Concord Forensic Mental Health Facility

11/10/2023

Ecologically Sustainable Development Schematic Design Report

Prepared for

NSW Health Infrastructure

Revision: Report 06

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Revision Information

Project	Concord Forensic Mental Health Facility
Title	Ecologically Sustainable Development For Tender Design Report
Client	NSW Health Infrastructure
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Revision Schedule

Revision	Date	Issue Name	Authorised
DRAFT	31/01/2023	Schematic Design	Garry Luu
Report 01	15/02/2023	Schematic Design	Garry Luu
Report 02	21/02/2023	Schematic Design WoL Updated	Garry Luu
Report 03	13/06/2023	50% Detailed Design	Zac Duryea
Report 04	19/09/2023	80% Detailed Design	Zac Duryea
Report 05	11/10/2023	For Tender Issue	Zac Duryea
Report 06	23/10/2023	Revised For Tender Issue	Zac Duryea

Contents

1 Executive Summary

LCI Consultants have been engaged to provide ESD advice for the Concord Forensic Mental Health Facility (CFMHF). A key requirement of the project is that it meets the sustainability expectations of Health Infrastructure NSW as laid out in the HI Design Guide Note (DGN) 58 Ecological Sustainable Design, and Evaluation Tool. The project must also meet the NSW Government Resource Efficiency Policy (GREP) which in 2019 added a requirement that all NSW Government projects with a build cost of >$10m, in the Sydney Metropolitan area must achieve a 5 Star Green Star Design and As-Built equivalent rating, which will be demonstrated through the self-certified rating outlined in the HI DGN 58.

A 5 Star rating is achieved when more than 60 points, not including buffer points, have been demonstrated through As-Built documentation including drawings, plans, material and product receipts and registers. Currently HI NSW recommends only 41 points and project teams have flexibility to choose the remaining 19 points in achieving the minimum 60 points.

At this point in design, CFMHF includes:

- 65 targeted points including 5 buffer points for flexibility throughout the remaining design phase and into construction phase
- 36 points considered standard and easy to achieve, low-risk credits
- 19 points considered achievable, but requires design resolution to be confirmed, or some credits where a commitment from LHD or HI to go ahead is required. These are considered to be medium-risk.
- 10 points are considered high-risk as they are typically difficult to achieve, or require more substantial time or financial commitment from the LHD/HI.

	Brief	**Concord Forensic Mental Health Facility**		
	HI (All Standard)	Low-risk	Medium-risk	High-risk
TOTALS	41	36	19	10

LCI's ESD team were appointed to orchestrate a whole of life costing exercise for the project. A whole of life plan has been coordinated, priced and recommended by the design team. This has been issued to the Sydney LHD, HI NSW and SWMHIP but no responses have been received.

A Climate Change Adaptation workshop has been conducted with no residual high risks to the development.

2 Introduction

LCI Consultants have been engaged to provide ESD advice for the Concord Forensic Mental Health Facility.

The Concord Hospital, Forensic Mental Health Unit project is part of the Statewide Mental Health Infrastructure Program (SWMHIP) and forms part of the $700m capital works component of a broader series of reforms across the state's mental health services. This project focuses on patient-centric models of care, engagement with consumers, carers and staff, and best practice service delivery with improve outcomes for consumers, carers, families, and stakeholders.

The SWMHIP vision is to 'create capacity for safe, high quality and integrated mental health care across NSW, co-designed with consumers, carers and staff.' The program will support the implementation of key reforms and deliver a range of benefits to mental health consumers and their families, carers, staff and the broader community.

As part of the SWMHIP, a Strategic Planning Approach has been developed for a new low and medium secure forensic mental health unit within the Sydney Local Health District. The facility is planned to be integrated within the grounds of the Concord Repatriation General Hospital(CRGH).

The Low and Medium Secure Forensic Mental Health Units will function as part of a wider network of services, which addresses mental health service capacity in community and hospitals across the state.

SWMHIP Strategic Direction is to improve capacity within the forensic mental health system to provide mental healthcare in facilities with a security level that suits the patient's needs. The Facility will have 18 Medium Secure Forensic Beds and 24 Low Secure Forensic Beds. This facility will allow patients who may be in High Secure facilities to move to a more appropriate level of care. Consequentially, this allows mentally ill individuals who are in jail to move into facilities of high security, overall, allowing people to rehabilitate in appropriate locations according to their needs.

3 ESD Requirements

The following sections outline the guidelines and policies that are relevant to the design of CFMHF from an ESD perspective.

3.1 HI ESD Guideline and Evaluation Tool (2019) – DGN 058

Health Infrastructure NSW released a guideline in 2019 to clarify their expectations for ESD and sustainability in the development of new healthcare projects. The guidelines are broadly aligned with demonstrating equivalence to a 5 Star Green Star rating but they do not require formal registration with, submission to, or assessment by the Green Building Council of Australia.

The guideline defines 41 points that are either considered standard practice or relevant to Healthcare design. Projects are expected to target these items plus an additional 19 points to achieve 60 points in total for 5 Star equivalence. Proponents must demonstrate compliance to the satisfaction of HI's ESD consultant who sets requirements up front, based on the Green Star manual.

3.2 Government Resource Efficiency Policy (GREP)

The Government Resource Efficiency Policy (GREP) was announced in 2014 to help the government achieve its commitment to making NSW a more sustainable, liveable and resilient state. This policy was reviewed in 2018 to take into account implementation challenges, technology development and market trends and was revised and reissued in 2019.

The policy applies to NSW government agencies. It requires agencies to implement resource efficiency measures and to report on their progress against GREP to the Department of Planning, Industry and Environment (DPIE).

GREP includes measures, targets and minimum standards to drive efficiency in four key areas:

- Energy use
- Water use
- Waste management
- Air quality

GREP sets targets for new government buildings and fitouts with a build cost >$10m using the NABERS and Green Star schemes. For offices, data centres and apartments (i.e. social housing) certification is mandatory but for all other types they are encouraged.

This means a new hospital development in a metropolitan area such as Sydney, Wollongong or Newcastle must be designed to the standards of a 5 Star Green Star rating.

Table 2 Minimum NABERS Energy and Green Star standards for new buildings

Type of building	Location	Type of rating	NABERS rating#	Green Star rating*
New facilities >1000 m^2 (net lettable area) and >$10 million	Sydney, Wollongong, Newcastle	Base Building	5 Star+ (without GreenPower)	5 Star Design & As-built
		Tenancy		5 Star Interiors
				4 Star^ Performance
	Rest of NSW	Base Building	4.5 Star+ (without GreenPower)	4 Star Design & As-built
		Tenancy		4 Star Interiors

Facilities eligible for NABERS Energy ratings relevant for government sites, i.e. offices, data centres and apartments.

* Facilities that are not offices or data centres (>1000 m^2), and small office tenancy fit-outs (between 1000 m^2 and 5000 m^2) must be designed to this Green Star standard. Certification is not mandatory but encouraged.

+ Landlords (developers) and tenants are required to sign a NABERS Energy and Water commitment agreement for these targets. Once the first official rating is achieved, ratings must be obtained annually prior to the expiry of current rating certificates.

^ Landlords are required to obtain this Green Star rating within two years after full occupancy is achieved in the leased space and maintain the rating throughout the lease tenure, where NSW Government leases 15,000 m^2 or more in a single building.

Table 2 from the 2019 NSW Government Resource Efficiency Policy (GREP)

4 5 Star Self Certified Rating

The Concord Forensic Mental Health Facility development must target a 5 Star rating using the HI DGN 58 and Evaluation Tool. The following sections outline the proposed pathway and a copy of the completed HI ESD Evaluation Tool (based on Green Star Design & As-Built v1.3 matrix) is provided in Appendix A – HI ESD Evaluation Tool.

To be awarded a credit within the Green Star rating tool, compliance must be demonstrated through documentation.

The guidance given in this report is based on Green Star design and as built v1.3 as this reflects the HI ESD Guideline and Evaluation Tool (2019).

4.1 Total Points Targeted

A 5 Star rating is achieved when more than 60 points, not including buffer points, have been demonstrated through As-Built documentation including drawings, plans, receipts and registers. Currently HI NSW recommends only 41 points and project teams have some flexibility to choose the remaining 19 points. As credits may be lost as the project progresses due to site, design or construction constraints, it is recommended that at least 5 more points are targeted to provide a buffer against these lost credits. This is in line with the approach laid out in the HI NSW ESD Framework for a 5 Star Green Star equivalent rating (which requires 64 points to be pursued for a target that requires 60 points).

At this point in design, CFMHF includes:

- 64 targeted points including 4 buffer points for flexibility throughout the remaining design phase and into construction phase
- 35 points considered standard and easy to achieve, low-risk credits
- 15 points considered achievable, but requires design resolution to be confirmed, or some credits where a commitment from LHD or HI to go ahead is required. These are considered to be medium-risk.
- 14 points are considered high-risk as they are typically difficult to achieve, or require more substantial time or financial commitment from the LHD/HI.

	Brief	Concord Forensic Mental Health Facility		
	HI (All Standard)	Low-risk	Medium-risk	High-risk
TOTALS	41	35	15	14

The following headings go through each sustainable design category within the HI ESD Evaluation Tool and encapsulates the requirements for each credit. A summary is made within each category that includes a how the project is responding to each credit, and what the risk of complying with each credit currently sits at.

4.2 Management

4.2.1 Introduction

This category rewards initiatives that drive better environmental outcomes through management practices. Of the 14 points available, at least 9 may be achievable with a point for high quality staff support dependent upon the contractor's employee support practices and 4 points dependent upon LHDs commitments to a 12-month post-construction building tuning program, engagement of an independent commissioning agent, extension of fit out life, and engagement of waste specialist to advise waste facilities requirements.

4.2.2 Credits

The following section summarises credit requirements from the Green Star Design and As-Built V1.3 Submission Guidelines.

1.0 Green Star Accredited Professional

- A Green Star Accredited Professional – Design & As Built (GSAP) has been contractually engaged to provide advice, support and information related to Green Star principles, structure, timing and processes, at all stages of the project, leading to certification.

2.0 Environmental Performance Targets (minimum requirement)

- The project team must set and document environmental performance targets for the project, commonly done through a **Design reports**; prepared in the design phase.

2.1 Services and Maintainability Review (1 point)

- Demonstrate a comprehensive services and maintainability review has been conducted to address the following aspects for all nominated systems: commissionability, controllability, maintainability, operability, and safety.

2.2 Building Commissioning (1 point)

- Pre-commissioning and commissioning activities have been performed based on approved standards and must document:
  - Commissioning Specification and Commissioning Plan
  - Air Tightness – Recent changes to Green Star mean that in order to achieve the commissioning credit, the team must conduct an air tightness test to at least 10% of the GFA or 10% of the façade area, whichever is greater. Many contractors are reluctant to undertake this test.

2.3 Building Systems Tuning (1 point)

- Following practical completion of the project, prior to occupation, the owner/ client has formally committed to a tuning process for all nominated building systems, including quarterly adjustments for the first year after occupation.
  - Operating and Maintenance Manuals
  - Building Tuning Manual

2.4 Independent Commissioning Agent (1 point)

- Utilisation of an Independent Commissioning Agent (ICA) to advise, monitor, and verify the commissioning and tuning of the nominated building systems throughout the design, tender, construction, commissioning and tuning phases.

3.1 Implementation of a Climate Adaptation Plan (2 points)

- Develop a project specific Climate Adaptation Plan has been developed in accordance with a recognized standard; **AND**
- Solutions have been included into the building design and construction that specifically address the risk assessment component of the plan.

4.1 Building Information (1 point)

- Comprehensive operations and maintenance information is developed and made available to the facilities management team (and form a building logbook); **AND**
- Relevant and current building user information is developed and made available to all relevant stakeholders (Building User Information/Guide)

5.1 Environmental Building Performance (1 point)

- At least 80% of the projects GFA is committed to set, measure and report on its environmental performance using either of the 2 compliance methods.
    - A: Building Performance Metrics – at least 2 of the following performance metrics must be targeted:
        - Greenhouse gas emissions
        - Potable water usage
        - Operation waste; and
        - Indoor environmental quality
    - B: Application of Performance Targets with Formal Agreements

5.2 End of Life Waste Performance (1 point)

- Commitment to reduce demolition waste at the end of life of an interior fitout or base building component.

6.0 Metering – minimum requirement

- Must provide accessible metering to all energy and water common uses and major uses, and to energy and water sources provided by the project.

6.1 Monitoring Systems (1 point)

- Monitoring systems to provide capable of capturing and processing the data produced by the installed energy and water meters. The monitoring system must accurately and clearly present the metered data and include reports on consumption trends, in accordance with the following
    - Monitoring Strategy: to be developed in accordance with a recognized Standard such as CIBSE TM39 *Building Energy Metering*
    - Automatic Monitoring Systems: record both consumption and demand of energy or water and produce reports hourly, daily, monthly and annual energy use for all meters

7.0 Environmental Management Plan (minimum requirement)

- Project-specific best practice EMP is developed and implemented from the beginning of construction works, including excavation and demolition.
- Requirements for EMP are outlined in the *NSW Environmental Management System Guidelines*

7.1 Environmental Management System (1 point)

- The responsible party for the site has a formalised approach to planning, implementing and auditing is in place during construction, to ensure conformance with the EMP.

7.2 High Quality Staff Support (1 point)

- high quality staff support practices are in place that:
  - Promote positive mental and physical health outcomes of site activities and culture of site workers, through programs and solutions on site; and
  - Enhance site workers' knowledge on sustainable practices through on-site, off-site, or online education programs.

8 Operational Waste (1 point)

- 8A. Performance Pathway - Specialist Plan or 8B Waste Management Plan
  - 8A Qualified waste auditor prepares an Operational Waste Management Plan (OWMP) for the building in accordance with best practice approaches.
    - Separation of Waste Steams
    - Dedicated Waste Storage Area
    - Access to Waste Storage Area
  - 8B Alternatively, an Operational Waste Management Plan can be specifically developed or updated (if one exists) to capture best practice operational waste management practices in accordance with the Green Star compliance criteria.

4.2.3 Summary

The following describes the actions and strategies that have been adopted for the credits.

- **1.0 Accredited Professional**
  - There is no issue with achieving this credit as the LCI team has GSAPs, and GSAPs are expected to be part of the Head Contractor's ESD Consultant team.
- **2 Commissioning and Tuning**
  - Environmental Performance Targets will be set once the design is developed further in the next stage.
  - A service and maintainability review led by the head contractor, a representative from the LHD's FM team, or the Independent Commissioning Agent, will be carried out for all services prior to the end of Schematic Design or early in Design Development. Issues raised in this review will be addressed in Detailed Design.

- Building commissioning will be carried out according to Green Star requirements, even if air tightness testing is not pursued. This would provide assurance that the building systems are operating as designed. However, air tightness testing must take place to claim the point.

- **3.1 Climate Adaptation Plan**
  - A Climate Change Resilience and Adaptation Workshop will be held early in detailed design to ensure the project design has no significant climate risks. Adjustments to design may be required after the assessment.
- **4.1 Building Operations and Maintenance Information**
  - No actions were required from the design team at this stage. Requirements will be put into specifications prior to tender.
- **5.1 Environmental Building Performance**
  - No action is required from the design team at this stage. This should not be difficult to achieve as the Metering credit is targeted, allowing targets to be set for the building.
  - A commitment to report on target achievement is required, but this can come at a later stage.
- **5.2 End-of-life Waste Performance**
  - LHD confirmation is required for this. More details can be found further in this section.
- **6 Metering and Monitoring**
  - Requirements were conveyed in ESD DTM workshop to the electrical, mechanical, and hydraulic designers during schematic design. Meters will be incorporated at appropriate locations in the design during Detailed Design and technical requirements will be included in the relevant specifications.
- **7 Responsible Construction Practices**
  - No actions were required from the design team at this stage as this credit is dependent mainly on the contractor. Requirements will be incorporated into specifications prior to tender.
- **8 Operational Waste**
  - LHD confirmation required. More details can be found further in this section.

Table 4.2 summarises targeted points in comparison to the HI Standard. The highlighted credits require further consideration. Some of these (highlighted in orange) indicate that confirmation is required from LHD/HI to ensure that the points are secured. The points highlighted in yellow rely on the head contractor for the project, which at this stage, is yet to be appointed. The points of consideration are summarised below.

- **2.2 Building Commissioning**

- Air tightness testing, which was not required in previous Green Star projects, will need to be committed to by the project team. Requirements can be placed in tender specifications.
- The Green Star DAB v1.3 tool requirements are less stringent than those in the National Construction Code 2019 JV4 for ward areas.
- This credit is high-risk as air-tightness testing is not yet commonplace in the industry, particularly in NSW.

- **2.3 Building Systems Tuning**
  - Confirmation must be obtained from LHD/HI for a commitment to carry out building systems tuning for all nominated building systems for 12 months at least a quarterly basis.
  - Building systems tuning will need to be conducted by the contractor and subcontractors according to a building tuning plan that will need to be completed before end of construction.
- **2.4 Independent Commissioning Agent**
  - Confirmation required from LHD/HI to engage an ICA to carry out commissioning activities, including putting together commissioning specifications, a commissioning plan, carry out commissioning and putting together a commissioning report.
  - The ICA must be engaged by HI or the Head Contractor at the Owner's cost, prior to the completion of detailed design phase.
  - The ICA can be an existing member of LHD's FM team.
- **5.2 End of Life Waste Performance**
  - LHD commitment required to put in place policies that reduce end of fit-out life demolition waste by committing to extend the life of fitouts and finishes to at least 10 years, barring minor wear and tear.
- **7.2 High Quality Staff Support**
  - The engaged contractor will need to either have existing policies and programs in place, or commit to implementing such policies and programs, that promote positive mental and physical health of site workers through on-site, off-site and online education.
  - An assessment on the feasibility of this credit can be conducted after the engagement of the contractor.
- **8A Operational Waste**
  - HI/LHD confirmation required that a waste specialist was engaged to prepare and implement an operational waste management plan for the project. The waste specialist can be engaged from within LHD/HI to advise on the waste facilities required for the project.

	Credit	HI (All Standard)	Low Risk	Medium Risk	High Risk
1.1	Accredited Professional	1	1	0	0
2.0	Environmental Performance Targets	C	Will Comply	0	0
2.1	Services & Maintainability Review	1	1	0	0
2.2	Building Commissioning	1	0	0	1
2.3	Building Systems Tuning	1	1	0	0
2.4	Independent Commissioning Agent (ICA)	0	1	0	0
3.1	Climate Adaption Plan	0	0	2	0
4.1	Building Operations & Maintenance Information	1	0	1	0
5.1	Environmental Building Performance	1	1	0	0
5.2	End of Life Waste Performance	1	1	0	0
6.0	Metering	C	Will Comply	0	0
6.1	Monitoring Systems	1	1	0	0
7.0	Environmental Management Plan (EMP)	C	Will Comply	0	0
7.1	Formalised Environmental Management System	1	1	0	0
7.2	High Quality Staff Support	0	0	1	0
8A	Performance Pathway: Specialist Plan	1	0	0	1
	TOTALS	**14**	**8**	**4**	**2**

Table 4.2 Management Credits

- *Yellow highlight – Head Contractor Responsibility*
- *Orange highlight – HINSW/SWIMHIP Responsibility*
- *C – represents the credit is a minimum expectation and which no points are allocated to*

4.3 Indoor Environment Quality

4.3.1 Introduction

This category rewards initiatives that drive a healthier indoor environment including air, noise, light, pollutants. Of the 17 points available, up to 12 may be achievable. Additional outdoor air (2 points), daylight penetration to 60% of the floor (1 point) and uniform surface illumination (1 point) are considered incompatible with healthcare design. Advanced thermal comfort (1 point) is difficult to confirm without detailed modelling that should be done during detailed design stage. Of the 12 points that may be achievable, daylight penetration to 40% of the floor (1 point) and good access to views for 60% of the floor may be at risk due unknown results from the Section J assessment thus far.

4.3.2 Credits

The following section summarises IEQ credit requirements from the Green Star Design and As-Built V1.3 Submission Guideline.

9.1 Ventilation System Attributes (1 point)

- Ventilation system designed to minimise entry of outdoor pollutants (ASHRAE Standard 62.1:2013 minimum separation distance) for all PRIMARY and SECONDARY spaces
- Design for ease of maintenance and cleaning (access for ducted system to be provided at both sides of components including cooling/heating coils, humidifiers & filters in the air handling system / separate access & cleaning requirements for residential VRV system)
- New ductworks to be cleaned prior to occupation (to avoid moisture & debris during construction)

9.2 Provision of Outdoor Air (1-2 points)

- 1 point 50% more Outside Air than the minimum required (or designed to maintain CO_2 concentration < 800ppm) for all PRIMARY and SECONDARY spaces
- 2 points 100% more Outside Air than the minimum required (or designed to maintain CO_2 concentration < 700ppm) for all PRIMARY and SECONDARY spaces

9.3 Exhaust or Elimination of Pollutants (1 point)

- Printing Equipment
  - product with low chemical emissions to be selected; OR
  - equipment located in an enclosed area with dedicated exhaust & does not recycle to other zones
- Kitchen (not residential) to be physically separated from adjacent spaces (or have opening no greater than 2.5 m2);
- Residential kitchen
  - Non-recirculating exhaust system; OR
  - Recirculating system with quality filter
- Car park to have its dedicated exhausts systems

10.1 Internal Noise Levels (1 point)

- For all PRIMARY and SECONDARY spaces the internal ambient noise levels in the nominated area are no more than 5dB(A) above the lower figure recommended in Table 1 of AS/NSA 2107:2016

10.2 Reverberation (1 point)

- For all PRIMARY and SECONDARY spaces either:
  - Demonstrate he reverberation time in the nominate area is below the maximum stated in the 'Recommended Reverberation Time' provided in Table 1 of As/NZ 2107:206; OR

- Treat 50% of the combined floor and ceiling area with a material having a noise reduction coefficient (NRC) of at least 0.5.

10.3 Acoustic Separation (1 point)

- For all PRIMARY and SECONDARY spaces the project must address noise transmission by one of the following 2 pathways:
  - Partitions between spaces to be constructed to achieve a specified weighted sound reduction (Rw)
  - The sound insulation between enclosed spaces complies with Dw + LAeqT > 75

11.0 Minimum Lighting Comfort (Minimum requirement)

- All lights to be installed with ballast (flicker free) and achieve minimum Colour Rendering Index (CRI) of 80.
- Flicker Free lighting: for 95% of all PRIMARY and SECONDARY spaces or 95% of fittings
  - Electronic drives that feature 12-bit or greater resolution for all Light-emitting Diode (LED) lighting; or
  - High frequency ballasts for all other lighting types, including incandescent (incl Halogen, dichroic (e.g. low-voltage downlights), and High-intensity Discharge (e.g. metal halide, low/high pressure sodium).

11.1 General Illuminance & Glare Reduction (1 point)

- Glare from lamps must be eliminated within the nominated area. 3 options are available, a combination may be used to demonstrate compliance:

  A. Prescriptive Method 1: bare light sources must be fitted with baffles, louvers, translucent diffusers, ceiling design, or other means that obscure the direct light source from all viewing angels of occupants, including upwards

  B. Prescriptive Method 2: the lighting system must comply with the Luminaire selection as detailed in Clause 8.3.4 of AS/NZS 1680.1-2006

  C. Performance Method 1: Unified Glare Rating (UGR) calculated for the lighting on a representative floor must not exceed the maximum values listed in Table 8.2 of AS/NZS 1680.1-2006

11.2 Surface Illuminance (1 point)

- A combination of lighting and surfaces improve uniformity of lighting to give visual interest in the nominated area.

