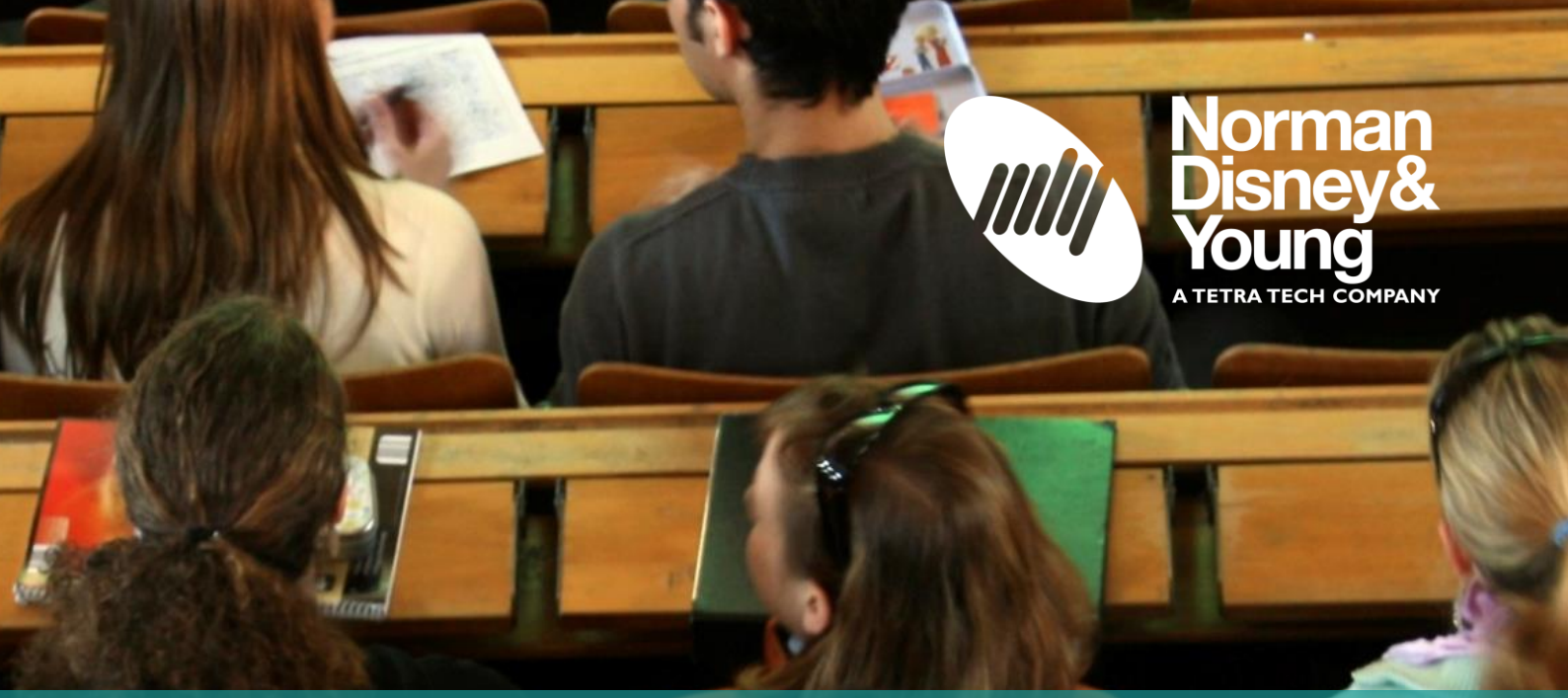

Norman Disney & Young
A TETRA TECH COMPANY

School Infrastructure NSW

New primary school at Gregory Hills

Sustainable Development Plan

27 October 2022

CONFIDENTIAL | **Revision:** P05 – For SSDA | **Issued:** 27 October 2022

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1 PREAMBLE

1.1 Introduction

This Sustainable Development Plan accompanies an Environmental Impact Statement (EIS) pursuant to Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act), in support of a State Significant Development Application (SSDA) for the construction and operation of a new primary school at Gregory Hills (SSD-41306367).

This report addresses the Secretary's Environmental Assessment Requirements (SEARs) issued for the project, notably:

SEARs Requirement	Response	Compliance
SEARS Key Issues **8. Ecologically Sustainable Development (ESD** ▸ Identify how ESD principles (as defined in section 193 of the EP&A Regulation) are be incorporated in the design and ongoing operation of the development.	*The Precautionary Principle* The design has been reviewed against holistic sustainability principles to ensure a high ecologically sustainable design (ESD) outcome is achieved. The ESD initiatives proposed for the new primary school at Gregory Hills Project aim to reduce the environmental impacts typically associated with buildings during the construction and ongoing operation of the building. Sustainability measures have been incorporated, spanning across the project's design, construction and operations, based around the core principles of: ▸ Efficient use of resources (energy, water and materials) ▸ Enhancing indoor environment quality and occupant comfort ▸ Minimising ecological impacts. In line with the Green Star pathway, the head contractor will implement an Environmental Management Plan (EMP) ensuring there will also be a systematic approach to environmental considerations throughout construction. A climate change risk assessment has been completed to assess the anticipated impacts of climate change and implement design strategies to mitigate these impacts. Refer to Section 6 for details. *Inter-Generational Equity* Student and staff health has been considered through the incorporation of Indoor Environmental Quality design features such as daylight and glare analysis for natural lighting, best-practice lighting design, indoor air quality, thermal comfort assessment, acoustic design, and responsible material selection to reduce internal pollutants and resource depletion for future generations. In relation to cultural diversity, the project will look to incorporate the NSW Department of Education organisational Reconciliation Action Plan and use it as an opportunity to further embrace the objectives, including but not limited to: ▸ Procurement of all materials and labour will be in accordance with the NSW DoE Aboriginal Procurement Policy and NSW DoE Main Works 21 Preliminaries - Section 4.4 'Aboriginal Participation' ▸ A project-specific Aboriginal Participation Plan will be developed to monitor and report on the minimum Aboriginal participation requirements. Incorporation of Indigenous design elements will be considered, such as incorporation of aboriginal artwork, language elements and engagement with aboriginal workers during construction. The project will also investigate opportunities for community use of the school facilities to provide benefits to the broader community. Universal	✓ ✓

SEARs Requirement	Response	Compliance
	design principles will be implemented to provide safe, equitable and dignified access for persons with disabilities. Prioritising multi-modal transport planning and infrastructure provision to the school will reduce the carbon emissions from occupants to the building and also encourage different socio-economic groups to the site. *Conservation of Biological Diversity and Ecological Integrity* The proposed design has considered design strategies to minimise the urban heat island effect and improve ecological value of the site, such as the use of light-coloured external finishes and landscaping including native and endemic vegetation. High quality access to external views will be considered to increase student engagement with the natural environment. Opportunities to promote biophilia on the project have been reviewed and will be developed through detailed design with the assistance of the landscaping and architectural teams. *Improved Valuation, Pricing, and Incentive Mechanisms* Total cost of operation will be reduced through sustainable considerations to reduce energy, water and waste requirements, taking into consideration whole-of-life costing. The project will ensure sustainable principles are extended to include value for money, fit for purpose, long term reliability/resilience and flexibility. Designing with the long-term operation of the building in mind will create further buy-in and cooperation from the operating stakeholders. Strategies to reduce operational waste have been considered such as the development of an operational waste management plan and separation of waste streams.	✓ ✓
SEARS Key Issues 8. Ecologically Sustainable Development (ESD ▸ Demonstrate how the development will meet or exceed the relevant industry recognised building sustainability and environmental performance standards, and integrate environmental design strategies in accordance with the Environmental Design in Schools Manual.	The project will be designed and delivered in line with the standard SINSW sustainability brief, detailed in the SINSW Sustainable Development Practice Note, with key commitments including: ▸ 5 Star Green Star certification ▸ SINSW EFSG compliance ▸ NCC Section J compliance The development will be verified through a Green Star Design & As-Built v1.3 formal certification, committed to a 5 Star rating which is defined by the Green Building Council of Australia (GBCA) as an *Australian Excellence* development. Refer to Appendix 8.1 for an indicative Green Star Design & As-Built v1.3 scorecard. Refer to Appendix 8.2 for the full EFSG ESD schedule outlining all EFSG requirements and additional commentary. The Environmental Design in Schools Manual is prepared by the office of the Government Architect NSW and sets out guidelines for ensuring high quality, well designed schools throughout NSW. Refer to Section 4.6 for details. The following highlights the key design principles as nominated in the manual: Context, built Form and Landscape; Sustainable Efficient and Durable; Accessible and Inclusive; Health and Safety; Amenity; Whole of life, flexible and adaptive; Aesthetics. The following summarises how these will be addressed by the project: ▸ High indoor air quality (natural ventilation openings, removal of indoor pollutants) ▸ Acoustic comfort with noise levels suitable to the activities within each space ▸ Best practice lighting design and control that is suitable to the space and free from glare ▸ High quality levels of thermal comfort	✓ ✓

SEARs Requirement	Response	Compliance
	▸ Consideration of the building design's resilience and adaptation to climate change impacts ▸ Passive design principles including consideration for building orientation and façade design to reduce energy consumption ▸ Maximise energy efficiency of systems	
SEARS Key Issues 8. Ecologically Sustainable Development (ESD ▸ Demonstrate how the development minimises greenhouse gas emissions (reflecting the Government's goal of net zero emissions by 2050) and consumption of energy, water (including water sensitive urban design) and material resources.	The development will be designed and delivered over and above the minimum energy efficiency requirements stated in the EFSG, GREP and Section J. Energy modeling will be undertaken to quantity the energy consumption and greenhouse gas (GHG) emissions, and used to inform design decisions to improve efficiencies. The following energy efficiency and GHG emissions reduction initiatives are proposed: ▸ Exceeding NCC 2019 Section J minimum deemed-to-satisfy (DtS) requirements. The EFSG Section DG02.03 requires the development to achieve a 10% reduction in energy consumption, in comparison to a minimum NCC 2019 DtS compliant building, excluding any contribution from renewable energy (e.g. rooftop solar PV). Final improvement will be demonstrated via energy modelling in detailed design. ▸ All electric air conditioning systems and domestic hot water systems. ▸ Roof mounted solar photovoltaic (PV) system in accordance with EFSG requirements. ▸ Exceeding the minimum building envelope R-values of Section J1.3, J1.5 & J1.6. ▸ Improving on the glazing performance requirements of Section J1.5. ▸ Energy-efficient lighting (typically LED) will be provided throughout, and high efficiency heating and cooling. Improving on the maximum illumination power densities of Section J6.2. ▸ Effective shading devices which reduce solar heat gains to conditioned spaces. The following initiatives are currently included in the preliminary sustainability strategy to enhance the water efficiency of the proposed development and reduce potable water consumption: ▸ Rainwater harvesting and water reuse system ▸ Selection of water-efficient sanitary fittings and fixtures in line the Green Star and EFSG requirements ▸ No water-based heat rejection systems for air conditioning (no cooling towers)	✓ ✓

1.2 Proposal

The proposal is for a new primary school at Gregory Hills that generally comprises the following:

- 44 General Learning Spaces.
- 4 Support Learning Spaces.
- Administration, staff hub, amenity and building service areas.
- Library, communal hall and canteen.
- Outside School Hours Care (OSHC) services.
- Sport courts, outdoor play space, a Covered Outdoor Learning Area (COLA) and site landscaping.
- Dedicated bicycle and scooter parking.
- Three (3) kiss and drop spaces for Supported Learning Students (SLS) located on Wallarah Circuit.
- On-site car parking.
- Signage.
- Footpath widening on Wallarah Circuit.

Figure 1 Site Plan (Source Bennet and Trimble

1.3 Site Description and Location

The site is located in Dharawal Country at 28 Wallarah Circuit, Gregory Hills NSW 2557, and is legally described as Lot 3257 DP1243285.

The site is located within the Camden Local Government Area and is within the Turner Road Precinct of the South-West Growth Centre.

The site has an area of approximately 2.926ha (by Deposited Plan). This will be reduced to 2.907ha under approved DA2022/742/1 once Long Reef Circuit has been widened.

Topography is minimal with a fall from the south-east corner (RL116.5) to the north- west corner (RL113).

The site has three (3) street frontages:

- Wallarah Circuit (southern boundary)
- Gregory Hills Drive (northern boundary)
- Long Reef Circuit (eastern Boundary)

The site is primarily vacant land, with the exception of an existing group of trees in the southwest corner of the site that pre-date the subdivision and development of the precinct. There is also an existing electrical substation located on the south-eastern boundary.

There are easements of varying widths located to the northern boundary identified for drainage.

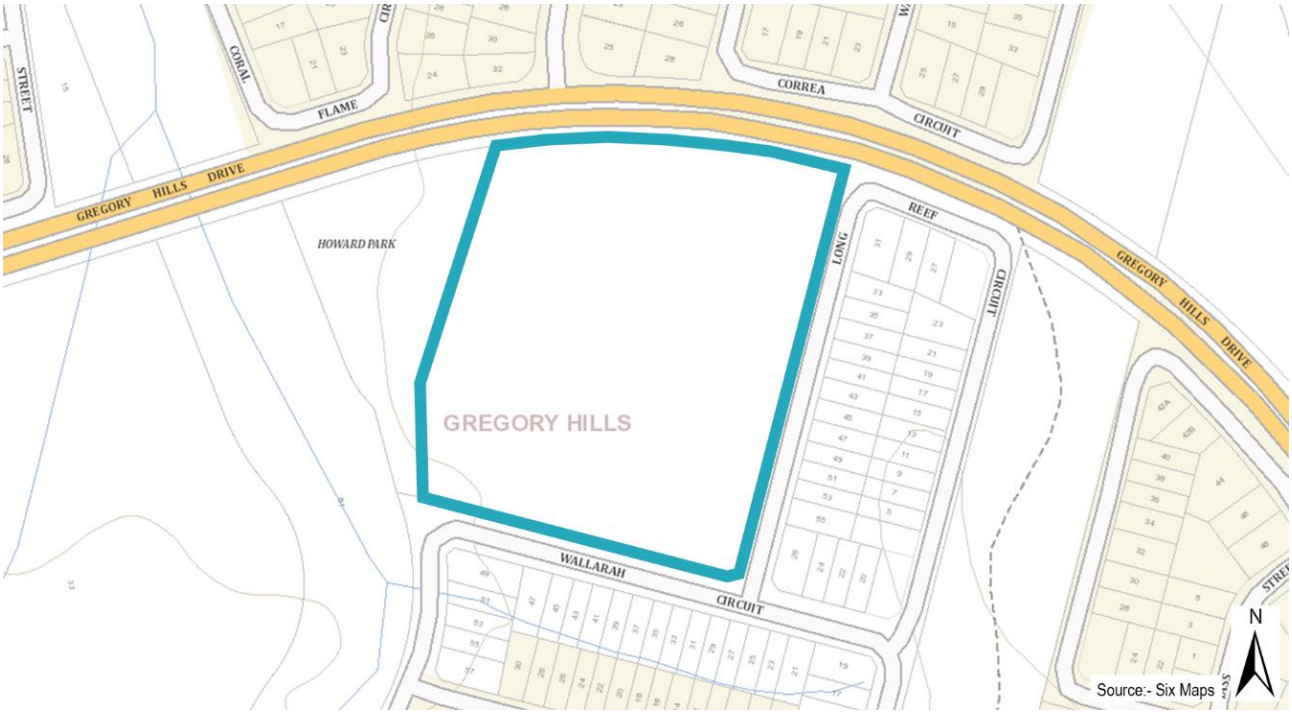


Figure 2 Locality Map (Six Maps)

Figure 3 Site Aerial Map, (Source Bennet and Trimble)

1.4 Surrounding Development

To the north, east and south of the site is emerging and recently completed residential development.

To the east of the residential area fronting Long Reef Circuit are high voltage power lines within an easement which include pedestrian paths and cycleways.

To the west of the site, beyond Sykes Creek and Howard Park, is the Gregory Hills town centre. A pedestrian bridge links Wallarah Circuit with the town centre across Sykes Creek.

Figure 4 Surrounding Development (Nearmap)

2 EXECUTIVE SUMMARY

Norman Disney & Young a Tetra Tech company (NDY) has been engaged by School Infrastructure NSW (SINSW) to develop a Sustainable Development Plan (SDP) for the proposed new primary school at Gregory Hills development.

The principal objective of this report is to address the minimum requirements set out in the following:

- *Secretary's Environmental Assessment Requirements* (SEARs) – SSD-41306367, Key Issues Part 6, "Ecologically Sustainable Development (ESD)"
- SINSW *Education Facilities Standard and Guidelines* (EFSG)
- Government Architect NSW (GANSW) *Design Guide for Schools* and *Environmental Design in Schools Manual*
- NSW Government Resource Efficiency Policy (GREP) 2019

The project will be designed and delivered in line with the standard SINSW sustainability brief, detailed in the SINSW *Sustainable Development Practice Note*, with key scope including:

- 5 Star Green Star certification
- SINSW EFSG compliance
- NCC Section J compliance

The project will be delivered under an early contractor involvement (ECI) approach and will utilise modern methods of construction (MMoC) methodologies. The proposed development aims to go beyond minimum building statutory requirements and provide a progressive sustainability outcome for the community.

Through early design input from sustainability professionals, key initiatives incorporated in the proposed development include:

- Passive design elements, such as high performance façade, effective shading and natural ventilation to reduce the energy demand of the buildings and improve indoor environment quality for students and staff.
- Energy efficient building systems and on-site renewable energy to reduce greenhouse gas emissions.
- Preliminary consideration of the building design's resilience and adaptation to climate change impacts.
- High indoor air quality, acoustic design principles, visual amenity and thermal comfort to support the site functions as training and teaching spaces and private staff areas.
- Best practice waste management principles in operation, and construction and demolition waste diversion from landfill.
- Water efficient fixtures and fittings (high WELS ratings), and rainwater collection from the roof and stored for use on-site (landscaping irrigation, toilet flushing) to reduce potable water consumption.
- Incorporation of stormwater management systems and water sensitive urban design (WSUD) to minimise peak stormwater flows and pollutants.
- Social sustainability initiatives such as incorporation of indigenous design elements, implementation of universal design principles and providing community benefits via community use of the school facilities.

The ESD initiatives of the proposed development will be verified through a Green Star Design & As-Built v1.3 formal certification. The development is committed to a 5 Star rating, which is deemed to represent *Australian Excellence* by the Green Building Council of Australia (GBCA).

Green Star is considered the most widely-adopted sustainability framework in Australia, covering a broad range of sustainability initiatives. Green Star Design & As Built incorporates a mixture of initiatives in line with the intent of WELL (healthy environment for occupants), NABERS (efficient building in operation), Passive House (high performing façade & mechanical systems), as well as other sustainability frameworks.

3 PROJECT SUMMARY

3.1 Purpose of This Report

The principal objective of this report is to detail the sustainability strategy of the proposed development, in order to address the minimum requirements set out in the following:

- *Secretary's Environmental Assessment Requirements* (SEARs) – SSD-41306367, Key Issues Part 6, "Ecologically Sustainable Development (ESD)"
- Clause 193 of Division 5 of the *Environmental Planning and Assessment Regulation 2021*
- SINSW *Education Facilities Standard and Guidelines* (EFSG) – Design Guides
- Government Architect NSW (GANSW) *Design Guide for Schools* and *Environmental Design in Schools Manual*
- NSW Government Resource Efficiency Policy (GREP) 2019

3.2 Climate Zone Considerations

The site is located in Gregory Hills, NSW, and is under the jurisdiction of Camden Council. The school is located within climate zone 6 – mild temperate conditions, which is associated with:

- High diurnal ranges inland and four distinct seasons
- Summer and winter that can exceed human comfort range, while spring and autumn are ideal for human comfort
- Mild to cool winters with low humidity
- Hot to very hot summers, with moderate humidity

3.3 Information Sources

The following information sources have been used in the preparation of this report:

- *Secretary's Environmental Assessment Requirements* (SEARs) – SSD-41306367, Key Issues Part 6, "Ecologically Sustainable Development (ESD)"
- Clause 193 of Division 5 of the *Environmental Planning and Assessment Regulation 2021*
- NSW Department of Education – School Infrastructure documents:
  - Sustainable Development Practice Note
  - Education Facilities Standard and Guidelines (EFSG) – Design Guide
  - GANSW Design Guide for Schools
  - GANSW Environmental Design in Schools Manual
  - DfMA Guidelines
- NSW Government Resource Efficiency Policy (GREP) 2019
- NSW and ACT Government Regional Climate Modelling (NARCliM) climate change projections
- NCC Section J 2019 Amendment 1
- Green Star Design & As Built v1.3 Submission Guidelines
- Architectural drawings prepared by Bennet & Trimble Architects
- Discussions and workshops with the design team.

3.4 Revision History

Table 1 Revision History

Revision	Date	Reason for Issue
P01	11/04/2022	Preliminary
P02	03/05/2022	Concept Design
P03	21/09/2022	For SSDA
P04	07/10/2022	For SSDA
P05	27/10/2022	For SSDA

4 SUSTAINABILITY FRAMEWORKS & LEGISLATION

Relevant sustainability frameworks and legislation applicable to the proposed development are detailed in the following sub-sections.

4.1 NCC 2019 – Section J

The National Construction Code (NCC) is produced and maintained by the Australian Building Codes Board (ABCB) on behalf of the Australian Government with the aim of achieving nationally consistent, minimum necessary standards of relevant health and safety, amenity and sustainability objectives efficiently. Section J of the NCC Volume 1 2019 sets out the minimum energy efficiency requirements for all commercial buildings in Australia.

There are 6 Deemed-to-Satisfy subsections, focusing on different aspects of energy efficiency as follows:

- J1 - Building Fabric (i.e. the ability of the roof, walls and floor to resist heat transfer)
- J3- Building Sealing (i.e. how well parts of a building are sealed to ensure comfortable indoor environments are efficiently maintained)
- J5 - Air Conditioning and Ventilation Systems (i.e. the efficiency and energy saving features of heating, ventilation and air-conditioning systems)
- J6 - Artificial Lighting and Power (i.e. power allowances for lighting and electric power saving features)
- J7 - Hot Water Supply and Swimming Pool and Spa Pool Plant (i.e. the efficiency and energy saving features of hot water supply)
- J8 – Facilities for Energy Monitoring (i.e. access to certain energy efficiency equipment for maintenance purposes)

The development will achieve compliance with NCC 2019 Section J either through Deemed-to-Satisfy (DTS) Provisions, or a JV3 Performance Solution.

