'Recommended Reverberation Time' provided in Table 1 of AS 2107:2016 - Ensure acoustic separation; that is, enclosed spaces (where it is expected that noise should not carry over from one space to the next) are built to minimise crosstalk	Implemented in design

Structural / Civil Services

Initiative	Green Star Credit	Details	Future Action
Stormwater Management	26.1, 26.2 & 30C	- Demonstrate the project's post development peak event stormwater discharge from the site does not exceed that of the pre-development peak event, using the Average Recurrence Interval (ARI) of 1 year (if low risk of increased rainfall and/or flooding during design life of the project), or 5 year ARI (if medium or high risk) - Demonstrate that all stormwater discharged from the site meets the required pollution reduction targets stipulated in column B of Table 26.2 of the GS DAB v1.2 technical manual when compared to untreated runoff	Implemented in design

Appendix B – Green Star Design & As Built v 1.2 Scorecard

Green Star - Design & As Built Scorecard

Project:	Tweed Heads Valley Hospital
Targeted Rating:	4 Star - Best Practice

Core Points Available	Total Score Targeted
100	50.0

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.	1.0	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	
		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	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	1
Responsible Building Practices	To reward projects that use best practice formal environmental management procedures during construction.	7.0	Environmental Management Plan	-	Complies
		7.1	Formalised Environmental Management System	1	1
		7.2	High Quality Staff Support	1	1
Operational Waste	Performance Pathway	8A	Performance Pathway - Specialist Plan	1	1
		8B	Prescriptive Pathway - Facilities	-	
Total				14	11

Indoor Environment Quality				17	
Indoor Air Quality	To recognise projects that provide high air quality to occupants.	9.1	Ventilation System Attributes	1	1
		9.2	Provision of Outdoor Air	2	1
		9.3	Exhaust or Elimination of Pollutants	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	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	1	1
		11.2	Surface Illuminance	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	-	Complies
		12.1	Daylight	2	
		12.2	Views	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	1	1
		13.2	Engineered Wood Products	1	1
Thermal Comfort	To encourage and recognise projects that achieve high levels of thermal comfort.	14.1	Thermal Comfort	1	1
		14.2	Advanced Thermal Comfort	1	1
Total				**17**	**11**

Energy				**22**	
Greenhouse Gas Emissions	E. Modelled Performance Pathway	15A.0	Conditional Requirement: Prescriptive Pathway	-	
		15A.1	Building Envelope	-	
		15A.2	Glazing	-	
		15A.3	Lighting	-	
		15A.4	Ventilation and Air-conditioning	-	
		15A.5	Domestic Hot Water Systems	-	
		15A.6	Accredited GreenPower	-	
		15B.0	Conditional Requirement: NatHERS Pathway	-	
		15B.1	NatHERS Pathway	-	
		15C.0	Conditional Requirement: BASIX Pathway	-	
		15C.1	BASIX Pathway	-	
		15D.0	Conditional Requirement: NABERS Pathway	-	
		15D.1	NABERS Energy Commitment Agreement Pathway	-	
		15E.0	Conditional Requirement: Reference Building Pathway	-	Complies
		15E.1	Comparison to a Reference Building Pathway	20	6
Peak Electricity Demand Reduction	Prescriptive Pathway	16A	Prescriptive Pathway - On-site Energy Generation	1	
		16B	Performance Pathway - Reference Building	-	
Total				**21**	**6**

Transport					10	
Sustainable Transport	Performance Pathway	17A.1	Performance Pathway		10	2
		17B.1	Access by Public Transport		0	
		17B.2	Reduced Car Parking Provision		0	
		17B.3	Low Emission Vehicle Infrastructure		0	
		17B.4	Active Transport Facilities		0	
		17B.5	Walkable Neighbourhoods		0	
Total					10	2

Water					12	
Potable Water	Performance Pathway	18A.1	Potable Water - Performance Pathway		12	3
		18B.1	Sanitary Fixture Efficiency		0	
		18B.2	Rainwater Reuse		0	
		18B.3	Heat Rejection		0	
		18B.4	Landscape Irrigation		0	
		18B.5	Fire System Test Water		0	
Total					12	3

Materials					14	
Life Cycle Impacts	Performance Pathway - Life Cycle Assessment	19A.1	Comparative Life Cycle Assessment		6	5
		19A.2	Additional Life Cycle Impact Reporting		4	
		19B.1	Concrete		0	
		19B.2	Steel		0	
		19B.3	Building Reuse		0	
		19B.4	Structural Timber		4	
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		1	1
		20.2	Timber Products		1	1
		20.3	Permanent Formwork, Pipes, Flooring, Blinds and Cables		1	1
Sustainable Products	To encourage sustainability and transparency in product specification.	21.1	Product Transparency and Sustainability		3	1
Construction and Demolition Waste	Fixed Benchmark	22A	Fixed Benchmark		1	
		22B	Percentage Benchmark		-	
Total					14	9

Land Use & Ecology				6	
Ecological Value	To reward projects that improve the ecological value of their site.	23.0	Endangered, Threatened or Vulnerable Species	-	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	1	
		24.2	Contamination and Hazardous Materials	1	1
Heat Island Effect	To encourage and recognise projects that reduce the contribution of the project site to the heat island effect.	25.0	Heat Island Effect Reduction	1	1
Total				**6**	**2**

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	1	1
Microbial Control	To recognise projects that implement systems to minimise the impacts associated with harmful microbes in building systems.	28.0	Legionella Impacts from Cooling Systems	1	
Refrigerant Impacts	To encourage operational practices that minimise the environmental impacts of refrigeration equipment.	29.0	Refrigerants Impacts	1	
Total				**5**	**3**

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		
Market Transformation	The project has undertaken a sustainability initiative that substantially contributes to the broader market transformation towards sustainable development in	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	1
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		2
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	30E	Global Sustainability		
Total				**10**	**3**

TOTALS	AVAILABLE	TARGETED
CORE POINTS	100	47.0
CATEGORY PERCENTAGE SCORE		47.0
INNOVATION POINTS	10	3.0
TOTAL SCORE TARGETED		50.0