11.3 Localised Lighting Control (1 Point)

- In the nominated area, occupants have the ability to control the lighting in their immediate environment.

12.0 Glare Reduction (minimum requirement)

- The glare from sunlight through all viewing facades and skylights in the PRIMARY spaces is reduced through a combination of blinds, screens, fixed devices, or other means.

12.1 Daylight (1-2 points)

- 1 point: for 40% of nominated area
- 2 points: for 60% of nominated area
- Compliance can be achieved through any of the 3 methods:
  - A. Prescriptive Methodology: manual calculations compliant with *Green Star Daylight and Views hand Calculation Guide*
  - B. Compliance Using Daylight Factor: modelling the Daylight Factor across the PRIMARY spaces
  - C. Compliance Using Daylight Autonomy: modelling the Daylight Illuminance (DI) across the PRIMARY spaces

12.2 Views (1 point)

- At least 60% of the PRIMARY spaces have a clear line of sight to a high quality internal or external view. All floor areas within 8m, with a line at 45 degrees from the corners, can be considered compliant.

13.1 Paints, Adhesives, Sealants and Carpets (1 point)

- The project must demonstrate either of the following:
  - No paints, adhesives, sealants or carpets are used in the PRIMARY, SECONDARY or TERTIARY spaces; **OR**
  - At least 95% of internally applied paints, adhesives, sealants (by volume) or carpets (by area) meet the total VOC limits specified in Green Star Design & As Built v1.3 guidelines

13.2 Engineered Wood Products (1 point)

- The project must demonstrate either of the following:
  - No new engineered wood products are used in the building
  - At least 95% (by area) of all engineered wood products meet the formaldehyde emission limits specified in the Green Star Design & As Built v1.3 guidelines. There are 2 ways to demonstrate that engineered wood products comply:
    - A. Product certification
    - B. Laboratory testing

14.1/14.2 Thermal Comfort (1-2 points)

- For all PRIMARY and SECONDARY spaces
- Demonstrate that for 95% of the nominated area and 98% of the year, a high degree of thermal comfort is provided (i.e. PMV +/- 1.0).
- A second point is available for advanced thermal comfort where PMV is +/- 0.5.

4.3.3 Summary

The following describes the design measures that will be adopted by the design team. The highlighted credits require further consideration, some of which require confirmation from the LHD/HI. These include:

- **9.1 Ventilation System Attributes**
  - Entry of outdoor pollutants will be minimised by keeping minimum distances between exhausts from intakes, windows, grills as outlined in ASHRAE 62.1.
- **9.3 Exhaust or Elimination of Pollutants**
  - Confirmation from LHD required to procure only certified printers for open plan nurse stations and clinical support areas so that dedicated exhaust systems are not required.
- **10 & 11 Acoustics and Lighting**
  - These requirements *SHOULD* be met by complying with HI NSW Engineering Manual requirements but in some instances, there are contradictions that will need to be resolved during detailed design.
  - For 11.3 Localised Lighting Control, lighting zones will be designed so that each lighting zone serves at most 6 people generally for administration areas, including clinical support and large nurse stations. Localised control at each bed is common practice and will not be a problem for this credit.
- **12 Views**
  - Ok, windows generally cantered in the rooms allowing maximum view/window size ratio
- **13 Indoor Pollutants**
  - These are dependent on the contractor engaged and their procurement practices. No action was taken by the design team at this stage. The requirements for these credits will need to be put into specifications for tender of the contractor.
- **14.2 Advanced Thermal Comfort**
  - This credit can only be assessed after design development as it requires detailed energy modelling.

The credits highlighted in blue indicate items that could be lost due to the later building design.

- **12 Daylight**
  - Daylight modelling has yet to be completed. It is also a scope gap for the project now. Opportunity for Mechanical Team to complete since they have an IES Model.

Table 4.3 summarises targeted points for IEQ.

		HI (All Standard)	Low Risk	Medium Risk	High Risk
9.1	Ventilation System Attributes	1	0	1	0
9.2	Provision of Outdoor Air	1	0	0	0
9.3	Exhaust OR Elimination of Pollutants	1	1	0	0
10.1	Internal Noise Levels	1	1	0	0
10.2	Reverberation	1	1	0	1
10.3	Acoustic Separation	1	1	0	1
11.0	Minimum Lighting Comfort	C	Will Comply	0	0
11.1	General Illuminance & Glare Reduction	1	1	0	0
11.2	Surface Illuminance	1	0	0	0
11.3	Localised Lighting Control	1	1	0	0
12.0	Glare Reduction	C	Will Comply	0	0
12.1	Daylight	1	0	0	tbc
12.2	Views	1	1	0	0
13.1	Paints, Adhesives, Sealants & Carpets	1	1	0	0
13.2	Engineered Wood Products	1	1	0	0
14.1	Thermal Comfort	1	1	0	0
14.2	Advanced Thermal Comfort	1	0	0	tbc
	TOTALS	**15**	**10**	**1**	**2**
	TOTAL		**13**		

Table 4.3 IEQ Credits

- *Blue highlight – Credits that are yet to be considered in the project*
- *C – represents the credit is a minimum expectation and which no points are allocated to*

4.4 Energy

4.4.1 Introduction

This category rewards up to 22 points for initiatives that lower energy consumption and/or greenhouse gas emissions. This is a significant issue for Hospitals because they can consume significant amounts of energy. Green Star rewards projects that minimise energy demand and switch supply from fossil fuels to renewable energy. Due to the plant room required for the building, it is unclear for the size of the solar array that will be on top of the roof. The project will operate without burning any fossil fuels onsite.

4.4.2 Credits

The following section summarises energy credit requirements from the Green Star Design and As-Built v1.3 Submission Guidelines

15E GHG Emissions – Reference Building Pathway (4 points)

- Comparing performance of Reference Building Model (Minimum DTS Model) vs Proposed Building Model
- 2 points from Overall Building Performance – 10% improvement via proposed building as a whole (can be more depending on services design)
- 2 points from Fuel Switching, no fossil fuels are burned on site for cooking and space heating.
- A minimum of 3 points in this credit is required to achieve 5 Star Green Star equivalency (Only 1 of these 3 points can be made from prescriptive measures i.e. Fuel Switching)

16 Peak Electricity Demand Reduction – Modelled Performance Pathway: Reference Building (1-2 points)

There are 2 compliance pathways to achieving points in tis credit:

> A. Prescriptive Pathway: On-site Energy Generation (1 point)
>> Onsite electricity generation system reduced the total peak electricity demand by at least 15%

> B. Modelled Performance Pathway (Reference Building)
>> 1 point – 20% reduction from Reference Building
>> 2 points – 30% reduction from Reference Building

4.4.3 Summary

Table 4.4 summarises targeted points for Energy.

Points are awarded for credit 15E by comparing the proposed design to a reference version of the design that just complies with legislated minimum (deemed-to-satisfy) requirements in the Building Code of Australia 2019 Section J. Because the energy consumption of a hospital is significant, small changes in design to specific elements have less of an effect on overall consumption, making points harder to achieve. It is anticipated, based on experience with the design of other NSW hospitals, that around a third of the energy efficiency points will be achievable through practical measures.

The best way to make significant reductions in carbon emissions will be to introduce renewable energy generation; either on site or via a power purchase agreement for off-site renewable energy. The latter is becoming more popular for government agencies where renewable energy may be procured at no additional cost impost. The number of points that could be achieved from renewable energy is 1.5 times the points achieved through improvements in the building fabric and systems.

		HI (All Standard)	Low Risk	Medium Risk	High Risk
15E.0	Conditional Requirement	C	Will Comply	0	0
15E.1	Intermediate Building Improvement	1	0	0	0
15E.2	Proposed Building Improvement	1	2	0	0
15E.3	Off-Site Renewables	0	0	0	0
15E.4	District Services	0	0	0	0
15E.5	Fuel Switching	0	2		
16A	Prescriptive Pathway: On-site Energy Generation	0	0	0	0
16B	Modelled Performance Pathway: Reference Building	1	0	1	0
	TOTALS	**3**	**4**	**1**	0
	TOTAL		**5**		

Table 4.4 Energy Credits

- *Orange highlight – HINSW/SWIMHIP Responsibility*
- *C – represents the credit is a minimum expectation and which no points are allocated to*

4.5 Transport

4.5.1 Introduction

This category rewards initiatives that reduce carbon emissions associated with transport of people to and from the project site.

4.5.2 Credits

17 Sustainable Transport (up to 10 points)

- 17B Prescriptive Pathway (up to 7 points)
  - B.1 - Access by Public Transport (up to 3 points)
    - Points based on the accessibility of the site by public transport (only estimates available for this credit since the score is issued by the GBCA and this project will not be registered with the GBCA.)
  - B.2 - Reduced Car Park Provision(1 point)
    - No new car parks on site (1 point)
  - B.3 - Low Emission Vehicle Infrastructure
    - Provisions to support the uptake of low-emission vehicles.
  - B.4 - Active Transport Facilities (1 point)
    - Bicycle parking and associated facilities are provided to regular building occupants and visitors.
  - B.5 - Walkable Neighbourhoods (1 point)

- Determined by project's Walk Score. > 80 = 1 point.

4.5.3 Summary

The project receives a score of 13/100 as a Walk Score and 50/100 as a Transit Score. This suggests the project is quite car dependent. It will not achieve a point for B.5 and may achieve 1 point for B.1.

The project has not provided any carparking within its boundary, although the overall hospital site has a car park. This should provide a credit for B.2. B.3 is unachievable. No Active transport facilities have been provided at this point, therefore B.4 is not targeted.

This totals 2 points currently being targeted for Transport.

		HI (All Standard)	Low Risk	Medium Risk	High Risk
17A	Performance Pathway	0	0	0	0
17B.1	Access by Public Transport (Up to 3 points)	0	0	0	tbc
17B.2	Reduced Car Park Provision (1 point)	0	0	0	0
17B.3	Low Emission Vehicle Infrastructure (1 point)	0	0	0	0
17B.4	Active Transport Facilities (1 point)	0	0	0	0
17B.5	Walkable Neighbourhoods (1 point)	0	0	0	0
	TOTALS	**0**	**0**	**0**	1
	TOTAL		**1**		

4.6 Water

4.6.1 Introduction

This category rewards up to 12 points for initiatives that lower water consumption through efficiency and wastewater recycling.

4.6.2 Credits

Credits can be achieved by either one of two methods:

- **18A. Performance Pathway**
  - 5 prescriptive strategies must be adopted. These include:
    - Provision of highly efficient sanitary fixtures with minimum WELS ratings for taps, urinals, toilets, showers, clothes washing machines and dishwashers.
    - Rainwater reuse through the installation of a rainwater tank of a certain size within the site boundary to collect and reuse rainwater.

For this project, a tank sized according to 10L/m^2 GFA is required. (1 point). 34 kL RWT currently proposed to satisfy this requirement.

- Heat rejection: no water is used for heat rejection
- Landscape irrigation system uses either drip irrigation with moisture sensor override, or does not use any potable water.
- Fire protection system test water:
  - The fire protection system water does not expel water for testing; or
  - temporary storage for 80% of the routine fire protection system test water and maintenance drain-downs for reuse on-site is included in design; or
  - if sprinkler systems are installed, each floor must be fitted with isolation valves or shut-off points for system-by-system testing.

4.6.3 Summary

Water efficient fittings and appliances are sensible and are mandated by GREP.

Healthcare operators are nervous about reuse of captured rainwater for toilet flushing because of airborne contamination risk but rainwater can be captured for use in irrigation, that in turn can create cooler microclimates around hospitals. Additionally, fire system test water can be reused in the irrigation system. Current provisions for a 36 kL underground rainwater tank. This size complies with the Green Star requirement of 10L/m^2 GFA.

No water consumption used for heat rejection equipment.

Highly efficient landscape irrigation systems such as drip irrigation with moisture sensor override will need to be used to achieve the credit.

The combination of these initiatives would score 5 points out of the available 12, as detailed in Table 4.6

		HI (All Standard)	Low Risk	Medium Risk	High Risk
18A	Performance Pathway	0	7	0	0
	TOTALS	**3**	**7**	**0**	**0**
	TOTAL		**7**		

Table 4.6 Water Credits

4.7 Materials

4.7.1 Introduction

Materials used in buildings are the next focus area for reducing greenhouse gas emissions after the current focus on switching operational energy to renewables.

This category rewards initiatives that reduce materials used or at least ensure they have environmentally preferred content or sourcing. Of the 14 points available, up to 9 may be achievable, with 1 additional point available subject to contractor procurement practices to source materials that are reused, have recycled content, are environmentally certified or have stewardship programs.

4.7.2 Credits

The following section summarises material credit requirements from the Green Star Design and As-Built V1.3 Submission Guidelines

19B.1.1 Concrete – Portland Cement Reduction (up to 2 points)

- Portland cement content is reduced by 30% OR 40% across all concrete used in the project against a reference case (1 point targeted)

19B.1.2 Water Reduction (0.5 points)

- Mix water for all concrete used contains at least 50% captured or reclaimed water (0.5 points)

19B.1.3 Aggregate Reduction (0.5 points)

- At least 40% of coarse aggregate in the concrete is crushed slag aggregate or another alternative material, OR at least 25% of fine aggregate sand in the concrete are manufactured sand or other alternative material (0.5 points)

20.1 Structural and Reinforcing Steel (1 point)

- 95% (by mass) of the buildings steel is sourced from a Responsible Steel Maker; **AND**
- For steel framed buildings: at least 60% of the fabricated structural steelwork is supplied by contractors accredited to the Environmental Sustainability Charter of the Australian Steel Institute
- For concrete framed buildings: at least 60% (by mass) of all reinforcing bar and mesh is produced using energy-reducing processed in its manufacture

20.2 Timber (1 point)

- 95% (by cost) of the buildings timber is either:
  - Certified by a forest certification scheme that meets GBCA criteria; **OR**
  - From reused source

20.3 Permanent Formwork, Pipes, Flooring, Blinds and Cables (1 point)

- 90% (by cost) of the building permanent formwork, pipes, flooring, blinds and cables either:
  - Doesn't contain PVC and have recognized product declarations; **OR**

- Meet the GBCA's *Best Practice Guidelines for PVC*

21 Product Transparency and Sustainability (up to 3 points)

- Up to 3 points are available when a proportion of all materials used in the project meet transparency and sustainability requirements under one of the following initiatives:

  A. Reused Products;

  B. Recycled Content Products;

  C. Environmental Product Declarations;

  D. Third-Party Certification; or

  E. Stewardship Programs.

  Points are calculated based on specified benchmarks for the percentage of compliant products used in the project.

22.0 Construction and Demolition Waste: Reporting Accuracy (minimum requirement)

- All waste contractors and waste processing facilities that provide waste management and report services must
  - Hold a 'Compliance Verification Summary' issued by a 'Suitably Qualified Auditor' **OR**
  - Complete a 'Disclosure Statement' outlining how much of the *Green Star Construction and Demolition Waste Reporting Criteria* has been implemented

22B Percentage Benchmark (1 point)

- Demonstrate that 90% (by weight) of the waste generated during construction and demolition has been diverted from landfill.

4.7.3 Summary

Table 4.7 summarises the targeted points for Materials. The credits highlighted in orange indicate credits that require confirmation from LHD/HI, while the credit highlighted in yellow would be dependent on the contractor and will require confirmation upon their engagement.

The orange-highlighted credits are LCA-related that require further confirmation from the LHD/HI to engage an LCA specialist to carry out an LCA study.

Also, an increasing number of products are disclosing their environmental content/performance through an Environmental Product Declaration (EPD). Points are available for Credit 21 by ensuring between 3% to 9% of materials by cost have an EPD.

Structural and Reinforcing Steel and Timber Products will require active procurement from the contractor engaged for the project.

Table 4.7 shows the materials outcomes to be targeted in this project.

		HI (All Standard)	Low Risk	Medium Risk	High Risk
19B.1.1	Concrete (Cement reduction)	1	0	1	0
19B.1.2	Concrete (Water reduction)	0	0	0.5	0
19B.1.3	Concrete (Aggregate Reduction)	0	0	0.5	0

19B.2	Steel	1	0	0	0
19B.3	Building Reuse		0	0	0
19B.4	Structural Timber	1	0	0	0
20.1	Structural and Reinforcing Steel	1	1	0	0
20.2	Timber Products	1	1	0	0
20.3	Permanent Formwork, Pipes, Flooring, Blinds & Cables	1	1	0	0
21	Product Transparency		0	0	1
22.0	Reporting Accuracy	C	0	Will Comply	0
22B	C&D Waste - % Benchmark	1	0	1	0
	TOTALS	**7**	**3**	**3**	**1**
	TOTAL		**7**		

Table 4.7 Materials Credits

- *Yellow highlight – Head Contractor Responsibility*
- *C – represents the credit is a minimum expectation and which no points are allocated to*

4.8 Land Use & Ecology

4.8.1 Introduction

This category rewards initiatives that minimise negative impact or create improvement in land use and ecology of the project site. 4 of the 6 points in total are being targeted, the balance of the points coming from significant improvement of ecological value of the site.

4.8.2 Credits

The following section summarises Land Use and Ecology credit requirements from the Green Star Design and As-Built V1.3 Submission Guidelines.

23.0 Endangered, Threatened or Vulnerable Species and Communities (conditional requirement)

> The minimum requirement is met where the project can demonstrate that at the date of site purchase or option contract, no critically endangered, endangered or vulnerable species, or ecological communities were present on the site.

23.1 Ecological Value (up to 3 points)

> Awarded where the ecological value of the site is improved by the project.

> The number of points awarded is determined by the Ecological Value Calculator based on a comparison of the condition of the site before and after design/construction

24.0 Sustainable Site (conditional requirement)

> At the date of site purchase or option contract, the project site didn't:

- Include: old growth forests, prime agricultural land **OR** wetland of 'High National Importance
- Impact on 'Matters of National Significance'

24.1 Reuse of Land (1 point)

- 75% of the site was previously developed land at the date of purchase **OR**
- for previously developed owned land, at the projects Green Star registration date

24.2 Contamination and Hazardous Materials (1 point)

- Either of the following are met:
  - A. Site Contamination:
    - developer has implemented best practice for site remediation strategy and been signed off by an auditor prior to occupation
  - B. Hazardous Materials:
    - hazardous materials survey carried out on any existing buildings or structures in accordance with OH&S **AND**
    - hazardous materials have been stabilized, removed or disposed of in accordance with best practice

25 Heat Island Effect Reduction (1 point)

- When assessed in plan view, at least 75% of the whole site area comprises of one or a combination of the following:
  - Vegetation;
  - Green roofs;
  - Roofing materials, including shading structure, having 3 yr SRI of minimum 64 (for roof pitch < 15 degrees) **OR** 34 (for roof pitch > 15 degrees);
  - Unshaded hard-scaping elements with a 3 yr SRI of minimum 34 or initial SRI of minimum 39;
  - Hardscaping elements shaded by overhanging vegetation or roof structures, including solar hot water panels and photovoltaic panels;
  - Water bodies and/or water courses; **OR**
  - Areas directly to the south of vertical building elements, including green walls and areas shaded by these elements at the summer solstice.

4.8.3 Summary

The constrained nature of the site means it can be difficult to score points in this category. The following design measures can be adopted to meet the credit requirements.

- **23.0 Endangered, Threatened or Vulnerable Species**
  - As the site has been previously developed, there is little risk that there are any endangered threatened or vulnerable species on site.
- **23.1 Ecological Value**

- As the site has been previously developed there is little risk of reducing ecological value, such as habitat. 1 point can be achieved through the introduction of 2% native vegetation coverage into the landscape design. This could be more or less depending on the vegetation and hardscape coverage in the proposed design compared to the pre-development scenario. Currently, the design is still in its early stages without information on the proposed areas of native vegetation, so it is difficult to determine whether this credit is achieved without further development of the landscape design.

- **24.0 Sustainable Sites**
  - As the site has been previously developed, there is little risk that any of the Green Star precluded land types (old growth forests, prime agricultural land, 'High National Significance' wetlands or land that impact on 'Matters of National Significance'.
- **24.1 Reuse of Land**
  - This credit is achieved as the site is 100% previously developed.
- **24.2 Contamination and Hazardous Materials**
  - Remediation of any contamination discovered during demolition works can be recognised as best practice and therefore is considered to be low-risk. This will be required to be put into tender specifications.
- **25 Heat Island Effect**
  - The greatest challenge for this credit is to ensure that light-coloured finishes with low SRI are selected for paving and hardscape and sufficient soft landscaping is included in the landscape design. This credit requires further development of the landscape design in order to be secured.

Table 4.8 describes the emissions credits that may be achieved by the project. Currently targeting 4 points in Land Use and Ecology.

		HI (All Standard)	Low Risk	Medium Risk	High Risk
23.0	Endangered, Threatened or Vulnerable Species	C	Will Comply	0	0
23.1	Ecological Value	0	0	0	tbc
24.0	Conditional Requirement	C	Will Comply	0	0
24.1	Reuse of Land	0	1	0	0
24.2	Contamination and Hazardous Materials	0	1	0	0

25	Heat Island effect	1	0	0	tbc
	TOTALS	**1**	**2**	**0**	**2**
	TOTAL		**4**		

Table 4.8 Land Use and Ecology Credits

- *C – represents the credit is a minimum expectation and which no points are allocated to*

4.9 Emissions

4.9.1 Introduction

This category rewards initiatives that reduce environmental pollution from a project including water runoff, light spill, microbial contaminants from heat rejection and refrigerant leakage. 4 of the 5 available points can be achievable by the project, with microbial control considered difficult to achieve due to the proposed use of water-cooled chillers for the HVAC system.

4.9.2 Credits

The following section summarises emissions credit requirements from the Green Star Design and As-Built V1.3 Submission Guidelines.

26.1 Stormwater Peak Discharge (1 point)

- Project teams must demonstrate that the post-development peak event stormwater discharge from the site doesn't exceed the pre-development peak event stormwater discharge, using the Average Recurrence Interval (ARI)
  - Low risk of increased rainfall/ flooding during lifetime of project – 1 year ARI
  - Medium – high risk of increased rainfall/ flooding during lifetime of project – 5 year ARI

26.2 Stormwater Pollution Targets (1 point)

- All stormwater discharged from the site meets the required pollution reduction targets when compared to untreated runoff in accordance with the Table 26.2 of Green Star Design & As Built v1.3
- Pollutants to be measured include:
  - Total Suspended Solids (TSS)
  - Gross Pollutants
  - Total Nitrogen (TN)
  - Total Phosphorus (TP)
  - Total Petroleum Hydrocarbons (if site contains less than 200m2 of uncovered areas where vehicles are likely to transit)

- Free Oils (if site contains less than 200m2 of uncovered areas where vehicles are likely to transit)

27.0 Light Pollution to Neighbouring Bodies (minimum requirement)

- Design to avoid light pollution to neighbouring properties – all outdoor lights to comply against AS4282:1997

27.1 Light Pollution to Night Sky (1 point)

- This credit can be demonstrated using either of the following methods:
  - A. Control of upward light output ratio (ULOR)
    - External luminaires has upward light output ratio (ULOR) < 5% OR External luminaries produces a maximum initial point illuminance value of no greater than 0.5 Lux to the site boundary and 0.1Lux to 4.5m beyond the site into the night sky
  - B. Control of Direct Illuminance
  - Demonstrate that direct illuminance from external luminaires on the project produces a minimum initial point illuminance value no greater than:
    - 0.5 Lux to the site boundary
    - 0.1 Lux to 4.5 meters beyond the site into the night sky, when modelled using a calculation plane set at the highest point of the building

28 Legionella Impacts from Cooling Systems (1 point)

- 1 point is available where the building:
  - Is naturally ventilated; or
  - Has waterless heat-rejection systems; or
  - Has water-based heat rejection systems that includes measures for Legionella control and Risk Management.