4.2 Educational Facility Standards and Guidelines (EFSG)

The Educational Facilities Standards and Guidelines (EFSG) are intended to assist those responsible for the management, planning, design, construction and maintenance of new and refurbished school facilities. The EFSG is a suite of information compiled into Design Guides to aid in the planning, design and use of NSW Department of Education school facilities. The guides aim to provide functional and durable facilities within a systematic whole of life, value for money framework that takes into account enhancement of learning and teaching, planning and development, sustainability and facilities management.

4.3 SINSW Design for Manufacture & Assembly (DfMA) Guidelines

Design for Manufacture and Assembly (DfMA) or Modern Methods of Construction (MMC) is a design approach that focuses on ease of manufacture and efficiency of assembly. In addition to reduced manufacturing time and construction costs, DfMA principles can lead to reduced material wastage which can have significant sustainability benefits.

The SINSW DfMA guidelines have been developed to describe the drivers, principles, system and performance criteria of the DfMA system in an aim to enable the application of DfMA principles to schools' projects across NSW. The Department of Education continues to set itself innovative and ambitious sustainability objectives, and the SINSW DfMA guidelines have been developed with these objectives in mind.

4.4 NSW Government Resource Efficiency Policy (GREP)

The aim of the NSW Government Resource Efficiency Policy (GREP) is to reduce the NSW Government's operating costs and lead by example in increasing the efficiency of its resource use. The policy intends to drive resource efficiency by NSW Government agencies in four main areas – energy, water, waste and air emissions from government operations. The policy describes measures to achieve set targets and minimum standards.

4.5 Green Star

Green Star is a voluntary sustainability rating tool for buildings, tenancies and communities in Australia. It was launched in 2003 by the Green Building Council of Australia (GBCA), a not-for-profit organisation with the key objective of driving the transition of the Australian property industry towards the design and construction of a more sustainable built environment.

Although initially developed specifically for the design and construction of office buildings, the Green Star suite of rating tools has now expanded to cover all habitable buildings and communities across a design, as built and operational performance life cycle.

4.6 Government Architect NSW Environmental Design Guide for Schools

The Government Architect NSW (GANSW) released an Environmental Design in Schools Manual which illustrates a set of design principles as guidelines to follow for new development and expansion of schools. The design principles from the GANSW Design Guide for Schools include:

- Context, Built Form and Landscape
- Sustainable, Efficient and Durable
- Accessible and Inclusive
- Health & Safety
- Amenity
- Whole of Life, Flexible and Adaptive
- Aesthetics

4.7 Environmental Planning and Assessment Regulation 2021

Environmental Planning and Assessment Regulation 2021 is a planning tool that captures NSW legislation relating to planning. Division 5 of the act calls for an Environmental Impact Statement to be provided to planning authorities that addresses project specific Secretary's Environmental Assessment Requirements (SEARs).

4.8 Sustainable Development Practice Note

The SINSW *Sustainable Development Practice Note* outlines the framework for the integration of sustainable development principles in the planning, design, tender and construction phases for all School Infrastructure projects. This framework is closely aligned to NSW Government policy positions and the United Nations Sustainable Development Goals.

Sustainability commitments for the new primary school at Gregory Hills are in accordance with SINSW *Sustainable Development Practice Note*, version V-2.0 dated 30/04/2021.

5 SUSTAINABILITY INITIATIVES

The proposed development aims to go beyond minimum building requirements and provide a progressive sustainability outcome for the community. The ESD principles adopted for the project will contribute to the conservation of resources and future resilience, across the whole life cycle of the project; from construction, through to the operational phase.

The ESD initiatives of the proposed development will be verified through a Green Star Design & As-Built v1.3 formal certification, with the development committed to a 5 Star rating.

The following sub-sections (5.1 to 5.9) outline the initiatives incorporated into the proposed development in line with the EFSG and Green Star categories and credits. Refer to Appendix 8.1 and 8.2 for the detailed schedules outlining specific sustainability initiatives proposed for the project, including:

- Green Star Design & As-Built v1.3 Pathway
- EFSG ESD Schedule

Under each sub-category, the initiatives already incorporated into the design, and additional opportunities identified for further investigation have been outlined. These will be refined through further investigation in design development.

The Green Star pathway and associated relevant design details will be incorporated into project contract documentation, noting that final pathway is still under review and will be further developed during later design stages. The head contractor will ultimately be responsible for ensuring the Green Star 5 Star outcome is achieved.

5.1 Management

5.1.1 General Principles

Good management - adopted from design phase, construction and through to building operation - should be used to support best practice sustainability outcomes. These practices and processes include:

- Guidance from sustainability professionals
- Pre-commissioning, commissioning and tuning
- Adaptation and resilience
- Building information to facilitate operator and user understanding
- Metering and monitoring
- Responsible construction practices
- Commitments to performance (e.g. reducing building and operational waste).

5.1.2 Best Practice Initiatives

The following initiatives are currently included in the preliminary sustainability strategy, in order to ensure that the project minimises its environmental impact through construction and operational management:

- Green Star accredited professional has been contractually engaged to provide advice, support and information.
- Pre-commissioning, commissioning, and tuning of building systems to ensure systems are operating as intended.
- SINSW Commissioning and Temporary Schools Program reviews process to assist in advising, monitoring, and verifying the commissioning and tuning of the nominated building systems throughout the design, tender, construction, commissioning and tuning phases.
- Preliminary consideration of the proposed development to assess how the proposed design is responsive to future climate impacts by undertaking a climate change risk assessment. A climate adaptation risk register

developed for the building to address specific climate risks of the design and how they might be mitigated to reduce risk.

- Provision of building information to facilitate operator and user understanding of all building systems, and their specific operation and maintenance requirements and/or environmental targets
- Environmental targets for the development and a system in place to measure results, for reduction of energy and water consumption.
- Responsible construction practices in place, including development of project-specific best-practice environmental management plan (EMP) and high-quality staff support services. Implementation of a formalized approach to planning, implementing and auditing during construction to ensure conformance with the EMP.
- Specialist waste consultant has been engaged to development of an operational waste management plan (OWMP). OWMP principles to be incorporated into the design in future project stages, including separation of waste streams (e.g. paper, cardboard, glass, plastics, toner cartridges, batteries, organics etc.) to facilitate reuse, recycling, composting, and overall waste reduction.

5.1.3 Opportunities

In addition to the management initiatives outlined above, the following initiatives are currently being explored:

- Air permeability testing in line with Green Star Credit 2.2, noting that SINSW is currently undertaking a pilot to determine the feasibility of this credit on future projects.

5.2 Indoor Environmental Quality

5.2.1 General Principles

Healthy, comfortable learning environments are vital for students and staff, particularly when they may require spaces that facilitate focus and engagement for a considerable amount of time. General principles of indoor environmental quality (IEQ) include:

- High indoor air quality
- Acoustic comfort with noise levels suitable to the activities within each space
- Good lighting design and control that is suitable to the space and free from glare
- High levels of daylight amenity and views for visual interest
- Reduced internal air pollutant levels (e.g. product and material selection)
- Thermal comfort

5.2.2 Best Practice Initiatives

The following initiatives are currently included in the preliminary sustainability strategy:

- Passive design principles have been incorporated in the design, including high-performance building envelope, effective shading and building orientation, and natural ventilation openings to support comfortable and low-energy indoor environment quality.
- Acoustic consultant is engaged to advice design to support the building's function as training, teaching and multi-purpose spaces for students, staff and community use.
- Best-practice lighting will be provided to improve lighting comfort via flicker-free, high-quality lighting that accuracy addresses the perception of colour within the space.
- High levels of daylight and external views are provided to regularly occupied learning and administration areas, to support high levels of visual comfort for building occupants. Detailed daylight modelling will be undertaken in future project stages.
- Internal air pollutants have been reduced via selection of materials with low or no volatile organic compound (VOC) levels and low formaldehyde concentrations.
- Effective heating and cooling to improve thermal comfort, in accordance with EFSG guidelines. Detailed thermal comfort modelling will be undertaken in future project stages.

5.2.3 Opportunities

In addition to the indoor environmental quality initiatives outlined above, the following initiatives are currently being explored:

- Localised lighting controls or motion and/or daylight sensors.
- Increased provision of outside air exceeding minimum compliance ventilation rates

5.3 Energy

5.3.1 General Principles

Ineffective energy management can lead to unnecessary growth in greenhouse gas emissions and consumption of natural resources. An effective energy plan should aim to:

- Minimise energy consumption through good passive design
- Maximise energy efficiency of systems
- Consider renewable energy technologies.

5.3.2 Best Practice Initiatives

The following initiatives are currently included in the preliminary sustainability strategy, in order to enhance the energy efficiency of the building. It is worth highlighting that many initiatives are currently being explored that go over and above the minimum requirements stated in the SEARs, EFSG, GREP and Section J.

- Exceeding NCC 2019 Section J minimum deemed-to-satisfy (DtS) requirements. The EFSG Section DG02.03 requires the development to achieve a 10% reduction in energy consumption, in comparison to a minimum NCC 2019 DtS compliant building, excluding any contribution from renewable energy (e.g. rooftop solar PV). Final improvement will be demonstrated via energy modelling in detailed design. Potential specific provisions currently include:
  - Exceeding the minimum building envelope R-values of Section J1.3, J1.5 & J1.6 where feasible
  - Improving on the glazing performance requirements of Section J1.5
  - Improving on the maximum illumination power densities of Section J6.2
- Effective shading devices which reduce solar heat gains to conditioned spaces
- Energy-efficient lighting (typically LED) will be provided throughout, and high efficiency heating and cooling
- All electric air conditioning systems and domestic hot water systems.
- Roof mounted solar photovoltaic (PV) system in accordance with EFSG requirements

5.3.3 Opportunities

In addition to the best practice initiatives above, further energy efficiency improvements for the development could be achieved by implementing additional initiatives that are currently being explored, in particular:

- Adoption of minimum targets energy efficiency of appliances (air conditioners, TVs, fridges, computers) to make energy efficiency one of the selection requirements. Major appliances to be within one star of the highest available at the time of purchase
- High performance building sealing for conditioned spaces
- Specification of minimum energy efficiency targets for appliances (refrigerators, freezers clothes dryers, washing machines, dishwashers, pool pumps, domestic-type air conditioning units, televisions) in accordance with the EFSG requirements
- Adaptable building design that is climate responsive
- Lighting controlled by motion and/or daylight sensors to reduce the operation of artificial lighting when it is not required.

5.4 Transport

5.4.1 General Principles

Sustainable transport has a role in encouraging healthier active transport options while also decreasing greenhouse gas emissions from transport.

5.4.2 Best Practice Initiatives

The following initiatives are currently included in the preliminary sustainability strategy to improve sustainable transport options:

- Traffic engineer has been engaged to carry out a transport assessment in line with the SINSW requirements
- To encourage active and public transport, bicycle parking for staff and students as well as change facilities for staff to be provided to the development.

The site's transport plan will be carried out in accordance with the SINSW transport assessment process, which is guided by the following 8 principles:

- Students achieve daily physical activity requirements through active travel to school
- Prioritise multi-modal transport planning and infrastructure provision to school
- Consult with transport stakeholders early and regularly
- Install supporting infrastructure to the school and on-site
- Minimise traffic disruption to the school and community during construction
- Implement and commit to a visible, funded, feasible Travel Plan
- Monitor and evaluate the School Transport Plan process to revise and improve the process to achieve outcomes
- Increase consistency and quality of deliverables

5.5 Water

5.5.1 General Principles

Ineffective management of water use can lead to unnecessary potable water consumption. An effective water management plan should aim to:

- Reduce consumption by focusing on efficiency of major uses (hydraulic fittings and fixtures, landscape irrigation, and HVAC)
- Incorporate appropriate building management systems to reduce leakage
- Reduce consumption by encouraging a change in user behavior.

5.5.2 Best Practice Initiatives

The following initiatives are currently included in the preliminary sustainability strategy to enhance the water efficiency of the proposed development and reduce potable water consumption associated with the above major uses:

- Rainwater harvesting and water reuse system
- Selection of water-efficient sanitary fittings and fixtures in line the Green Star and EFSG requirements, refer to Section 5.5.2.1.
- No water-based heat rejection systems for air conditioning (no cooling towers)

5.5.2.1 FIXTURES & FITTINGS

Water sanitary fittings and fixtures are expected to account for a large portion of water use for the development. By selecting water efficient sanitary fittings and fixtures, potable water demand can be significantly reduced. Refer to the table below for the minimum WELS ratings for all fittings and fixtures installed by the project in accordance with the Green Star and EFSG requirements. It is noted that EFSG

nominates more onerous WELS requirements for showers and clothes washing machines than Green Star. The more onerous requirements will be implemented in the project.

Table 2: WELS rated fittings and fixtures as per the Green Star (Design & As Built v1.3) Potable Water credit

Fittings and Fixtures	Standard Practice Benchmark	Proposed WELS Rating
Taps	4 Star	5 Star
Showers	3 Star	3.5 Star (maximum 6.0 L/s)
WC	3 Star	4 Star
Urinals	3 Star	5 Star
Dishwashers	3.5 Star	5 Star
Clothes Washing Machines	3 Star	4.5 Star

5.5.3 Opportunities

The following initiatives will be considered during the design development stage to further reduce potable water consumption:

- Motion sensor taps
- Develop a water management plan for post-occupancy monitoring and provide a platform to allow the facilities manager to identify leaks and water inefficiencies
- Water wise landscaping principles incorporated, including using xeriscape (drought tolerant species) landscaping, and/or irrigation with non-potable water, sub-soil dripper irrigation and moisture sensors
- Water meters installed to assist with monitoring and detection of leaks or excessive consumption
- Trigger hoses and recycled water connections for any wash-down areas.

5.6 Materials

5.6.1 General Principles

The construction sector is a significant contributor to greenhouse gas emissions and climate change. Building construction should aim to reduce the natural resources consumption and environmental impacts resulting from the manufacture and procurement of materials, and waste impacts from demolition and construction. Materials selections can also impact health and wellbeing by reducing the source of indoor pollutants.

5.6.2 Best Practice Initiatives

To raise the level of sustainability for the project regarding material use, the following initiatives are currently included in the preliminary sustainability strategy:

- Design for Manufacture & Assembly (DfMA) principles implemented in the building design to reduce material wastage as well as manufacturing costs and time.
- Low-VOC and low- or no-formaldehyde products specified where possible to improve the indoor environment quality for users.
- Selection of timber products that are either third-party environmentally certified or sourced from a reused source.
- Minimum of 90% of waste generated from construction and demolition will be reused or recycled, to limit the amount of waste going to landfill. Waste management plans will be developed for demolition, construction and operation of the site.
- Procurement of responsible PVC materials.

5.6.3 Opportunities

The following initiatives will be considered during the design development stage to further reduce consumption of natural resources and the generation of waste:

- Selection of materials that do not require chemical pesticide and termicide treatments where possible.

- Reduction of Portland cement content and aggregates in all concrete used in the project.
- Products and materials procured for the development should come from a local source, contain a low embodied energy content, or be selected for their product transparency and sustainability (e.g. reused or recycled products, or those with third-party environmental certifications).
- Life cycle assessment (LCA) to quantify embodied carbon footprint of the development, and inform design decisions to reduce embodied carbon.
- Reduced materials strategies such as exposed services or prefabricated components to reduce material consumption.
- Select resistant materials to reduce wear and tear requiring replacement
- Selection of materials that are easily cleaned with low-toxicity cleaning products
- Procurement of responsible structural and reinforcing steel

5.7 Land Use & Ecology

5.7.1 General Principles

Building developments can lead to loss of ecology and biodiversity. The proposed development will limit its impact on the ecology and biodiversity by reusing land.

5.7.2 Best Practice Initiatives

To raise the level of sustainability for the project regarding ecology and biodiversity, the following initiatives are currently included in the preliminary sustainability strategy:

- Selection of locally indigenous native planting where feasible.
- Strategies to minimise the urban heat island effect including light-colored roofing and external finishes, as well as maximising the extent of landscaping elements.
- Improvement of the ecological value of the site through large extent of native and endemic landscaping.

5.8 Emissions

5.8.1 General Principles

In any new development there is a risk that the project will generate negative impacts including:

- Light pollution
- Pollutants in stormwater runoff
- Environmental damage from refrigerant leaks
- Harmful microbes in cooling systems.

5.8.2 Best Practice Initiatives

The following initiatives are currently included in the preliminary sustainability strategy, in order to reduce harmful emissions from the site:

- Landscaping and rainwater harvesting to support Water Sensitive Urban Design and limit stormwater pollutants leaving the site
- Appropriate internal and external lighting design to reduce light pollution. External lighting to be designed such that the Upward Light output Ratio (ULOR) <5%.
- All heat-rejection systems to be waterless to eliminate risk of Legionella (no cooling towers)
- Stormwater treatments to reduce pollutants in water leaving the site
- Comprehensive hazardous materials survey to be carried out in accordance with the relevant Environmental and Occupational Health and Safety (OH&S) legislation, and treatment, removal and disposal of any contaminants in accordance with best practice guidelines.

5.8.3 Opportunities

The following initiatives will be considered during future design stages to significantly reduce impacts from pollutants:

- Use of awnings to block light pollution to neighbors and the night sky.
- Water detention or infiltration to native soils for management of stormwater peak flows.
- On-site detention (OSD) tank to reduce peak discharge to the sewer.

5.9 Innovations

The proposed development will focus on exceeding minimum building requirements, incorporating innovative technologies, and exceeding Green Star benchmarks.

5.9.1 Best Practice Initiatives

Specific strategies for Innovation will be explored further in the detailed design phase. However the following initiatives are currently included in the preliminary sustainability strategy:

- Design for Manufacture & Assembly (DfMA) principles implemented in the building design to reduce material wastage as well as manufacturing costs and time.
- The project will implement specific action items from the NSW DoE Reconciliation Action Plan, including:
  - Procurement of all materials and labour will be in accordance with the NSW DoE Aboriginal Procurement Policy and NSW DoE Main Works 21 Preliminaries - Section 4.4 'Aboriginal Participation'
  - A project-specific *Aboriginal Participation Plan* will be developed to monitor and report on the minimum Aboriginal participation requirements.
  - Incorporation of Indigenous design elements.
- The school will implement the DoE *Healthy Canteen Policy* to encourage healthy dietary options in the school canteen and reduce childhood obesity and associated lifestyle diseases. By this means the project will promote positive consequences on community health.
- Incorporation of Indigenous design elements into the design, addressing each of the principles from the Australian Indigenous Design Charter (AIDC). Aboriginal and Torres Strait Islander communities to be engaged throughout. The school is to be designed in such a manner as to acknowledge and recognise the Indigenous culture of the site, and information on the reconciliation and cultural values made available to the public visitors and users of the building.
- Community benefits through community use of the school facilities. Design elements to be incorporated into the site Masterplanning and facilities to facilitate community use .
- Universal design principles implemented to provide safe, equitable and dignified access for persons with disabilities. A site-specific accessibility plan (or similar) to be developed for the project, and recommendations implemented in the building design.
- Disclosure of the financial impacts of sustainability initiatives, to inform the construction industry on the true costs of sustainability, with an aim to provide greater transparency and provide clear information to the broader industry on the value proposition of sustainable infrastructure.

5.9.2 Opportunities

The following initiatives will be considered during future design stages:

- Selection of paints with ultra-low VOC content.
- Implementation of a 'Green Cleaning' policy that prevents the use of contaminants that impact on indoor environment quality, occupant health and the environment.

6 CLIMATE CHANGE RESILIENCE

The projected impacts of climate change on the proposed development have been assessed, based on predicted climate change models. A Climate Adaptation Workshop was held with all project stakeholders to:

- Identify and describe risks posed by climate change to the development and rate the consequences and likelihood of each.
- Identify and evaluate potential adaptation actions and/or design strategies to mitigate those risks which are deemed unacceptable.

To facilitate this process, pre-workshop notes were provided to all stakeholders attending the workshop which consisted of the following parts:

- Climate change projections
- Consequence scale for the risk assessment
- Likelihood scale for the risk assessment.

A climate change risk assessment undertaken as per AS 5334-2013 and Green Star Design & As Built v1.3 requirements. Expected impacts from climate change were identified with reference made to both CSIRO projections for the East Coast (South) sub-cluster and the NSW Government's NSW and ACT Regional Climate Modelling (NARCliM) projections. The results showed the following:

- Extreme temperatures are projected to increase with very high confidence, and substantial increases in temperatures reached on hot days, as well as the frequency of hot days.
- Average temperatures will continue to increase in all seasons (very high confidence).
- Generally, less rainfall is expected in winter (medium confidence), but the intensity of extreme rainfall events is projected to increase (high confidence).
- There is high confidence that climate change will result in a harsher fire-weather climate in the future.
- Time spent in drought projected to increase (low confidence) over the course of the century.

The design's responsivity to the above impacts was then assessed. The climate change risk analysis identified no 'High' or 'Extreme' risks due to climate change impacts after design elements were considered for this project. All risks, including existing controls, were identified as being either 'Low' or 'Medium'.

In accordance with the Green Star requirements, at least two of the risks identified will be addressed by specific design responses – to be detailed in future design stages.

Refer to Appendix 8.3 for the Climate Change Adaptation: Pre-Workshop Notes and draft Climate Change and Adaptation Risk Register.

7 CONCLUSION

This report identifies the sustainability measures being pursued or investigated by the project team, demonstrating how the *Environmental Planning and Assessment Regulation*, GANSW Environmental Design in Schools, and the Educational Facilities Standard Guidelines requirements have been addressed.

The proposed design for the development incorporates sustainability measures that have far reaching benefits from the perspective of energy, water and waste reduction; as well as providing good indoor environment quality, thermal comfort and visual comfort. By this means, the proposed development will have a positive impact on the health and wellbeing of the students and staff occupying the building.