29 Refrigerant Impacts (1 point)

There are 4 pathways for demonstrating compliance with this credit:

- A. Calculating TSDEI
  - The calculated Total System Direct Environmental Impact (TSDEI) of the refrigerant systems in the building is less than 15; or
- B. Leak Detection Systems
  - The calculated TSDEI of the refrigerant system is between 15 – 25 **AND** a leak detection system with automated refrigerant recovery is in place
- C. Low Impact Refrigerants
  - All refrigerants in the project have an ozone depletion potential of zero, and a global warming potential of 10 or less; or
- D. No Refrigeration Equipment
  - Where there are no refrigerants employed within the building system, this point is awarded.

4.9.3 Summary

The following describes the design measures that will be adopted by the design team and any additional actions required to achieve the credits.

- **26.1 Stormwater Peak Discharge**
  - Peak stormwater discharge calculations will need to be carried out to inform the stormwater management systems and landscape design in order to secure this credit in the next stage. As increased risk of heavy rain and flooding has been identified in the Climate Adaptation Risk Assessment, the post-development stormwater runoff has been simulated according to a higher precipitation level compared to the pre-development scenario (5 year compared to 1 year design Average Recurrence Interval).
- **26.2 Stormwater Pollution Targets**
  - Stormwater pollution reduction may be achieved using cassettes attached to the wider stormwater system inlets. A stormwater pollution simulation will be required to inform the design of stormwater management systems in the next stage. The Civil Concept Design Report shoes modelling for only total suspended solids, gross pollutants, total nitrogen and total phosphorus. Results are needed for total petroleum hydrocarbons and free oils.
- **27.1 Light Pollution Night Sky**
  - Light Pollution can be reduced by selecting fittings with little or no Upwards Light Output Ratio. This will need to be done during luminaire selections and the requirements put into specifications for tender.
- **29.0 Refrigerants**
  - Refrigerant impact can be reduced by using the latest low global warming HFO refrigerants such as R-1234yd. This has been incorporated into the design of the HVAC plant.

Table 4.9 describes the emissions credits that may be achieved by the project. Currently targeting 5 points in Emissions.

		HI (All Standard)	Low Risk	Medium Risk	High Risk
26.1	Stormwater Peak Discharge	1	1	0	0
26.2	Stormwater Pollution Targets	0	0	1	0
27.0	Light Pollution Neighbouring Properties	C	0	Will Comply	0
27.1	Light Pollution Night Sky	0	0	1	0
28.0	Microbial control	1	0	1	0
29	Refrigerants	0	0	1	0
	TOTALS	**2**	**1**	**4**	**0**

	TOTAL		**5**

Table 4.9 Emissions Credits

- *C – represents the credit is a minimum expectation and which no points are allocated to*

4.10 Innovation

4.10.1 Introduction

This category rewards initiatives that reduce environmental pollution from a project including water runoff, light spill, microbial contaminants from heat rejection and refrigerant leakage.

4.10.2 Targeted Credits

There are many innovation challenges available and it's not practical to list them all here. The following innovations are those that are most applicable in this instance based on our experience from other similar projects. Many of the innovations are dependent upon Head Contractor or LHD controls that are beyond the scope of the design team. Early engagement is essential.

10 Innovation Points have been targeted.

30A.1 Individual Thermal Comfort

> Consumers are able to control the temperature of their immediate environment by controlling their individual FCU within their space and by operating the window for natural ventilation.

30C.1 Stormwater Pollution Targets

> Up to 2 points can be achieved if more stringent stormwater pollution targets can be achieved. Generally, 1 credit is not difficult to achieve.

> Simulations will be provided in Detailed Design to confirm this.

30C.2 Ultra Low VOC (1 point)

> Over 50% of paints (by volume) specified in the building have a maximum TVOC content of 5g/L. This must be verified by one of the approved paint test methods.

> No actions were required from the design team in Schematic Design. Requirements will be incorporated into specifications prior to tender.

30D.1 High Performance Site Offices (1 point)

> Site sheds to achieve 75% of the initiatives in the High Performance Site Office Checklist . Initiatives cover Energy, IEQ, Materials and Water.

> This is dependent on the contractor engaged, but could be a condition of engagement.

30D.2 Occupant Engagement (1 point)

> Preoccupancy survey on staff or occupants

- Post occupancy on significant proportion of occupants between 6-12 months after practical completion.
- Commitment from the LHD is required to achieve the aims of this credit.

30D.3 Reconciliation Action Plan (1 point)

- This innovation challenge rewards projects that have a Reconciliation Action Plan (RAP) and use it to deliver tangible outcomes through the delivery of a project.
- The RAP can be for the Building Owner's corporate entity or via the Head Contractor.
- The project must have specific targets that are tracked during delivery. Its not sufficient to have general corporate targets for the parent organization that are not reflected on the project site.
- Aboriginal Participation Targets such as the NSW APIC legislation and the NSW Government Aboriginal Procurement Policy are ideal for this challenge.

30D.4 Universal Design

- Projects will only be rewarded for going beyond compliance with access standards and legislation. Project teams are required to understand the accessibility issues specific to their project ('needs analysis') prior to developing design solutions in order to address these ('accessibility plan'). To claim this Innovation Challenge the project team must:
- Review the Design for Dignity Guidelines, or similar guidelines for inclusive design and dignified access.
- Perform a 'needs analysis' identifying the project's accessibility issues. See the Guidance section for additional detail.
- Develop an 'accessibility plan' (or similar) that provides strategies to address the needs determined and identifies actions for how the project will incorporate inclusive design.
- Implement the 'accessibility plan' and demonstrate that accessibility initiatives have been carried out for the project.

30D.5 Incorporation of Indigenous Design

- Design of areas for Indigenous people in the building follow four principles from the Australian Indigenous Design Charter: Indigenous Led, Community Specific, Impact of Design, Shared Knowledge (Collaboration, Co-creation, Procurement)
- Relevant Indigenous groups have been consulted for the design of the smoking ceremony area and the aboriginal courtyard, which goes towards the first 3 principles. A way of educating the public on an ongoing basis during building operation should be devised to raise awareness of indigenous culture and design.

30D.6 Financial Transparency (1 point)

- Project to disclose costs associated with Green Star for both implementation and documentation. Cost breakdown per credit required.

30E.1 Circadian Lighting (WELL)

- From WELL building rating system, the circadian lighting credit can be achieved.

5 Green Star Briefing Document and Design Workshops

A Green Star Workshop was run by LCI's ESD Team, analysing through the HI ESD Evaluation Tool. This workshop was run on the back of a Design Team Meeting on the 29th of November 2022. Following the workshop, the preliminary HI ESD Evaluation Tool was distributed amongst the design team to incorporate into their design. (Aconex reference: LCI Aus-GCOR-000008)

6 Whole of Life Assessment

LCI was responsible for delivering a Whole of Life (WoL) assessment for the project. The WoL assessment informed HINSW on financially viable upfront investments for the project. The results will depict whether an increased upfront investment will pay off over the lifespan of the project or not. The recommendations proposed will be in the interest of reducing costs over the building's life comparing the sum of capital expenditure and operational expenditure throughout the buildings lifetime for each option analysed.

The Whole of Life Costing Plan was issued, each service consultant reviewed the document and made comment at a follow up WoL Approach Discussion Meeting. At this meeting LCI requested each stakeholder to come forward with options they saw value in exploring.

Some options were determined mandatory for the design (DGN 58) or not applicable to the design, and for others, further whole of life costing needed to be assessed. This decided which options were to undertake a WoL assessment. The following RASCI Matrix outlines the options currently being investigated. It should be noted that one column addresses whether the design has been included in DGN058. The options deemed not applicable to the design have not been included in the RASCI matrix. They have been included in the mechanical whole of life report and the hydraulic schematic design report.

LCI received the capital expenditure and operational consumptions from each option and created a WoL assessment with recommendations for the project.

LCI then created a follow up Memo outlining which design decisions are to be implemented into the project and issued around the design team as a guideline to follow. This memo will also outline what options have not been applied to the project and why.

The design teams will then need to implement the requirements of the follow up Memo into their respective design.

See Whole of Life Selections Memo Attached in Appendix B

7 Section J Analysis

Section J assessment is being completed by Stantec's Mechanical and ESD teams. This analysis will explore improvements to the building envelope and determine starting points for glazing thermal performance parameters to meet Section J compliance. Further analysis including façade calculations and detailed modelling will be required during Design Development to fine tune the building fabric performance.

Improvements over DTS requirements will need to be explored to achieve additional energy savings to fulfil the energy aspirations of the project. A minimum of 2 points in Credit 15E, or at least 10% better than a DTS-compliant building, is a minimum requirement for 5 Stars Green Star equivalency.

8 Climate Change Resilience and Adaptation

A climate change adaptation and resilience workshop was held in late March, shortly after issuing the Climate Change Adaptation Memo to the design team. The Memo outlined historic weather data alongside future climate projections for NSW East Coast.

Through design, high risk items have been mitigated as seen in the figure below. 2090 had more climate risks than 2050, naturally and the Residual after resilience methods had been adopted relieved the high risk items.

In general, the Concord Forensic Mental Health Facility is safe from extreme climactic events. It is well elevated from the Parramatta River avoiding flood inundation, it is not in a bushfire zone, it is on a peninsula significantly reducing urban heat island effect.

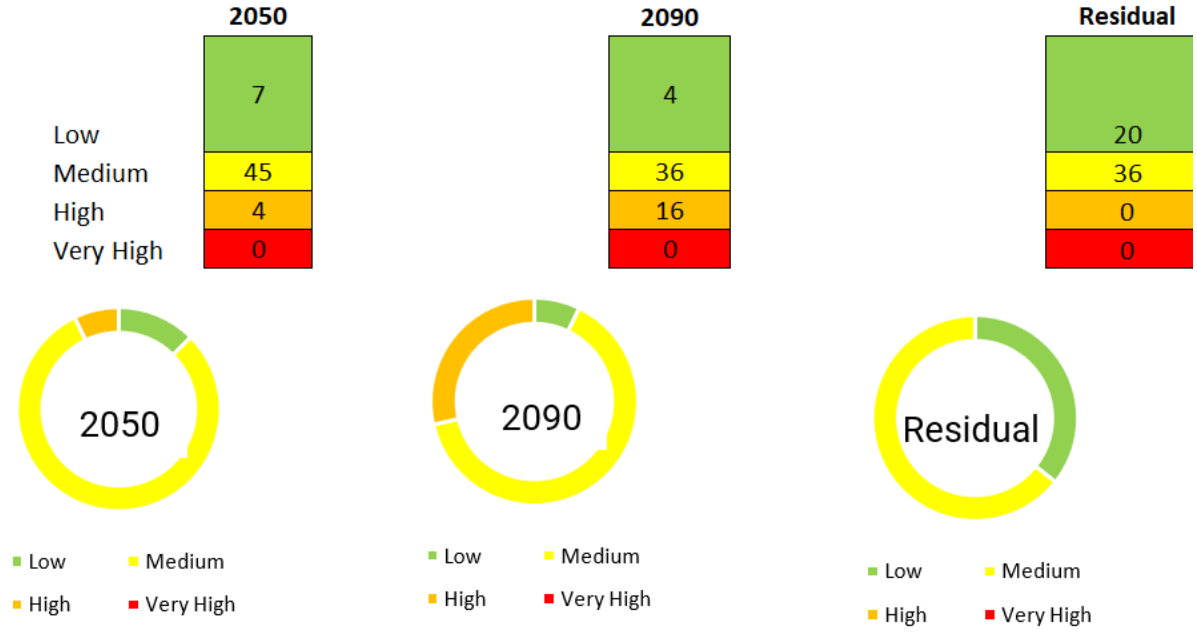

Figure 1- Climate Change Workshop Summary

The Climate Change Adaptation Memo and Workshop Matrix can be seen in Appendix C & D respectively.

9 Next Steps

As the project progresses into the next phase of design development, criteria for demonstrating that the targeted credits will be achieved must be embedded into the design documentation. This will require ongoing and iterative engagement with the whole design team. Requirements will also need to be incorporated into specifications for the contractor and nominated subcontractors.

LHD/HI confirmation for the following credits, as mentioned in Section 4, will need to be finalised. It is recommended that the LHD/HI are engaged early in the Design Development phase to close these out.

- 2.3 Building Systems Tuning
- 2.4 Independent Commissioning Agent
- 5.2 End-of-life Waste Performance
- 8A Operational Waste
- 9.3 Exhaust OR Elimination of Pollutants
- 15E.3 Off-site Renewables
- 30D.2 Occupant Engagement

Development of design elements that impact Green Star credits, including intake and exhaust separations, metering systems, acoustics, landscape design and stormwater system design will need to be followed up to ensure that the credits are still on track.

Climate change adaptation workshop will occur early in design development to ensure the project's design has mitigated itself from high or extreme climate risks.

Section J analysis would need to continue, potentially involving energy modelling to determine compliance. Regardless of whether energy modelling is required for Section J analysis, energy modelling will most likely be required in order to explore improvements in the building envelope and building systems to achieve the energy reductions required to meet the minimum of 3 points in the Green Star energy credit to achieve 5 Star Green Star Equivalency.

If all of these steps are undertaken, it is possible to demonstrate that the project would be capable of achieving the equivalent 5 Star Green Star Design & As Built Rating v1.3.

Appendix A – HI ESD Evaluation Tool

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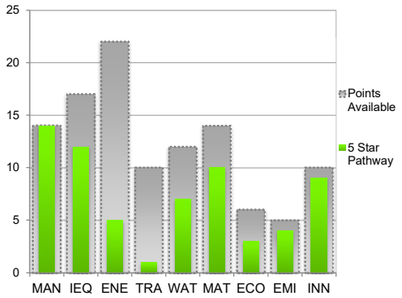

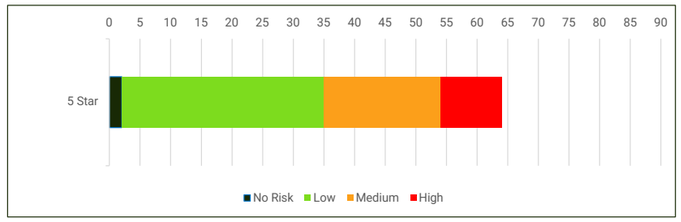

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4 Star: 45 to 59 Points, **5 Star:** 60 to 74 Points, **6 Star:** 75+ Points

Credit Title	Aim of Credit	Credit Code	Criteria Title	Credit Requirements Summary *For full criteria refer to Green Star Design and Asbuilt v1.3 Submission Guidelines*	Points Available	Risk	Green Star Design and 5 Star	Responsibility	Pre Contract Evidence	Pre Contract Evidence Due Date
MANAGEMENT										
Accredited Professional	To recognise the appointment and active involvement of a Green Star Accredited Professional in order to ensure that the rating tool is applied effectively and as intended.	1.1	Accredited Professional	Contractual engagement of GSAP at all stages of the project from schematic design through to practical completion and certification	1	No Risk	1	HI / LHD / ESD	**ESD:** SD ESD Report	100% SD
Commissioning and Tuning	To encourage and recognise commissioning, handover and tuning initiatives that ensure all building services operate to their full potential.	2.0	Environmental Performance Targets	Minimum Credit Requirement: Documented targets for the environmental performance of the project to be set through a design intent report or an owner's project requirements document.	Credit Minimum	No Risk	To Comply	Client / ESD / All input	**ESD:** SD ESD Report	100% SD
		2.1	Services & Maintainability Review	Comprehensive services and maintainability review of the project led by the head contractor or owner's representative (e.g. ICA) during the design stage and prior to construction	1	Low	1	PM / FM team / Building Services team / Head contractor	**TBC (LHD FM or ICA):** - Services & Maintainability Review Register No.1 - Services & Maintainability Review Register No.2	No.1: 50% DD No.2: 100% DD
		2.2	Building Commissioning	Comprehensive pre-commissioning and commissioning activities are performed for all building services according to AIRAH/CIBSE codes for all services or ASHRAE for mechanical services only. Air permeability test to be carried out in accordance with AS/NZS ISO 9972:2015.	1	High	1	Building Services team / Head contractor	**Mech, BMCS, Elec, Hydraulics, Lighting:** 1. Tender Specifications	100% DD SINSW may not be interested in air tightness testing
		2.3	Building Systems Tuning	Tuning process in place requiring, as a minimum, quarterly adjustments and measurements for the first 12 months after occupancy and review of building system manufacturer warranties. Tuning process requires analysis of monitoring system data and assessment of occupant feedback on building conditions.	1	Low	1	Building Services team / Head contractor	**Mech, BMCS, Elec, Hydraulics, Lighting:** Tender Specifications	100% DD
		2.4	Independent Commissioning Agent (ICA)	Engagement of an ICA to advise, monitor, and verify the commissioning and tuning of all building systems	1	Low	1	HI / ICA	**ICA:** - ICA CV - ICA Scope of Works - Services Maintainability Review	100% DD
Adaptation and Resilience	To encourage and recognise projects that are resilient to the impacts of a changing climate and natural disasters.	3.1	Climate Adaption Plan	Implementation of a Climate Adaption Plan according to AS5334:2013 or ISO31000-2009 & AGO, Climate Change Risks and Impacts	2	Medium	2	PM / All / Climate Assessor	**ESD:** - Climate Adapation Plan + Register - Confirmation No.1 from Design Team all **high risk** measures addressed - Confirmation No.2 from Design Team all high risk measures addressed	CAP + Confirmation No.1 100% SD Confirmation No.2 100% DD
Building Information	To recognise the development and provision of building information that facilitates understanding of a building's systems, operation and maintenance requirements, and environmental targets to enable the optimised performance.	4.1	Building Operations & Maintenance Information	Produce comprehensive Building Operation and Maintenance information made available to Facilities Management team. Relevant and current building user information is developed and made avaialble to all relvant stakeholders.	1	Medium	1	Head Contractor	**Mech, BMCS, Elec, Hydraulics, Lighting:** Tender Specifications	100% DD
Commitment to Performance	To recognise practices that encourage building owners, building occupants and facilities management teams to set targets and monitor environmental performance in a collaborative way.	5.1	Environmental Building Performance	Commitment to set performance targets for 80% of the Gross Floor Area (GFA) to measure, and report on at least two environmental building performance metrics such as GHG emissions, potable water usage, operational waste etc. OR achieve certified operational performance ratings in accordance with Green Star.	1	Low	1	LHD	**LHD:** Internal policy/commitment letter in line with GREP reporting requirements	100% DD
		5.2	End of Life Waste Performance	Commitment to reduce demolition waste at the end of life of an interior fit out or base building component for at least 80% of the GFA	1	Low	1	LHD / NBRS	**LHD:** Internal policy/commitment letter	100% DD

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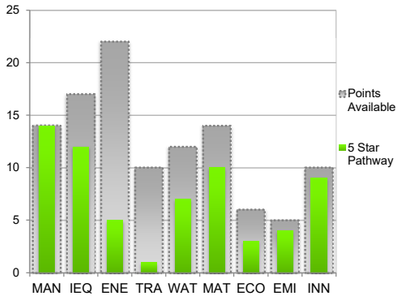

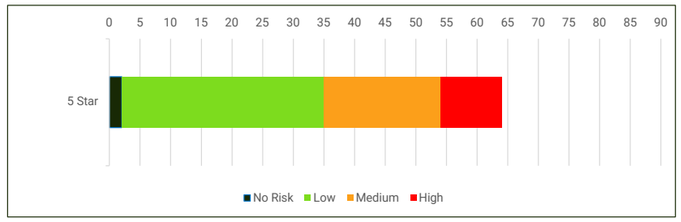

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Credit Title	Aim of Credit	Credit Code	Criteria Title	Credit Requirements Summary *For full criteria refer to Green Star Design and Asbuilt v1.3 Submission Guidelines*	Points Available	Risk	Green Star Design and **5 Star**	Responsibility	Pre Contract Evidence	Pre Contract Evidence Due Date
Metering and Monitoring	To recognise the implementation of effective energy and water metering and monitoring systems.	6.0	Metering	Minimum Credit Requirement: Provide accessible metering to all energy and water consumption covering common and major uses and sources for distinct uses or floors (whichever is smaller). Energy items >100kVA must be individually metered. Meters are to be commissioned and validated as per NABERS protocol.	Credit Minimum	Low	Yes	Electrical / Mechanical / Hydraulics	**Mech, BMCS, Elec, Hydraulics:** Tender Specifications **Mech, Elec, Hydraulics:** Single Line Metering Diagrams (not typically provided at design stage)	100% DD
		6.1	Monitoring Systems	Implementation of a monitoring strategy in accordance with a recognised standard (e.g. CIBSE TM39 Building Energy Metering), capable of capturing and processing data from all energy and water meters, and accurately and clearly presenting data consumption trends.	1	Low	1	Mechanical	**Mechancial & Electrical:** Tender Specifications **EMS typically provided by electrical trade.**	100% DD
Responsible Construction Practices	To reward responsible construction practices that manage environmental impacts, enhance staff health and wellbeing, and improve sustainability knowledge on site.	7.0	Environmental Management Plan (EMP)	Minimum Credit Requirement: Engaged Contractor must implement a project specific EMP meeting requirements of the NSW Environmental Management System Guidelines.	Credit Minimum	Low	To Comply	Head Contractor	**TBC (LHD FM or ICA):** **- Services & Maintainability Review Register No.1** **- Services & Maintainability Review Register No.2**	100% DD
		7.1	Formalised Environmental Management System	Engaged Contractor to have a Formalised Environmental Management System with evidence of independent auditing & system compliance to ISO 14001.	1	Low	1	Head Contractor	**ESD:** Tender Specifications	100% DD
		7.2	High Quality Staff Support	Promote positive mental and physical health outcomes of site activities and culture of site workers through programs and solution on-site. Enhance site workers' knopwledge on sustainable practices through on-site, off-site, online education programs	1	Medium	1	Head Contractor	**ESD:** Tender Specifications	100% DD
Operational Waste: Performance Pathway	To recognise projects that implement waste management plans that facilitate the re-use, upcycling, or conversion of waste into energy, and stewardship of items to reduce the quantity of outgoing waste.	8A	Performance Pathway: Specialist Plan	Engagement of a qualified waste auditor/professional specialist to prepare and implement an Operational Waste Management Plan (OWMP) for the project in accordance with best practice approaches. Requirements of the OWMP must be reflected in the development waste facilities provided.						
		8B	Prescriptive Pathway: Facilities	Provide occupant waste storage containers for separation of all applicable waste streams, have a dedicated waste storage area for collection of all waste sized to handle all waste streams that is provided to meet best practice access requirements.	1	High	1	Operational Waste Auditor / HI / LHD / PM / Architect	**LHD:** Operational Waste Management Plan Currently some waste information in the functional breif - REVIEW	100% SD
				Category Total	**14**		**14**			