8 APPENDICES

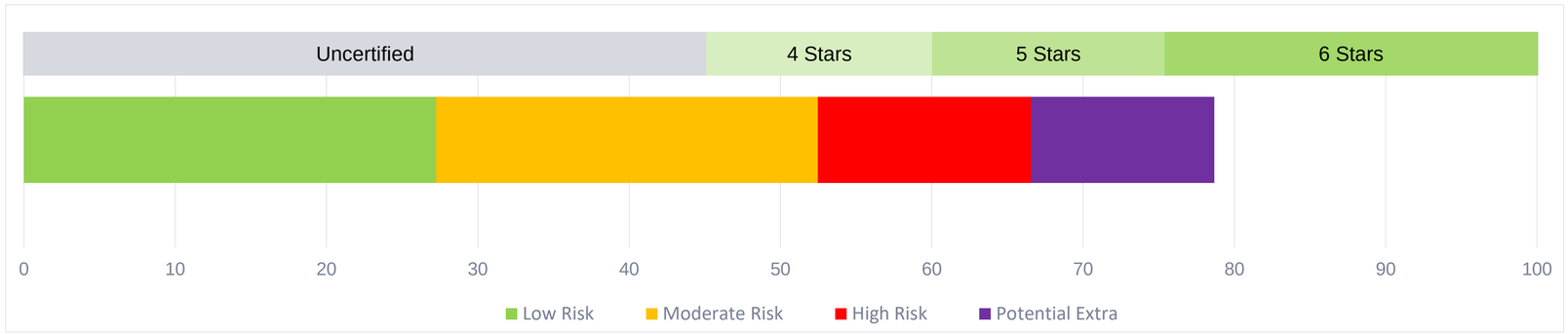
8.1 Green Star Design & As-Built v1.3 Pathway

Refer over.

Design & As Built v1.3 Scorecard

Project:	**New primary school at Gregory Hills**
Targeted Rating:	**5 Star - Australian Excellence**
Date:	**03/05/2022 - Preliminary** **Rev P02**

Core Points Available	Low Risk	Moderate Risk	High Risk	Potential Extra	Total Score Targeted
99	27.2	25.2	14.1	12.1	66.6



NA	CATEGORY / CREDIT	AIM OF THE CREDIT / SELECTION	CODE	CREDIT CRITERIA	POINTS AVAILABLE	Low Risk	Moderate Risk	High Risk	Potential Extra	Responsible Party	Comments
	Management				**14**						
	Green Star Accredited Professional	To recognise the appointment and active involvement of a Green Star Accredited Professional in order to ensure that the rating tool is applied effectively and as intended.	1.0	Accredited Professional	1	1				ESD Consultant	NDY currently engaged as GSAP for Phases 1 & 2. Credit will require engagement of GSAP for all remaining phases (in line with SINSW delivery).
	Commissioning and Tuning	To encourage and recognise commissioning, handover and tuning initiatives that ensure all building services operate to their full potential.	2.0	Environmental Performance Targets	-	Complies				Client / ESD Consultant	Set and document operational environmental performance targets for the project (generally energy and water or waste consumption) in early design phase. Design team to create an Owners Project Requirements (OPR) document that describes basic functions, operations, metering, and maintenance of the Nominated Building Systems, or adapt the services return brief to document. Generally aligned with EFSG requirements.
			2.1	Services and Maintainability Review	1	1				Services / Contractor / SINSW Commissioning Team	Review of the design prior to construction for maintainability, commissionability, safety, and fitness-for-purpose by construction and operation-side stakeholders, with responses by relevant design team members. As per GBCA-approved technical question R-14417, compliance can be achieved via the EFSG, provided that there is a process in place to verify that the project has been delivered as per the EFSG and that any issues identified have been rectified and any actions have been incorporated in the design intent report. EFSG departures to be formally documented and reviewed via the departures register throughout project.
			2.2	Building Commissioning	1					Services / Contractor / SINSW Commissioning Team	Pre-commissioning and commissioning to be undertaken for the project in accordance with Commissioning Specification, Commissioning Plan(s) and Green Star recognised standards (e.g. CIBSE commissioning codes). Air permeability testing will be required, which is not part of standard SINSW delivery.
			2.3	Building Systems Tuning	1					Services / Contractor / SINSW Commissioning Team	Minimum 12 month building tuning from occupancy with quarterly measurement and adjustments including warranty reviews. Building Tuning team to be created to undertake the process, including the Facilities Manager, Owners Representative, Commissioning Manager, Head Contractor and Services design team as required. Main contractor to coordinate with SI NSW Commissioning team. This is not currently included in SINSW D&C contracts as standard and may require a variation to head contractor.
			2.4	Independent Commissioning Agent	1	1				Contractor / SINSW Commissioning Team	As per GBCA-approved technical question R-14422, credit can be achieved via the commissioning in accordance with SINSW Commissioning and Temporary Schools Program. Main contractor to coordinate with SI NSW Commissioning team.
	Adaptation and Resilience	To encourage and recognise projects that are resilient to the impacts of a changing climate and natural disasters.	3.1	Implementation of a Climate Adaptation Plan	2	2				ESD Consultant	A climate change impact assessment has been undertaken by NDY, including workshop with the client and design team to review climate change adaptation and resilience measures to be incorporated into the project. Minimum of two risks identified must mitigated through specific design responses, including mitigation of all high risk items.
	Building Information	To recognise the development and provision of building information that facilitates understanding of a building's systems, operation and maintenance requirements, and environmental targets to enable the optimised performance.	4.1	Building Information	1	1				Contractor / Services / ESD Consultant	Best Practice O&M Manuals to be developed by the Contractor (as defined under Green Star credit 4), and all services to provide input into the Building User Guide. As per GBCA-approved technical question R-15394, the requirements for Building Log Book can be demonstrated via implementation of NSW Government FMWeb Maintenance Platform.
	Commitment to Performance	To recognise practices that encourage building owners, building occupants and facilities management teams to set targets and monitor environmental performance in a collaborative way.	5.1	Environmental Building Performance	1	1				SINSW / ESD Consultant	SINSW to make a written internal commitment (policy, guideline, or environmental management plan) to at least 2 environmental performance targets (GHG emissions, Potable Water consumption, Operational Waste, Indoor Environment Quality). Commitment must include quarterly reporting to relevant stakeholders and must state the targets in units (e.g. kWh/m2, kg/CO2/m2, kL/m2). Energy and water are expected to be easiest to track and report on, although waste could also be considered. Generally aligned with EFSG and GREP requirements, though some additional prescriptive environmental reporting requirements are specified by the GREP. It is understood that SINSW is currently developing a custom approach to this credit with the GBCA. This has not yet been formalised but may become available as the project progresses.
			5.2	End of Life Waste Performance	1	1				SINSW / ESD Consultant	Building Owner to make a written internal commitment (policy, guideline, or environmental management plan) to extend the life of the interior fitout or finishes to at least 10 yrs, barring minor wear and tear or minor repairs. Final confirmation from SINSW Asset Management Unit. It is understood that SINSW is currently developing a custom approach to this credit with the GBCA. This has not yet been formalised but may become available as the project progresses.
	Metering and Monitoring	To recognise the implementation of effective energy and water metering and monitoring systems.	6.0	Metering	-					Services	Metering to be included to monitor all major energy and water uses (>5% energy, >10% water) for the project, and all different functional spaces (different usage profiles) to be separately metered. Meters to be validated as per NABERS Ratings Protocol and be capable of producing alerts for inaccuracies exceeding their meter class rating. Additional meters (beyond EFSG requirements) will likely be required to satisfy credit.
			6.1	Monitoring Systems	1					Services	Monitoring system and strategy, capable of capturing and processing data produced by water meters. Metering equipment must be validated in accordance with the most current 'Validating Non-Utility Meters for NABERS Ratings' protocol. Requirements of this credit are likely to be satisfied (in line with EFSG requirements) however credit points are contingent on credit 6.0.
	Responsible Building Practices	To reward projects that use best practice formal environmental management procedures during construction.	7.0	Environmental Management Plan	-	Complies				Services	Head contractor must develop and implement project specific best practice EMP meeting requirements of the NSW EMS Guidelines.
			7.1	Formalised Environmental Management System	1	1				Contractor	Contractor to hold and maintain a formalised Environmental Management System (EMS) independently certified to AS/NZS ISO 14001, BS 7750, or EMAS. Certification party must be an International Accreditation Forum member. Contractor to provide certification as part of tender submission. Auditing reports, including non-conformities and actions taken must be provided.
			7.2	High Quality Staff Support	1		1			Contractor	At least 3 issues (mental and physical) addressed through programs and policies. Sustainability training to site workers. Note that Needs-Analysis must be carried out by principal contractor
	Operational Waste	Performance Pathway	8A	Performance Pathway - Specialist Plan	1	1				Waste Consultant / Architect	EcCell Environmental have been engaged to develop an Operational Waste Management Plan (OWMP). Requirements and recommendations from this report must be implemented into the design. Generally aligned with EFSG and GREP requirements, though some additional prescriptive requirements are specified by the EFSG .
			8B	Prescriptive Pathway - Facilities	-						
	Total				**14**	**10**	**1**	**0**	**0**		
	Indoor Environment Quality				**17**						
☐	**Indoor Air Quality**	To recognise projects that provide high air quality to occupants.	9.1	Ventilation System Attributes	1		1			Mechanical	Requires co-ordination from mechanical services and contractor regarding position of air intakes, design for ease of maintenance and cleaning and ductwork to be cleaned prior to occupation. Entry of outdoor air pollutants is mitigated (as per ASHRAE Standard 62.1:2013) through minimum separation distances between pollution sources and outdoor air intakes.
☐			9.2	Provision of Outdoor Air	2					Mechanical	Outdoor air provided at a rate of 50% (1pt) greater than AS 1668.2:2012 minimum requirements, or CO2 control is provided to maintain concentrations below 800ppm. Excess provision of outside air is not required under the EFSG and has negative energy efficiency implications.
☐			9.3	Exhaust or Elimination of Pollutants	1			1		Mechanical	Relates to removing the source of pollutants (e.g. kitchen exhaust, printers) or exhausting pollutants directly to the outside. Provision for exhaust in printing/photocopying rooms. Guidance to be provided to the tenant to ensure appropriate installation. Each print room must achieve a minimum flow rate in accordance with AS1668.2-2012. May require SINSW to commit to procuring only compliant printing/photocopying equipment.
☐	**Acoustic Comfort**	To reward projects that provide appropriate and comfortable acoustic conditions for occupants.	10.1	Internal Noise Levels	1		1			Acoustic Consultant	Noise levels are designed to be suitable and relevant to the activity type. Ambient noise levels in primary and secondary spaces to be no more than 5dB(A) above the lower figure in Table 1 of AS/NZS 2107:2016. This applies to all primary and secondary spaces. Generally aligned with EFSG requirements.
☐			10.2	Reverberation	1		1			Acoustic Consultant	The reverberation time in the nominated area are below the maximum stated in the 'Recommended Reverberation Time' provided in Table 1 of AS/NZ 2107:2016. This applies to all primary and secondary spaces. Generally aligned with EFSG requirements.
☐			10.3	Acoustic Separation	1		1			Acoustic Consultant	Project to addresses noise transmission between enclosed spaces in line with Green Star requirements, with requirements differing according to the space type. Glazed operable walls have reduced requirements (30Rw) as per the approved TQ R-14412. This applies to all primary and secondary spaces. Generally aligned with EFSG requirements.
☐	**Lighting Comfort**	To encourage and recognise well-lit spaces that provide a high degree of comfort to users.	11.0	Minimum Lighting Comfort	-	Complies				Electrical / Architect	Primary and secondary spaces to have lighting that is flicker free and accurately address the perception of colour in the space. High frequency ballasts and CRI of at least 80 for all luminaires.
☐			11.1	General Illuminance and Glare Reduction	1	1				Electrical / Architect	Glare from artificial lighting is eliminated and minimum lighting levels provided as per best practice general illuminance guidelines (AS1680.1/2). Fitting all bare light sources with baffles, louvers, translucent diffusers or other means that obscures the direct light source from all viewing angles will be achievable.
☐			11.2	Surface Illuminance	1					Electrical / Architect	
☐			11.3	Localised Lighting Control	1					Electrical / Architect	
☐	**Visual Comfort**	To recognise the delivery of well-lit spaces that provide high levels of visual comfort to building occupants.	12.0	Glare Reduction	-		Complies			Architect / ESD Consultant	Compliance to be demonstrated by glare modelling in Phase 3. Alternatively, blinds with occupancy control and a VLT <10% must provide glare reduction to 95% of the area of viewing facade and skylights in all Primary Spaces.
☐			12.1	Daylight	2		1			Architect	High levels of natural daylight to be achieved in 40% (1 point) or 60% (2 points) of the nominated area. Compliance to be demonstrated by daylight modelling in Phase 3. EFSG requires minimum 40% compliance area demonstrated by SDA modelling. Credit points are contingent on credit 12.0.
☐			12.2	Views	1		1			Architect	60% of the nominated area has clear line of sight to a high quality internal or external view. Credit points are contingent on credit 12.0.
☐	**Indoor Pollutants**	To recognise projects that safeguard occupant health through the reduction in internal air pollutant levels.	13.1	Paints, Adhesives, Sealants and Carpets	1	1				Architect / Contractor	At least 95% of all internally applied paints, adhesives, sealants and carpets must meet stipulated 'Total VOC limits'. EFSG nominates that ALL items must meet the Green Star specified limits (i.e. not just 95%)
☐			13.2	Engineered Wood Products	1	1				Architect / Contractor	At least 95% (by area) of all engineered wood products must meet stipulated formaldehyde emission limits. EFSG nominates that ALL items must meet the Green Star specified limits (i.e. not just 95%)
☐	**Thermal Comfort**	To encourage and recognise projects that achieve high levels of thermal comfort.	14.1	Thermal Comfort	1			1		Services / ESD Consultant / Architect / Façade Consultant	Modelling to demonstrate PMV between -1 and +1. Targeted point to be confirmed through modelling in Phase 3. May not be achievable for non-conditioned or partially conditioned occupied spaces such as gymnasiums or halls. Generally aligned with EFSG requirements.
☐			14.2	Advanced Thermal Comfort	1					Services / Sustainability Consultant / Architect / Façade Consultant	
	Total				**17**	**3**	**6**	**2**	**0**		

Energy								
				22				
Greenhouse Gas Emissions	E. Modelled Performance Pathway	15A.0	Conditional Requirement: Prescriptive Pathway	-				
		15A.1	Building Envelope	-				
		15A.2	Wall-Glazing Construction and Retail Display Glazing	-				
		15A.3	Lighting	-				
		15A.4	Ventilation and Air-conditioning	-				
		15A.5	Domestic Hot Water Systems	-				
		15A.6	Transition Plan	1				
		15A.7	Fuel Switching	1				
		15A.8	On-Site Storage	1				
		15A.9	Vertical Transportation	1				
		15A.10	Off-Site Renewables	5				
		15B.0	Conditional Requirement: NatHERS Pathway	-				
		15B.1	NatHERS Pathway	-				
		15C.0	Conditional Requirement: BASIX Pathway	-				
		15C.1	BASIX Pathway	-				
		15D.0	Conditional Requirement: NABERS Pathway	-				
		15D.1	NABERS Energy Commitment Agreement Pathway	-				
		15E.0	Conditional Requirement: Reference Building Pathway	-	Complies			
		15E.1	Comparison to a Reference Building Pathway	20	4	2	3	3
Peak Electricity Demand Reduction	Performance Pathway	16A	Prescriptive Pathway - On-site Energy Generation	-				
		16B	Performance Pathway - Reference Building	2			2	
Total				**31**	**4**	**2**	**5**	**3**

ESD Consultant	
Architect	
Architect	
Architect / Electrical	
Mechanical	
Hydraulics	
Client	
Client	
Client	
Vertical Transportation	
Client	
ESD Consultant	
ESD Consultant / Services / Architect	
ESD Consultant	
ESD Consultant / Services / Architect	
ESD Consultant	
Client	
ESD Consultant / Services / Architect	Requires a 10% improvement in operational greenhouse gas emissions compared to a Section J compliant building. Aligned with EFSG requirements.
ESD Consultant / Services / Architect	Points awarded based on additional reduction in greenhouse gas emissions below the benchmark building. Energy modelling to be undertaken in Phase 3 to demonstrate points. Proposed strategy to include: - Passive design including careful use of shading and building layout/orientation to minimise peak heat loads in summer and use passive heating in the winter. - Well insulated building fabric and high performance glazing. - Energy-efficient HVAC systems selected for each space type and usage. Note there are additional prescriptive requirements specified by the EFSG - Energy-efficient LED lighting with automated controls. Note there are additional prescriptive requirements specified by the EFSG - Rooftop PV in line with EFSG requirements - Purchasing Power Agreements for GreenPower can provide additional GHG reduction. GREP requires 6% Green Power purchase, already included in 777 and 776 contracts. Credit will further benefit from: - Maximising rooftop solar PV capacity - Eliminate use of gas for heating and cooling (all-electric services). - Improving on EFSG performance requirements
Electrical / Architect / ESD Consultant	
Electrical / Architect / ESD Consultant	Points awarded based on reduction in building peak electricity demand in comparison to a reference building (20% for 1 point, 30% for 2 points). To be demonstrated via energy modelling undertaken in Phase 3.

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

Traffic Consultant	Ten points can be awarded for this credit using the SINSW Schools Transport Assessment process as per GBCA-approved technical question R-14426. Traffic consultant to develop transport assessment in line with the SINSW 'Transport Assessment: Template', and recommendations implemented in the school design. Endorsement will be required from the SINSW Transport Project Director.
ESD Consultant	
Architect	
Architect / Electrical	
Architect	
ESD Consultant	

Water								
				11				
Potable Water	Prescriptive Pathway	18A.1	Potable Water - Performance Pathway	0				
		18B.1	Sanitary Fixture Efficiency	1	1			
		18B.2	Rainwater Reuse	1			1	
		18B.3	Heat Rejection	2	2			
		18B.4	Landscape Irrigation	1				1
		18B.5	Fire System Test Water	0				
Total				**5**	**3**	**0**	**1**	**1**

ESD Consultant / Hydraulics	Performance pathway 18A will be cinsidered in future project stages and will be utilisied if it yields additional points.
Architect / Hydraulics	Low-flow fixtures and fittings throughout (bathroom and kitchen). Generally aligned with EFSG requirements, however EFSG requirements are more onerous for showers and washing machines.
Hydraulics	Requires rainwater harvesting to the size of 10L per square metre of GFA. To be reused for landscape irrigation and/or toilet flushing. EFSG requirements nominate provision of rainwater tank, however minimum size is not specified. Hydraulic consultant to advise in future project stages based on water balance assessment.
Mechanical	No water-based heat rejection (cooling towers or evaporative coolers) used in the mechanical design.
Landscape Consultant / Hydraulics	Credit is achieved where either irrigation is provided via drip irrigation with motion sensor override, or where no potable water is used for irrigation (i.e. 100% of irrigation water is from rainwater reuse). Current design includes majority of native and/or endemic planting which will require minimal irrigation, however final credit compliance to be confirmed by landscaping consultant. Generally aligned with EFSG requirement.
Fire / Hydraulics	Fire system to not expel water during testing. Where a sprinkler system is not provided/required, this credit is deemed Not Applicable

Materials								
				14				
Life Cycle Impacts	Prescriptive Pathway - Life Cycle Impacts	19A.1	Comparative Life Cycle Assessment	0				
		19A.2	Additional Life Cycle Impact Reporting	0				
		19B.1	Concrete	3				2
		19B.2	Steel	1				
		19B.3	Building Reuse	4				
		19B.4	Structural Timber	4				
Responsible Building Materials	To reward projects that include materials that are responsibly sourced or have a sustainable supply chain.	20.1	Structural and Reinforcing Steel	1				1
		20.2	Timber Products	1		1		
		20.3	Permanent Formwork, Pipes, Flooring, Blinds and Cables	1		1		
Sustainable Products	To encourage sustainability and transparency in product specification.	21.1	Product Transparency and Sustainability	3				2
Construction and Demolition Waste	Percentage Benchmark	22A	Fixed Benchmark	-				
		22B	Percentage Benchmark	1	1			
Total				**12**	**1**	**2**	**0**	**5**

LCA Consultant	
LCA Consultant	
Structural / Contractor	Points are awarded where the portland cement content in all concrete in the project is reduced by 30% (1 points) or 40% (2 points) when compared to the reference case. Additional points are awarded where the mix water for all concrete used contains 50% captured or reclaimed water. Concrete must make up at least 1% of Project Contract Value.
Structural / Contractor	
Architect / Contractor	
Structural / Contractor	
Structural / Contractor	95% of all steel is sourced from a responsible steel maker and either 60% of fabricated structural steelwork is supplied by a steel fabricator accredited to ASI, or 60% of all reinforcing bar and mesh is produced using energy-reducing processes in its manufacture.
Architect / Contractor	95% of all timber used in building and construction must either be certified by a forest certification scheme that meets GBCA's criteria, or from a reused source. Generally aligned with EFSG requirements, though some additional prescriptive requirements are specified by the EFSG. Timber must make up at least 0.1% of Project Contract Value.
Architect / Services / Contractor	90% of all permanent formwork, pipes, flooring, blinds and cables either do not contain PVC or meet the GBCAs best practice guidelines for PVC.
Architect / Contractor	1 point = 3% compliant products, 2 points = 6% compliant products, 3 points = 9% compliant products (by cost against total project materials cost). FF&E, Steel, Third Party Certified Timber etc.
Contractor	
Contractor	90% of construction and demolition waste diverted from landfill - achieved by engaging a reliable, suitably qualified waste contractor who will undertake verification summaries. Generally in line with the EFSG requirements.