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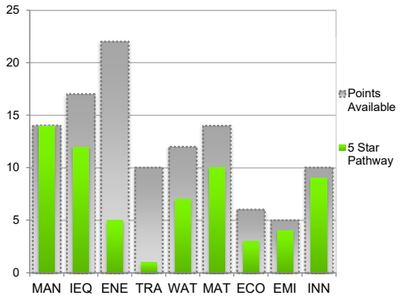

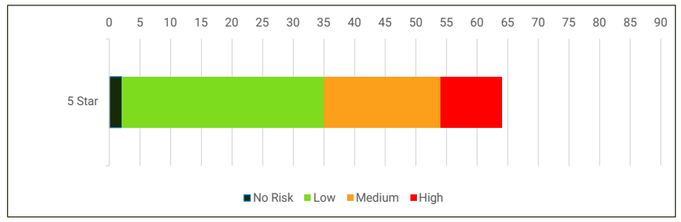

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INDOOR ENVIRONMENT QUALITY										
Indoor Air Quality	To recognise projects that provide high indoor air quality to occupants	9.1	Ventilation System Attributes	Mechanical ventilation systems are to be: 1. designed in accordance with ASHRAE Standard 62.1:2013 regarding separation of outdoor air intakes & pollution sources to minimise entry of pollutants; 2. designed with provision of access for maintenance and cleaning to both sides of all moisture and debris-catching components; and 3. cleaned prior to occupation and use, covering all new and existing ductwork.	1	Low	1	Mechanical	**Mech:** 1. Floor plan or Elevation markups showing seperation distances in accordance with ASHRAE Standard 62.1:2013 regarding separation of outdoor air intakes & pollution sources to minimise entry of pollutants 2. Tender Specifications for cleaning	1. 50% SD 2. 100% DD
		9.2	Provision of Outdoor Air	For mechanically ventilated or mix mode spaces, outdoor air is provided at a rate 50%(1 point) /100% (2 points) greater than the minimum required by AS1668.2-2012, or CO2 concentrations are maintained below 800ppm/700ppm through a CO2 monitoring & control system. For naturally ventilated spaces 2 points are awarded where the requirements if AS 1668.4-2012 are met.	2	No Risk	0	Mechanical	**Mech:** - O/A schedule showing an increase in Outdoor air L/s and minimum 50% increase - Tender Specifications	1. 50% SD 2. 100% DD
		9.3	Exhaust OR Elimination of Pollutants	Provide exhaust systems in accordance with AS1668.2-2012 to remove pollutants from printing and photocopy equipment, cooking processes and equipment, and vehicle exhaust &/OR remove the source of these pollutants. (For photocopiers, equipment with listed certifications can be used in place of dedicated exhaust ventilation)	1	Low	1	Mechanical (building exhaust)/ LHD (printers and photocopiers)	**Mech:** 1. Source pollutants are exhausted directly to outside or to a dedicated exhaust riser **HI/LHD:** 2. Confirmation fom the LHD that low emission photocopiers and printers (in accordance with either ECMA-328, RAL-UL 171 or GGPS.003) will be procured.	1. 50% SD 2. 100% DD
Acoustic Comfort	To reward projects that provide appropriate and comfortable acoustic conditions for occupants	10.1	Internal Noise Levels	Internal noise levels in the nominated area considering all internal & external noise sources are to be no more than 5dB(A) above the "satisfactory" sound levels listed in AS/NZS 2107:2016	1	Medium	1	Acoustics	**Acoustics:** 1. Acoustic Design Report with design recommendations to achieve the Acoustic Targets **Architectural:** 2. Architectural drawings showing acoustic recommendations have been incorporated in building elements.	1. 50% DD Acoustic Consultant yet to be appointed, therefore these items are rated medium to high risk. High risk items are chosen due to their ability to achieve compared to medium
		10.2	Reverberation	The reverberation time in the nominated area must be below the maximum stated in AS/NZS 2107:2016	1	Medium	1	Acoustics	**Acoustics:** 1. Acoustic Design Report with design recommendations to achieve the Acoustic Targets **Architectural:** 2. Architectural drawings showing acoustic recommendations have been incorporated in building elements.	1. 50% DD Acoustic Consultant yet to be appointed, therefore these items are rated medium to high risk. High risk items are chosen due to their ability to achieve compared to medium
		10.3	Acoustic Separation	The partition between the nominated enclosed (typically occupied) spaces should be constructed to achieve a weighted sound reduction index (Rw) of at least 45 OR the sound insulation between enclosed spaces complies with DW + LAeqT > 75	1	Medium	1	Acoustics	**Acoustics:** 1. Acoustic Design Report with design recommendations to achieve the Acoustic Targets **Architectural:** 2. Architectural drawings showing acoustic recommendations have been incorporated in building elements.	1. 50% DD Acoustic Consultant yet to be appointed, therefore these items are rated medium to high risk. High risk items are chosen due to their ability to achieve compared to medium

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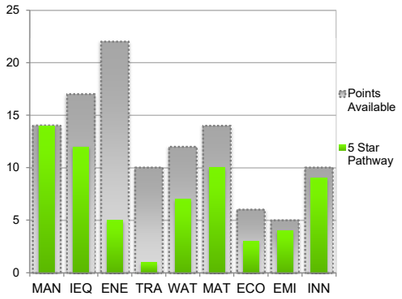

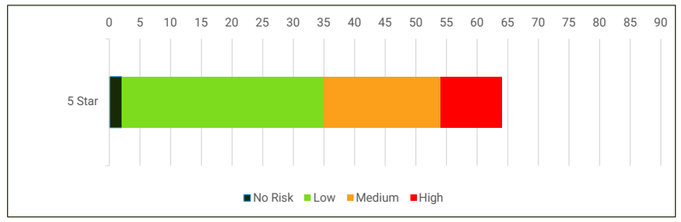

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Lighting Comfort	To encourage and recognise well-lit spaces that provide a high degree of comfort to users	11.0	Minimum Lighting Comfort	Minimum Credit Requirement: All lights in the nominated area are installed with ballasts (flicker free) and have a minimum Colour Rendering Index (CRI) of 80	Credit Minimum	Low	To Comply	Lighting	**Lighting:** - Lighting schedule showing design criteria for 12-bit drivers and minimum 80 CRI.	100% SD
		11.1	General Illuminance & Glare Reduction	Maintained illuminance meets the recommended levels of AS1680.2.1, and lighting glare is eliminated.	1	Low	1	Lighting	**Lighting:** - ISOLUX plots confirming maintained illuminance levels in accordance with AS1680.2.1.	100% SD
		11.2	Surface Illuminance	A combination of lighting and surfaces in the nominated area improve uniformity of lighting to give visual interest. Over 95% of nominated area's ceiling to have an surface reflectance value >0.75 and a lighting system to provide an average surface illuminance of at least 30% of the lighting levels on the working plane.	1	No Risk	0	Lighting		
		11.3	Localised Lighting Control	Occupants have the ability to control the lighting in their immediate environment including on/off switching and adjusting lighting levels.	1	Low	1	Electrical / Lighting	**Lighting:** - Lighting Controls strategy.	100% SD
Visual Comfort	To recognise the delivery of well-lit spaces that provide high levels of visual comfort to building occupannts	12.0	Glare Reduction	Minimum Credit Requirement: Demonstrate that glare from sunlight through the viewing facades in the nominated area is reduced through a combination of blinds, screens, fixed devices, or other means. Where the functional requirements of an are require the exclusion of daylight and views, these areas may be excluded.	Credit Minimum	Low	Complies	Architect	**Architectural:** 1. Architectural Drawings showing location of internal blinds to all primary spaces 2. Architectural specifications indicating blind material with less than 10% VLT.	1. 100% SD 2. 100% DD
		12.1	Daylight	At least 40% or 60% of the nominated area must demonstrate a daylight factor (DF) of 2%.	2	High	1	Architect	**Mech:** 1. Daylight Modelling report demonstrating daylight level achievement. **Architectural:** 2. Material finishes aligning with material LRV and Glazing VLT in the	1. 50% DD Elevations only recently provided. Not enough time to calculate views or daylight before SD Final Report. Will be analysed in DD
		12.2	Views	At least 60% of the nominated area has a clear line of sight to an external view or a high quality internal view. Floor area within 8m from a compliant window, atrium or view can be considered to meet the criteria.	1	Low	1	Architect	**Architectural:** - Views markups in accordance with: https://www.gbca.org.au/uploads/79/35919/Green%20Star_Daylight%20and%20Views%20Hand%20Calculation%20Guide%20May%202015%20RELEASE.pdf	1. 50% DD Elevations only recently provided. Not enough time to calculate views or daylight before SD Final Report. Will be analysed in DD
Indoor Pollutants	To recognise projects that safeguard occupant health through the reduction in internal air pllutant levels	13.1	Paints, Adhesives, Sealants & Carpets	At least 95% of all internally applied paints, adhesives, sealants and carpets meet the stipulated 'T-VOC limits'	1	Low	1	All / Head Contractor	**ESD:** Tender Specifications	100% SD
		13.2	Engineered Wood Products	Engineered Wood Products: At least 95% of all engineered wood products meet the stipulated formaldehyde limits	1	Low	1	All / Head Contractor	**ESD:** Tender Specifications	100% SD
Thermal Comfort	To recognise projects that achieve high levels of thermal comfort	14.1/2	Thermal Comfort	For mechanically ventilated spaces,a Predicted Mean Vote (PMV) levels between -1 and +1 must be achieved (1 point) and PMV levels between -0.5 and +0.5 much be achieved for advanced thermal comfort (2 points)	2	High	1	Mechanical	**Mechanical:** PMV calculation in accordance with the NCC2019 Section J.	100% DD 14.1 Low risk, since compliance is required in JV3 Analysis. 14.2 This will be based on mechanical As-Built equipment selection.
				Category Total	**17**		**12**			

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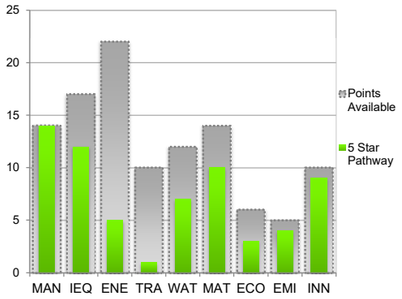

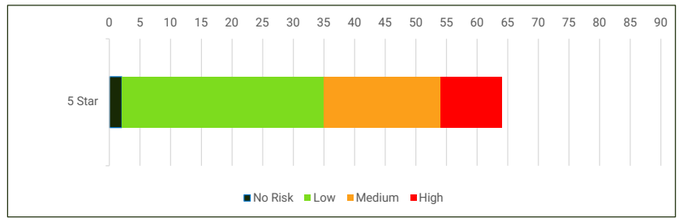

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ENERGY										
Greenhouse Gas Emissions	To encourage reduction of greehouse gas (GHG) emission associated through energy efficiency measures and to drive uptake of renewable energy	15E.0	GHG Emissions Reduction	Project teams must demonstrate that the project is subject to a NABERS Energy Commitment Agreement for a minimum of 5 Stars.	Conditional	Low	To Comply	Arch / ESD / Mechanical / Electrical / Hydraulics / VT	**Mechanical:** Energy Modelling Report demonstrating compliance.	100% SD & 100% DD
		15E.1	GHG Emissions Reduction	GHG Emissions reduction: Building Fabric Intermediate Building Relative to Benchmark Building: - Conditional Requirement: 2 points **- 2%: 1.0 points** - 4%: 2.0 points - 6%: 3.0 points - 8% (max): 4.0 points	4	Low	TBC	Arch / ESD	**Mechanical:** Energy Modelling Report demonstrating any achievement of points between the reference model and intermediate model.	100% SD & 100% DD
		15E.2	GHG Emissions Reduction	GHG Emissions reduction - Proposed Building Relative to Benchmark Building: - Conditional Requirement: 2 points - 10%: 3.4 points - 20%: 4.8 points - 30%: 6.2 points - 40%: 7.6 points - 60%: 10.4 points - 80%: 13.2 points - 100% (max): 16.0 points	16	Low	2	Arch / ESD / Mechanical / Electrical / Hydraulics / VT	**Mechanical:** Energy Modelling Report demonstrating achievement of points between the reference model and proposed model.	100% SD & 100% DD
		15E.3	Off-Site Renewables	Commit to procuring 100% off-site renewable electricity for a minimum period of ten years.	15E.2 Result X 1.5 Points	No Risk	0	LHD / HI / PM		
		15E.3	District Services		N/A	High				
		15E.5.1.1	Transition Plan	Project teams reduce their fossil fuel use and develop a transition plan to phase them out.	1	No Risk	0	HI/LHD / PM / Mechanical / Electrical / Hydraulics		
		15E.5.1.2	Fuel Switching	No fossil fuels are burned on site to generate electricity, heating or cooling.	2	Low	2	HI/LHD / PM / Mechanical / Electrical / Hydraulics	**Mechanical:** - Design drawings demonstrating no fossil fuel systems in HVAC i.e. VRF systems **Hydraulics:** - Design drawings demonstrating no fossil fuel systems i.e. Heat Pumps for DHW **Electrical:** - Sufficient capacity in Substation to facilitate electrification. **Kitchen:** - No gas based stoves i.e. induction cooktops	100% DD
		15E.5.1.3	On-Site Storage	On-site procurement and use strategy demonstrating to match the requirements of the building. Stored energy will be used to reduce evening peak electricity demand. All renewable energy not used by the building will be stored for later use.	1	No Risk	0	HI/LHD / PM / Electrical		
Peak Electricity Demand Reduction	To encourage the reduction of peak demand load on the electricity network infrastructure	16A	Prescriptive Pathway: On-site Energy Generation	The use of on-site electricity generation systems reduces the total peak electricity demand by at least 15% (1 point)	0					
Modelled Performance Pathway *(max 2 of 2 points)*		16B	Modelled Performance Pathway: Reference Building	Improvement in Proposed Building Peak Electricity Demand over Reference Building Peak Electricity Demand v1.3 - sliding scale **20 (1pt)** -30 (2pt)%	1	High	1	Mechanical / Electrical / ESD	**Mechanical:** Energy Modelling Report demonstrating achievement of points between the reference model and proposed model for peak demand reduction.	100% DD This will be confirmed later in DD. Relies on efficient systems and PV sizing (yet to be confirmed)
				Category Total	**22**		**5**			

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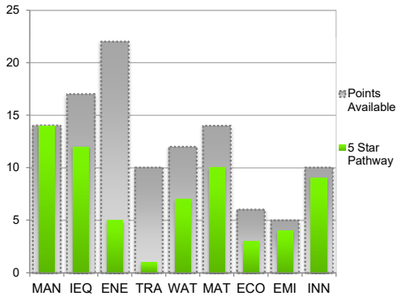

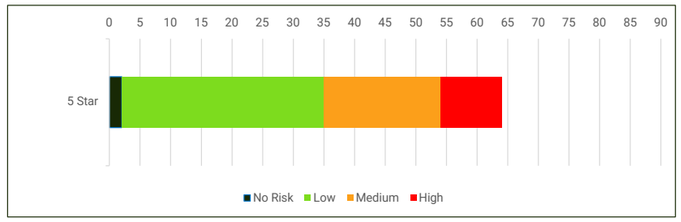

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TRANSPORT										
Sustainable Transport: Prescriptive Pathway	To reward projects that implement design and operational measures that reduce the carbon emissions arising from occupant travel to and from the project, when compared to a reference buildnig. This also promotes the health and fitness of commuters, and the increased liveability of the location	17A	Performance Pathway	Up to 10 points are awarded where the proposed transport solutions on site decrease emissions from transport, decrease mental and social impacts of commuting, and encourage uptake of healthier active transport options based on comparison to a Reference Building.	10	No Risk	0	PM / Traffic		
		17B.1	Prescriptive Pathway	B.1 Access by Public Transport (up to 3 points) - Points are awarded based on the accessibility of the site by public transport	3	Low	1	HI / PM		This item is linked to an Official Green Star calculator. Since this project is not targetting an official green star rating, this is an estimate at this stage and will need to be accepted by HINSW. Will need confirmation from transport consultant
		17B.2		B.2 Reduced Car Parking Provision (1 point) - Reduction of car parking spaces for the proposed building compared to maximum rates allowed	1	No Risk	0	HI / LHD		No new car parks on project site, but provisions for a neighbouring carpark on whole Concord Hospital site. LCI consider this not valid for a points as it is not promoting use of alternative transport
		17B.3		B.3 Low Emission Vehicle Infrastructure (1 point) - 15% of parking is for fuel efficient vehicles and a maximum of 5% for motorcycle parking OR dedicated car share spaces and vehicles are provided at the rate of 1 per 70 building occupants	1	No Risk	0	HI / LHD / Electrical	**Architectural:** - Architectural site plan showing either low emission vehicle infrastructure. **Electrical:** - Drawings showing provision for EV chargers i.e. conduits	100% SD
		17B.4		B.4 Active Transport Facilities (1 point) - Provision of bicycle parking (occupants and visitor) and associated facilities (showers & lockers)	1	No Risk	TBC	Architect		
		17B.5		B.5 Walkable Neighbourhoods (1 point) - At least 8 amenities are within 400m of the development; OR achieve a walk score of at least 80	1	No Risk	0	Architect		
				Category Total	**10**		**1**			

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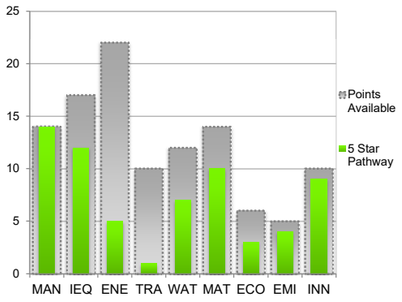

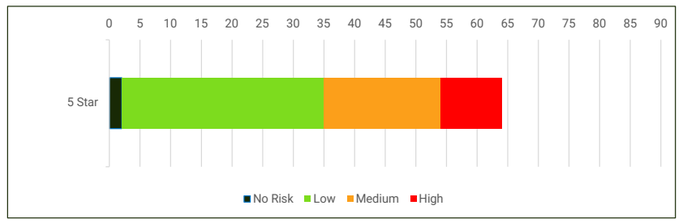

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WATER										
Potable Water: Performance Pathway	To encourage building design that minimses potable water consumption in operations	18A	Performance Pathway	Up to 12 points are awarded for predicted reduction in potable water use across all building uses when compared to a Reference Building.	12	Medium	7	ESD / Architect / Hydraulics / Landscapes / Fire		
				Category Total	**12**		**7**			

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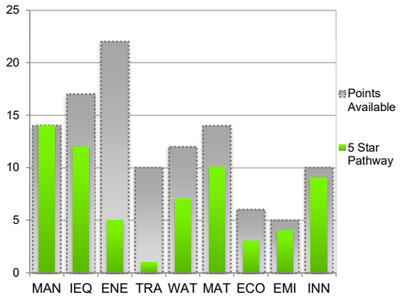

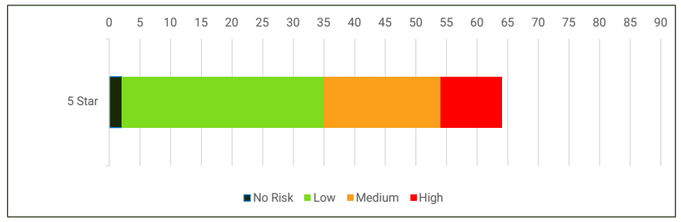

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MATERIALS										
Life Cycle Impacts: 19B Life Cycle Impacts	To reward the reduction of the environmental impacts of building materials for the whole building over its entire life cycle	19A.1	Comparative Life Cycle Assessment	Up to 6 points are awarded based on the extent of environmental impact reduction achieved under six environmental impacts categories compared against a Reference Building using a Life Cycle Assessment (LCA) (sliding scale 0 to 6 points for 30%-130% impact reduction)	6	No Risk	0	HI / PM / LCA assessor (specialist) / QS (BoQ) / Structural		
		19A.2	Additional Life Cycle Impact Reporting	An additional point is awarded where the LCA is used to inform building design process or as-built outcome	4	No Risk	0	LCA assessor		
		19B.1	Concrete	*Portland Cement Reduction* - Portland cement content is reduced by 30% OR 40% across all concrete used in the project against a reference case (1 OR 2 points)	2.0	Low	1	Structural / Civil	**Structure:** Tender Specifications Recommended products: Holcim Envirocrete or Boral Envisia	100% DD
		19B.2	Concrete	Water Reduction - Mix water for all concrete used contains at least 50% captured or reclaimed water (0.5 points)	0.5	Low	0.5	Structural / Civil	**Structure:** Tender Specifications Recommended products: Holcim Envirocrete or Boral Envisia	100% DD
		19B.2	Concrete	Aggregates Reduction - At least 40% of coarse aggregate in the concrete is crushed slag aggregate or another alternative material, OR at least 25% of fine aggregate sand in the concrete are manufactured sand or other alternative material (0.5 points)	0.5	Low	0.5	Structural / Civil	**Structure:** Tender Specifications	100% DD
		19B.2	Steel	Steel Framed Building - *Reduced Mass of Steel Framing* - Reduce the mass of steel framing used by one of the following options (1 point): - Using high strength steel that meet specific strength grades for usage type; OR - Reduce mass of steel by 5% when compared to a suitable reference building. Concrete Framed Building - *Reduced Use of Steel Reinforcement* - Reduce the mass of steel reinforcement used by at least 5% when compared to a standard practice building (1 point)	1.0	No Risk	1	Structural / Civil		
		19B.3	Building Reuse	*Façade Reuse* - At least 50% OR 80% of the building facade is retained (1 OR 2 points) *Structure Reuse* - At least 30% OR 60% of the existing major structure is retained (1 OR 2 points)	2.0					
		19B.4	Structural Timber	Minimum Requirement: All structural timber are responsibly sourced. Points are awarded based on the % of structural timber used compared to the building's GFA - 30 / 70 / 90% = 1 / 2 / 3 points.	1.0	No Risk	0	Architect / Structural		

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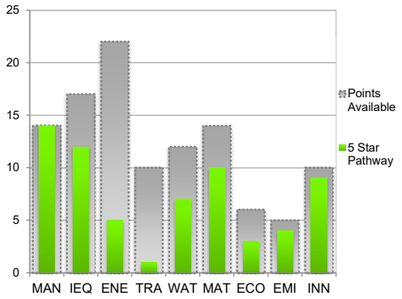