Land Use & Ecology								
				6				
Ecological Value	To reward projects that improve the ecological value of their site.	23.0	Endangered, Threatened or Vulnerable Species	-		Complies		
		23.1	Ecological Value	3		1		1
Sustainable Sites	To reward projects that choose to develop sites that have limited ecological value, re-use previously developed land and remediate contaminate land.	24.0	Conditional Requirement	-		Complies		
		24.1	Reuse of Land	1				
		24.2	Contamination and Hazardous Materials	1		1		
Heat Island Effect	To encourage and recognise projects that reduce the contribution of the project site to the heat island effect.	25.0	Heat Island Effect Reduction	1	1			
Total				**6**	**1**	**2**	**0**	**1**

Ecologist	The existing site must contain no critically endangered, endangered or vulnerable species, or ecological communities. To be confirmed by Biodiversity Development Assessment Report or similar.
Landscape Architect	Points are awarded where the ecological value of the site is improved when compared to the existing site. Credit will benefit from maximising extent landscaping and native planting.
Ecologist	The existing site must not contain old growth forest; prime agricultural land; wetland of 'High National Importance'; or impact on 'Matters of National Significance'. To be confirmed by Biodiversity Development Assessment Report or similar.
ESD Consultant	
Demolition Contractor	Comprehensive hazardous materials survey to be carried out in accordance with the relevant Environmental and Occupational Health and Safety (OH&S) legislation. If the survey identifies asbestos, lead or PCBs, all materials are been stabilised, or removed and disposed of in accordance with best practice guidelines. Generally in line with standard Government contracts and/or SSDA conditions.
Landscape Architect / Contractor	Point is awarded where 75% of the site comprises elements that reduce the impact of the heat island effect. Landscaping to be maximised and roofing materials to be kept light in colour. In line with EFSG requirements.

Emissions								
				5				
Stormwater	To reward projects that minimise peak stormwater flows and reduce pollutants entering public sewer infrastructure.	26.1	Stormwater Peak Discharge	1		1		
		26.2	Stormwater Pollution Targets	1			1	
Light Pollution	To reward projects that minimise light pollution.	27.0	Light Pollution to Neighbouring Bodies	-	Complies			
		27.1	Light Pollution to Night Sky	1	1			
Microbial Control	To recognise projects that implement systems to minimise the impacts associated with harmful microbes in building systems.	28.0	Legionella Impacts from Cooling Systems	1	1			
Refrigerant Impacts	To encourage operational practices that minimise the environmental impacts of refrigeration equipment.	29.0	Refrigerants Impacts	1				
Total				**5**	**2**	**1**	**1**	**0**

Civil	The post-development peak event stormwater discharge from the site does not exceed the pre-development peak event stormwater discharge, using the Average Recurrence Interval (ARI), in accordance with the Green Star requirements. The stormwater peak discharge assessment shall use the 5 year ARI.
Civil	All stormwater discharged from the site meets the Green Star specified pollution reduction targets, when compared to untreated runoff. Proposed design satisfied requirements for major pollutant sources, however demonstrating reductions for petroleum hydrocarbons and free oils is to be confirmed by civil engineer.
Architect / Electrical	Outdoor lighting to comply with AS4282:1997 control of the obtrusive effects of outdoor lighting.
Client / Electrical	Control of external light sources - no external luminaire shall have an ULOR that exceeds 5%
Mechanical	No water-based heat rejection proposed.
Mechanical	Unlikely to be feasible for school project.

Innovation				10						
Innovative Technology or Process	The project meets the aims of an existing credit using a technology or process that is considered innovative in Australia or the world.	30A	Innovative Technology or Process - On-site Renewable Energy				1		ESD Consultant	One point available if onsite solar PV contributes at least 5% to the overall annual energy consumption (10% for two points). To be demonstrated via energy modelling in Phase 3.
Market Transformation	The project has undertaken a sustainability initiative that substantially contributes to the broader market transformation towards sustainable development in Australia or in the world.	30B	Market Transformation - Design for Manufacture & Assembly			1			Architect	As per GBCA approved technical question R-14427, an innovation point can be awarded for incorporating Design for Manufacture & Assembly principles in the project. At least 3 sustainability advice items from the SINSW DfMA Guidelines have been integrated into the design of component-based structures
Improving on Green Star Benchmarks	The project has achieved full points in a Green Star credit and demonstrates a substantial improvement on the benchmark required to achieve full points.	30C	Improving on Green Star Benchmarks - Stormwater				1		Civil	All stormwater discharged from the site meets the Green Star specified pollution reduction targets, when compared to untreated runoff. Proposed design satisfied requirements for major pollutant sources, however demonstrating reductions for petroleum hydrocarbons and free oils is to be confirmed by civil engineer.
			Improving on Green Star Benchmarks - Sustainable Products							
			Improving on Green Star Benchmarks - Ultra Low VOCs					1	Architect	Over 50% of paints (by volume) have a maximum TVOC content of 5g/L. May be challenging for some colours/types of paint.
Innovation Challenge	Where the project addresses an sustainability issue not included within any of the Credits in the existing Green Star rating tools.	30D	Innovation Challenge - Financial Transparency	10	1				Client / Contractor / Architect	Requires confidential reporting to the GBCA on costs of implementing Green Star. Required consent from SINSW to provide financial information to GBCA.
			Innovation Challenge - Reconciliation Action Plan (RAP)		1				Client/Architect	Requires development and implementation of a Reconciliation Action Plan (RAP). As per the GBCA approved FAQ F-00101, compliance with this credit can be achieved by using an organisation RAP. The project must summarise the initiatives included in the specific project to support the RAP outcomes. DoE RAP has been developed. It is recommended DoE RAP is implemented via minimum participation rates and procurement from Aboriginal and Torres Strait Island peoples in accordance with: - DoE's Aboriginal Procurement Policy - Standard main works contract MW21 Preliminaries section 4.4
			Innovation Challenge - Incorporation of Indigenous Design				1		Architect	The project shall incorporate indigenous design elements in to the design, addressing each of the principles from the Australian Indigenous Design Charter (AIDC): - Indigenous Led - Community Specific - Impact of Design - Shared Knowledge Aboriginal and Torres Strait Islander communities shall be engaged throughout. The precinct must been designed in such a manner as to acknowledge and recognise the Indigenous culture of the site. Information on the reconciliation and cultural values of the project has been made available to the public visitors and users of the building. The intention is to meet this criteria, however will require increased participation from Indigenous consultant groups and ongoing management.
			Innovation Challenge - Integrating Healthy Environments		1				Client	This credit aims to support high-performance, cost-effective and health-promoting project outcomes through an early analysis of the interrelationships among systems.. As per GBCA approved technical question R-14476, credit can be claimed by providing the Healthy Canteen Policy research report in lieu of a community analysis report, and providing evidence that this policy has been/will be implemented on the project. It is understood that Healthy Canteen Policy applies to all NSW schools, however formal letter of commitment will be required from SINSW and/or school operations team.
			Innovation Challenge - Community Benefit				1		Client	This credit aims to encourage investment by projects in infrastructure for use by the broader community, such as the incorporation of spaces that are publicly accessible. As per GBCA approved technical question R-14478, credit can be claimed using the Schools Infrastructure policy 'Community Use of School Facilities' and the 'Share Our Spaces' program guide in lieu of a Needs Analysis Report. Evidence must be provided to demonstrate that these policies have been implemented in the design. The intention is to meet this criteria, however discussions between SINSW and Council are in the early phases and Joint Use Agreements are not guaranteed at this stage.
			Innovation Challenge - Universal Design				1		Architect / Accessibility Consultant	This credit aims to encourage projects to provide safe, equitable and dignified access for persons with disabilities. In accordance with the GBCA approved technical question R-14538, this credit can be claimed using the Education Facilities Sustainable Guidelines (EFSG) in lieu of a needs analysis report. An accessibility plan (or similar) must be developed for the project, and evidence must be provided to demonstrate how these policies have been implemented in the design.
Global Sustainability	Project teams may adopt an approved credit from a Global Green Building Rating tool that addresses a sustainability issue that is currently outside the scope of this Green Star rating tools.	30E	Global Sustainability					1	Client	Implementation of a 'Green Cleaning' policy that prevents the use of contaminants that impact on indoor environment quality, occupant health and the environment. Policy must cover all cleaning and monitoring procedures, and associated materials and tasks undertaken within the building owner's control. SINSW and/or school operations to confirm in later project phases.
Total				**10**	**3**	**1**	**5**	**2**		

8.2 SINSW ESD Schedule

Refer over.

PROJECT:	New primary school at Gregory Hills
REVISION	P01 - Concept Design
AUTHOR	Justin Peberdy

Sustainability Strategy Priority	Sustainability initiatives / requirements Where application, this is an extract only from the relevant EFSG. For full requirements refer to https://efsg.det.nsw.edu.au/	Project stage	Basis for Initiative	Crossover with Green Star	Recommended evidence to demonstrate compliance	Has this been implemented in the project? Y or N or NA	Contractor's ESD consultant comments	Actual evidence This evidence needs to show that the requirement from column C has been met	Responsibility: (identify party responsible to provide evidence)
Act on climate change	**Improvement over NCC** All new facilities must be designed and built so that energy consumption is predicted to be at least 10% lower than if build to minimum compliance with National Construction Code requirements. Each building's system and façade must comply with the corresponding Section J requirements in the National Construction Code. That is, the building cannot show that their façade, or any system, performs worse than the reference building. The energy consumption reduction must be achieved without including renewable energy generation in the calculation.	Ph 2-5: Architectural Design	DG02.03 GREP	DAB c15E.0 GHG Emissions Reduction - Conditional Requirement	**1.** Energy modelling report / Predictive energy modelling and thermal comfort assessment. Report needs to show at least 10% improvement of building over minimum NCC requirements; and **2**. As-built evidence that model is an accurate representation of the building, e.g. drawings; and **3**. Specifications / calculations supporting modelling inputs, e.g. window energy rating scheme certificates, calculated R-values of walls, roofs, etc. 4. As an alternative to 2 and 3 above, a Statement by energy modeller confirming that the model accurately represents the building.	Y	This will be demonstrated via modelling commencing in Phase 3		ESD
Act on climate change	**Passive design** The need for active cooling and heating shall be minimised by employing passive / sustainable design principles listed in DG 55, DG 06.02 and DG 27.12 as well as the GA NSW Environmental Design in Schools Guidelines. This includes: - Window size and shading to prioritise passive cooling in summer and heating in winter - Orientation - Thermal mass - building fabric colour and performance - shading	Ph 2-5: Architectural Design	DG55 DG06.02 DG27.12 GA NSW Environmental Design in Schools	DAB c15 GHG Emissions Reduction	**1.** Thermal modelling report **2.** As built evidence demonstrating measures implemented to reduce need for active cooling / heating **3.** Passive design report by Architect listing all passive design initiatives implemented	Y	This will be demonstrated via modelling commencing in Phase 3		ESD
Act on climate change	**Energy efficient lighting design and modelling** - LED lighting must be installed - The design of the lighting systems and the selection of fittings is to be undertaken based on a Whole of Life approach, such as diodes and control gear with a long life - Section J part 6 maximum illumination power density provisions must be adhered to, along with all other elements of part 6 - System must support sustainable design principles including reducing energy consumption, such as timed or sensor feedback functionality - Lighting designs should be carried out utilising industry standard lighting design software such as AGI32, Dialux or Relux.	Ph 2-5: Services Design	DG2.3.1 DG63.01 DG63.04 DC63.05 DG63.03.02	DAB c15 GHG Emissions Reduction	**1.** Lighting drawings **2.** Lighting specifications / schedules **3**. Lighting modelling report showing compliant power densities	Y	Lighting calculations will be completed by an experienced Lighting designer. Design will be in compliance with Section J6. All fittings will be LED		Electrical Contractor
Act on climate change	**Lighting control and switching** - The use of lighting controls will assist in substantially improving energy efficiency on sites, and should be considered for all new lighting systems, in new build or site refurbishments. - Lighting control should be simple to operate and adhere to all requirements of DG 63.06 - Constant Light Output and Daylight Harvesting systems are recommended given their ability to reduce lighting energy whilst maintaining comfortably lit spaces. Consideration should be given to these strategies as stipulated in DG 63.06 - Including daylight sensors in rooms to reduce light output or turn off light when sufficient daylight is provided within the space - When the space is large and perimeter lighting is adjacent to windows, perimeter lighting is on a separate zone to make maximum use of daylight - Local switching should be provided where it is identified that the users can benefit from manual operation of the lighting and other lighting automation technology is considered cost prohibitive. The switching should be clearly marked and robust. Provisions for energy efficient switching in Schools are outlined within DG63 and DG65.	Ph 2-5: Services Design	DG63.06 DG63.07 DG65.03.01	DAB c15 GHG Emissions Reduction DAB c4 Building Information	**1.** Electrical & lighting drawings showing switching groups and automatic controls **2.** Lighting modelling report showing compliant power densities **3.** Lighting operations and maintenance manual	Y	A smart Lighting control system is to be installed. Daylight switching can be used to reduce electrical load. Local switching will be provided on A room basis.		Electrical Contractor
Act on climate change	**Energy efficient appliances & equipment** Electrical equipment must be at least 0.5 stars above the market average star rating or comply with high efficiency standards specified in the GREP HVAC system must have timed or sensor feedback functionality for energy conservation Systems shall be designed to minimise energy consumption. System design / equipment selection is to be based on whole of life cost analysis. Specific requirement are outlined in the EFSG.	Ph 2-5: Services Design	DG2.3.3 DG55	DAB c15 GHG Emissions Reduction	**1.** Schedule of appliances and equipment with their star ratings or performance standards, signed by head contractor or architect. All appliances and equipment required in the GREP must be listed, incl air conditioning equipment, electric motors, transformers, etc. **2.** As built mechanical drawings / statement from head contractor; **3.** Whole of life cost analysis demonstrating systems were selected based on WOL performance.	Y	To be included in design specifications		Main Contractor
Act on climate change	**Heat loss/gain** The design must take steps to control heat loss from the building during cooler winter months and heat gain during the warmer months. Refer to HVAC Design considerations in DG04.01	Ph 2-5: Services Design	DG04.01	DAB c15 GHG Emissions Reduction	**1**. Thermal modelling report **2**. As built evidence demonstrating that model is an accurate representation of the building **3.** Specifications/ calculations supporting modelling inputs	Y	This will be demonstrated via modelling commencing in Phase 3		ESD
Act on climate change	**Indoor environment controls** - Both the thermal comfort and indoor air quality shall be controlled automatically within specified parameters. - Controls shall be simple and intuitive to use. - A "traffic light" light system (described in DG 55.01 Thermal Comfort and Indoor Air Quality Policy) should be used to inform users of the suitability of outdoor conditions to utilise natural ventilation.	Ph 2-5: Services Design	DG55 DG 55.01 Thermal Comfort and Indoor Air Quality Policy	DAB c15 GHG Emissions Reduction	**1.** As built evidence demonstrating controls have been installed as required. **2**. Commissioning report / statement by head contractor confirming controls have been set as required	Y	Incorporated as part of BMS controls strategy. Systems shall be sized and selected accordingly.		Mechanical Contractor
Act on climate change	**Renewable energy** A grid connected solar PV system must be installed in line with DG66 requirements Where feasible, PV systems shall be installed to offset as much of the electricity consumed by the school as is practicable	Ph 2-5: Services Design	DG2.3.4 DG55	DAB c15 GHG Emissions Reduction; DAB c16 Peak Electricity Demand Reduction	**1.** As installed drawings of PV system **2.** Energy modelling report showing renewable energy generation	Y	A 70kW PV system will be installed in line with the EFSG's		Electrical Contractor
Act on climate change	**Battery Energy Storage System** A battery energy storage system shall only be designed in consultation with SINSW Sustainability sustainability.enquiries@det.nsw.edu.au	Ph 2-5: Services Design	DG66.8.3	DAB c15 GHG Emissions Reduction; DAB c16 Peak Electricity Demand Reduction	As installed drawings of battery storage system	N			
Act on climate change	**Heaters** Electric heating must be preferred over gas heating. Where gas heating is considered, it must be approved by SINSW Sustainability Heating equipment must be designed from a whole-of life perspective and: - Support sustainable design principles including reducing energy consumption and carbon emissions - Be accessible and serviceable - easy to maintain with minimal impact on school use when maintenance is being performed	Ph 2-5: Services Design	DG56	DAB c15 GHG Emissions Reduction	1. If reverse cycle air conditioning is installed, confirmation that gas heaters are not installed, OR **2.** Evidence that the gas heaters installed are energy efficient	Y	Reverse cycle AC units only, no gas heating is proposed.		Mechanical Contractor
Act on climate change	**Water heaters** - Hot water and tempered water generation for schools must be carefully considered to ensure that a Whole of Life assessment is undertaken to minimise life cycle costs and carbon emissions - Environmentally friendly options such as solar heating (if vandal resistant) and heat pumps are preferred energy sources to minimise energy consumption.	Ph 2-5: Services Design	DG53.09	DAB c15 GHG Emissions Reduction	1. WOL cost assessment for hot water systems 2. Hydraulic drawings/schematics showing installed DHW systems	Y			Hydraulic Contractor
Build resilience	**Site investigations for resilience** The following detailed reports/ surveys/ information should be considered in developing the business case: - Slope, drainage and erosion issues including flood risks (if any) - Geotechnical and soil conditions - Airborne pollutants - Bushfire risks - Appraisal of available services infrastructure - Climate change risk assessment must be undertaken considering at least two different climate change scenarios An environmental risk report will be required for developments proposed within sensitive natural environments or sites subject to natural risks (i.e. flood prone sites, bush fire areas).	Ph 1: Site Selection and Masterplan	DG03.02	DAB c3 Adaptation and Resilience	**1.** Detailed reports or surveys developed **2.** Environmental risk report **3.** Evidence demonstrating recommendations have been implemented and risks addressed through design responses.	Y	Site survey has been completed. Slope drainage and erosion issues will be coordinated with Civil, landscape and discussed with Council to ensure all issues meet their LEPs/DCP and other criteria. DPIE will also review and respond as part of the SSDA. Geotechnical and soil conditions will be inspected as part of the projects due diligence. BlackAsh Consultants have been engaged to prepare a Bushfire report and any design issues will be captured/mitigated as part of the design solution. Existing service infrastructure will be assessed by the design team. Climate change risk assessment and planning has been undertaken by NDY.		Project Manger