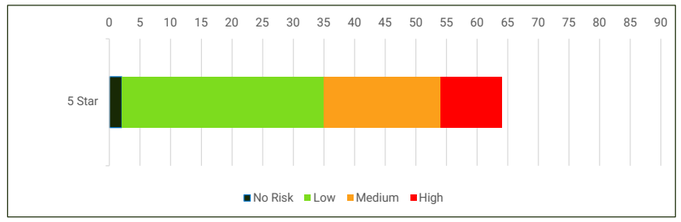

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Responsible Building Materials	Responsible Building Materials	20.1	Structural and Reinforcing Steel	95% of the building steel is sourced from a Responsible Steel Maker; and *- For steel framed buildings:* at least 60% of the fabricated structural steelwork is supplied by a steel fabricator accredited to the Australian Steel Institute; OR ***- For concrete framed buildings* : at least 60% of all reinforcing bar and mesh is produced using energy-reducing processes**	1	Low	1	Structural	**Structure:** Tender Specifications	100% DD
		20.2	Timber Products	At least 95% (by cost) of all timber used is certified by a forest certification scheme OR is from a reused source	1	Low	1	Architect / Landscape	**ESD:** Tender Specifications	100% SD
		20.3	Permanent Formwork, Pipes, Flooring, Blinds & Cables	At least 90% (by cost) of all permanent formwork, cables, pipes, flooring and blinds do not contain PVC and have an Environmental Product Declaration (EPD) OR meet Best Practice Guidelines for PVC	1	Low	1	Architect / Structure / Electrical / Mechanical / Hydraulics / Civils / Landscapes	**ESD:** Tender Specifications	100% SD
Sustainable Products	Sustainable Products	21.1	Product Transparency	Points are awarded via the Product Transparency & Sustainability Calculator where the Product Sustainability Value (PSV) achieves a percentage of the Product Contract Value (PCV) - 3 / 6 / 9% = 1 / 2 / 3 points. PSV is contributed to for products that; have reused content, have recycled content, are environmentally certified or have stewardship programs.	3	High	3	Head Contractor / PM	**ESD:** Tender Specifications	50% DD This relies on head contractor, not yet appointed or discussed therefore high risk
Construction and Demolition Waste	Construction and Demolition Waste	22.1	Demolition and Construction Waste	Fixed Benchmark: Construction and demolition waste is less than 12.5Kg/m2 GFA OR 10Kg/m2 GFA. (0.5 OR 1 point) OR Percentage Benchmark: 90% of the waste generated during construction and demolition has been diverted from landfill (1 point)	1	Medium	1	Head Contractor	**ESD:** Tender Specifications	100% SD Relies on head contractor not yet appointed, generally business as usual with leading C&D waste contractors
				Category Total	**14**		**10**			

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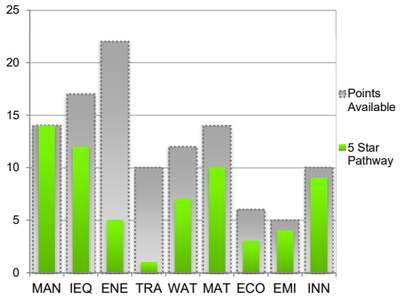

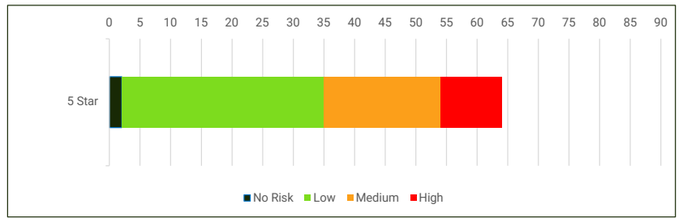

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LAND USE & ECOLOGY										
Ecological Value	To reward projects that improve the ecological value of their site	23.0	Endangered, Threatened or Vulnerable Species	Minimum Credit Requirement: Demonstrate no critically endangered, endangered, vulnerable species or ecological communities were present on the site at the time of purchase.	Credit Minimum	Low	Complies	HI / PM	**PM:** Ecological Assessment demonstrating no critically endangered, endangered, vulnerable species or ecological communities were present on the site at the time of purchase.	100% SD
		23.1	Ecological Value	Points are awarded based on the relative improvement of ecological value by 20% / 40% / 60% (1 / 2 / 3 points)	3	No Risk	0	Architect / Landscape	**Architect & Landscapes:** Ecological Value Calculator including supporting area markups.	50% SD High risk as there has been no demonstration of landscape to LCI at this stage
Sustainable Sites	To reward project that choose to developsites that have limited ecological value, that reuse previously developed land, and that remediate contaminated land	24.0	Conditional Requirement	The site did not include old growth forest or wetland of 'High National Importance', or did not impact on 'Matters of National Significance'	Conditional	Low	Complies	HI	**PM/OzArk:** Ecological Assessment stating the site did not include old growth forest or wetland of 'High National Importance', or did not impact on 'Matters of National Significance'	100% SD
		24.1	Reuse of Land	At least 75% of the site was previously developed land	1	Low	1	Architect	**Architect & Landscapes:** Site reuse markup.	50% SD
		24.2	Contamination and Hazardous Materials	Any significant site contamination is identified with remedial steps undertaken to decontaminate site prior to construction	1	Medium	1	PM / Head Contractor	**PM:** - Remediation Action Plan (RAP) - HAZMAT Report (re demolition scope)	50% DD Reliant on headcontractor, not yet appointed
Heat Island Effect	To encourage and recognise projects that reduce the contribution of the prjoect site to the 'heat island effect'	25.1	Heat Island effect	At least 75% of the whole site area to comprise of one of a combination of: - Vegetation; - Green roofs; - Roofing material with high solar reflectance index (initial SRI>82 or 3yr SRI>64); - Water bodies; and - Hard-scaping elements shaded by overhanging vegetation or roof - Unshaded hard-scape with high SRI (initial SRI>39 or 3yr SRI>34).	1	Medium	1	Architect / Landscape	**Architect & Landscapes:** - Surface Heat Island Markup **ESD:** - Surface Heat Island Calculation	50% DD Reliant on landscape and further architectural plans, not confirmed at this stage
				Category Total	**6**		**3**			

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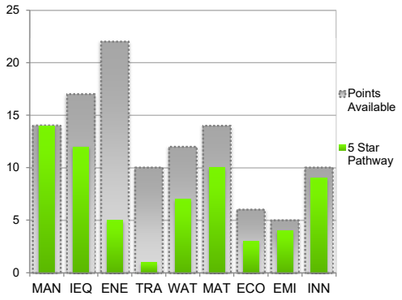

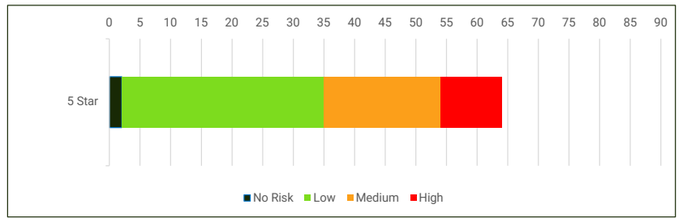

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EMISSIONS										
Stormwater	Stormwater	26.1	Peak Discharge	Demonstrate a reduction in peak stormwater discharge comparing pre-development to post-development discharge	1	Low	1	Civil	**Civil:** - Civil Design Report demonstrating post-development flows do not exceed pre-development flows, and Stormwater Management Systems.	50% DD Civil Report outlined that this will be implemented into the design but has not yet been designed, therefore medium risk
		26.2	Stormwater Pollution Targets	Stormwater discharged from the site must meet the following Pollution Reduction Targets: - Total Suspended Solids (TSS) - 80% - Gross Pollutants - 85% - Total Nitrogen (TN) - 30% - Total Phosphorus (TP) - 30% - Total Petroleum Hydrocarbons - 60% - Free Oils - 90%	1	Low	1	Civil	**Civil:** - Civil Design Report demonstrating pollution reduction targets and treatment devices, including Total Petroleum Hydrocarbons and Free Oils.	50% DD Civil Report outlined that this will be implemented into the design but has not yet been designed, therefore medium risk
Light Pollution	Light Pollution	27.0	Light Pollution Neighbouring Properties	Minimum Credit Requirement: Light Pollution to Neighbouring Properties: All outdoor lighting must comply with AS4282:1997	Credit Minimum	Low	To Comply	Electrical / Lighting	**Lighting:** - Light pollution calculations demonstrating compliance with AS4282:1997. Note the assessment plane is to be located on the site boundary.	100% DD Lighting design not considered at this stage
		27.1	Light Pollution Night Sky	Light Pollution to Night Sky: No external luminaire has a Upward Light Output Ratio (ULOR) that exceeds 5%; OR External luminaries produces a maximum initial point illuminance value of no greater than 0.5 Lux to the site boundary and 0.1Lux to 4.5m beyond the site into the night sky	1	Low	1	Electrical / Lighting	**Lighting:** - Design documentation complyign with either option.	50% DD Lighting design not considered at this stage
Microbial Control	Microbial Control	28.1	Microbial control	Demonstrate the building is: - naturally ventilated; or - has waterless heat rejection systems; or - has water-based heat rejection systems that includes measures for Legionella control and Risk Management (1 point)	1	Low	1	Mechanical	**Mechanical:** - Mechanical Single Line drawing showing no water based heat rejection systems have been used.	100% SD
Refrigerant Impacts	Refrigerant Impacts	29.1	Refrigerants	1 Point is awarded for achieving 1 of the following: 1. The combined Total System Direct Environmental Impact (TSDEI) of the refrigerant is less than 15; 2. The combined TSDEI of the refrigerant is between 15 and 35, AND a leak detection system with automated recovery covering plant >50kWr; 3. All refrigerants used have a zero Ozone Depletion Potential (ODP); AND a Global Warming Potential (GWP) of 10 or less; OR 4. No refrigerants are used	1	High	0	Mechanical	Mechanical Green Star calculation to be completed upon equipment finalisatio	70% DD When specifications of mechanical equipment have been issued this will drop to low risk
				Category Total	**5**		**4**			
				BASE TOTAL POINTS	***100***		**56.0**			

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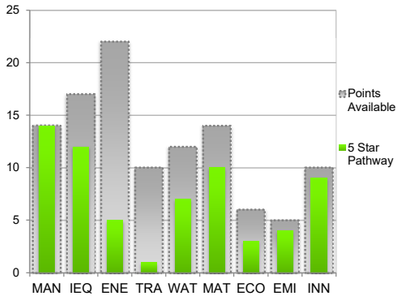

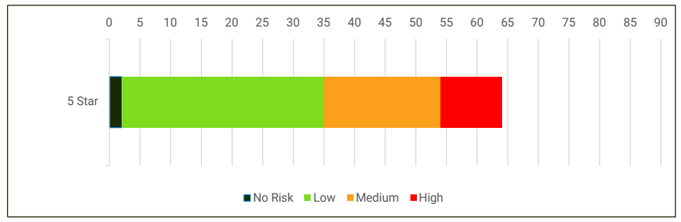

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INNOVATION										
Innovative Technology or Process	The project meets the aims of an existing credit using a technology or process that is considered innovative in Australia or the world	30A	Individual Comfort Control	One (1) additional point is available where the project has open plan work spaces (such as offices or education facilities), has achieved either the first or second 'Thermal Comfort' point, is mechanically ventilated, and meets the following requirements for individual thermal comfort control. The individual comfort control system must allow control over at least one of the following: - Air velocity; - Temperature (whether radiant or from direct air temperature); or - Air direction.	10	No Risk	1	Mechanical		
			On-site Renewable Energy	Up to two points may be rewarded in the Innovation Category for installing renewable energy sources on site. - 15% Energy contribution = 1 point - 30% Energy contribution = 2 points		No Risk	0	Electrical	**Mechanical:** Energy Modelling report showing the Solar PV contribution offsetting at least 15% of energy consumption.	100% SD
			Circadian Lighting	Follow WELL credit requirement for Circadian Lighting.		Medium	0			50% DD Lighting design not finalised at this stage
Exceeding Benchmarks		30C	Building Air Permeability Rates	Up to two (2) additional points may be awarded where projects can demonstrate achieving air permeability rates from the •normal' column (1 point) or 'best practice' column (2 points) as stated in Table 2.2, or where projects can demonstrate they have met the requirements of JV4 Section J NCC 2019 For any Innovation points to be awarded, the testing must be to a pressure difference Of 50 Pascals (Pa) or greater. Additionally, the testing sample area must be 5000m2 or 20% of the building's total envelope area, whichever is greater. Points are awarded on a sliding-scale basis to one decimal place. For example, a warehouse that achieves an air permeability rate of 4 m3/(h.m2) at 50 Pa would achieve 1.5 Innovation points.		High		HI/LHD / PM		
			Ultra Low VOC Paints	One (1) additional point may be awarded where over 50% of paints (by cost) specified in the building have a maximum TVOC content of 5g/L. This must be verified by one of the approved paint test methods.		Low	1	All / Head Contractor	**ESD:** Tender Specifications	100% SD
			Discharge to sewer	Improving Green Star Benchmarks — Discharge to sewer One Innovation point is avallable for a 90% or greater reduction in flow to sewer as determined by the Potable Water Calculator.		High	0	Hydraulics / Civil		
			Stormwater Pollution Targets	Up to two (2) additional points may be awarded where projects can demonstrate achieving Pollution Reduction Targets from column B (1 point) or C (2 points)		Low	1	Civil	**Civil:** - Civil Design Report demonstrating post-development flows do not exceed pre-development flows, and Stormwater Management Systems.	50% DD Civil Report outlined that this will be implemented into the design but has not yet been designed, therefore medium risk
Innovation Challenges			Incorporation of Indigenous Design			High	1	HI / LHD / PM / Architect / Landscapes (potentially)		Discussed in meetings but no current documentation demonstrating implemented indiginous design
			Financial Transparency	Project to disclose costs associated with Green Star for both implementation and documentation. Cost breakdown per credit required.		Low	1	PM / ESD	**MC/ESD:** Financial Transparency Disclosure Template.	100% DD
			High Performance Site Offices	To improve the sustainability performance of site offices thus increasing health and productivity outcomes of site workers.		Medium	1	PM / Head Contractor	**ESD:** Tender Specifications	70% DD Reliant on head contractor

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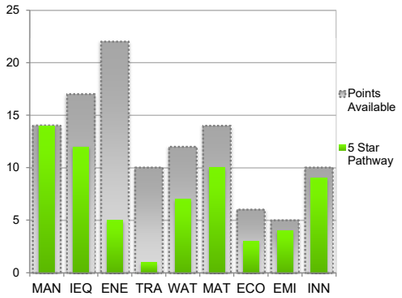

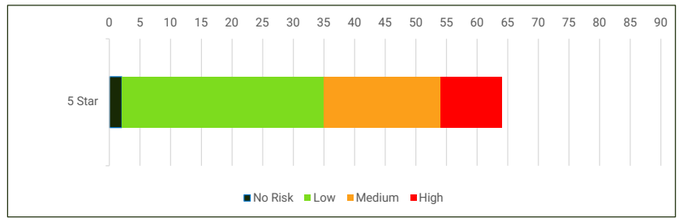

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Innovation Challenges		30D	Local Procurement	Local Products and Materials: 1 point is awarded where the project team demonstrates that a percentage of the products and materials used in the project were produced or manufactured in Australia. Local Services and Skilled Labour: 1 point is awarded where the project team demonstrates that a percentage of the services and skilled labour employed by the project come from the local area surrounding the site.		High	TBC	PM / Head Contractor	**ESD:** Tender Specifications	70% DD Reliant on head contractor
			Occupant Engagement	To increase the availability of information on the benefits and outcomes of sustainable design practices and sustainable operation practices across the industry.		Low	1	HI / LHD / PM		
			Reconciliation Action Plan	To encourage organisations to take formalised steps to provide opportunities for Aboriginal and Torres Strait Islander peoples.		High	1	PM / HI / LHD / Head Contractor		Discussed in meetings but no current documentation demonstrating implemented RAP
			Universal Design	Projects will only be rewarded for going beyond compliance with access standards and legislation. Project teams are required to understand the accessibility issues specific to their project ('needs analysis') prior to developing design solutions in order to address these ('accessibility plan'). To claim this Innovation Challenge the project team must: - Review the Design for Dignity Guidelines, or similar guidelines for inclusive design and dignified access. - Perform a 'needs analysis' identifying the project's accessibility issues. See the Guidance section for additional detail. - Develop an 'accessibility plan' (or similar) that provides strategies to address the needs determined and identifies actions for how the project will incorporate inclusive design. - Implement the 'accessibility plan' and demonstrate that accessibility initiatives have been carried out for the project.		Medium	1	PM / LHD / HI / Architect / DDA consultant	**Architect or DDA:** 1. Needs Analysis **Architectural:** 2. Architectural Design features to address needs analysis.	1. 50% DD Architectural plans demonstrating universal design have not been finalised at this stage.
				Category Total	**10**		**9**			

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15/10/2023
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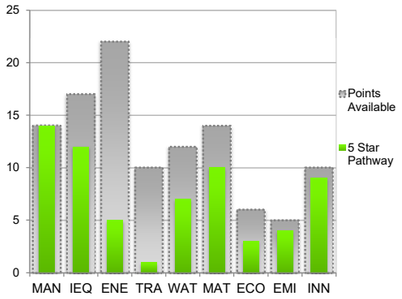

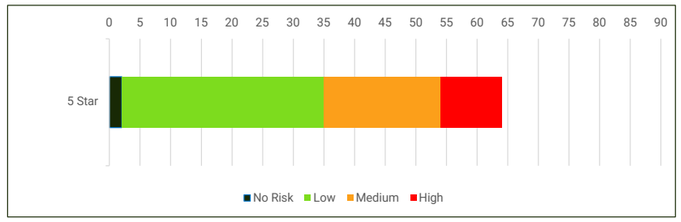

Risk	Explanation
No Risk	Already covered or it is business as usual
Low	Addressed but not finalised
Medium	Yet to be addressed but lower risk once addressed at later stage
High	Beyond control at this point in scope and will need to be addressed later in design/construction or No documentation/investigation has been provided at this point in time

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

Credit Title	Aim of Credit	Credit Code	Criteria Title	Credit Requirements Summary *For full criteria refer to Green Star Design and Asbuilt v1.3 Submission Guidelines*	Points Available	Risk	Green Star Design and 5 Star	Responsibility

Results

Environmental Category	Points Available		5 Star
Management	14		14
Indoor Environment Quality	17		12
Energy	22		5
Transport	10		1
Water	12		7
Materials	14		10
Land Use & Ecology	6		3
Emissions	5		4
TOTAL POINTS	**100**		**56**
WEIGHTED SCORE	**100**		**56**
Innovation	10		9
TOTAL WEIGHTED SCORE (Including Innovation)	**110**		**65.0**
4 Star - 45 to 59.9 score | **5 Star** - 60 to 74.9 score | **6 Star** - 75+ score			

Pre Contract Evidence	Pre Contract Evidence Due Date

Appendix B – Whole of Life Selections Memo

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Memorandum

Report Name	Whole of Life (WOL) Selections
Project	Concord Forensic Mental Health
Author	Zac Duryea
Date	07/08/2023

1 Concord Hospital Mental Health – WOL Sustainability Assessment

The Memorandum has been prepared by LCI Consultants (ESD Consultant) for the Concord Forensic Mental Health Facility (CFMHF). The purpose of this Memorandum is to outline whole-of-life (WoL) options that have been selected by Sydney Local Health District (SLHD), Health Infrastructure NSW (HINSW) and State Wide Mental Health Infrastructure Program (SWMHIP).

Health Infrastructure's DGN 58 Ecologically Sustainable Design has many mandatory initiatives that have been implemented into the design regardless of the WoL assessment. The WoL options were not intended to capture all strategies, just options that had flexibility and allowed further investigation in evaluating their WoL.

The table on the following page outlines which options have been selected into the project in agreeance with SLHD, SWMHIP and HINSW. These must be implemented into the project in the final stages of detailed design.

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2 Whole of Life - Selected Options

Discipline	Options	Outcome
Mechanical	1. VRF AHUs and FCUs 2. Chilled and Heating hot water system 3. VRF PAC units and FCUs	3. VRF PAC units and FCUs - Based on cost, about half the WoL cost compared to other options
Electrical	1. No Solar Array 2. Solar Array	2. Solar Array - significant payback over WoL. Project to atleast set up provisions for solar panels to be installed.
	1. Wired 2. Wireless Lighting Control	1. Wired - Cheaper install and not a flexible space, therefore no benefit from Wireless
	1. LED Lighting 2. Circadian Lighting Design	1. LED Lighting - Cost, to be installed with timer based controls to reduce illumination power in the mornings and evenings
Hydraulic	1. Rainwater Tank (RWT) 2. No Rainwater Tank	1. Rainwater Tank, already included in design, financially viable from WoL perspective
	1. Recovering Fire Test Water to RWT or Sprinkler Tank 2. Not recovering	1. Recover water, finacially viable in WoL. Both from town mains into Rainwater Tank & Fire Sprrinkler tank closed loop tank refill.
	1. Lowest GWP Heat Pump 2. Low GWP Heat Pump 3. Standard GWP Heat Pump	3. Standard - This option is the cheapest and most carbon equivalent efficient. Since SLHD do not have targets inplace for procuring Green Power. From WoL lens, the emissions from the increase in electrical energy outweighed the refirgerent emissions.

3 Sustainable Design Priorities for Concord Mental Health

This is a facility where people have been found not guilty of committing a criminal offence on the grounds of mental impairment. The function of this building is to rehabilitate forensic mental health patients to enable them to live safely within the community again.
To have this building operating as efficiently as possible is to have the patient turnover rate as quick as possible while ensuring a safe, high quality care with a full recovery. .
From a building design perspective, this creates the major focus to be the quality of the environment the patients are in.
There are studies that demonstrate humans innate desire to be connected to nature. Exposure to sunlight, natural light, fresh air, thermal comfort, acoustic comfort and connection to nature are all themes that improve mental health resulting improved patient recovery times.
From an ecologically sustainable design perspective a sustainable building is one that performs its function, has designed occupancy rates, exceeds its expected design life, and is resource efficient (energy and water).
For a building to exceed its expected design life, it needs to be in use and be resilient to potential climate risks such significant temperature changes, floods, bushfire etc.
Therefore, climate resiliency sits as priority in the design phases.. Exceeding its expected design life will also require careful consideration of the ongoing maintenance.
As previously stated, occupant environment quality is the priority for this building extension. Unfortunately, occupant environment quality and building efficiency have generally conflicting optimisations. At this stage, design solutions should favour patient turn over to energy efficiency.
To ensure a valuable outcome from the WoL Assessment, it is important the team understands the key priorities for the project, and thus have a point of reference and defined purpose/strategy for each proposed opportunity. LCI understand there are 13 key Design Principles for the project as shown in Figure 1.

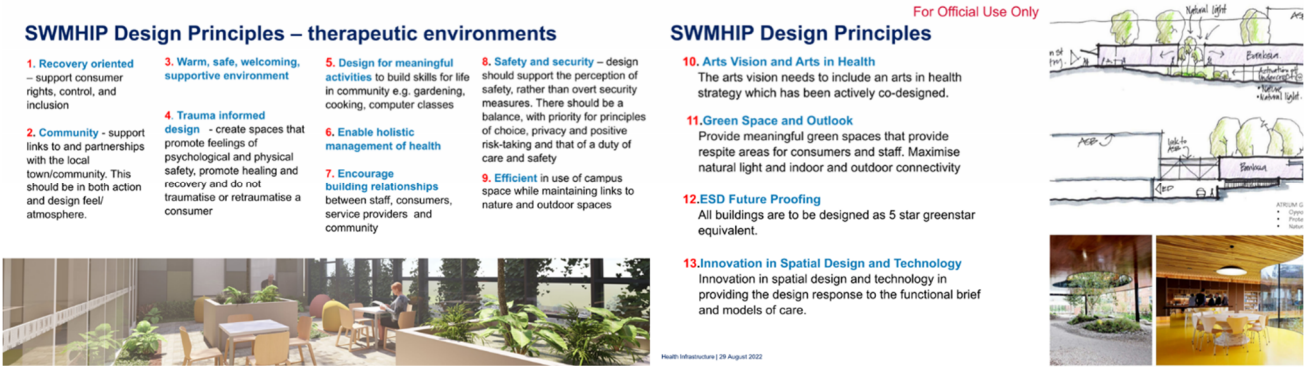

Figure 1 – SWMHIP Design Principles [for] therapeutic environments and Design Principles

To align with the design principles and Health Infrastructure's sustainability priorities for building design, LCI propose the following areas of focus for the WoL Assessment as shown in Figure 2.

Figure 2 - Mental Health Facility Sustainability Building Design Priorities

4 Approach to Whole of Life Assessment

4.1 Summary of Approach and Steps:

This section outlines the steps during throughout Concept, Schematic and Detailed design phase:

4.1.1 Concept Feasibility Phase:

- Issue of draft WoL Plan
- Review of plan from all stakeholders
- Each stakeholder lists options they see value in exploring
- WoL plan meeting to agree on approach and collect stakeholder perceived value options
- LCI collate all options
- Design Team Meeting where each option is deemed mandatory in design, not applicable to project, or further whole of life costing needs to be assessed
- Review contracts to ensure necessary scope is included for WoL modelling is considered
- Accountability for each stakeholder outlined is RASCI matrix
- Capital expenditure and operational demands completed by each design discipline and transferred to LCI
- LCI produce WoL Assessment report with recommendations
- Recommendations issued to client
- Client responds with selected options to be implemented
- LCI creates Memo that acts as a further guideline to overall project design
- Design teams implement relative selected options into their design

4.1.2 Schematic Design:

- Ensure strategies agreed upon have been incorporated
- Report back on WoL status

4.1.3 Detailed Design:

- Ensure strategies agreed upon have been incorporated into tender documentation
- Ensure equipment selection has been cross checked with facilities manager for ease of maintenance
- Report back on WoL status

5 Whole of Life Analysis

Whole of Life Duration

The Whole of Life study should be completed with a 40 year timeline in mind.

5.1 Mechanical

Completed by the Stantec Mechanical Team, the analysis was done initially as a desktop study to eliminate the systems that are not suitable for development with a list of reasons why these solutions have been discarded at an early stage. The most suitable systems have been determined and a whole-of-life assessment including a Net Present Value (NPV) calculation has been conducted.

For CFMH Unit Stantec identified the following options for WoL assessment:

- Type of Heat Rejection (Air, Water-cooled, or other heat rejection systems)
- Type of system (Water-based or refrigerant-based systems)
- Type of system (centralized AHUs or local FCUs)
- Air distribution (Underfloor or In-ceiling air distribution)

The above options were evaluated by multiple Senior Engineers within Stantec. Many options were eliminated from comprehensive analysis based on the following characteristics of the development:

- Project scale (small development)
- Project type (Hospital)
- Design Guidelines Requirements (HI ESG)
- Project-specific requirements (Mental Health development)
- Building location and Architectural design
- System cost
- System maintenance requirements
- System operation
- System spatial requirements

Based on the desktop study Stantec identified a valuable WoL assessment study between a water-based chilled and heating hot water system and a VRF/PAC Units system.

5.1.1 Assessed Options

Option 1: VRF Air Handling Units (AHUs) and Fan Coil Units (FCUs)
In this option the cooling and heating needs of the building are met by centrally located air-cooled plant on the roof. The system comprises from the DX refrigerant AHUs with dedicated condenser and on-floor mounted FCUs. The VRF (AHUs) are located on the roof and serve IPUs and central clinical areas, while the on-floor FCUs serve the “high density” spaces.

Option 2: Chilled and Heating Hot Water system
In this option the cooling and heating needs of the building are met by the centrally located plant on the roof. The plant is air cooled and comprises of a 4-pipe chiller, cooling and heating hot water pumps, pipework reticulation and ancillary equipment. The chilled and heating hot water AHUs are located on the roof and serve IPUs and central clinical areas, while the on-floor FCUs serve the “high density” spaces.

Option 3: VRF Packaged Units (PAC) and Fan Coil Units (FCUs)
In this option the cooling and heating needs of the building are met by centrally located air-cooled plant on the roof. The system comprises from the DX refrigerant PAC and on-floor mounted FCUs.

The PACs are located on the roof and serve IPUs and central clinical areas, while the on-floor FCUs serve the “high density” spaces.

5.1.2 Summary of Life Cycle Cost

	OPTION 1	OPTION 2	OPTION 3
Description	DX AHUs and On- floor DX Units	Chilled/Heating Hot Water AHUs and FCUs	Rooftop PAC units + On-floor DX FCUs
Life Span of Equipment	15 years	20 years	15 years
Heat Exchanger Method	Refrigerant	Water	Refrigerant
Electrical Demand (MWh)	183	220	183
Efficiency	3.68	3.07	3.68
Refrigerant Used (GWP)	R410a (2088)	R454B (465)	R410a (FCUs) (2088) + R32 (PAC Units) (675)
Capital Cost	**$ 1,460,000.00**	**$ 1,120,000.00**	**$ 590,000.00**
Maintenance Cost per year	$ 90,000.00	$ 100,000.00	$ 90,000.00
20-year total cost	$ 6,520,000.00	$ 6,390,000.00	$ 4,250,000.00
30-year total cost	$ 11,610,000.00	$ 7,940,000.00	$ 7,100,000.00
40-year total cost	$ 12,950,000.00	$ 13,410,000.00	$ 8,440,000.00
50-year total cost	$ 20,350,000.00	$ 15,020,000.00	$ 12,250,000.00

Comments associated with this table:

- Calculations are based on preliminary layouts and selections
- Maintenance costs include labour
- Capital Cost includes installation labour cost
- Values above are approximate and are subject to change due to inflation, market factor, and other unforeseen aspects

Following this assessment and the discussion with ERG, **Option 3** is recommended and is most likely to be employed with further resolution on the individual FCUs for both medium and low secure units.

5.2 Electrical/Lighting

The following options have been proposed by Stantec Electrical Team. All costs are approximate.

Option 1: Solar Array vs No Solar Array

Stantec Electrical Team have approximated the following for a solar array.

- ~ $1000/kW for equipment and installation
- ~ nil maintenance
- 10-15 year service life

Using an online solar yield calculator with an estimated 10% efficiency loss throughout the system, 1 kW of solar produces 1,550 kWh/annum.
SLHD procures electricity for $0.15/kWh.
Energy cost procured/year = $232.5/annum
Energy cost procured over minimum lifetime of 10 years = $2325
This outweighs the initial cost, therefore maximising the solar array will maximise return on investment.

Option 2: Wired Lighting Control vs Wireless Lighting Control

Component	Wired Lighting Control	Wireless Lighting Control
Recessed Troffer	$300	$360
Downlight	$160	$260
Installation	$25 increase per light	N/A
Total Cost per Downlight	**$485**	**$620**

Although installation of the Wireless Lighting Control is cheaper, the hardware costs outweigh the installation savings.
The benefit of a wireless system is flexibility. If the project seeks flexibility in the future with special rearrangements, then a wireless system should be considered.
If not, a wired system will be a cheaper option.

Option 3: LED lighting vs Circadian Lighting Design

Component	LED Lighting	Circadian Lighting Design
Capital Expenditure per room	$750	$1750
Additional Installation (assuming 4 lights per room)	N/A	$100
Total Cost per Room	$750	$1850
Extra Green Star point	**No**	**Yes**
Improved patient care	**No**	**Yes**

The primary function of a circadian lighting design is to improve the occupants circadian rhythms. This is adjusting the lighting according to the time of day to mimic natural daylight where possible which allows occupant's sleep cycles to be in synchronisation with the day.

This is a direct quote from the conclusion of review article - Walker, W. H., Walton, J. C., DeVries, A. C., & Nelson, R. J. (2020). Circadian rhythm disruption and mental health. This review is relatively current (2020) and has been cited over 370 times.

“Targeted resynchronization of circadian rhythms improves symptoms of mood disorders. In sum, while circadian disruption may not be the sole cause of mood disorders, it may elicit or exacerbate symptoms in individuals with a predisposition for mental health disorders.”

The implementation of circadian lighting resonates with the typology of this building, follow on savings from improved sleep in occupants for the operations of the building may include: reduced mental episodes, improved total rehabilitation time.

5.3 Hydraulic

Option 1: Rainwater Catchment for Irrigation and Water Features
Water balance calculations have been calculated using the Green Star Potable Water Calculator. Assuming the Rainwater is collected from over 1000 m2 of the roof area and rainwater is used for landscape and water fountains. The rainwater tank will save ~ 500 kL per year.

During these water balance calculations, the size of the rainwater tank will be able to reduce down to approximately 20 kL, rather than 36 kL that was previously put forward based on the Green Star prescriptive pathway.

Sydney Local Health District purchase their potable water for $4.50/kL.
Assuming the rainwater tank would last the whole building service life. For this assessment we are using 40 years.

The rainwater tank system would save $90,000 dollars in water bills, excluding its upfront costs.

The installation costs include:

Component	Cost
Equipment (pump, filtration, controls)	$8000
Installation of equipment	$2500
Rainwater Tank	$1000/kL (min 20kL)
Total Cost (excluding minor operational energy)	$30,500
Water cost saved	$90,000
All incorporated savings (water bill savings – upfront cost)	$59,500

Therefore it is financially recommended to install the rainwater tank. It is also included in the DGN058 pathway.

Option 2: 90% fire test water recovery
The fire test water recovery will save approximately 60 kL/annum. With the cost of potable water at $4.50/kL, this will save $10,800 of water bills over the 40 year assessment.

Component	Cost
Equipment (test pit over RWT)	$3500
Water bills saved	$10,800
All incorporated savings (water bill savings – upfront cost)	$7,300

Option 3: Low GWP Refrigerant Heat Pumps

Component	Standard Practice Heat Pump	Low GWP Heat Pump	Lowest GWP Heat Pump
Refrigerant Type	R134a	R531a	R744 (CO2)
Refrigerant GWP	1300	575	1
Installation & equipment	Nil difference	Nil difference	Nil difference
Electricity costs over 40 years	$3,960,000	$4,056,585	$4,264,615
Total CO2 emissions – Electricity & Refrigerant (Tonnes CO2e) (assuming grid electricity is used)	181.40	157.1	142.2

Currently waiting for refrigerant volume from ARUP to finalise calculations.

From a cost perspective, the standard heat pump will be the cheapest option. From an emissions perspective inclusive of the NEM GHG emissions factor standard heat pump will still be significantly less carbon equivalent consumption.

Appendix C – Climate Change Adaptation Memo

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Memorandum

Report Name	Green Star Climate Adaptation Plan Memorandum
Project	Concord Forensic Mental Health Facility
Author	Zac Duryea
Date	10/02/2023

1 Introduction

This memorandum aims to convey key information around the project's exposure to current and future environmental pressures prior to the Resilience Workshop hosted by LCI. The CFMHF is targeting a Green Star Design & As Built equivalent, which targets the following credit:

- Credit 3.1: Implementation of a Climate Change Adaptation Plan

1.1.1 About the project

The Concord Hospital, Forensic Mental Health Unit project is part of the State Wide Mental Health Infrastructure Program (SWMHIP) and forms part of the $700m capital works component of a broader series of reforms across the state's mental health services. This project focuses on patient-centric models of care, engagement with consumers, carers and staff, and best practice service delivery with improve outcomes for consumers, carers, families and stakeholders.

The project is located within Concord Repatriation General Hospital, commonly referred to as Concord Hospital, a district general hospital in Sydney, Australia, on Hospital Road in Concord approximately 10 km WNW from Sydney Observatory. Due to this close proximity, past and future data has been considered from the Sydney Observatory site.

2 Climate Resilience

2.1 Current Climate

The data used to analyse the current climate is sourced from the Bureau of Meteorology (BOM) weather data for Sydney Observatory Hill. The data sets have been separated into pre 2018 and post 2018 as the previous weather station was upgraded and a new station number was assigned.

Table 1: BOM weather station data

Station Name	Years of Data	Station Number	Latitude	Longitude
Sydney Observatory Hill/Sydney Botanical Gardens	1885 – 1980	66006	33.87 °S	151.22 °E
	1980 – 2017	66062	33.86 °S	151.21 °E
	2018 - current	66214	33.86 °S	151.21 °E

2.1.1 Temperature

The temperature data over the last 40 years is summarised in Table 2, showing the maximum, minimum annual temperature as well as the number of days above 35^{0}C an 40^{0}C. The highest maximum temperature recorded was 45.8^{0}C and a minimum of 3.1^{0}C. The maximum temperature is seen to increase from 1980-2019 where the La Nina and flooding events may have decreased the temperature in the past year. This trend is similarly seen in the increase of the minimum temperature and number of heatwave events.

Table 2: Summary of temperature data for Sydney Observatory Hill 1980 to current time

Year	Max Temp (^{0}C)	Min Temp (^{0}C)	Days above 35^{0}C	Days above 40^{0}C	Heatwaves
1980-1989	41.8	3.1	39	3	0
1990-1999	40.9	4.3	30	3	1
2000-2009	44.2	3.7	37	4	0
2010-2019	45.8	4.0	53	6	0
2020- now	41.2	5.2	9	3	0
1980-now (Average per decade)	**43.2**	**3.8**	**40**	**4**	**0.25**

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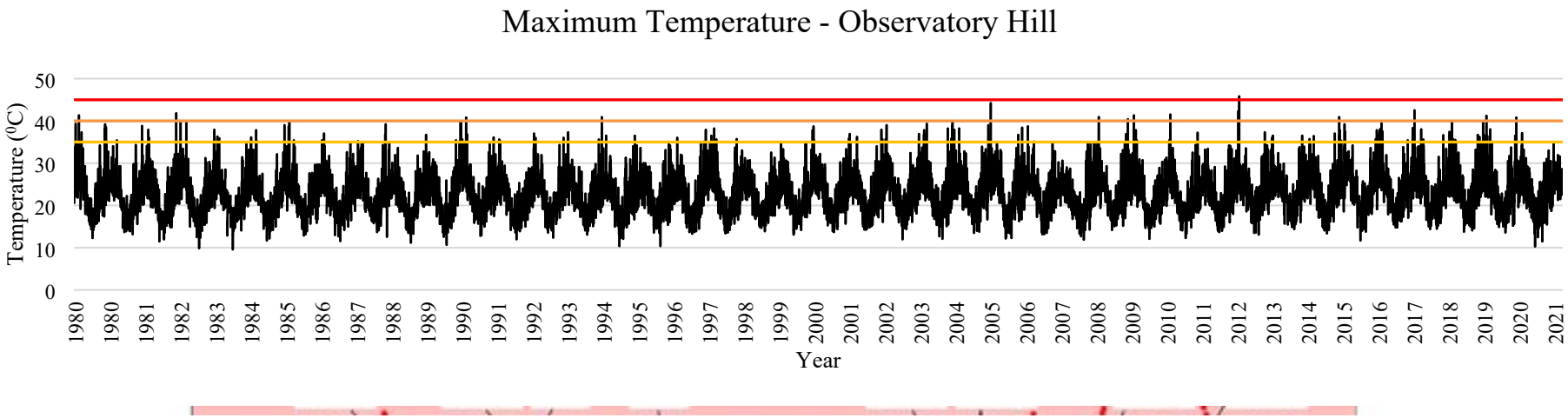

Figure 1: Maximum temperature for Sydney Observatory Hill 1980 to current day

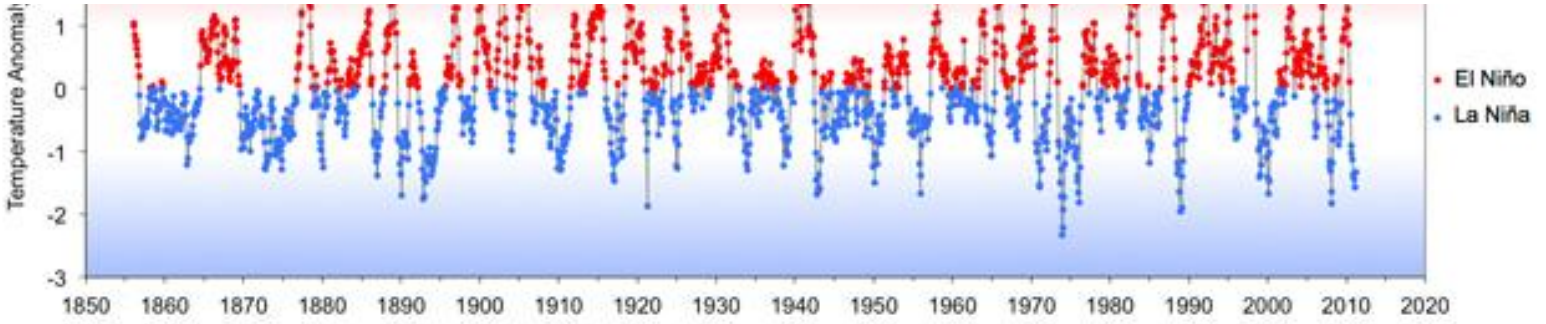

Figure 2: ENSO cycle through history

2.1.2 Precipitation

Precipitation is controlled by multiple factors, including the El Nino Southern Oscillation (ENSO), with the ENSO cycle loosely operating over a 1 to 8 year cycle. Australia is currently in the end of a La Nina phase of the ENSO cycle, meaning it has experienced slightly cooler temperatures, higher winds and increased precipitation. It can be expected that as Australia transitions into the El Nino phase warmer and drier temperatures will occur.

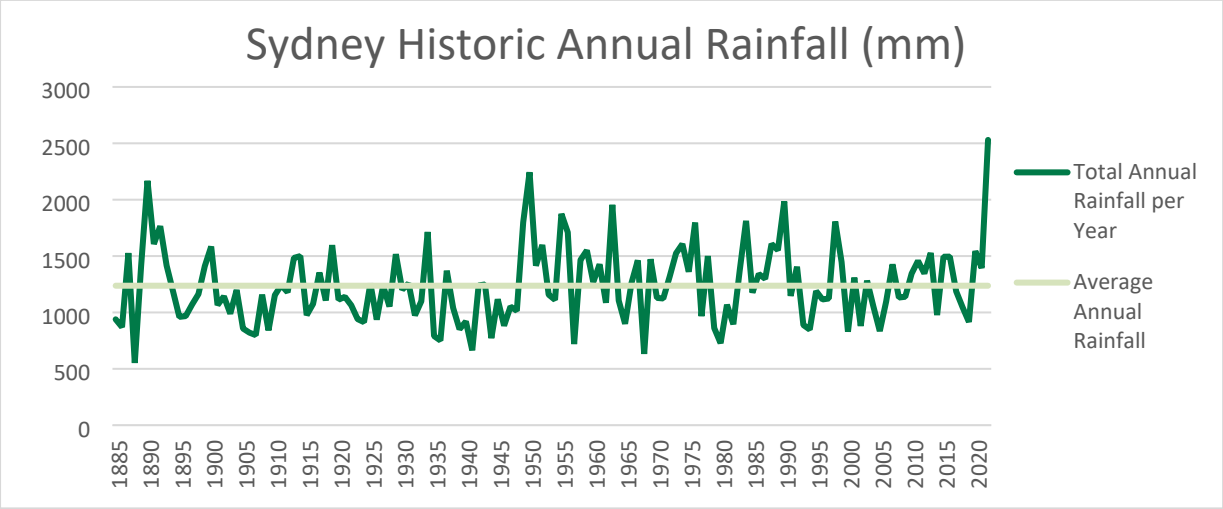

Figure 3: Annual Total Rainfall in Sydney from 1885 to current day

The above graphs demonstrates rainfall fluctuations occurring every few years reflecting the change in ENSO phase between La Nina (high rainfall) and El Nino (low rainfall). 2022 was the highest rainfall Sydney has recorded since 1885 with a annual rainfall total of ~ 2530mm. This amount of rainfall can classify the climate as tropical and is typical of monsoonal regions closer to the equator. When Australia passes through its peak El Nino phase, the total annual rainfall historically drops below 1000mm which would classify the region as semi-arid.

This data demonstrates that the development should be designed with both drought and monsoon in mind. In times of drought, water is scarce, so limiting potable water usage is desired particularly for applications that do not require potable water. For example, implementing a rainwater tank that is connected to irrigation and washdown. For monsoon, the drainage on site from the down pipes off the roof to the effluent stormwater should be designed with the appropriate sizing to be able to handle the conditions of 2022 at a minimum.

2.1.3 Sea Level Rise

The CSIRO have used a series of satellites to measure the (near) global mean sea level from 1992 to 2020. There has been an average increase of sea level by 3.5 mm per year since measurements first began. While this is a global average, the Sydney harbour would follow similar trends (CSIRO, 2020). Sea level rise is not synonymous with inundation level, as the geography of the site must be considered.

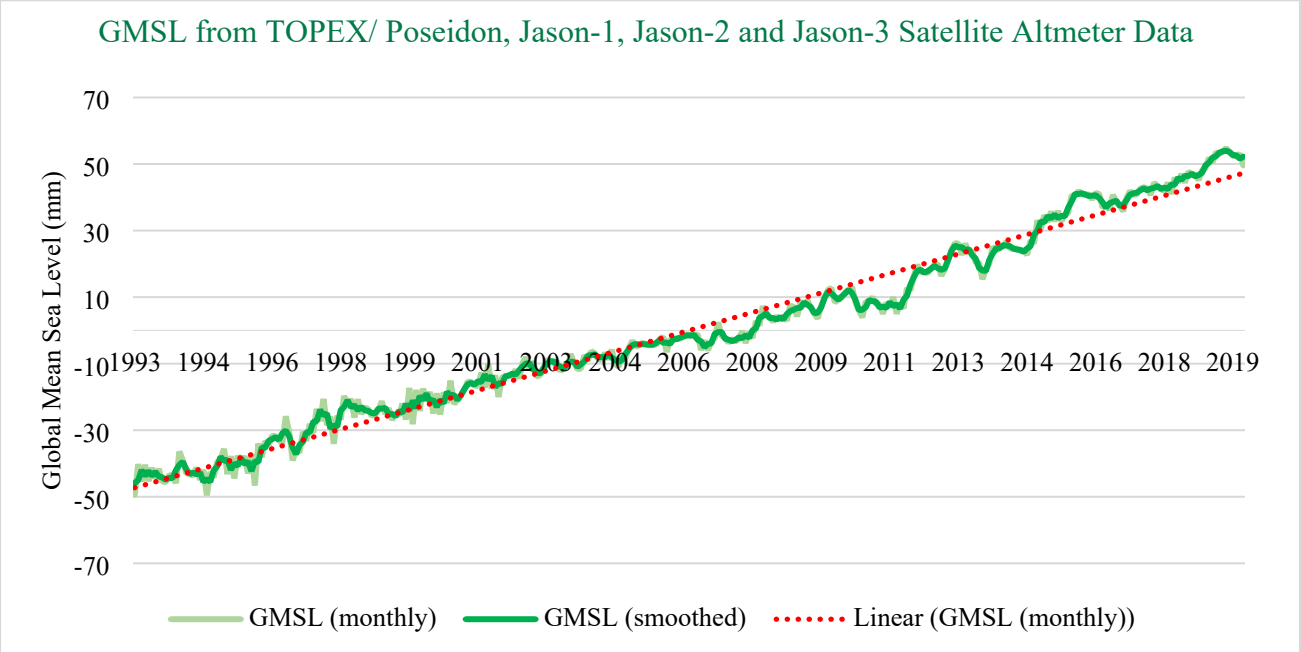

Figure 1: Global mean sea level rise from 1993 to 2019

2.1.4 Secondary Impacts

Relative Humidity

The relative humidity (RH) for Sydney Observatory Hill fluctuates with temperature and time, with a consistently high 9am humidity and lower 3pm humidity. The RH is seen the decrease from July to October, with November to March acting as transitional months until the RH starts to peak from April to June.