Build resilience	**Bushfire protection** Development applications on bush fire prone land must be accompanied by a Bush Fire Assessment Report demonstrating compliance with the aim and objectives of Planning for Bush Fire Protection and the specific objectives and performance criteria for the land use proposed. Local Authorities and the Rural Fire Service can provide advice on the design of buildings in bush fire prone areas. The Building Code of Australia and AS3959 "Construction of buildings in bushfire-prone areas" set out the requirements for buildings which are within close proximity to a defined bush fire zone. Mandatory landscape management strategies: - Keep the amount of fuel (leaves, twigs, logs, dead grass) in the vicinity of buildings to a minimum. - Ensure trees are located at away from buildings to avoid branches overhanging and leaves collecting on roofs. - Do not plant shrubs against buildings. - The crowns of trees planted on the hazard side of the development should not be contiguous. - Plant fire resistant trees and shrubs on the hazard side of the development to reduce the potential impact of wind, fire intensity, radiant heat, and rate of spread as well as intercepting burning embers. - Avoid combustible fencing materials. - Provide irrigation and garden sprinklers to water areas near the buildings (subject to water authority approval).	Ph 1: Site Selection and Masterplan	DG13.01	DAB c3 Adaptation and Resilience	**1.** Bush fire assessment report **2.** Statement by Architect / fire consultant outlining building strategies implemented in line with BCA and AS3959. **3.** Bush fire management plan outlining management strategies implemented **4.** Landscape plans detailing bush fire management measures implemented	Y	BlackAsh consultants have been engaged to provide a bushfire assessment report. This will be coordinated with Landscape architect, architect and other consultants to meet compliance as per the BCA and AS 3959		Project Manger
Build resilience	**Climate change adaptation** Sites and school communities must be able to withstand natural and urban hazards and adaptively respond to climate change over time, especially for projects involving vulnerable communities e.g. climate generating exacerbated flood, storm surge, inundation, heatwaves, bush fires, extreme storm and other weather events. School facilities must be able to withstand natural hazards and adapt to shocks and stresses to avoid social and economic costs of interrupted operation and repairing or replacing damaged assets. To achieve this, increasing resilience to natural hazards must be considered in the business case development so that associated costs are budgeted. An initial assessment of natural hazards and project vulnerability must be carried out, in consultation with resilience experts, to inform the business case and identify hazards where further analysis is required. The assessment must report on at least two different timescales (2050 and 2070) and consider high emissions scenarios consistent with 2C and 4C for each timescale. The Intergovernmental Panel on Climate Change (IPCC) endorsed emissions scenarios should be used to dictate the assessed scenarios Where significant risks are identified in the initial assessment, a comprehensive climate change risk assessment must be undertaken. Any high or extreme risks identified must be addressed through design measures.	Ph 1: Site Selection and Masterplan	DG02.08	DAB c3 Adaptation and Resilience	**1.** Climate risk assessment, and **2.** Climate adaptation plan **3.** Emergency management plan	Y	Climate change risk assessment and planning has been undertaken by NDY in accordance with Green Star D&AB Credit 3.		ESD
Build resilience	**Weather protection** Circulation areas provided between administrative, staff and all student spaces (except Agriculture), should be protected from sun, rain and unfavourable winds.	Ph 2-5: Architectural Design	DG08.05	Not covered in Green Star	As built drawings showing circulation areas are protected as required	TBC	Awaiting feedback from architect		
Build resilience	**Urban Heat Island Mitigation - Roof Colour** The roof colour will also have an impact on the thermal performance of the roof, therefore the product's Solar Reflectance Index (SRI) should be considered to mitigate the heat island effect. The product selected must meet the following three-year Solar Reflectance Index (SRI) requirements: For roof pitch < 15, minimum SRI of 64 For roof pitch > 15, minimum SRI of 34 Where a three-year SRI is not available, the following requirements must be met: For roof pitch < 15, minimum SRI of 82 For roof pitch > 15, minimum SRI of 39'	Ph 3-4: Product and Material Selection	DG20 Fabric	DAB c25 Heat Island Effect	**1.** Site Plan highlighting all relevant areas as referenced within the area schedule; **2.** Area Schedule listing the areas of each of the relevant site elements and where relevant, the SRI values and referencing plan drawings for the site; and **3.** Supplier Documentation material data sheet for compliant roofing and hardscape materials.	TBC	Awaiting feedback from architect for final compliance. Compliance is assumed and relevant credit has been included in current Green Star pathway.		
Consume responsibly	**Building User's Guide** Produce a Building User's Guide to enable the client to understand the building systems and operate systems to maximise efficiency. This must: - Clearly and concisely describe the operation of building and its services - Detail a reasonable maintenance program - Advise the user of the most suitable replacements for consumables	Ph 7-9: Construction, Commissioning Post Occupancy and Operation		DAS c4 Building Information	**1.** Building user's guide	Y	To be included in the Sustainability Specification		Main Contractor
Consume responsibly	**Stormwater management** Must aim to minimise the transportation of toxicants to waterways and other offsite environments, and maintain the existing hydrological regimes. Due diligence for flooding must be done early to inform building and landscaping design	Ph 1: Site Selection and Masterplan	DG2.4.3	DAB c26 Stormwater	**1.** Stormwater modelling report showing stormwater pollution and flows. **2**. Civil / Hydraulic drawings showing management measures. **3.** Water sensitive urban design report (if WSUD was use4)	Y	1. Stormwater modelling will be undertaken for design of the site. This will include flows and WSUD pollutants. 2. The Civil plans will show management measures and include the hydraulic measures as an overlay for context. 3. WSUD will be modelled, incorporated in the design and reported.		Civil Consultant
Consume responsibly	**Drinking water catchment protection** For developments within drinking water catchment areas, a water cycle management study is to be included with the Development Application for Education Facility developments involving: - Agriculture facilities - Biosolids and effluent re-use schemes - Sewerage systems or works (including package sewerage treatment plants) - Stormwater or works involving the disposal of untreated runoff	Ph 1: Site Selection and Masterplan	DG51.07	GSC c24 Integrated Water Cycle	**1.** Water cycle management study **2.** Evidence that recommendations in the study have been followed / implemented	TBC			
Consume responsibly	**Hazardous materials** Where a new school is to be developed a Hazardous materials study is to be conducted, including: - Asbestos Containing Materials (ACM) - Synthetic Mineral Fibres (SMF) - Polychlorinated Biphenyl's (PCB) - Lead Paint - Ozone Depleting Substances Any existing structures and all parts of the site should be examined in order to determine the presence of hazardous materials before commencement of any renovation or demolition. Inspection should be conducted in accordance with DG48. Where hazardous materials are found a Hazardous Materials Management Plan should be prepared	Ph 1: Site Selection and Masterplan	DG48.01	DAB 24.2 Contamination and Hazardous Materials	**1.** Hazardous materials study / site inspection report / survey **2.** Management plans for hazardous materials identified **3.** Remediation strategies implemented **4.** Environmental auditor certificates / clearance certificates	TBC			
Consume responsibly	**Operational waste** A waste storage area must be included in all new school sites. The provision of space must include source separation including bin stations and appropriate signage of waste and receptacles for multiple waste streams, including: - Organics - Comingled containers - Paper & cardboard - Container deposit scheme - Soft plastic - General waste Designers must refer to AS 4123.7 Mobile waste containers - Colours, markings, and designation requirements for further guidance on bin colour, waste stream and waste type. Safe methods for vehicle access and the transfer of waste must also be considered. For new and refurbished schools, an operational waste management plan (OWMP) must be developed to establish operational waste targets, identify opportunities for reuse and recycling in the operation of the facilities and make adequate provision for the facilities to accommodate for the OWMP. The OWMP must address all requirements from DG 2.7.2	Ph 2: Concept Design - Space planning	DG02.7.1	DAB c8 Operational Waste	Operational waste management plan Operational waste reports showing diversion rates	Y	EcCell consultants have been engaged to develop OWMP.		ESD
Consume responsibly	**Building flexibility** Position structural members considering the future flexibility of the structure. Avoid ad hoc placing of columns internally, giving preference to uniformity in layout. Design all internal walls as non-load bearing to enable future flexibility.	Ph 2: Concept Design - Space planning	DG21.1.16	Not covered in Green Star	As built drawings or statement by relevant professional	Y	Structure members will be positioned in a reasonably simple grid orientation. MMoC Grid system will be employed.		Main Contractor
Consume responsibly	**Hydraulic services** Hydraulic services should: - Support sustainable design principles including reducing water consumption and waste production. - Appropriately treat any trade waste to ensure minimal environmental impact - Be accessible and serviceable - easy to maintain with minimal impact on school use when maintenance is being performed - Use products with a long life span – many hydraulic services are concealed so durability is essential	Ph 2-5: Services Design	DG51.01	DAB c18 Potable Water	**1.** Hydraulic report showing sustainability initiatives implemented to reduce potable water consumption **2.** As built drawings showing trade waste arrestors	Y	Concept Design report describes water saving initiatives.		Hydraulic Contractor
Consume responsibly	**Water sub-metering** In addition to the main water meter for the site provide sub meters for the following: - Mixed irrigation systems - Laboratory buildings - Amenities blocks - Canteens - Any other major water use on the site	Ph 2-5: Services Design	DG53.04	DAB c6.0 Metering	**1.** As built hydraulic drawings	TBC	Awaiting feedback from hydraulic consultant		Hydraulic Contractor

Consume responsibly	**Rainwater collection** Include roof water harvesting and tank storage in new schools and where practical in existing schools to reduce the demand on drinking water supplies. Tank water can connect to drip irrigation systems for adjacent landscape/gardens with the major preference being for gravity fed supply to minimise ongoing maintenance. The rainwater tanks must be connected to toilets for toilet flushing. If this is not feasible, approval must be granted by SINSW.	Ph 2-5: Services Design	DG53.14 DG2.4.2 DG53.01	DAB c18B.2 Rainwater Reuse	**1.** As built hydraulic drawings showing tank connection to end uses and capacity	Y			Hydraulic Contractor
Consume responsibly	**Fire system water reuse** Where schools are required to install a sprinkler system for fire safety, it is recommended to install a closed loop system must be installed to capture and reuse fire systems testing and maintenance water, or by using an alternative non-potable water source.	Ph 2-5: Services Design	DG2.4.2	DAB c18B.5 Fire System Test Water	Fire engineering report	N/A	No sprinkler systems required.		
Consume responsibly	**Ground water** Where ground water is available for use for irrigation purposes in drought affected locations, enquiries must be undertaken with the Department of Planning, Industry and Environment to determine the suitability of a ground water system.	Ph 2-5: Services Design	DG53.03	DAB c18 Potable Water	1. Relevant due diligence report / investigation	TBC	Awaiting feedback from hydraulic consultant		
Consume responsibly	**Trade waste** Arrestors for acid, grease, plaster and clay of adequate capacity must be installed to treat wastewater from science laboratories, kitchens, art rooms and canteens as required in DG52.	Ph 2-5: Services Design	DG52	Not covered in Green Star	**1.** As built drawings showing trade waste arrestors or **2.** Letter by Hydraulic Engineer confirming arrestor have been installed as required	TBC	Awaiting feedback from hydraulic consultant		Hydraulic Contractor
Consume responsibly	**Water fixture efficiency** All products must be rated to AS 6400 to the following minimum WELS ratings: - Tapware to 5 star flow rating requirements - Showers to have 3 star flow rating requirements - Water Closet Pans to 4 star flow rating requirements - Urinals to 5 star flow rating requirements - Flow restrictors can be used to minimise water usage and wastage for staff amenities - Taps with timed flow can be used to minimise water usage and wastage in student amenities. - New and replacement urinals must use manual in lieu of automatic flushing mechanisms. A microwave-activated urinal flushing system may be used as an alternative. In any case, all new water-using appliances must be at least 0.5 stars above the average WELS star rating by product type, except toilets and urinals, which must be purchased at the average WELS star rating. Where WELS rating is not available, use the alternative WaterMark rating scheme.	Ph 3-4: Product and Material Selection	DG53.02 DG2.4.1	DAB c18B.1 Potable Water - Sanitary Fixture Efficiency	1. Schedules of materials, fixtures, fittings and equipment with WELS/WaterMark ratings, demonstrating compliance and identifying those with flow restrictors and timed flow.	Y	This will be communicated to the design team and included in design specifications		Main Contractor
Consume responsibly	**Life cycle assessment (environmental)** Environmental impacts of products and materials has been assessed and inform material selection	Ph 3-4: Product and Material Selection	DG01.03	DAB c19A - Life cycle assessment	Life cycle assessment report	Y			
Consume responsibly	**Whole of life costing (WOL)** Total cost of ownership (TCO) assessment / Analysis of direct and indirect costs and benefits / Life cycle costing analysis When calculating the whole of life cost for the different materials / building elements or systems, the following must be considered: - the total initial capital cost of the system/s – including design, project management, builder and building services works in connections etc. - resources (energy and where applicable water) consumption. - Maintenance. - the replacement of component parts. - disposal costs - ecological sustainable options - durability - vandalism - safety The whole of life cost shall be calculated over the estimated life of the asset/s.	Ph 3-4: Product and Material Selection	DG01 All design guides for selection of materials and building systems	GSC c20 - Return on Investment	Life cycle costing report for relevant system	N	Not part of current NDY scope		
Consume responsibly	**Sustainable materials** Construction materials must be selected based on the following: - Adequately and economically perform their intended functions, and also have lower adverse environmental impacts throughout their life cycle (refer to DG 3) - Contain reduced or no hazardous substances (e.g. low VOC) to ensure effective indoor environmental quality. Reduce the demand for rare or non-renewable resources. - Have low embodied energy and water. - Are made from or contain recycled materials or can be reused or recycled at the end of their useful life.	Ph 3-4: Product and Material Selection	DG02.05	DAB c21 Sustainable Products	**1.** Environmental Product Declarations of products / materials used; Product certificates (like GECA, FSC, et3) **2.** Suppliers' declarations confirming recycled contents in products **3.** Bill of quantities	Y	All specific requirements of the EFSGs will be included in design specifications.		Main Contractor
Consume responsibly	**Sustainable timber** - No rainforest timbers, or timbers from high conservation forests, are to be used unless plantation grown. Use only recycled timber, engineered and glued timber composite products, or timber from plantations or from sustainably managed regrowth forests that is FSC, AFS or PEFC certified - All timber used is to be termite (white ant) resistant or treated to be termite resistant to the appropriate hazard level.	Ph 3-4: Product and Material Selection	DG2.5.1 DG21.05.01	DAB c20.2 Responsible Building Materials - Timber	**1.** Evidence of chain of custody **2.** Bill of quantities	Y	To be included in design specifications		Main Contractor
Consume responsibly	**Built for disassembly** Consider the use of building materials which are able to be disassembled for re-use, in conjunction with considerations for the addition and removal of accommodation over time.	Ph 3-4: Product and Material Selection	DG02.07			Y	Materials will be considered that can assembled and dissembled, such as Steel, timber, precast concrete. Elements to be able to be broken down into transportable elements. Consider connections with priority to bolted connections (over welded).		Main Contractor
Consume responsibly	**Concrete** - Use materials complying with AS based on the Whole of Life approach to materials selection. - Do not use breccia or dolerite in concrete mixes. - Fly ash is a manufacturing bi-product that can be used as a cement replacement but should limited to a maximum of 20% by weight of cement content.	Ph 3-4: Product and Material Selection	DG21.02	DAB c19B.1	**1.** Structural specifications and drawings **2**. Structural Engineer's report showing % cement replacement	TBC	Awaiting feedback from structural consultant		Main Contractor
Consume responsibly	**Construction waste** Targets must be established to increase diversion of waste sent to landfill, with a minimum diversion rate target of 90%. Consider opportunities for re-use and recycling of materials in the construction phase	Ph 7-9: Construction, Commissioning Post Occupancy and Operation	DG02.07	DAB c22 Construction and Demolition Waste	Construction waste reports showing percentage (minimum 90%) of waste re-used and recycled (diverted from landfill)	Y	To be included in design specifications		Main Contractor
Consume responsibly	**Maintainability** All systems and equipment that is installed within a school is to be provided with suitable access to ensure that this equipment is safely and efficiently maintainable. In order to ensure that maintenance is available, on the completion of all buildings, drawings are to be provided showing the completed (As Built) building including all equipment and equipment access arrangements. Any mechanical ventilation system within the building must be designed to provide adequate access for maintenance, to both sides of all moisture and debris-catching components, within the air distribution system. Moisture-producing and debris-catching components include items such as cooling coils, heating coils, fan coil units, humidifiers and filters in the air handling system. The project team should demonstrate that there is a project level review process in place to ensure that the building has been designed as per the EFSG, that any issues identified have been closed out and that the outcomes can be communicated to the relevant facilities/ operations teams Maintenance required and cost of this maintenance are to be considered in assessment of the project's life cycle cost. Operation and Maintenance manuals (O&M Manuals) are to be provided, written in clear, concise English covering the various building elements, assemblies, equipment, service installations and systems incorporated into the Works.	Ph 2-5: Services Design	DG16.10 DG 01.04	DAB c2.1 Services and Maintainability Review DAB c9.1.2 Ventilation System Attributes DAB c4 Building Information	**1.** As built drawings including all equipment access arrangements for maintenance	Y	Adequate space provision shall be considered and demonstrated as part of the mechanical design in accordance with design standards, industry best practice, manufacturers guidelines and EFSG's. Mechanical specification shall include maintenance routine and requirements.		Main Contractor
Foster connections	**Site investigations for place making / community connections** The following detailed reports/ surveys/ information should be considered in developing the business case: - Local environment/ character - Climate and microclimate - Heritage significance / impact - Appraisal of physical and visual factors affecting site development - Available transport/ road infrastructure servicing the site - Geo-technical and Soil reports will be required for each site to investigate the suitability of the topsoil and anticipated sub-grade materials for horticultural purposes. - Testing for toxic residues must be undertaken in all areas identified as being a possible risk - i.e. filled or dumped ground.	Ph 1: Site Selection and Masterplan	DG03.02	GSC c12 Culture, Heritage and Identity DAB 24.2 Contamination and Hazardous Materials	**1.** Relevant reports/surveys developed (these ideally include recommendations for further development stages) **2.** Evidence demonstrating recommendations / best practice solutions have been implemented/addressed.	TBC	Awaiting feedback from Project Manager		Project Manager

Foster connections	**Ecological conservation** Schools sites must conserve for future generations, the biological diversity of genetic materials, species and ecosystems on that site and consider the surrounding natural environment. An Ecological Assessment Report must be prepared for the site in order to understand the existing conditions and future conservation strategies. The design of the facilities must provide unique and valuable environmental conservation learning opportunities and effective environmental modelling to the wider community. Schools must connect with nature and incorporate biophilic design principles. Open space must allow for exploration, and biodiversity and earth education to enhance the site's outdoor learning potential.	Ph 1: Site Selection and Masterplan	DG02.06	DAB c23 Ecological Value GSC c29 Ecological Value (incl Biodiversity Enhancement)	**1.** Biodiversity or ecological assessment / local flora and fauna survey **2.** Ecological Assessment Report which documents the following: - ecological values (current, future, and past) identified for the site and their protection measures - ecological impacts from light and noise pollution and water quality and their mitigation requirements - existing vegetated areas and biodiversity values being retained how biodiversity has been considered within the project's material supply chain - list of management strategies to protect the integrity of ecological values throughout project planning, construction, and occupancy community and local stakeholder expectations including Aboriginal or Torres Strait Islander groups and environmental groups - Adequate due diligence must be conducted where an area of biodiversity or high ecological value is identified on the site, where at least 50% of this area must be retained. **3.** Biodiversity management plan describing measures for the conservation and protection of threatened species or communities, biodiversity enhancement, tree protection, etc. **4.** Evidence demonstrating measures have been implemented to protect and enhance endangered species / ecological communities identified; to preserve or re-establish native flora; etc.	Y	An Ecologist will be engaged to provide a report - this will be supplemented by a report prepared by an arborist.		Ecologist
Foster connections	**Productive landscape** Consider including opportunities for development of community garden within the site and relationships with community groups for this to occur.	Ph 1: Site Selection and Masterplan	DG2.06	GSC c14.2 Local Food Production	Site plan demonstrating location and size of community garden	TBC	Awaiting feedback from architect		Landscape Architect
Foster connections	**Bicycle storage** Provide 1 space for every 20 students to AS2890.3 standard	Ph 2: Concept Design - Space planning	SG552 4.36	DAB c17 Sustainable Transport		Y			Architect
Foster connections	**Community use of facilities** Some school facilities are used out of hours for activities such as weekend church groups, sport events and public meetings. Liaise with the Project Director to gain an understanding of any shared use, or community use arrangements that are being considered for the site. New schools should be designed so that direct access to the open play space, fields , hall and gym can be achieved without the public gaining access to the buildings.	Ph 2: Concept Design - Space planning	DG16.08 Department of Education's Community Use of School Facilities Implementation Procedures	DAB c30B Community Benefits	**1.** Confirmation by the Architect that direct access has been provided to open space and any other facilities that could be shared with the community. **2**. A list of community engagement activities undertaken to develop a community benefits strategy. **3.** Plans clearly outlining how the outcomes from the community benefits strategy have been implemented in the project **4.** Joint-use or lease agreements where already in place	TBC	Feedback is required from SINSW to confirm, however it is understand that this is typically implemented on new SINSW schools and the relevant Green Star credit has been included.		ESD / SINSW
Foster connections	**Open play space** Open play space must be provided for students to access during recess, lunch breaks and for outdoor learning. Open play space can be comprised of - Paved and grassed areas - Rooftops and terraces - Covered outdoor areas The designated open play space must be easily monitored and managed by school staff. Where a joint use agreement can be negotiated with a local council or land owner, the required play space can be located off-site, providing the facilities are - In close proximity to the school - Easily accessible - Safe and secure Designs must aim to achieve a minimum of 10m2 per student. Where this figure is not achievable the proposed m2 per student of the completed project must not be less than the existing m2 per student currently on the site.	Ph 2: Concept Design - Space planning	DG10.03	Not covered in Green Star	Plan view drawings showing provision of open space	TBC	Awaiting feedback from architect		Architect
Foster connections	**Staff room** Staff rooms should adequately accommodate staff work and recreation, and focus on indoor environment quality, enjoyment and interaction through provision of the following: •Daylight • Ventilation • Views • Landscaping/Indoor Plants • Acoustic Comfort	Ph 2: Concept Design - Space planning	EFSG Staff Unit	GSI c Amenity Space	**1.** Extracts from the EFSG requirements for staff rooms **2.** Evidence of staff room delivered accordingly	TBC	Awaiting feedback from architect		Architect
Foster connections	**Reconciliation action plan (RAP)** The project should adopt formalised steps to provide opportunities for Aboriginal and Torres Strait Islander peoples Projects must implement strategies during design, construction and operation that contribute positively towards reconciliation with Australia's first people and address social inequalities within Australia is between Indigenous and non-Indigenous Australians. The project demonstrate a relationship to, and a role in delivering the action items within the Department of Education's RAP. This could include incorporation of Indigenous design strategies and indigenous designers, celebration of indigenous culture on the site through art or landscape, and procurement from indigenous suppliers and workers. Refer to the GA NSW 'Designing with Country' Discussion paper for guidance and examples. The project must adopt all relevant requirements within the NSW Government's Aboriginal Procurement Policy (January 2021)	Ph 2-5: Architectural Design	Department of Education's Reconciliation Action Plan NSW Government Aboriginal Procurement Policy GANSW 'Designing with Country' discussion paper x	DAB c30D Reconciliation Action Plan	**1.** Evidence of the project's relationship with the RAP, e.g. actions implemented in line with RAP, etc.	Y	Minimum participation rates and procurement from Aboriginal and Torres Strait Island peoples in accordance with: - DoE's Aboriginal Procurement Policy - Standard main works contract MW21 Preliminaries section 4.4		Main Contractor
Foster connections	**Security** Safety in Design and Crime Prevention Through Environmental Design (CPTED) principles are to be implemented in project planning stage. Advice on the electronic surveillance systems can be sought early in the design phase. CCTV systems are required in several locations where indicated in the Rooms and Spaces Technical Data table, including: - Secondary clinic - Primary sick bay - Library	Ph 2-5: Services Design	DG14.10 DG65.08 DG65.10	GSC c15 Safe Places	**1.** Crime risk assessment or equivalent **2.** Evidence of designing out crime principles implemented **3.** Security services plans, schedules and forms by School Security Unit (SSU) **4.** SSU specification and evidence of input on project specification	TBC	Awaiting feedback from architect		Architect
Foster connections	**Digital infrastructure** New buildings and refurbishments are required to provide a common wireless solution compatible across the school, providing a consistent user experience and support mechanism. This involves the replacement of existing legacy wireless equipment, such as wireless access points and site switches	Ph 2-5: Services Design	DG64.12.02	GSC c22.2 Digital Infrastructure	**1.** Contracts describing the network infrastructure specification and operational requirements	**Y**			Electrical Contractor
Foster connections	**Sustainable Transport Planning / Transport Assessment** Transport planning must prioritise the delivery of feasible, connected networks and rectify transport deficiencies. The **School Transport Assessmen**t process must prioritise critical transport infrastructure to satisfy community expectations and statutory planning obligations. The assessment seeks to address school travel demand efficiently, safely and sustainably by maximising the most active and sustainable transport modes and reducing car parking capital expenditure and car travel demand. The School Travel Plan must be developed to inform the design response, construction traffic management, travel plan and post-occupancy operations to meet daily travel demand to school	Ph 1: Site Selection and Masterplan	Schools Transport Practice Note	DAB c17 Sustainable Transport	1. Transport Assessment, which must address: • A review of the school's travel demand; • The establishment of transport modes to promote during construction and post-occupancy; • Identification of transport improvements required to meet school travel demand; • Actions to inform the site design, master plan, Construction Traffic and Pedestrian Management Plan and Travel Plan; • Actions to address road safety concerns; and • Compliance with the Transport Planning Advisory Note.	TBC	Ason has been engaged as Traffic Engineer for the project. Awaiting feedback confirming implementation in line with the SINSW template. However it is understood this is implemented on all new SINSW projects and the relevant Green Star credits (10 points) have been targeted.		Traffic Engineer
Unlock human potential	**Green cleaning** Designs should support the implementation of a Green Cleaning policy for the school, this may include: - Appropriate cleaning areas are to be provided to safely store chemicals and equipment. - Hand washing stations - Use of HEPA filtration in vacuum equipment - Use of materials and surfaces that are easily cleaned - Consideration of operational waste procedures and the safe and simple transfer of waste throughout the school	Ph 7-9: Construction, Commissioning Post Occupancy and Operation	WoG Facilities M	GSP c6 Green Cleaning	**1.** WEB Clean School User Guide **2**. Green Cleaning specifications	Y			Architect

Unlock human potential	**Healthy canteen policy** The NSW Healthy School Canteens Strategy applies to all NSW Government schools (primary, secondary and central schools) with a canteen. The school should play a role in encouraging healthy dietary options in an effort to help reduce childhood obesity through food provided in the school canteens. As such, School canteens should be designed to encourage onsite preparation, storage, display and promotion of healthy 'everyday' foods.	Ph 2: Concept Design - Space planning	Department of Education's Healthy Canteen Policy	DAB c30D Integrating Healthy Environments	**1.** Research report behind Healthy Canteen Policy **2**. Evidence that policy initiative has been incorporated into the school under assessment.	TBC	Formal confirmation is required from SINSW, however it is understood this is implemented on all SI projects and the relevant Green Star credit has been targeted.		SINSW
Unlock human potential	**Daylight glare control** Discomforting glare and brightness contrasts must be avoided. Designers must seek to: - Exclude direct sunlight from all learning spaces, libraries, administrative offices and staff studies for the period of 9.00am to 3.30pm including Eastern Daylight Saving Time between 21st September to 21st March (equinoxes). - Exclude direct sunlight from desk level in all learning spaces between 9am and 3:30pm. 'Sun exclusion and glare control can be achieved by the use of elements such as sun shades, eave extensions, tinted glazing, screens, vertical blades and the like'. Glare must only be controlled by blinds as a last resort. Designers must prepare sun diagrams in the design phase as a minimum requirement.	Ph 2-5: Architectural Design	DG12 DG07.01	DAB c12.0 Glare Reduction	**1.** Daylight glare modelling report / sun diagrams showing direct sunlight has been excluded as required. **2.** Drawings supporting inputs of model, showing location of blinds and any other glare control device	Y	This will be demonstrated via modelling commencing in Phase 3		ESD
Unlock human potential	**Acoustic Performance** Design of internal spaces must address the following Acoustic outcomes: **- Internal Noise Levels** : An internal noise level assessment must be carried out for all new buildings to ensure comfortable acoustic conditions for the spaces occupied. The internal noise levels within the space must meet the limits stipulated in Table 11.06.1 of Section 11.06 Acoustic Performance Guidelines or be within the range stipulated in Table 1 of the AS/NZS 2107:2016 standard. The more stringent of the two should be met. - **Room to room noise control:** Sound insulation must be provided in accordance with the requirements of Table 11.06.2 "Guideline airborne and impact sound insulation requirements" and Table 11.06.3 "Sound insulation requirements (minimum design Rw)" . Doors, walls, operable walls, partitions etc. must meet prescriptive requirements for acoustic separation to provide privacy and comfort within relevant spaces. - **Minimum Speech Transmission** Index is > 0.60 for Teaching and learning spaces as per Table 11.06.4 **- Reverberation**: Reverberation time is fundamental to describing the 'acoustical liveliness' of a room. The reverberation time within a room must be within the range stipulated in table 11.06.1 of Section 11.6 Acoustic Performance Guidelines or Table 1 of the AS/NZS 2107:2016 standard. The more stringent of the two should be met.	Ph 2-5: Architectural Design	DG 11.06 DG 11.03 DG 11.02	DAB c10 Acoustic comfort	**1.** Report by qualified acoustics consultant demonstrating noise measurements are compliant. **2.** Detailed Drawings indicating sound insulation details and other relevant acoustic design features.	Y	Internal noise levels: Internal noise levels are influenced by two main factors: external noise sources (typically road traffic) and internal noise sources (typically HVAC equipment). Façade will be designed with specific acoustic performance parameters and HVAC equipment will be selected and treated to ensure internal noise criteria are achieved. Room to room noise control: wall, door and glazing build-ups will be provided to architect to achieve nominated Rw rating. Minimum speech transmission: absorptive and reflective finishes will be selected to achieve speech transmission index. Reverberation: absorptive finishes will be selected to achieve reverberation criteria		Acoustic Engineer
Unlock human potential	**Noise emission (to the environment)** Generally noise emission to the environment from mechanical services noise sources (such as air conditioners) are the subject of a development consent conditions. In NSW the development consent conditions will refer to the Industrial Noise Policy (INP) or Local Council requirement. Where no condition regarding noise sources exists for a school development, noise emission from such sources should be designed, in-principle, to satisfy the requirements of the Industrial Noise Policy.	Ph 2-5: Architectural Design	DG11.04	Not covered in Green Star	1. Report by qualified acoustics consultant	Y	Note: INP has been superseded by the Noise Policy for Industry. Noise treatments such as acoustic barriers, acoustic louvres, silencers, duct lining, will be applied to noise sources to achieve compliance with boundary noise criteria.		Acoustic Engineer
Unlock human potential	**Fly free indoors** Fly screening must be provided in all schools to the doors, windows and other openings in food preparation, biology, and non-water-closet toilet spaces or where specifically nominated in the EFSG. Schools in localities where fly incidence constitutes a health hazard (especially trachoma or other nuisance) will require fly screens to all opening sashes.	Ph 2-5: Architectural Design	DG31.01	Not covered in Green Star	As-built drawings showing fly screening has been provided as required	TBC	Awaiting feedback from architect		Architect
Unlock human potential	**Accessibility** -All new facilities must meet current DTS provisions of the NCC and the associated standards. Generally AS 1428.1 is the minimum design standard for access and mobility. However, it is DoE's policy that any enhanced requirements noted in AS 1428.2 be incorporated in any new design. -Additionally, DoE have enhanced circulation requirements as noted in DG / CIRCULATION - Provide hearing augmentation system for areas that have amplification, generally within Gymnasium, libraries, movement studios and Communal Halls, provide a system to assist the aurally challenged to hear music and speech within the main auditorium and on the stage - Provide the International Symbol for Deafness to indicate that an assistive hearing device is installed.	Ph 2-5: Architectural Design	DG19.01 DG65.14	DAB 30D Universal design	**1.** Accessibility plan **2.** As-built drawings or other evidence demonstrating that minimum and enhanced accessibility requirements have been provided for walkways, corridors, ramps, etc. **3.** Photographic or other evidence of signage installed	Y	The design will be reviewed by the TSG DDA stakeholder and we are in the process of engaging a DDA consultant to review compliance. This will meet the BCA/DDA statutory req's, standards. Accessibility Plan will incorporate access to lifts, and other area to ensure equitable access for all students, adults, and visitors to the school. If areas are not accessible due to WHS criteria, this will be noted as such.		Project Manager
Unlock human potential	**Access to Views** Building design must ensure that at least 60% of primary occupied spaces have a clear line of sight to high quality internal or external views. The space must be within 8m from the view. High quality views include: External views - vegetation, body of water, sky, or frequent outdoor movement (people, vehicles, animals) Internal views - landscaped area, water features, atrium' Note: Primary Spaces are defined as spaces that where students or staff are expected to work, or remain for an extended period of time, typically longer that 2 hours. This includes classrooms, laboratories, computer labs and office/administration areas.	Ph 2-5: Architectural Design	DG2.10	DAB c12.2 Views	**1.** Views Calculations and Mark-up this must be done in accordance with the GBCA's *Daylight and Views Hand Calculation Guide:* https://www.gbca.org.au/uploads/79/35919/Green%20Star_Daylight%20and%20Views%20Hand%20Calculation%20Guide%20May%202015%20RELEASE.pdf)	Y	This will be demonstrated via calculations commencing in Phase 3		ESD
Unlock human potential	**Access to Daylight** Designers must seek to maximise natural daylight in all learning and administration spaces to improve indoor amenity and create a pleasant environment and reduce energy usage through windows and skylights - Access to high levels of daylight must be ensured for at least 40% of primary occupied spaces per floor. A space is considered to have high levels of daylight if: the space has minimum 160 lux due to daylight during 80% of the nominated hours OR the following requirements are met: No overshadowing – external shading should not impinge on the direct 25 degree line from centre of the window Minimum 40% Visual Light Transmittance (VLT) for building glazing' Note: Primary Spaces are defined as spaces that where students or staff are expected to work, or remain for an extended period of time, typically longer that 2 hours. This includes classrooms, laboratories, computer labs and office/administration areas.	Ph 2-5: Architectural Design	DG2.3.1 DG12	DAB c12 Visual Comfort	**1.** Daylight modelling report demonstrating how natural daylight has been maximised in all habitable spaces; and **2.** As built drawings demonstrating that the model accurately represents the building (i.e. window size and location; skylights installed, etc.); and **3.** Specifications supporting inputs used in modelling (e.g. skylights and glass specs)	Y	This will be demonstrated via calculations commencing in Phase 3		ESD
Unlock human potential	**Ventilation and Indoor Air Quality** The maximum Co2 concentration must not exceed **1,500ppm** for more than 20 consecutive minutes in each day A ventilation strategy must be developed to ensure that sufficient ventilation is provided to all spaces to meet the requirements of the BCA/NCC and associated standards. Specifically ventilation equipment must be designed from a whole-of-life perspective and support healthy indoor environments, energy efficiency and ease of maintenance. This must also meet requirements for: - Natural ventilation mode and cross ventilation: in line with DG5.01 - Mechanically Assisted cross ventilation: In two storey blocks where cross flow ventilation is not possible to the lower floor, mechanically assisted cross ventilation is to be provided to the lower floor learning spaces nominated in the EFSG, the design must adhere to DG57.18. - Roof ventilator control: in line with DG65.16 - Wind powered roof ventilators: Designed to suit local ambient climatic conditions to ensure correct sizes, locations and numbers as detailed in DG57.14 - Sanitary Spaces sufficient natural ventilation or mechanical ventilation, to disperse odours and /or humidity in line with - Cross ventilation is to be used where possible. - Provide mechanical ventilation to all Disabled Toilets. - Ventilation in storage spaces in line with DG5.05 - Ventilation in permanent learning spaces and libraries in line with DG55 - Outdoor air requirements and control of Indoor CO2 levels – designs must adhere to DG55.02 - Ventilation in printing rooms: The ventilation system is to be designed to serve the whole room and is not intended to provide localised exhaust at equipment. Adhere to ventilation requirements set out in DG57.07. - Chemical store ventilation: Provide mechanical exhaust system with high and low level exhaust points to all chemical stores, with a minimum of 15 air changes per hour flow rate. Adhere to ventilation requirements set out in DG57.09	Ph 2-5: Services Design	DG57.01 DG05.04 DG05.05 DG57.16 DG05.01 DG57.18 DG05.02 DG37 DG65.16 Thermal Comfort and Indoor Air Quality – Performance Brief	DAB c15 GHG Emissions Reduction	**1.** Cooling system strategy including WOL analysis **2**. Concept plans **3.** Construction drawings **4.** Trade-based specification **5.** As built drawings, including indication of windows and cross ventilation	Y	Mechanical design will be developed in conjunction with the architect in line with EFSG's		Mechanical Contractor

Unlock human potential	**Lighting comfort** - Consider the furniture layouts to determine the orientation of luminaires. Especially when positioning luminaires in Materials Technology spaces to ensure adequate illumination on machines and work surfaces; - avoid potential stroboscopic effects and avoid shadows from ductwork - Mount luminaires as high as possible, but generally no higher than 4000mm AFFL (excluding Gymnasiums and Halls), to improve luminance uniformity and reduce direct glare in the direction of normal view - The standard lamp colour temperature is 4,000°K, except in certain toilet areas where the Design Guide requires the use of blue colours. - The Colour Rendering Index (CRI) for light sources must be minimum 80 or higher - Compliance with the uniformity requirements stipulated in Table 3.2 of the AS/NZS 1680 standard should be demonstrated by the presentation of the output from lighting design software. - The Unified Glare Rating (UGR) must be calculated in accordance with the procedure outlined in Clause 8.3.3 of AS/NZS 1680.1:2006 standard, and the calculated value must not exceed the maximum values specified in Table 8.2 of the standard - The maintained illuminance levels must meet the recommended levels as specified in the AS/NZS 1680 standard., and the maintained illuminance values achieve a uniformity of no less than the values given in Table 3.2 of AS 1680.1:2006, with an assumed standard maintenance factor of 0.8. - To ensure flicker-free lighting, the following luminaire requirements should be considered: LED lighting – electronic drivers with 12-bit or greater resolution - Modelling must provide output that clearly demonstrates that the proposed design is compliant with the standards including but not limited to the parameters listed in DG 63.03.02	Ph 2-5: Services Design	DG63.03	DAB c11 Lighting Comfort DAB c11.1 General Illuminance and Glare Reduction	**1.** Lighting drawings **2.** Architectural drawings **3.** Lighting specifications / schedules 4. Product data sheets **5.** Isolux plot drawings **6**. Lighting modelling report showing compliant uniformity and UGRs	Y			Electrical Contractor
Unlock human potential	**Thermal comfort** The inclusion of active cooling within school facilities is directed by the Department's Air Cooling policy: 2.1 Schools with a long term average mean maximum January temperature of 33 oC and above: Generally, air conditioning is to be provided to all school buildings. 2.2 Schools with a long term average mean maximum January temperature of below 33oC: Air conditioning is to be installed in all permanent learning spaces and libraries forming part of each projects scope. - Thermal modelling is undertaken to demonstrate that learning spaces and libraries have been designed to achieve a predicted mean vote (PMV) of +/- 1 for 95% of occupied hours.	Ph 2-5: Services Design	DG06.03 DG55.01 DG55.02	DAB c14 Thermal Comfort	**1.** Mechanical drawings showing HVAC systems installed, or **2.** Confirmation from sub-contractors that services have been installed and commissioned as required; and **3.** Modelling report showing required PMV is achieved. Modelling report to be done in line with methodology described in Draft thermal comfort and indoor air quality interim performance brief for DG55	Y	This will be demonstrated via calculations commencing in Phase 3		ESD
Unlock human potential	**Microbial control** As a measure to prevent legionella, heated water to hand basins, showers etc. shall be stored at temperature above 65 C. Thermostatic mixing valves are to be used for tempered water generation at each point of use. Valves need to comply with microbe disinfection requirements - "Code of Practice for Thermostatic Mixing Valves NSW" as approved by the NSW Health Department.	Ph 2-5: Services Design	DG51.09 DG53.11	DAB c28 Microbial Control	1. Letter by hydraulic engineer confirming hot water is stored above 65 deg and that valves comply with code of practice.	TBC	Awaiting feedback from hydraulic consultant		Hydraulic Consultant
Unlock human potential	**External access lighting** External Access Lighting shall be provided to illuminate building entrances, footpaths, sheltered walkways, roadways and car park. External Access Lighting must: - Be minimal and designed to prevent glare to pedestrians, nearby residents and to motorists. Evidence of compliance with AS4282, AS/NZS 1158 and other applicable Australian Standards must be provided by the designer. - Be located so as to link various sources of illumination such as street lighting (for carpark and roadways) and internal security lighting (for footpaths, walkways and entrances). - Illuminate building entry doors. - Highlight 'accident-prone' areas such as changes in level, stairs and ramps. - Provide vertical illumination.	Ph 2-5: Services Design	DG63.08.01	DAB c27.0 Light Pollution to Neighbouring Bodies	**1.** As built drawings indicating the location of all external luminaires **2.** Letter by lighting designer describing glare prevention measures	Y	External lighting will be provided as per the EFSGs which is 21 lux for pathways and 3.5 lux for carparks.		Electrical Contractor
Unlock human potential	Low VOC-emitting materials All surface coatings, and other volatile organic compound (VOC) emitting products including adhesives, sealants, carpets, carpet tiles, and carpet underlays, must be made from low-VOC emission materials. - Paints must meet the limits stipulated in the Australian Paint Approval Scheme's (APAS) VOC limits for low VOC paints. - Paints, adhesives and sealants must not exceed the maximum VOC limits stipulated in the Green Star Buildings rating tool. - Carpets must not exceed the total VOC limits stipulated in the Green Star Buildings tool.	Ph 3-4: Product and Material Selection	DG2.5.2	DAB c13 Indoor Pollutants	**1.** Product specifications, certificates, safety datasheets that demonstrate low-VOC contents **2.** Bill of quantities	Y	To be included in design specifications		Main Contractor
Unlock human potential	**Low formaldehyde-emitting materials** Only low formaldehyde-emitting engineered wood products should be used, such as those that meet the Australian Standards for formaldehyde emission limit E1 (NICNAS classification) or lower. The engineered wood products must not exceed the emissions limits stipulated in the Green Star Buildings rating tool. Engineered wood products include particleboard, plywood, Medium Density Fibreboard (MDF), Laminated Veneer Lumber (LVL), High-Pressure Laminate (HPL), Compact Laminate and decorative overlaid wood panels. This requirement excludes formwork.	Ph 3-4: Product and Material Selection	DG2.5.2	DAB c13 Indoor Pollutants	**1.** Product specifications, certificates, safety datasheets that demonstrate low-formaldehyde contents Bill of quantities	Y	To be included in design specifications		Main Contractor
Unlock human potential	**Acoustic post-occupancy evaluation** Post Occupancy evaluations are often undertaken to assess the performance of recently completed or existing facilities. Where a Post Occupancy Evaluation is to be undertaken it should be conducted by the project team or acoustic engineer and should be undertaken of selected acoustic parameters only. Evaluation must include (as per the above criteria) - Internal noise levels, - Room acoustics, - Noise emission, - Room-to-room acoustics performance The noise measurement and documentation must be provided by a qualified acoustic consultant and in accordance with AS/NZS 2107:2016 Measurements shall be conducted in at least 10% of regularly occupied spaces.	Ph 7-9: Construction, Commissioning Post Occupancy and Operation	DG11.07	GSP c13 Internal Noise Levels	**1.** Commitment by SI to conduct acoustic post-occupancy evaluation	Y			Acoustic Engineer
Unlock human potential	**Pesticide free environments** Schools must be designed, constructed and maintained, without using chemicals for termite and other pest control. No chemical pesticides and termicide to be used. Preventive treatments to be by physical means and careful design to minimise risk	Ph 7-9: Construction, Commissioning Post Occupancy and Operation	DG2.5.3	Not covered in Green Star	Statement by head contractor that no pesticides or termites have been used.	TBC	Awaiting feedback from architect.		Main Contractor
Unlock human potential	**Healthy Places** The design of the project should address five key principles for Healthy Places, as defined in Green Star Communities credit 9.3. These are: - Walkability - Active and public transport, - Wayfinding -Good public space design - Social interaction	Ph 2-5: Architectural Design	DG2.5.4	Healthy Places [GSC 9.2]	**1.** Narrative providing examples of how each principle is being addressed, with examples from the Masterplan Report and Traffic/Transport Plan	TBC	Ason has been engaged as Traffic Engineer for the project. Awaiting feedback confirming implementation in line with the SINSW template. However it is understood this is implemented on all new SINSW projects and the relevant Green Star credits (10 points) have been targeted.		Traffic Engineer

8.3 Climate Change Adaptation Plan

Refer over.

Norman Disney & Young
A TETRA TECH COMPANY

School Infrastructure NSW

Cluster F – New public school at Gregory Hills

Climate Change Adaptation Plan

3 May 2022

CONFIDENTIAL | **Revision:** 1.0 – Concept Design | **Issued:** 3 May 2022

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EXECUTIVE SUMMARY

East Australia faces a combination of potential climate change scenarios. NDY assessed the impacts of predicted climate change models on the design and operation of the New public school at Gregory Hills, NSW, over the expected 50-year life of the development. Projections in this report were based on outputs from global climate models (GCMs) with data provided by CSIRO's Climate Change in Australia's database relevant to the Sydney region. The results showed the following (CSIRO Climate Change Projections, East Coast Cluster Report 2015):

- Extreme temperatures are projected to increase with very high confidence, and substantial increases in temperatures reached on hot days, as well as the frequency of hot days.
- Average temperatures will continue to increase in all seasons (very high confidence).
- Generally, less rainfall is expected in winter (medium confidence), but the intensity of extreme rainfall events is projected to increase (high confidence).
- There is high confidence that climate change will result in a harsher fire-weather climate in the future.
- Time spent in drought projected to increase (medium confidence) over the course of the century.

A climate change risk assessment was undertaken as per AS 5334-2013 and Green Star Design & As Built v1.3 requirements using CSIRO projections for the East Coast (South) sub-cluster to identify expected impacts from climate change. A stakeholder workshop was undertaken to seek input from the design team members to identify the likely risks and how these would impact the project. Design mitigation strategies were developed to reduce these risks and design the building to be more resilient to future climate change. The climate change risk analysis identified no 'High' or 'Extreme' risks due to climate change impacts after design elements were considered for this project. Therefore, the credit criteria under Green Star Adaptation and Resilience (Credit 3) is deemed to be met.

Table 1: Summary of initial risks and reassessed risks

Risk Rating	Year	Low	Medium	High	Extreme	Total
Number of risks based on existing controls	2030	12	6	0	0	18
	2070	8	10	0	0	18
Number of risks following adaptation measures	2030	15	3	0	0	18
	2070	13	5	0	0	18

1 INTRODUCTION

1.1 Development Description

1.1.1 Site

The new public school proposed will be situated in Gregory Hills, a suburb of Sydney, New South Wales (NSW). The site coordinates are 34° 1' 41.916'' S, 150° 46' 19.884'' E. The new development consists of the following major scope elements:

- New 3-storey school building, 1-storey hall, learning hub, student amenities and storage, landscaping, and parking and drop off area.
- The project is committed to achieving the following:
  - 5 star Green Star Design & As-Built v1.3
  - NCC Section J Compliance
  - SINSW Educational Facilities Standards and Guidelines (EFSG)

1.1.2 Location

The new public school at Gregory Hills falls within the East Coast (South) Sub-cluster, which categorises data within natural resource management (NRM) regions that are defined by catchments and bioregions by the CSIRO and Australian Bureau of Meteorology's "Climate Change in Australia" climate projections.