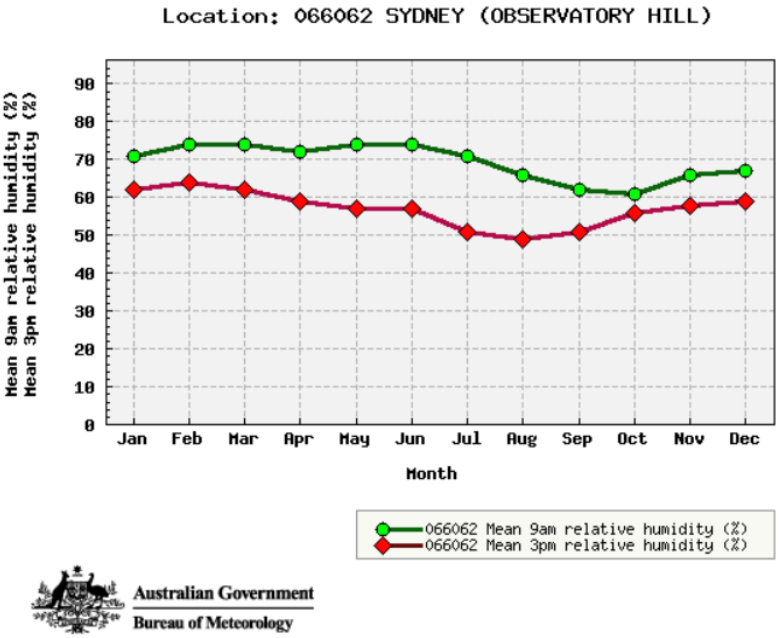

Figure 4: Relative humidity for Sydney Observatory Hill

Drought

Drought is defined by a 3-month period of rainfall in the lowest decile of the region's historical levels. In Australia drought occurs on a 'severe' level once every 18 years with more moderate and minor droughts in the interim. Perhaps the most severe drought in Australian history is the 'Millennium' drought in South-Eastern Australia from 1996-2010 (BOM, 2015). The peak of this drought was from 2001-2009, as a strong El Nino affected South East Australia, increasing temperatures, and decreasing rainfall.

Flood

Flood events occur when the capacity for a water way is exceeded due to a sudden ingress of rainfall, in NSW this historically has happened approximately every 6 years. The latest flooding event across NSW and Queensland was a 1 in 1,000 year event, with the last large flood in NSW the previous year, that reached 1 in 100 year rainfall levels. The recent 2022 devastating flood event displaced over 20,000 homes in Queensland and 5,000 in NSW with a current death toll of 22 people across the 2 states; with over $1 billion in damages.

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Wind

The local topography has a large impact on the wind speed as wind tunnels and eddy currents are created when wind hits a building. The data described in this section is an approximation of the sites current climate using the closest weather data of good quality available. The morning and afternoon wind speed conditions are similar in May-July with the early and later portions of the year showing greater deviation from the 9am and 3pm conditions.

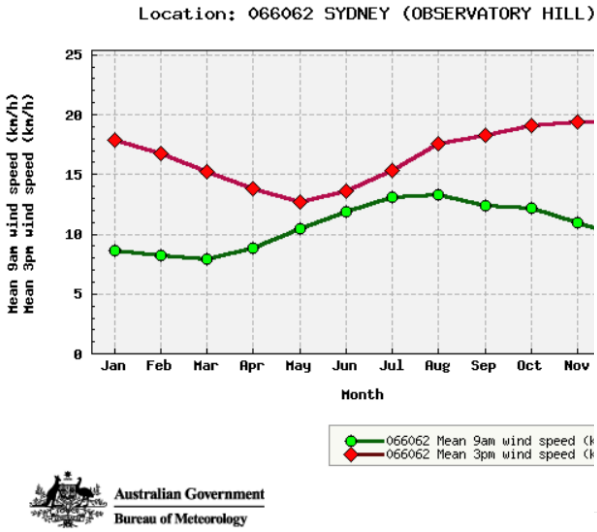


Figure 5: Wind speed for Sydney Observatory Hill

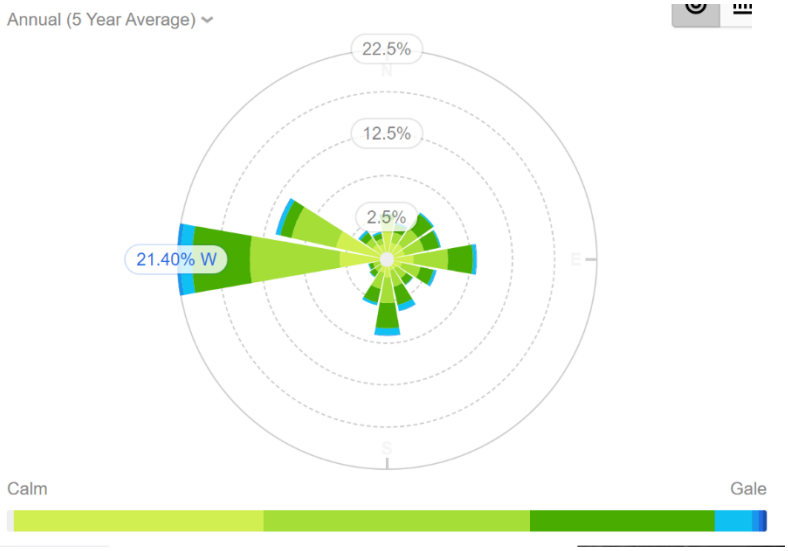


Figure 6: Annual Wind Rose for Observatory Hill – 5 year average (WillyWeather (BOM Data))

Figure 6 demonstrates that Westerly winds are the most common, blowing an average of 21.4% of the time. Westerly winds are also the most common gale force winds. This should be considered with external structures particularly eaves, exposed rooves and proximity of neighbouring trees.

Cyclones

Cyclones are not common in NSW, with 7 cyclones occurring from 1980 to 2022. However, there hasn't been a named cyclone to hit NSW since 2006, cyclone Wati, causing large waves in the NSW coastal area. Larger cyclones can have more devastating impacts, causing flooding, landslides, gale force winds and severely damaging the coastal landscape through beach erosion. There have been instances, such as cyclone Colin in 1976 where houses have been unroofed such as in Swansea NSW (BOM, 2020).

Bushfire

Australia has a devastating history with bushfires, with every year for the last decade (2010-2020) experiencing a large bushfire. The most recent of bushfires in late 2019 – early 2020 caused 33 deaths, 3,094 homes lost and burned over 17 million hectares (Richards, et al., 2020). Many local areas have back burnings regularly to decrease the ground fuel load of an area, should a bushfire occur. The Australian Fire Danger Rating System has since been updated to simplify the potential level of danger should a bushfire start. They do not indicate the chance of a fire occurring, although this is a common misconception. Ratings are calculated using a combination of weather forecasting and information about vegetation that could fuel a fire.

2.2 Emission Scenarios

The Intergovernmental Panel on Climate Change (IPCC) releases Assessment Reports every few years, with the Fifth Assessment Report (AR5) released in 2009 and the latest Sixth Assessment Report (AR6) released beginning of 2022. AR5 included the Representative Concentration Pathways (RCPs) which are a series of projection models developed by a different modelling group. While the RCPs are not initially directly comparable, the pathways are compared against levels of radiative forcing. Radiative forcing is the comparison of the energy that enters the atmosphere to the amount which leaves the atmosphere, by considering positive forcing (e.g. CO_2) and negative forcing (e.g. aerosols). The primary greenhouse gases (GHG) that are positive radiative forcing mechanisms are CO2, methane, nitrous oxide hexafluoride and sulphur. Examples of negative radiative forcing mechanisms are soot, sulphur dioxide, nitrogen oxides, ammonia and volatile organic compounds.

Since 2021/2022 a new generation of global climate models has become available to the climate modelling community, along with new descriptions of greenhouse gas and aerosol emissions scenarios. These scenarios are used to drive climate models, therefore it can be difficult to make a direct comparison between projections using the previous emissions scenarios (called RCP scenarios), and the current Shared Socioeconomic Pathways (SSPs), see Table 5). While the RCPs are describing different levels of greenhouse gases and other radiative forcings that might occur in the future, the SSPs are describing broad socioeconomic trends that could shape future society. (CarbonBrief, 2018)

Table 3: SSP Narratives (Riahi et al., 2017)

Scenario	Description
SSP1 Sustainable development	The world shifts gradually, but pervasively, toward a more sustainable path, emphasizing more inclusive development that respects perceived environmental boundaries. Management of the global commons slowly improves, educational and health investments accelerate the demographic transition, and the emphasis on economic growth shifts toward a broader emphasis on human well-being. Driven by an increasing commitment to achieving development goals, inequality is reduced both across and within countries. Consumption is oriented toward low material growth and lower resource and energy intensity.
SSP2 Middle of the Road	The world follows a path in which social, economic, and technological trends do not shift markedly from historical patterns. Development and income growth proceeds unevenly, with some countries making relatively good progress while others fall short of expectations. Global and national institutions work toward but make slow progress in achieving sustainable development goals. Environmental systems experience degradation, although there are some improvements and overall the intensity of resource and energy use declines. Global population growth is moderate and levels off in the second half of the century. Income inequality persists or improves only slowly and challenges to reducing vulnerability to societal and environmental changes remain.
SSP3 Regional Rivalry	A resurgent nationalism, concerns about competitiveness and security, and regional conflicts push countries to increasingly focus on domestic or, at most, regional issues. Policies shift over time to become increasingly oriented toward national and regional security issues. Countries focus on achieving energy and food security goals within their own regions at the expense of broader-based development. Investments in education and technological development decline. Economic development is slow, consumption is material-intensive, and inequalities persist or worsen over time. Population growth is low in industrialized and high in developing countries. A low international priority for addressing environmental concerns leads to strong environmental degradation in some regions.
SSP4 Inequality	Highly unequal investments in human capital, combined with increasing disparities in economic opportunity and political power, lead to increasing inequalities and stratification both across and within countries. Over time, a gap widens between an internationally-connected society that contributes to knowledge- and capital-intensive sectors of the global economy, and a fragmented collection of lower-income, poorly educated societies that work in a labor intensive, low-tech economy. Social cohesion degrades and conflict and unrest become increasingly common. Technology development is high in the high-tech economy and sectors. The globally connected energy sector diversifies, with investments in both carbon-intensive fuels like coal and unconventional oil, but also low-carbon energy sources. Environmental policies focus on local issues around middle and high income areas
SSP5 High energy demand, fossil-fuel development marker	This world places increasing faith in competitive markets, innovation and participatory societies to produce rapid technological progress and development of human capital as the path to sustainable development. Global markets are increasingly integrated. There are also strong investments in health, education, and institutions to enhance human and social capital. At the same time, the push for economic and social development is coupled with the exploitation of abundant fossil fuel resources and the adoption of resource and energy intensive lifestyles around the world. All these factors lead to rapid growth of the global economy, while global population peaks and declines in the 21st century. Local environmental problems like air pollution are successfully managed. There is faith in the ability to effectively manage social and ecological systems, including by geo-engineering if necessary.

The graphical representation of the linear relationship between the cumulative CO_2 emissions and global warming for five illustrative scenarios until year 2050 is illustrated in the figure below.

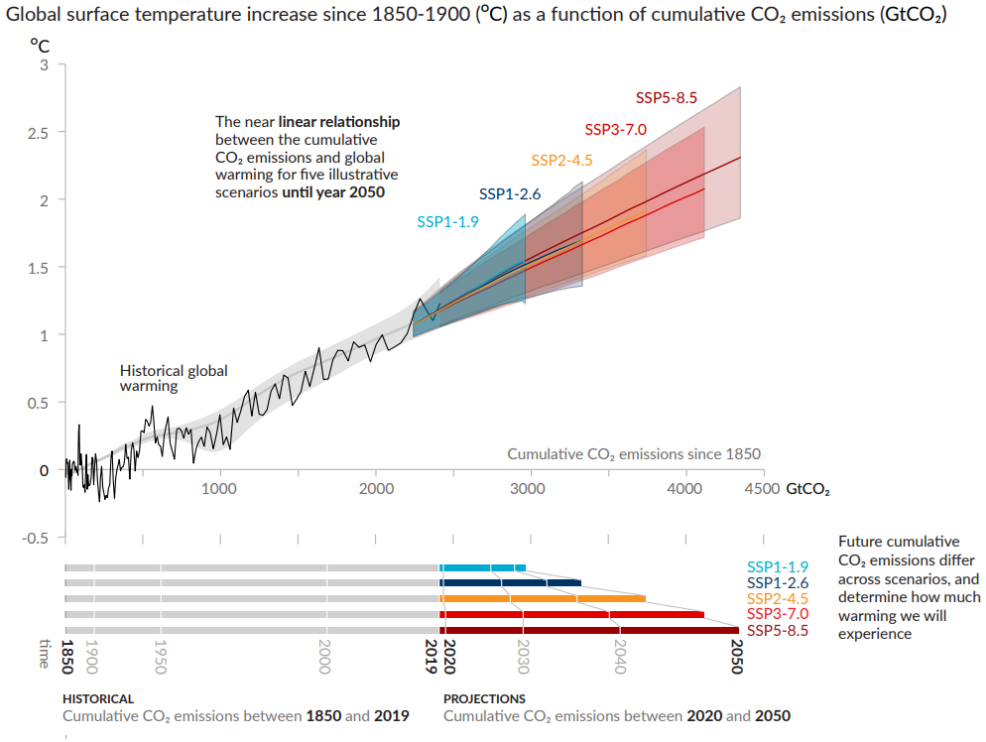


Figure 2: Linear relationship between the cumulative CO2 emissions and global warming for five illustrative scenarios until year 2050 (IPCC, 2021

2.2.1 Climate Modelling

The data used for this Climate Adaptation Assessment is primarily based on the Representative Concentration Pathways (RCPs) as this climate change projection data for Australia is based on regional climate data and has been made available by the website Climatechangeinaustralia.org.

RCP 4.5 is generally used to represent the expected climate change scenario, aligning with current global emissions targets. Locally, this scenario is recommended by Australian Rainfall and Runoff (AAR) 2016 and aligns with the Australian Government's commitment under the United Nations Climate Change Agreement - Paris (2015) to cap global warming below 2°C by the end of the 21st century, compared to pre-industrial levels. However, as per the latest IPCC report, the temperature rise is already 1.07°C and this scenario is unlikely to occur.

The decline in emissions from 2020 (RCP 2.6) is considered unlikely while the RCP 4.5 predictions of emissions decline from 2040 is considered reasonable at this point. The RCP 8.5 scenario is considered a worst-case scenario. In performing the climate adaptation assessment, an RCP 4.5 and an RCP 8.5 scenario will be considered, to provide a likely and worst-case scenario for consideration in both the identification and mitigation of risks.

In addition, data based on the Shared Socioeconomic Pathways (SSPs) will be mentioned in this report as well (see section 2.6). For the purpose of this report, the SSP5-8.5 scenario has been chosen to provide the worst-case scenario of the latest released climate projections.

2.3 Climate Projection Timescale

The timeline in which these scenarios are evaluated is important, with timescales ranging from the near future (2040, 2060) to the far future (2080, 2100). In accordance with the Green Star Adaptation and Resilience credit criteria, the two future slices which have been selected for the new development are 2050 ("near future") and 2090 ("far future"). These timescales have been used for the climate projections based on the Representative Concentration Pathways (RCPs) and Shared Socioeconomic Pathways (SSPs).

2.4 Climate Variables for Climate Projections

2.4.1 Climate Projection Data Sources

Climate projection data used for this CAP and reason for their inclusion;

- CMIP6 data – Multi-model Ensemble including the following models:
  - Cams-csm1-0
  - Canesm5
  - Cnrm-esm2-1
  - Ec-earth3-veg
  - Fgoals-g3
  - Gfdl-esm4
  - Ipsl-cm6a-lr
  - Micro-es2l
  - Micro6
  - Mri-esm2-0
  - Ukesm1-0-||

The CSIRO has developed climate change projections using an Australian regionalisation scheme, with eight clusters informed by logical groupings of recent past climatic conditions, biophysical factors and expected broad patterns of climate change. The project is covered by the East Coast Cluster, see Figure below.

Figure 3: NRM East Coast Cluster

The summary of the corresponding climate projection will be covered in the following section of the report.

Generally, the primary impacts of temperature and precipitation are considered heavily, as they are commonly simpler to predict than secondary impacts such as bushfires or droughts. This is because secondary impacts depend on various primary and secondary impacts to accurately predict the long or short term outcome, increasing their uncertainty.

Along with the above, data from the latest IPCC AR6 report has been included in this report. With the IPCC AR6 a web-based Interactive Atlas has been released to support the analysis of future projections. This interactive Atlas allows us to explore the latest climate change projections (CMIP6) on a wider regional level. For these climate projections, there are currently 4 clusters for Australia, see Figure 15. For this project the region 'Eastern Australia' has been used.

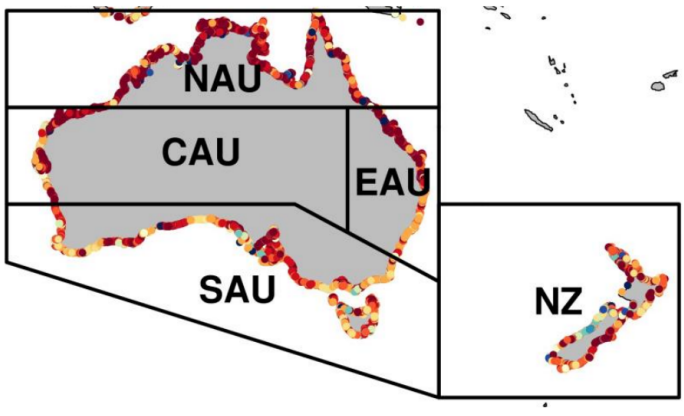


Figure 4: IPCC AR6 – Regions in Australia and New Zealand

2.4.2 Climate Projections

The IPCC AR6 projection data uses a multi model ensemble to create a more accurate data set, however not all of the impact categories are represented hence some impacts are based on the AR5 results; as summarised in Table 4.

Temperature is projected to increase by 1.6 degree in the near future, noting that we have already experienced a 1.05-degree increase in temperature. With higher temperatures there comes warmer nights, more days above 35˚C, increased rates of evapotranspiration and frequency of bushfires. The rainfall is expected to decrease by 33 mm in the near future and nearly 50mm in the far future. The distribution is expected to become more divisive with longer periods of droughts followed by floods. The wind speed and relative humidity aren't expected to change significantly, with minor decreases projected in the far future. The severity of sea-level rise is dependent on many other cycles and variables such as temperature, land ice melt and solar radiation; however, in all scenarios, it is expected to increase in both the near and far future. Projections predict a sea-level rise of up to 0.65 meters by 2070.

Table 4: Summary of CMIP6 Multi model ensemble projection for the near term (2040-2059) and long term (2080-2099) for Eastern Australia, Baseline 1986 - 2005

Impact Category	**Multi Model Ensemble – Eastern Australia**	
	Near term (2040 – 2059)	Long term (2080-2099)
	SSP5-8.5	SSP5-8.5
Mean Temperature [°C]	+ 1.6	+ 4.15
Maximum Temperature [°C]	+ 1.64	+ 4.09
Minimum Temperature [°C]	+ 1.59	+ 4.09
Heatwaves in days	+ 5.58	+ 25.57
Precipitation in mm	- 33.56	- 49.25
Relative Humidity in %	- 1.22	- 3.17
IPCC AR5 Results – RCP 8.5		
Solar Radiation in %	+4	+5.5
Wind Speed in %	+4	+5
Evapotranspiration in %	+7.9	+15.5
Sea level rise in m	+0.13	+ 0.65

3 Risk Assessment

In the following DTM, a list of generic risks will be run through which will need to be analysed by the design team. Each of these risks need to assessed based on their likelihood and consequence.

3.1 Identification

The climate context and future risk due to climate impacts inform the risk from each climate impact. The magnitude of the likelihood and consequence can be quantified using the following scales described in Table 5 and Table 6 respectively. The likelihood and consequence are then input into a risk matrix during the Resilience Workshop to determine the level of risk, from insignificant to catastrophic, Table 7.

Table 5: Likelihood rating scheme

	Description	Qualitative Expectation	Quantitative Frequency
L1	Almost certain	Expected to occur frequently during time of activity or project	10 times or more every year
L2	Very likely	Expected to occur occasionally during time of activity or project	1-10 times every year
L3	Likely	More likely to occur than not occur during time of activity or project	Once each year
L4	Unlikely	More likely not to occur than occur during time of activity or project	Once every 1 to 10 years
L5	Very unlikely	Not expected to occur during the time of activity or project	Once every 10 to 100 years
L6	Almost unprecedented	Not expected to ever occur during time of activity or project	Less than once every 100 years

Table 6: Consequences rating scheme

	Description	Health and Safety	Environment	Customer Experience and Operational Reliability
C1	Catastrophic	Multiple fatalities or > 20 major injuries/permanent disabilities/ chronic diseases, or both	Irreversible large-scale environmental impact with loss of valued ecosystems	Extensive shutdowns or extended disruptions with economy wide effects
C2	Severe	Single fatality or 10-20 major injuries/ permanent disabilities/ chronic diseases, or both	Long term environmental impairment in neighbouring or valued ecosystems. Extensive remediation required	Short duration shutdowns or substantial disruptions affecting multiple building services with sector wide cascading effect.
C3	Major	1-10 Major injuries requiring hospitalisation and numerous days lost, or medium-term occupational illness	Impacts external ecosystem and considerable remediation is required	Major disruptions affecting a building service, with consequent effects on one or more other building services
C4	Moderate	Single recoverable list time injury of illness, alternative/ restricted duties injury or short-term occupational illness	Short-term and/ or well contained environmental effects. Minor remedial actions probably required	Serious disruptions affecting one complete building service
C5	Minor	Illness or minor injuries requiring medical treatment	Change from normal conditions within environmental regulatory limits and environmental effects are within site boundaries	Minor disruptions affecting several parts of one building service
C6	Insignificant	Illness, first aid or injury not requiring medical treatment	No appreciable changes to environmental and/ or highly localised event	Short duration disruptions affecting part of one building service

3.2 Assessment

During the resilience workshop, climate risks will be identified by the project team and assigned a likelihood and consequence for the development. This will assess the 2030 and 2070 climate risks, with no mitigation or management included. For each risk identified, a risk owner will be established, who will take responsibility for managing and/or mitigating the risk and providing the necessary commentary and supporting documents.