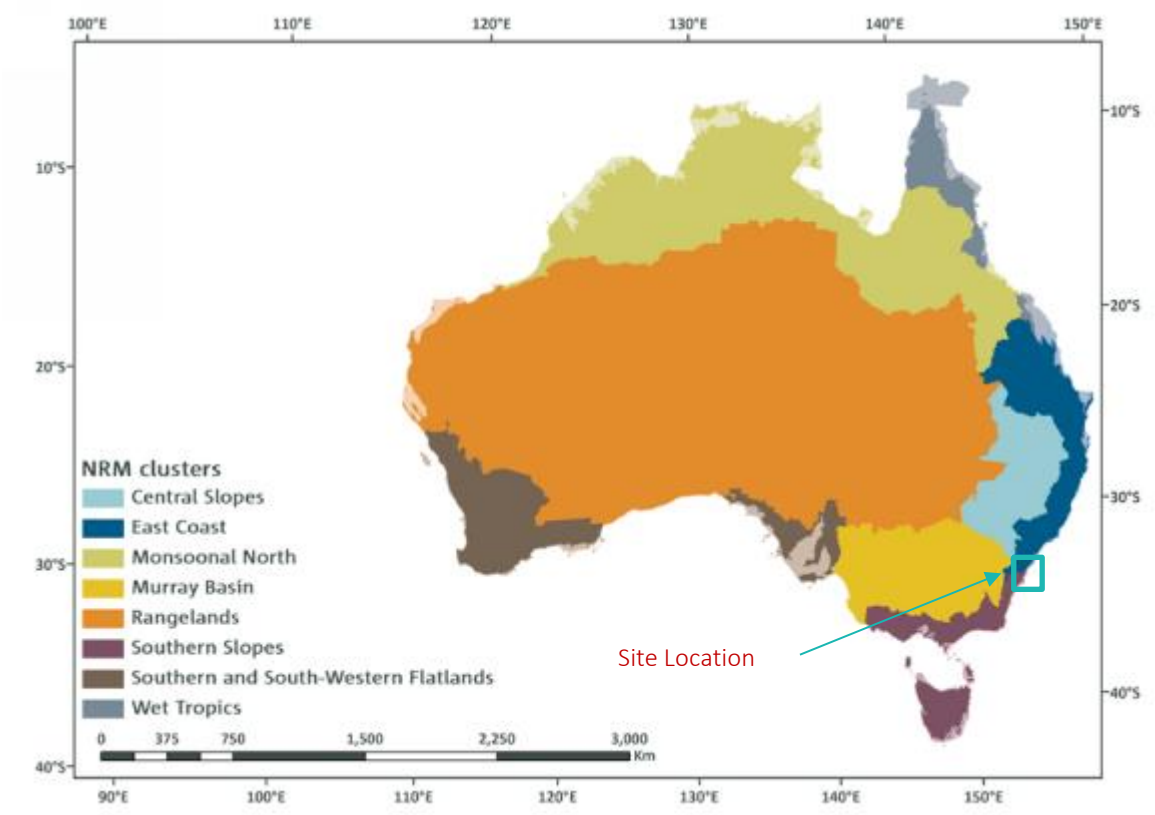


Figure 1 NRM Clusters – East Coast (South) Sub-cluster Location

1.1.3 Climatic Characteristics

The East Coast Cluster includes an area of ~395,000km^2 across NSW and Queensland, comprising 6 natural resource management regions with a Subtropical (East Coast North) or a Temperate (East Coast South) climate, and stretching across an extensive coastal zone (CSIRO Climate Change in Australia Projections, 2015).

As it spans a large range of latitudes and altitudes, the East Coast Cluster experiences a range of climate influences and drivers, both within and between regions, which result in a vast array of diverse bioclimatic zones. The cluster comprises the central part of the eastern seaboard of Australia and includes the drainage basins of several major rivers. The cluster contains both temperate broadleaf and mixed forests as well as tropical and subtropical grasslands, savannahs and shrublands.

The daily mean temperatures in the East Coast (South) sub-cluster ranges from 10°C (winter) to 22°C (summer), with a minimum of 4°C in July and maximum of 28°C in January (CSIRO Climate Change Projections, East Coast Cluster Report 2015). The rainfall characteristics of the region are a result of the interactions between several rain-bearing weather systems with monthly mean rainfall ranging from around 45 to 135mm (CSIRO Climate Change Projections, East Coast Cluster Report 2015). As a result of the varying rainfall and diverse landforms, the vegetation types, hydrology regimes, and land-uses vary greatly across this sub-cluster (CSIRO Climate Change Projections, East Coast Cluster Report 2015).

1.2 Climate Change Risk Assessment Overview

Norman Disney & Young (NDY) were commissioned to undertake a climate change risk assessment for the new public school at Gregory Hills in line with current predictions to determine the hazards and risks associated with future climatic conditions, and how these are likely to affect this building into the future.

This report details the methodologies and outcomes of the climate change risk assessment, which was performed during the design phase and used to inform detailed design for the project. The climate change risk assessment used scientific projections to inform the identification of hazards and respective risks specific to the site. The assessment was developed in accordance with AS 5334-2013 Climate Change Adaptation for Settlements and Infrastructure, with reference made to the Australian Government guideline document Climate Change Impacts & Risk Management: A Guide for Business and Government (2006).

The risk assessment is detailed in Section 4 of this report and is broken into a description of the predicted climate scenarios and effects (temperature, sea level rises, increases in rainfall, evaporation, and flooding likelihoods in storm surge events, etc.), and risk assessments of how these climate change conditions are likely to impact the building and its users into the future.

2 CONTEXT ESTABLISHMENT

2.1 Scope & Purpose

NDY was engaged to prepare a Climate Adaptation Plan in accordance with a recognised standard for the new public school at Gregory Hills development, in order to be awarded 2 points under Credit 3: Adaption and Resilience within the Green Star Design & As Built v1.3 rating tool. This assessment was undertaken during the design stage of the project to assess the effectiveness of adaptation measures that had already been incorporated. It set out to identify any additional risks and consequently identify any additional adaptation measures that may be required for implementation in order to mitigate any risks identified as "High" or "Extreme".

NDY set out to assess the site's climate conditions and select and consider climate change scenarios for two time scales relevant to the project's lifespan, which in this case included 2030 (~Practical Completion + 10 years) and 2070 (+ 50 years), and identify associated potential direct and indirect climate change impacts.

The preparation of a climate change risk assessment was undertaken based on AS5334 which identified the likelihoods and consequences of potential risks of expected climate change projections sought from the CSIRO's Climate Change in Australia Projections (CSIRO Climate Change in Australia Projections, 2015), with reference made to the NSW Government's NSW and ACT Regional Climate Modelling (NARCliM) projections.

NDY then facilitated a workshop with key project stakeholders and the design team to identify key issues and discuss climate change projections identified for the site and relevant to the project. This included collaborating with the design team to map climate variables and direct/indirect effects to different aspects of the design and then evaluate the potential adaptation actions and responsibilities to manage unacceptable risks to the project, owner and end-users.

2.2 Suitably Qualified Professional Undertaking Assessment

This Climate Adaptation Plan has been developed by Emily Howell (Sustainability Consultant – Graduate), and has been reviewed by Claudia Burbidge (Sustainability Consultant).

Emily has a formal tertiary qualification in Sustainability from Victoria University of Wellington (Master of Architectural Science) and has experience in Climate Adaptation Plans including for offices and education facilities.

Claudia has a formal tertiary qualification in Civil and Environmental Engineering from the University of New South Wales, Sydney (Bachelor of Engineering), graduating with Honours. Claudia is also a qualified Green Star Accredited Professional (GSAP), and WELL Accredited Professional (WELL AP), and has undertaken CC&R assessments on numerous project typologies including offices, residential and education facilities (primary, secondary and tertiary).

2.3 Objectives

Success criteria for future-proofing the new public school at Gregory Hills against climate change impacts included the following, as per the Department of the Environment and Heritage Australian Greenhouse Office Climate Change Impacts and Risk Management: A Guide for Business and Government (2006):

- Public Safety - Maintaining public safety
- Local Economy and Growth - Protecting and enhancing local business
- Community and Lifestyle - Protecting the existing lifestyle enjoyed by the local community and visitors
- Environment and Sustainability – Protecting environmental amenity
- Administration - Ensuring sound public administration and governance

2.4 Climate Change Context/Scenarios

2.4.1 Greenhouse Gas Emissions Scenarios

Although future emissions growth is complex and uncertain, the Intergovernmental Panel on Climate Change (IPCC) developed a range of potential future greenhouse gas emissions scenarios to address this uncertainty and represent a plausible set of future economic and social conditions on which emission levels were generated (Australian Government Department of Climate Change, 2009).

The following IPCC climate change scenarios from the CSIRO's Climate Change in Australia Projections (as at 2015) were referenced in this impact assessment. These reflect the global climate model (GCM) simulations, as defined by the Representative Concentration Pathways (RCPs) used by the IPCC, with a particular focus on RCP4.5 and RCP8.5.

Representative Concentration Pathway 4.5 (RCP4.5)

This scenario represents a pathway consistent with low-level emissions, which stabilise the carbon dioxide concentration at about 540 ppm by the end of the 21st century and assumes that global annual GHG emissions (CO2-e) peak around 2040 before declining (CSIRO Climate Change in Australia Projections, 2015).

Representative Concentration Pathway 8.5 (RCP8.5)

This scenario is representative of a high-emission scenario, for which the carbon dioxide concentration reaches about 940 ppm by the end of the 21st century and assumes that global annual GHG emissions (CO2-e) continue to rise through to 2100 (CSIRO Climate Change in Australia Projections, 2015).

2.4.1.1 JUSTIFICATION FOR SELECTING THESE RCP SCENARIOS

As per guidance in the AGO's Guide, "Climate Change Risks and Impacts: A Guide for Government and Business", Section B4.1, a limited number of scenarios covering the most plausible future climate changes was used for this analysis. This was deemed necessary to gain a holistic picture of predicted climate change impacts for this site.

These include the high emissions scenario (RCP8.5) which represents 'business as usual' and combines assumptions regarding the absence of climate change policies with higher world populations and modest rates of technological change or energy intensity improvements which culminate in higher energy demands and therefore Greenhouse Gas emissions increasing year on year. The final impact assessment used RCP8.5 as the basis for all projections.

The other, more optimistic emissions scenario referenced in this assessment includes emissions peaking at around 2040 and then declining due to rapid stabilization of Greenhouse Gas emissions in the global economy as a result of implementation of effective climate change policies (such as a price on emissions) and swift introduction of new, more resource efficient technologies that balance renewable energy sources with fossil-fuel sources and keep global mean warming within a 2 °C increase from pre-industrial levels.

2.4.2 Future Time Slices

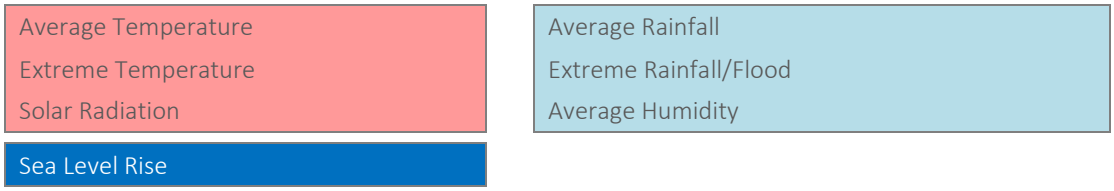
In accordance with the requirements of Green Star, two time slices were chosen for the site.

On the basis that the project will reach practical completion in approximately 2022 and will have a life of approximately 50 or 60 years before major refurbishment, 2030 and 2070 were selected as the most appropriate time slices.

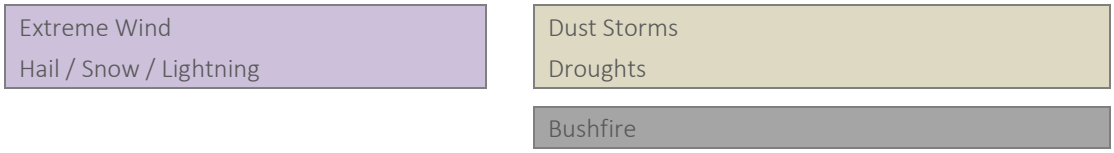
2.4.3 Climate Variables

Based on the site's location, vulnerabilities, and the explicit requirements of Green Star, the following climate variables have been considered:

Primary Effects



Secondary Effects



2.4.4 Standards

The recognised standard used to carry out this assessment was AS5334. Section B, Sub-sections 4 to 6 of the AGO Guide, "Climate Change Risks and Impacts: A Guide for Government and Business" were also used to establish the context for this assessment prior to the stakeholder workshop and to ensure that all risks were identified, analysed, evaluated, and mitigated accordingly.

2.4.5 Climate Data

In summary, the following are key projections for the East Coast (South) Sub-cluster (CSIRO Climate Change Projections, East Coast Cluster Report 2015):

- Mean, maximum and minimum temperatures will continue to increase in all seasons (very high confidence)
- More hot days and warm spells are projected with very high confidence. Fewer frosts are projected with high confidence
- Natural climate variability will remain the major driver of rainfall changes (high confidence). Generally, less rainfall in the winter and summer is projected with medium confidence. Increases and decreases to spring, and autumn rainfall are possible but less clear
- Increased intensity of extreme rainfall events is projected, with high confidence
- Greater time spent in meteorological drought is projected, with medium confidence. An increase in frequency and duration of extreme drought is projected, with low confidence
- Small changes in mean surface wind speed are projected with high confidence. Winter decreases are projected with medium confidence whilst spring increases are projected with low confidence
- Little change is predicted for solar radiation (high confidence) for the near future (2030)
- Little change in relative humidity (high confidence) for the near future (2030)
- Mean sea level will continue to rise (very high confidence)
- A harsher fire-weather climate is projected in the future (high confidence).

2.4.6 Past Meteorological Records

Data from the Camden Airport AWS weather station was used due to the proximity to the site and its extensive records. The 1981 – 2010 time period was chosen as it aligned most closely with the base case climate data used in the Climate Change in Australia projections (1986 – 2005).

2016 Intensity-Frequency-Duration (IFD) data regarding individual rainfall events was obtained for the site from the Bureau of Meteorology website.

2.5 Stakeholders

The following key stakeholders were identified for the project:

- Jacobs
- Schools Infrastructure NSW
- Norman Disney & Young
- ACOR
- Robert Bird
- Bennet and Trimble
- McIntosh & Phelps

2.6 Risk Criteria

2.6.1 Risk Assessment Likelihood Scale

The following likelihood scale, taken from AS 5334-2013, was used in the risk assessment for the project for recurrent and single events.

Table 2 Risk Assessment Likelihood Scale

Rating	Descriptor	Recurrent or Event Risks	Long Term Risks
Almost Certain	Could occur several times per year	Has happened several times in the past year and in each of the previous 5 years or Could occur several times per year	Has a greater than 90% chance of occurring in the identified time period if the risk is not mitigated
Likely	May arise about once per year	Has happened at least once in the past year and in each of the previous 5 years or May arise about once per year	Has a 60-90% chance of occurring in the identified time period if the risk is not mitigated
Possible	May arise a couple of times in a generation	Has happened during the past 5 years but not in every year or May arise once in 25 years	Has a 40-60% chance of occurring in the identified time period if the risk is not mitigated
Unlikely	May arise once in a generation	May have occurred once in the last 5 years or May arise once in 25 to 50 years	Has a 10-30% chance of occurring in the future if the risk is not mitigated
Rare	May arise once in a lifetime	Has not occurred in the past 5 years or Unlikely during the next 50 years	May occur in exceptional circumstances, i.e. less than 10% chance of occurring in the identified time period if the risk is not mitigated

2.6.2 Risk Assessment Consequence Scale

The following consequence scale, adapted from Climate Change Impacts & Risk Management, was adopted for the risk assessment.

Table 3 Risk Assessment Consequence Scale

Descriptor	Service Quality	Compliance	Infrastructure	Financial
Insignificant	Minor deficiencies in principle that would pass without comment	Concerns about compliance would be resolved without special attention	No infrastructure damage, little change to infrastructure service	Little financial loss or increase in operating expenses
Minor	Services would be regarded as satisfactory but personnel would be aware of deficiencies	Minor perceived or actual breaches of compliance would be resolved	Localised infrastructure service disruption, no permanent damage. Some minor restoration work required. Early renewal of infrastructure by 10-20%. Need for new/modified equipment	Additional operational costs. Financial loss is small <10%.
Moderate	Services would be regarded as barely satisfactory by the general public and the organisation's personnel	Formal action would be required to answer perceived breaches or charges of compliance failure	Limited infrastructure damage and loss of service. Damage recoverable by maintenance and minor repair. Early renewal of infrastructure by 20-50%	Moderate financial loss 10-50%
Major	The general public would regard the organisation's services as unsatisfactory	Significant amounts of management and advisers' effort would be required to answer charges of compliance failures	Extensive infrastructure damage requiring major repair. Major loss of infrastructure service. Early renewal of infrastructure by 50-90%	Major financial loss 50-90%
Catastrophic	Services would fall well below acceptable standards and this would be clear to all	Obvious and proven breaches of legal and regulatory requirements with the prospect of corporate or individual penalties	Significant permanent damage and/or complete loss of the infrastructure and infrastructure service. Loss of infrastructure support and translocation of service to other sites. Early renewal of infrastructure by >90%	Extreme financial loss >90%

2.6.3 Risk Rating Matrix

The following risk rating matrix, taken from AS 5334-2013, was used to determine risk levels.

Table 4 Priority Matrix

		Likelihood				
		Rare	Unlikely	Possible	Likely	Almost Certain
Consequence	Catastrophic	Low	Medium	High	Extreme	Extreme
	Major	Low	Medium	Medium	High	Extreme
	Moderate	Low	Low	Medium	High	Extreme
	Minor	Low	Low	Medium	Medium	High
	Insignificant	Low	Low	Low	Medium	Medium

3 CLIMATE CHANGE PROJECTIONS FOR EAST COAST (SOUTH)

The following climate change projections have been assigned a confidence rating which follows IPCC likelihood terminology. The IPCC uses the following terminology for certainty/likelihood of outcomes.

The confidence rating does not equate to a probabilistic confidence, rather it covers the type, amount, quality, and consistency of evidence, and the extent of agreement (CSIRO Climate Change Projections, East Coast Cluster Report 2015). The following terminology for certainty/likelihood of outcomes are used in this report:

- Low confidence
- Medium confidence
- High confidence
- Very high confidence

It is important to understand that climate change is not expected to be linear or smooth. It is anticipated that climate change will be characterised by extreme events that are hard to predict and even harder to manage and as a result many ecosystems, both natural and man-made, will find it difficult to adapt (IPCC, IPCC WGI AR5 Climate Change 2013: The Physical Science Basis, 2013).

3.1 Temperature

3.1.1 Higher Temperatures

Continued increases in mean, daily maximum and daily minimum temperatures are projected for the East Coast cluster with very high confidence with the near future (2030) projected increase of mean annual temperature around 0.4 to 1.3 °C above the climate of 1986–2005, with only minor differences between RCPs (CSIRO Climate Change Projections, East Coast Cluster Report 2015). Late in the century (2090), there is a large difference between scenarios, with projected warming of 1.3 to 2.5 °C for RCP4.5 and 2.7 to 4.7 °C for RCP8.5 (CSIRO Climate Change Projections, East Coast Cluster Report 2015).

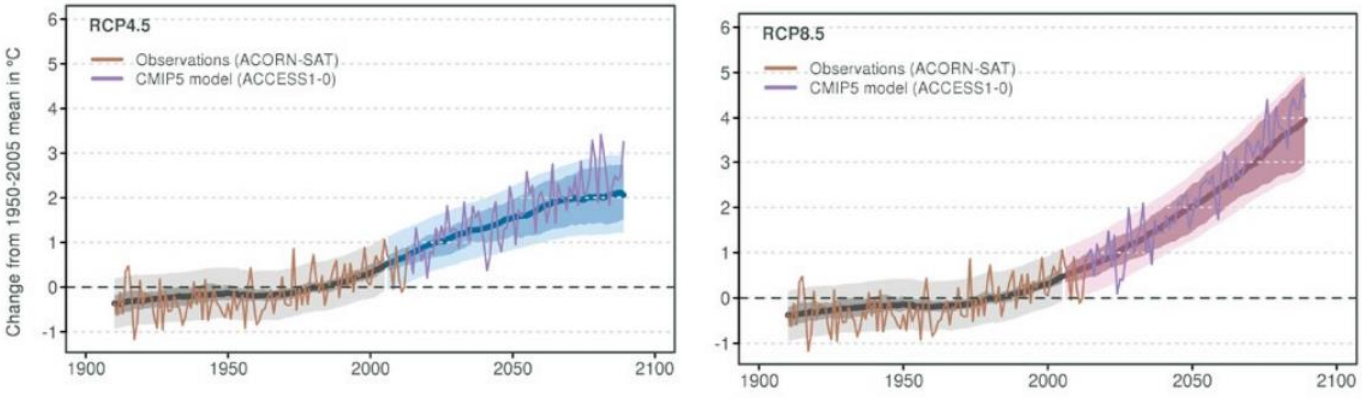


Figure 2 East Coast Annual Average Surface Air Temperature (°C) for 1910–2090 (CSIRO Climate Change Projections, East Coast Cluster Report 2015)

Table 5 Camden Airport Average Maximum Seasonal Temperature (Bureau of Meteorology) and Future Projections (CSIRO Climate Change Projections, East Coast Cluster Report 2015)

Season	Baseline (1981-2010)	2030 @ RCP8.5	2070 @ RCP8.5
Summer	28.97° C	29.97° C (+1° C)	31.22° C (+2.25° C)
Autumn	26.77° C	27.77° C (+1° C)	29.02° C (+2.25° C)
Winter	18.1° C	19.1° C (+1° C)	21.6° C (+2.25° C)
Spring	24.3° C	25.3° C (+1° C)	26.55° C (+2.25° C)

3.1.2 Hotter and More Frequent Hot Days, Fewer Frosts

A substantial increase in the temperature reached on the hottest days, the frequency of hot days and the duration of warm spells are projected with very high confidence and as a result, an expected decrease in the frequency of frost-risk days is projected with high confidence (CSIRO Climate Change Projections, East Coast Cluster Report 2015).