Each risk owner will receive a summary of their associated risks to review post workshop, for which they must agree with the 2050 and 2090 risk level, address any management and mitigation measures for each risk as well as assign the residual risk's likelihood and consequence.

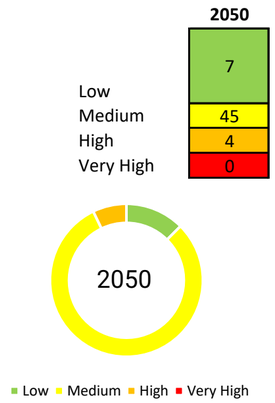
Table 7: Risk assessment matrix

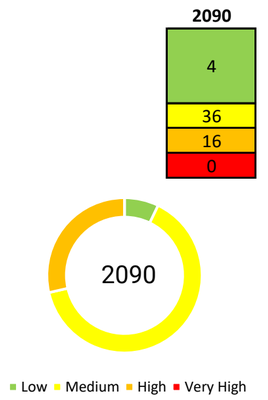
A = Extreme Risk B = High Risk C = Medium Risk D = Low Risk			Consequence					
			Insignificant	Minor	Moderate	Major	Severe	Catastrophic
			C6	C5	C4	C3	C2	C1
Likelihood	Almost Certain	L1	C	B	B	A	A	A
	Very likely	L2	C	C	B	B	A	A
	Likely	L3	D	C	C	B	B	A
	Unlikely	L4	D	D	C	C	B	B
	Very Unlikely	L5	D	D	D	C	C	B
	Almost Unprecedented	L6	D	D	D	D	C	C

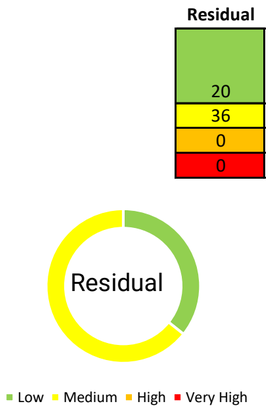
Appendix D – Climate Change Workshop Matrix

Concord Forensic Mental Health Facility - Climate Change Resilience and Adaptation Matrix

Category	Risks Registered	2040-2050	2070-2090
Temperature	17	+ 1.64 °c (2020-2040: +0.71°C increase)	+ 4.15 °C
Precipitation	4	- 33.56 mm	- 49.25 mm
Sea-level Rise	1	+ 0.3 m	+ 0.8 m
Relative Humidity	3	- 1.22%	- 3.17%
Drought	3	Max. no. of consecutive dry days: 4.58	Max. no. of consecutive dry days: 23.18 days
Flood	7	Avg. largest monly rainfall: 257.49 mm	Avg. largest monly rainfall: 263.88 mm
Wind+Storm	5	Wind Speed: + 4%	Wind Speed: +5%
Bushfire	10	SPEI Index: -0.17	SPEI Index: - 0.76
Cyclones	6	Data not available. Medium Level of Confidence for Increase	
Total Risks	**56**		







Ref	Category	Impact	Risk	Risk Owner	2050 Likelihood	2050 Consequence	2050 Risk 2030	2090 Likelihood6	2090 Consequence8	2090 Risk 2090	Controls/ Management Strategy	Residual Likelihood12	Residual Consequence14	Residual Risk Final
W	Wind+Storm	More frequent and intense extreme storms, increase in wind speed	Damage to ventilation system due to particulate matter carried by increased wind	Mechanical	Likely	Moderate	Medium	Very Likely	Moderate	High	External Plant be resilient and robust. Plant room to have louvres around it to act as a physical barrier while also providing the required ventilation. This will protect the plant room from damage from flying debris.	Likely	Moderate	Medium
W	Wind+Storm	More frequent and intense extreme storms, increase in wind speed	Façade elements (roof, long cantilevers etc) at risk of uplift	Architectural/Façade/Structural	Unlikely	Major	Medium	Unlikely	Major	Medium	Facade has built in windows which are significantly storger than window wall or curtain wall systems. The project does not have any major cantalivering elements. The only exposed covered areas include the balconies above the courtyards. Both of these balconies are surrounded by neighbouring spaces on three of fours sides.	Very Unlikely	Major	Medium
W	Wind+Storm	More frequent and intense extreme storms, increase in wind speed	Inceased storm/wind to impact landscaped areas	Landscape	Likely	Moderate	Medium	Likely	Moderate	Medium	Most of the landscaped areas are in courtyards enclosed in buildings on three of four sides and a wall on the remaining side. These elements are all over one storey high. These areas are sheltered from the wind.	Very Unlikely	Moderate	Low
W	Wind+Storm	More frequent and intense extreme storms, increase in wind speed	Increased wind, dust and hail damage to (Services Plant and Solar PV)	Electrical/Mechanical	Unlikely	Moderate	Medium	Unlikely	Moderate	Medium	There are no strategies for protecting solar PV panels from hail damage without compromising their efficiency. Solar panels within australia are rated to withstand hail stones of 35mm diameter. Hail on roof, 3.5 degree pitch is required to mitigate risk of acumulation damage	Unlikely	Moderate	Medium

Concord Forensic Mental Health Facility - Climate Change Resilience and Adaptation Matrix

W	Wind+Storm	More frequent and intense extreme storms, increase in wind speed	Concerns for the outdoor furniture	Architectural	Likely	Moderate	Medium	Likely	Moderate	Medium	Again, outdoor courtyarrd surrounded by buildings/walls all over a storey high, reducing wind within the courtyard.	Unlikely	Moderate	Medium
T	Temperature	Increase in daily temperature (min, max and mean), solar radiation and heatwaves. Decrease in cold nights	The heat rejection to the street, particularly the precinct may cause an increase in localised heat island effect	Mechanical	Likely	Minor	Medium	Very Likely	Minor	Medium	Heat rejection equipment on the roof, not affecting temperature outside building on ground as much.	Unlikely	Minor	Low
T	Temperature	Increase in daily temperature (min, max and mean), solar radiation and heatwaves. Decrease in cold nights	Blackout or brownout of the building due to increase load from mechanical equipment	Electrical	Likely	Major	High	Very Likely	Major	High	Safe operable windows for natural ventilation in bedrooms ensuring adequate outdoor air. Does not solve comfort. Back up generator for essential services. PV to alleviate this risk by reducing peak demand	Unlikely	Major	Medium
T	Temperature	Increase in daily temperature (min, max and mean), solar radiation and heatwaves. Decrease in cold nights	Building Systems Failure due from blackouts/ brownouts	Mechanical	Likely	Moderate	Medium	Very Likely	Moderate	High	Back up generator provided to maintain essential services. Electrical provisions for battery connection when technology become fincancially viable.	Very Likely	Minor	Medium
T	Temperature	Increase in daily temperature (min, max and mean), solar radiation and heatwaves. Decrease in cold nights	Buckling of materials (eg pavement, roads ect)	Civil	Unlikely	Moderate	Medium	Unlikely	Moderate	Medium	Likely thermally durable bitchumen to match the rest of the site. Unlikely to buckle. Designed for thermal expansion at 60degC, post curing cracking risk if very dry	Unlikely	Moderate	Medium
T	Temperature	Increase in daily temperature (min, max and mean), solar radiation and heatwaves. Decrease in cold nights	A reduction in the use of outdoor spaces and amenities.	Landscape	Very Likely	Moderate	High	Very Likely	Moderate	High	One courtyard dedicated to be a tranquil garden with water features and lots of greenery. Its narrow courtyard relative to the height of the building enclosing it. There would not be a great deal of time that this space is exposed to full sun. Generally will be a cool outdoor location.	Unlikely	Moderate	Medium
T	Temperature	Increase in daily temperature (min, max and mean), solar radiation and heatwaves. Decrease in cold nights	Conduction risk in the glass reducing the thermal comfort for the occupants	Mechanical/Architectural	Likely	Minor	Medium	Likely	Minor	Medium	Glazing selected to comply with Section J 2022.	Likely	Minor	Medium
T	Temperature	Increase in daily temperature (min, max and mean), solar radiation and heatwaves. Decrease in cold nights	Degradation and damage to building envelope (e.g. façade, roof) due to exposure to high temperatures (superficial peeling, cracking, corrosion, etc.)	Architect / Façade / Strucutral	Unlikely	Minor	Low	Unlikely	Minor	Low	Solar panels on roof, concrete roof structurally designed for thermal expansion.	Unlikely	Minor	Low
T	Temperature	Increase in daily temperature (min, max and mean), solar radiation and heatwaves. Decrease in cold nights	Degradation and damage to Building Systems due to exposure to high temperatures higher frequency system replacement requirements	Electrical / Mechanical	Likely	Moderate	Medium	Very Likely	Moderate	High	Mechanical VRF systems suitable to operate in 35-52 degree outdoor temperatures with reduced capacity.	Likely	Moderate	Medium

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T	Temperature	Increase in daily temperature (min, max and mean), solar radiation and heatwaves. Decrease in cold nights	Electrical equipment failure during heatwaves or projected increased temperatures.	Electrical	Unlikely	Major	Medium	Likely	Major	High	Fuses are being changed to increase the supply for energy estimates based on historic data rather than future data.	Unlikely	Major	Medium
T	Temperature	Increase in daily temperature (min, max and mean), solar radiation and heatwaves. Decrease in cold nights	Increase in hot days and heatwaves may impact the ability to maintain thermal comfort	Mechanical	Likely	Moderate	Medium	Very Likely	Moderate	High	Building is proposed to have individual control for the Consumer spaces. Thermal comfort thus maintaind by the end User. Plant selection design to accommodate increased air temperatures due to Climate Change.	Unlikely	Moderate	Medium
T	Temperature	Increase in daily temperature (min, max and mean), solar radiation and heatwaves. Decrease in cold nights	Increase in water demand from both occupants and landscape	Hydraulic	Likely	Minor	Medium	Very Likely	Minor	Medium	WSUD strategies around low flow fixtures/ fittings. Native drought species for drought resistance. Landscape well shaded. Large RWT to be used for irrigation tank. Subsurface irrigation	Unlikely	Minor	Low
T	Temperature	Increase in daily temperature (min, max and mean), solar radiation and heatwaves. Decrease in cold nights	Increased heat island effect	Architectural	Likely	Moderate	Medium	Very Likely	Moderate	High	Post development will have a significant increase in green space and solar panaels, reducing the localised heat island effect.	Likely	Moderate	Medium
T	Temperature	Increase in daily temperature (min, max and mean), solar radiation and heatwaves. Decrease in cold nights	Increased temperatures impact on HVAC peak loads and and Mechanical Plant capacity.	Mechanical	Likely	Minor	Medium	Very Likely	Minor	Medium	Mechanical system designed with a service life of 15-20 years and is designed to handle forecasted average temperature increase of 0.71 Degrees for 2020-2039	Unlikely	Minor	Low
T	Temperature	Increase in daily temperature (min, max and mean), solar radiation and heatwaves. Decrease in cold nights	Increased temperature in pipework may increase legionella risk	Mechanical	Likely	Major	High	Likely	Major	High	Waterless heat rejection	Almost Unprecedented	Major	Low
T	Temperature	Increase in daily temperature (min, max and mean), solar radiation and heatwaves. Decrease in cold nights	Mechanical equipment may fail under higher temperatures	Mechanical	Unlikely	Major	Medium	Likely	Major	High	System service life will not survive to 2070 time period. System designed to withstand forecasted temperatures to match service life. Consequence reduced due to operable windows.	Unlikely	Moderate	Medium
T	Temperature	Increase in daily temperature (min, max and mean), solar radiation and heatwaves. Decrease in cold nights	The natural ventilation system may not be able to be used for as much of the year as predicted	Architectural/Mechanical	Likely	Minor	Medium	Very Likely	Minor	Medium	No spaces are reliant on natural ventialtion. Mixed mode likely to occur in switch house only. Switch house will have more relaxed setpoints than other conditioned spaces, allowing for more time for natural ventilation/econocycle.	Very Likely	Minor	Medium
T	Temperature	Increase in daily temperature (min, max and mean), solar radiation and heatwaves. Decrease in cold nights	Thermal comfort of occupants in naturally ventilated spaces.	Mechanical	Likely	Minor	Medium	Very Likely	Minor	Medium	No indoor spaces rely soley on natural ventilation. Mixed mode proposed in some spaces but will switch to mechanical ventilation if outdoor conditions are undesirable	Unlikely	Minor	Low

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SL	Sea-level Rise	Site Innundation	Unusable Building	Civil	Almost Unpreced ented	Severe	Medium	Almost Unpreced ented	Severe	Medium	Generally the project is elevated to much of Sydneys other harbourside buildings. This building would not be at significant risk until many other buildings in Sydney/Parramatta River were inundated. Increase in sea level rise can effects of the towns outflow system. Low risk for the moment	Almost Unpreceden ted	Severe	Medium
RH	Relative Humidity	Slight decrease in RH	Condensation and moisture in the façade	Architectural/Façade	Unlikely	Moderate	Medium	Unlikely	Moderate	Medium	Condensation analysis to be considered and incorporated in Architectural design. Sarking and insulation locations will be considered for condensation dew points.	Unlikely	Moderate	Medium
RH	Relative Humidity	Consecutive days of intense rainfall, high RH, high temperature	HVAC system undersized for dehumidifaction. HVAC cannot simulataneously heat and cool	Mechanical	Likely	Moderate	Medium	Likely	Minor	Medium	No active humidity control to the building provided. VRF system is heat recovery hence can simultanously heat and cool on demand various rooms on demand.	Likely	Moderate	Medium
RH	Relative Humidity	Fluctuating RH during different ENSO cycles	Increased humidity during La Nina, Decreased humidity during El Nino, impacting thermal comfort, health risk and moisture indoors	Mechanical	Likely	Moderate	Medium	Likely	Moderate	Medium	No active humidity control to the building provided.	Likely	Moderate	Medium
P	Precipitation	Increased rainfall variability, less frequent but more severe storms events	Drainage from public system to cope with intense flows	Civil	Very Unlikely	Moderate	Low	Unlikely	Moderate	Medium	Very slight increase in post development flow compared with pre-development, this will be alleviated with a small OSD.	Unlikely	Moderate	Medium
P	Precipitation	Increased rainfall variability, less frequent but more severe storms events	Increased rainfall variability may impact the annual capcity of rainwater used for irrigation	Hydraulic	Unlikely	Minor	Low	Likely	Minor	Medium	Large RWT proposed for irrigation. Connection to the potable water mains is sufficient enough to compensate for rainfall variability. Landscape includes native species to lower landscape irrigation demand. Subsurface drip irrigation.	Unlikely	Minor	Low
P	Precipitation	Increased rainfall variability, less frequent but more severe storms events	Operation of natural ventilation louvers during rain events	Mechanical/Architectural	Likely	Minor	Medium	Likely	Minor	Medium	This will be occupant controlled standing in bedroom. Occupant to close while raining.	Likely	Minor	Medium
P	Precipitation	Increased rainfall variability, less frequent but more severe storms events	Penetrations through roofing.	Architectural/Structural	Unlikely	Moderate	Medium	Unlikely	Moderate	Medium	Concrete roof, penetrations will not travel through roofs entirity. To be water proofed approriately.	Unlikely	Moderate	Medium
F	Flood	More severe and prolonged flood events	Access to the building restricted by flood	Civil	Unlikely	Major	Medium	Unlikely	Major	Medium	Building is located on the ridge of the point at concord, access would not be restricted due to flood. Nearby amenities may be affected such as walks near the river.	Unlikely	Major	Medium
F	Flood	More severe and prolonged flood events	Death of flora due to flooding	Landscape	Unlikely	Minor	Low	Unlikely	Minor	Low	Soil mix to have sufficient drainage properties in planting beds. Landscaped areas to have fall away from building.	Unlikely	Minor	Low
F	Flood	More severe and prolonged flood events	Flood damage to building structure	Structural	Very Unlikely	Severe	Medium	Very Unlikely	Severe	Medium	Column and core foundations will be piled to the underlying weathered rock (shale). Flooding would not influence bedrock. Flooding is also not a major risk of the building due to its elevation compared to Parramatta River.	Almost Unpreceden ted	Severe	Medium

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F	Flood	More severe and prolonged flood events	Flooding causes power outage	Electrical/Mechanical/Civil/Landscape/Facilities Manager	Unlikely	Major	Medium	Likely	Major	High	Plant equipment is located on roof. walkways along ridge, loading dock does have a low drain. Not a catchment area, high above the river. no floods in the past 4 years that have caused power outage	Unlikely	Major	Medium
F	Flood	More severe and prolonged flood events	Overland flow during flood events	Civil	Unlikely	Moderate	Medium	Likely	Moderate	Medium	Civil engineer to ensure overland flow when RWT are full to flow away from project boundary towards stormwater.	Unlikely	Minor	Low
F	Flood	More severe and prolonged flood events	Site proximity to Darling Harbour causing concern around flooding to the domain surrounding the building.	Civil	Almost Unprecedented	Major	Low	Almost Unprecedented	Major	Low	Site is located on raised land compared to Parramatta River	Almost Unprecedented	Major	Low
F	Flood	More severe and prolonged flood events	Undersized systems for drainage, gutters, osd (if needed)	Hydraulic/Civil	Very Likely	Moderate	High	Very Likely	Moderate	High	Stormwater system designed for 110% increase on code.	Likely	Minor	Medium
D	Drought	More severe and prolonged drought events	Damage to landscaping due to drought.	Architectural	Likely	Minor	Medium	Likely	Minor	Medium	Majority of landscape has been planned using drought tolerent native species minimising this risk.	Likely	Insignificant	Low
D	Drought	More severe and prolonged drought events	Decreased availability of potable water. Local laws in place for preventing the use of potable water for non-potable uses.	Landscape	Likely	Moderate	Medium	Very Likely	Moderate	High	Project will consume significantly less water than a similar refernce project with DTS water measures. Large RWT.	Very Likely	Minor	Medium
D	Drought	More severe and prolonged drought events	Water scarcity during drought periods affecting towns water supply	Hydraulic	Likely	Minor	Medium	Likely	Minor	Medium	Reduced potable water consumption by efficient fixtures, seawater heat rejection avoiding cooling tower requirements, large RWT to service irrigation	Unlikely	Minor	Low
C	Cyclones	Less frequent but more severe tropical Cycles reaching further South	Blockage of drainage systems during large storm events	Hydraulic/Civil	Likely	Moderate	Medium	Likely	Moderate	Medium	Ensure guttering is sized for appropriate rain event. Ensure stormwater is sized for appropriate rain event considering a full rainwater tank. Hydraulic are using 110% sizing from code.	Unlikely	Minor	Low
C	Cyclones	Less frequent but more severe tropical Cycles reaching further South	Damage to landscaping and trees	Landscape	Likely	Moderate	Medium	Likely	Moderate	Medium	Gardens are surrounded by walls on all sides	Unlikely	Insignificant	Low
C	Cyclones	Less frequent but more severe tropical Cycles reaching further South	Hail damage to façade	Architect / Façade	Very Unlikely	Moderate	Low	Unlikely	Moderate	Medium	Hail storms most commonly coming from the W-NW. Most of these facades are solid wall. Low window to wall ratio	Very Unlikely	Moderate	Low

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C	Cyclones	Less frequent but more severe tropical Cycles reaching further South	Hail damaging the roof tiles/ strucutres	Architectural/Facilities Manager/Facade	Unlikely	Moderate	Medium	Unlikely	Moderate	Medium	Concrete roof can withstand hail damage	Very Unlikely	Moderate	Low
C	Cyclones	Less frequent but more severe tropical Cycles reaching further South	Hail damaging the solar panles	Electrical	Likely	Minor	Medium	Likely	Minor	Medium	Australian Code that Solar panels tested and certified to withstand hail up to 25mm falling at 23 m/s	Very Unlikely	Minor	Low
C	Cyclones	Less frequent but more severe tropical Cycles reaching further South	Lighting Strikes to the building	All	Unlikely	Moderate	Medium	Likely	Moderate	Medium	Lighting protection system, engineered so the building structure dissipates the strike to the earth	Unlikely	Minor	Low
B	Bushfire	Increased frequency and intensity of bushfires	Access to site blocked, preventing, or restricting access and egress to the site caused by bushfire	Landscape / Civil / Architectural	Very Unlikely	Moderate	Low	Very Unlikely	Moderate	Low	Project not in a bushfire risk zone.	Very Unlikely	Moderate	Low
B	Bushfire	Increased frequency and intensity of bushfires	Damage to buildings/ landscape/ occupants	Landscape	Very Unlikely	Major	Medium	Very Unlikely	Major	Medium	Gardens are surrounded by walls on all sides, it would be difficult for these to catch a blaze.	Very Unlikely	Major	Medium
B	Bushfire	Increased frequency and intensity of bushfires	False alarms from smoke ingress during bushfire periods	Fire Engineer / Mechanical	Likely	Moderate	Medium	Likely	Moderate	Medium	G4 pre-filter + F8 filters provided on all OA intakes. F9 filters can be provided for bushfire season pending review with the Client. For the VRF system a recirculation mode can be proposed for a short period of time. This will prevent bushfire smoke reaching threshold that triggers the alarm.	Unlikely	Moderate	Medium
B	Bushfire	Increased frequency and intensity of bushfires	Increase of particulate matter/ ash from bushfires in recycled water system	Hydraulic	Likely	Minor	Medium	Likely	Minor	Medium	First flush device in rainwater harvesting.	Likely	Minor	Medium
B	Bushfire	Increased frequency and intensity of bushfires	Ingress of smoke through natural ventilation louvers causing building system damage and increase health risks to the building occupants	Architectural/Mechanical	Unlikely	Moderate	Medium	Likely	Moderate	Medium	Natural ventilation is occupant controlled. If discomfort occurs due to smoke, occupants will close the windows.	Unlikely	Moderate	Medium
B	Bushfire	Increased frequency and intensity of bushfires	Internal smoke damage as a result of unsealed areas	Architectural/Mechanical	Likely	Moderate	Medium	Likely	Moderate	Medium	Filters provided to all Ooutdoor Air intakes.	Likely	Moderate	Medium
B	Bushfire	Increased frequency and intensity of bushfires	Particulate matter compromising the filtration of the mechanical system	Mechanical	Likely	Moderate	Medium	Very Likely	Moderate	High	Clogging of filters can occure during bushfire season. G4 pre-filter + F8 filters provided on all OA intakes. F9 filters can be provided for bushfire season pending review with the Client. For the VRF system a recirculation mode can be proposed for a short period of time.	Likely	Moderate	Medium
B	Bushfire	Increased frequency and intensity of bushfires	Particulate matter effect occupants during times of increased activity	Mechanical	Likely	Moderate	Medium	Very Likely	Moderate	High	As above	Likely	Moderate	Medium

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B	Bushfire	Increased frequency and intensity of bushfires	Particulate matter from bushfires increasing the soiling of PV panels	Electrical	Very Likely	Insignificant	Medium	Almost Certain	Insignificant	Medium	Ash causing soiling and reduction in module efficiency. Visual inspection may be required after bushfire to determine if cleaning is required.	Almost Certain	Insignificant	Medium
B	Bushfire	Increased frequency and intensity of bushfires	Reduced air quality within open space areas and increase health impacts - Outdoor AQ	Architectural	Likely	Moderate	Medium	Very Likely	Moderate	High	Create desirable indoor spaces where the outdoor can be filtered for particulate matter and have a higher quality air inside.	Very Likely	Minor	Medium