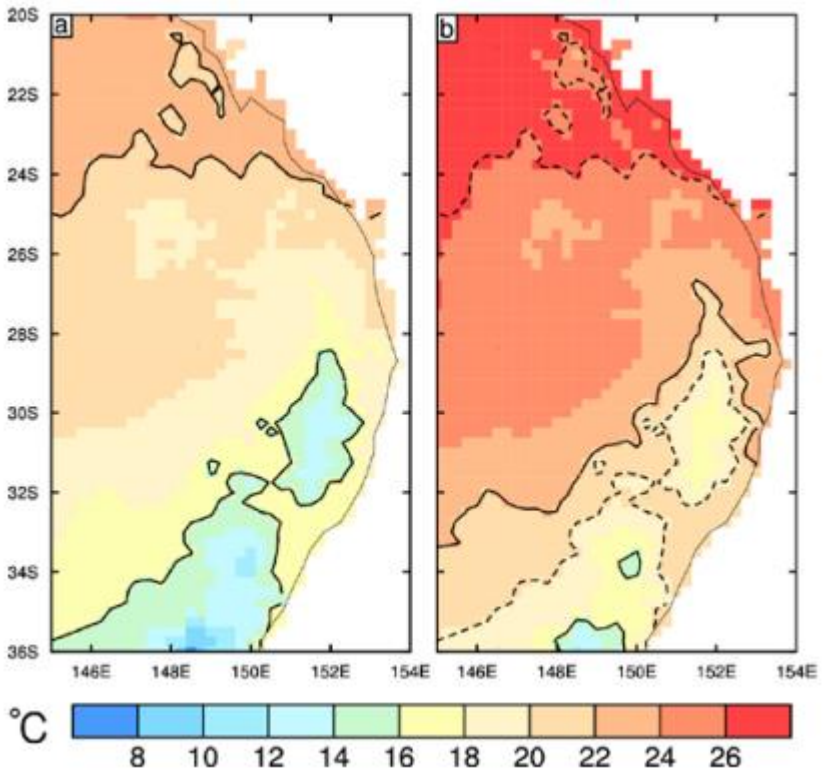


Figure 3 Annual Mean Surface Air Temperature (°C), for the Present Climate (a), and Median Warming under RCP8 5 for 2090 (b) (CSIRO Climate Change Projections, East Coast Cluster Report 2015)

Table 6 East Coast South – Average Annual Number of Days above 35°C and below 2 °C {Frosts} (CSIRO Climate Change Projections, East Coast Cluster Report 2015)

Threshold	East Coast (South) Sub-cluster			
	Current	**2030 RCP4.5**	**2090 RCP4.5**	**2090 RCP8.5**
Over 35 °C	3.1	4.3 (4.0 to 5.0)	6.0 (4.9 to 8.2)	11 (8.2 to 15)
Over 40 °C	0.3	0.5 (0.5 to 0.8)	0.9 (0.8 to 1.3)	2.0(1.3 to 3.3)
Below 2 °C	0	0	0	0

The risk of line outages, blackouts, and asset failures is likely to increase (IPCC, IPCC WGI AR5 Climate Change 2013: The Physical Science Basis, 2013). This is due to increases in peak demand from increased air-conditioning use exceeding baseload increases. Although the main drivers for energy consumption are demographic and socio-economic factors, climatic conditions are also linked to average and peak energy demands (CSIRO Climate Change in Australia Projections, 2015).

Higher rates of infectious and water-borne disease, as well as increased rates of heat-related stress and mortality, particularly among the aged and vulnerable populations, are likely outcomes (Grose et. al, 2015).

The frequency of hot days and the frequency of high fire risk weather is likely to increase. The East Coast (South) currently experiences temperatures above 35°C, on average, 3.1 days per year. Studies have highlighted that by 2030 this is predicted to increase to 4.3 days per year and by 2090 to between 6 and 11 days per year (CSIRO Climate Change Projections, East Coast Cluster Report 2015). This has important ramifications for air pollution and health, with ozone pollution events linked to the frequency of hot, sunny days and with the highest particle pollution concentrations linked to the presence of bushfire smoke (Grose et. al, 2015).

3.2 Precipitation

3.2.1 Extended Drought Periods

There is medium confidence that the time spent in drought will increase over the course of the 21st century in line with changes to mean rainfall, but low confidence in projecting the frequency and duration of extreme droughts (CSIRO Climate Change Projections, East Coast Cluster Report 2015).

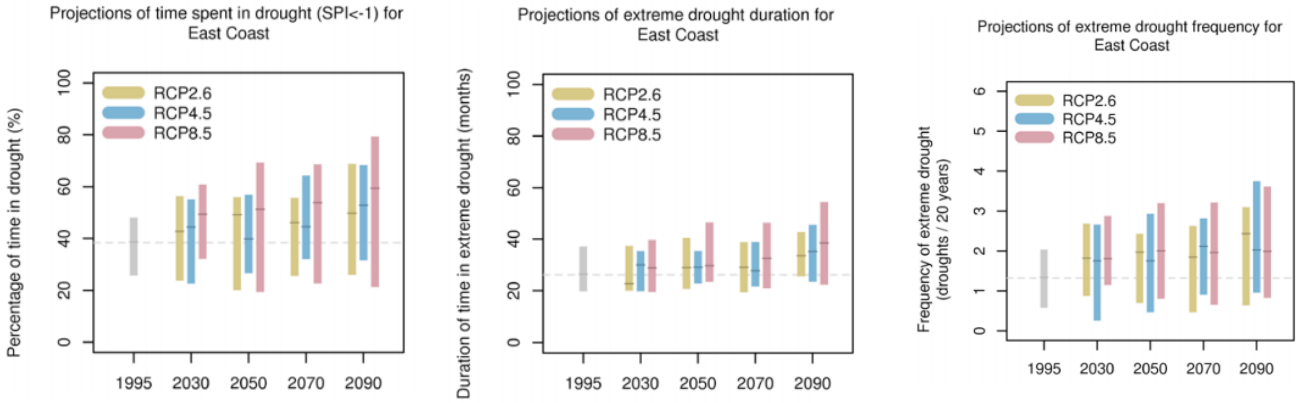


Figure 4 Time in Drought (Left), Duration of Extreme Drought (Middle), and Frequency of Extreme Drought (Right) (CSIRO Climate Change Projections, East Coast Cluster Report 2015)

3.2.2 Extreme Rainfall Events

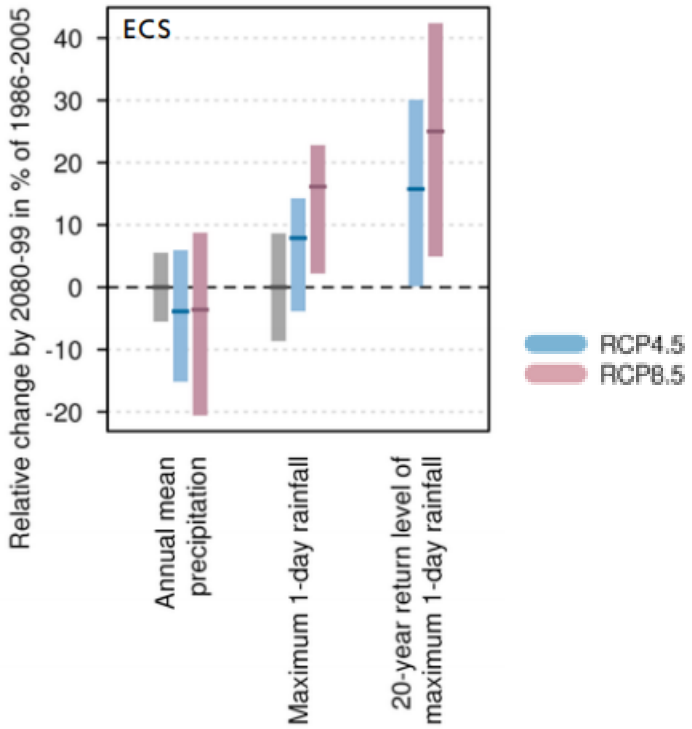
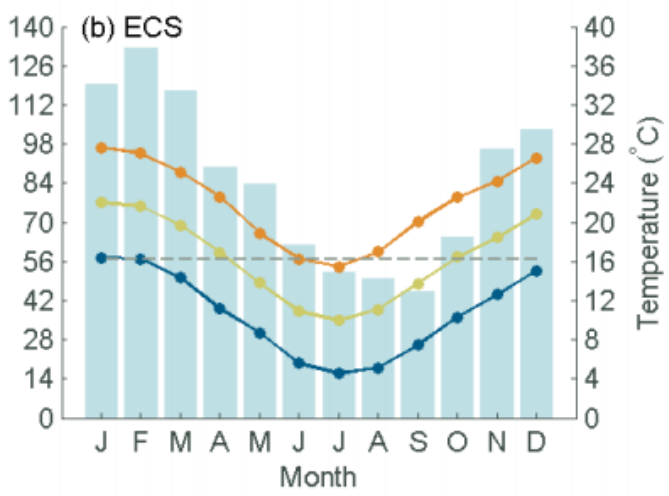


Figure 5 Projected Changes in Mean Rainfall, Magnitude of Annual Maximum 1-Day Rainfall, and Magnitude of 1 in 20-Year Rainfall Events for 2090 (CSIRO Climate Change Projections, East Coast Cluster Report 2015)

There is high confidence that whilst the intensity of heavy rainfall extremes will increase, the magnitude of change cannot be reliably projected (CSIRO Climate Change Projections, East Coast Cluster Report 2015). The trend of annual mean rainfall is unclear and tending toward decrease whilst increased magnitudes of extreme rainfall events are projected. The magnitude of the anticipated extremes of rainfall are highly dependent on the emission scenario and the future time period.

3.2.3 Average Rainfall



Rainfall has not shown any long-term trends, rather the East Coast cluster has experienced intermittent wetter and drier periods. The observed trends in rainfall throughout the East Coast cluster are not very significant, with low confidence in both the magnitude and sign of observed trends. (CSIRO Climate Change Projections, East Coast Cluster Report 2015)

Rainfall is projected to decrease in winter, consistent with a reduction in the number of storms (CSIRO Climate Change Projections, East Coast Cluster Report 2015).

Table 7 Camden Airport Average Seasonal Rainfall (Bureau of Meteorology) and Future Projections (CSIRO Climate Change Projections, East Coast Cluster Report 2015)

Season	Baseline (1981-2010)	2030 @ RCP8.5	2070 @ RCP8.5
Summer	80.67 mm	72.6 mm (-10%)	68.57 mm (-15%)
Autumn	70.53 mm	Little change	59.95 mm (-15%)
Winter	47.17 mm	40.09 mm (-15%)	40.09 mm (-15%)
Spring	59.1 mm	53.19 mm (-10%)	68.37 mm (-15%)

3.3 Sea Level Rise

Relative sea level has risen around Australia at an average rate of 1.4 mm per year between 1966 and 2009, and 1.6 mm per year after the influence of the El Niño Southern Oscillation (ENSO) on sea level is removed (CSIRO Climate Change Projections, East Coast Cluster Report 2015). Increasing global temperatures have a direct impact on sea level as the water expands with temperature and increases can also be expected from melting glaciers and ice caps. As temperatures are virtually certain to rise, sea levels are similarly virtually certain to rise, in line with IPCC predictions (CSIRO Climate Change in Australia Projections, 2015). There is very high confidence that sea level will continue to rise during the 21st century. In the near future (2030), the projected range of sea-level rise for the cluster coastline is 0.08 to 0.18 m above the 1986–2005 level, with only minor differences between RCPs (CSIRO Climate Change Projections, East Coast Cluster Report 2015). As the century progresses, projections are sensitive to emissions pathways. By 2090, RCP4.5 gives a rise of 0.30 to 0.65 m, and RCP8.5 gives a rise of 0.44 to 0.88 m (CSIRO Climate Change Projections, East Coast Cluster Report 2015).

Table 8 East Coast (South) Sea Level Predictions for 2090

IPCC Year Emissions Scenario	Sea Level Rise
RCP 4.5	0.14m
RCP 8.5	0.44-0.88m

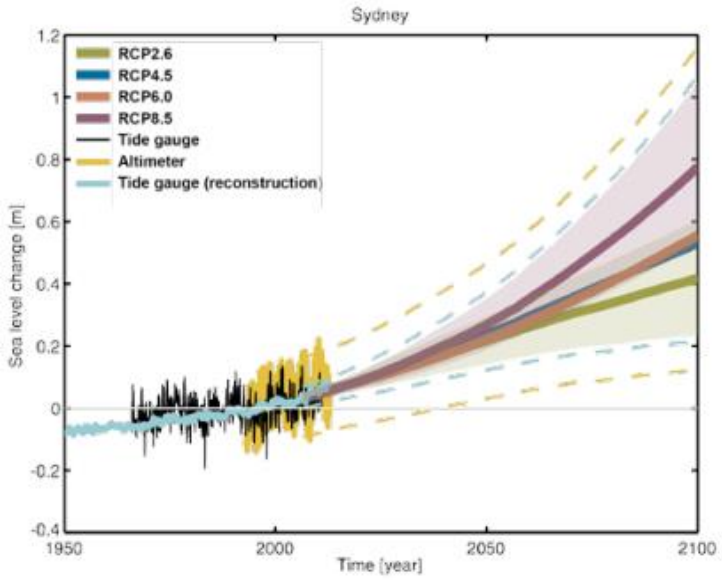


Figure 6 Observed and Projected Relative Sea Level Change (m) for Sydney (which has continuous records available (1966–2010) (CSIRO Climate Change Projections, East Coast Cluster Report 2015)

The new public school at Gregory Hills will be located approximately 118m above sea level – well above even the most extreme CSIRO Climate Change Projections. Sea level rise is, therefore, not an impact that is relevant to the project.

3.4 Gustier Wind Conditions

There is high confidence in little change to mean wind speed under RCP4.5 and RCP 8.5 scenarios by 2030. For 2090 changes are projected to remain small with medium confidence under RCP4.5, and winter wind speed is projected to reduce with medium confidence under RCP8.5. These reduced winter wind speeds are assumed to be due to a projected southward movement of storm tracks and the subtropical ridge, thus weakening westerly winds. There is medium confidence that there will be a reduction in extreme wind speeds (CSIRO Climate Change Projections, East Coast Cluster Report 2015).

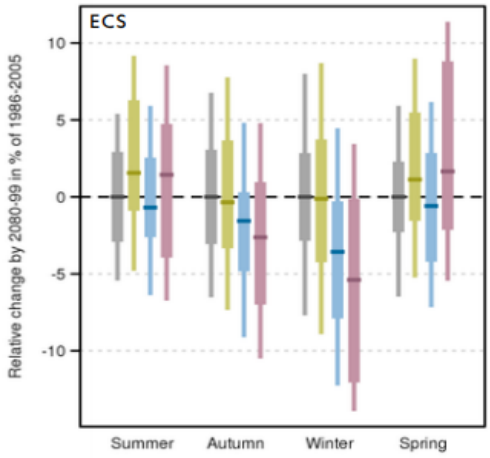


Figure 7 Projected Near-Surface Wind Speed Changes for 2090. Anomalies Are Given As A Percentage With Respect to the 1986-2005 Mean

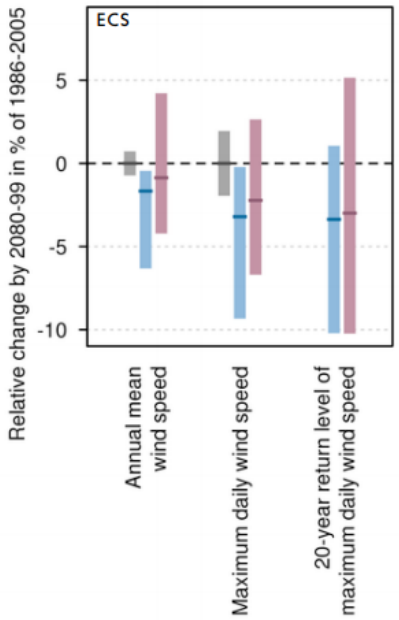


Figure 8 Projected Near-Surface Annual Mean Wind Speed, Annual Maximum Daily Wind Speed and the 20-year Return Value for the Annual Maximum Daily Wind Speed for 2090. Anomalies Are Given As A Percentage With Respect to the 1986-2005 Mean.

3.5 Solar Radiation & Relative Humidity

Solar radiation and relative humidity are projected to have little change for 2030 with high confidence. By 2090 there is medium confidence in a decrease in relative humidity and low confidence in increased winter and spring solar radiation with little change in other seasons (CSIRO Climate Change Projections, East Coast Cluster Report 2015).

Table 9 Camden Solar Radiation and Relative Humidity (CSIRO Climate Change Projections, East Coast Cluster Report 2015)

Climate Variable	Baseline	2030 @ RCP8.5	2070 @ RCP8.5
Yearly Average Daily Solar Radiation	16.1 MJ/m²	17.18 MJ/m² (+1.08%)	17.18 MJ/m² (+1.08%)
Yearly Average 3 pm Humidity	49% RH	Little change	Little change

3.6 Increased Evaporation Rates, Reduced Soil Moisture, and Runoff

There is high confidence that potential evapotranspiration will increase in the East Coast cluster in all seasons however, there is medium confidence about the magnitude of the increase. Changes to rainfall and evapotranspiration are projected to lead to a decrease in soil moisture, particularly in winter and spring, with medium confidence (CSIRO Climate Change Projections, East Coast Cluster Report 2015). There is low confidence that runoff will decrease by 2090 under RCP4.5 and RCP8.5 (CSIRO Climate Change Projections, East Coast Cluster Report 2015).

3.7 Bush Fire

Bushfire occurrence depends on four 'switches': 1) ignition, either human-caused or from natural sources such as lightning; 2) fuel abundance or load; 3) fuel dryness, where lower moisture contents are required for fire, and 4) suitable weather conditions for fire spread, generally hot, dry and windy (Bradstock, 2010). There is high confidence that climate change will result in a harsher fire-weather climate in the future. However, there is low confidence in the magnitude of the change, as this depends on the rainfall projection (CSIRO Climate Change Projections, East Coast Cluster Report 2015).

Table 10 Cluster Mean Annual Values of Maximum Temperature (°C), Rainfall (mm), Drought Factor, and Number of Severe Fire Danger days greater than 50 days per year (CSIRO Climate Change Projections, East Coast Cluster Report 2015)

Variable	1995 Baseline	2030 RCP4.5	2030 RCP8.5	2090 RCP4.5	2090 RCP8.5
T	24.9	26.0	26.3	27.2	28.8
R	1077	946	917	916	896
DF	6.3	6.4	6.5	6.6	6.9
SEV	0.9	1.1	1.3	1.3	2.1

4 RISK ASSESSMENT & ADAPTATION PLAN

4.1 Risk Management

Climate change adaptation is a risk management process just like any other risk considered by a successful modern business. The prioritisation of risk management actions comes from an informed understanding of the potential risks and the adaptation opportunities within the challenges ahead of us.

Modern business is ideally placed to tackle climate change, because businesses are inherently pragmatic and are used to change. However, the reason and time to act will be varied across the business community and must extend beyond legislated reporting of emissions and desire to curb energy use, to management of business risk for:

- Fiduciary liability
  - Fiduciary liability on Company Directors to consider and mitigate for climate change risk.
  - There is a real risk of 'litigation against a director who has failed to perceive, disclose or take steps in relation to a foreseeable climate-related risk that can be demonstrated to have caused harm to a company'. (Hutley SC, 2016)
- Risk disclosure
  - Publicly listed companies are increasingly being pressured to normalise their climate risk disclosure practices. Particularly as the world moves towards a carbon-constrained future.
- Financial risk
  - Long term financial planning. 'Climate change is a financial risk if you've got a long-term asset portfolio'. Paul Fisher who retired as deputy head of the Bank of England's Prudential Regulation Authority (climatealliance.org.au, 2016).
- Social license
  - Social license to operate. Failure to maintain your business social license with customers and the broader community at large has often resulted in real consequences for business operations because the market place is savage to businesses that ignore reality.

4.2 The Process

This Climate Adaptation Plan (CAP) for the new public school at Gregory Hills is the result of a collaborative and iterative risk management process engaging all relevant areas of the business as presented below:

- Step One: Climate projections with justification of modelling scenario
- Step Two: Risk management workshop records potential climate change impact and risk level
- Step Three: Risk management workshop records design and operational adaptation action and re-assessed risk level.

4.3 Step One: Before the Workshop – Establishing the Context

Prior to the stakeholder workshop, NDY established the frameworks for identifying and analysing the risks identified for the project in relation to the climate projection data to ensure a common understanding amongst project stakeholders.

A Consultant Advice Note (reference number G-001_ca220328s0011[1.0]) was issued by Justin Peberdy on 1st April 2022, prior to the workshop (Appendix B). This noted to stakeholders the difference between climate change mitigation versus adaption and summarised the following:

- The site specific climate change scenarios used to assume future changes
- The scope of the assessment including the boundaries, timescales and emissions scenarios utilized
- A 'Consequence Scale for Risk Assessment' and a 'Likelihood Scale for Risk Assessment' that would be required to be used in defining how the project risks would be defined and evaluated to measure the consequences, likelihoods and risk priorities for the project

- Set the priorities of the workshop as identifying and describing the risks posed by climate change for the development, rating these using the above scales, as well as identifying and evaluating potential adaptation actions to mitigate any risks identified as unacceptable.

4.4 Step Two: During the Workshop

The following stakeholders attended the workshop and/or included their views to contribute to the climate change assessment and analysis of risks for the project:

Attendees:

- Michael Ashe (Robert Bird – Structural and Civil)
- Rhys Baynham (Norman Disney & Young – Mechanical)
- Rhys Edwards (ACOR – Hydraulic)
- Matthew Haddrick (Bennett and Trimble Architecture)
- Kate Kelly (School Infrastructure NSW)
- Ares Liu (Jacobs)
- Brendan Madders (Jacobs)
- Sam McCartney (ACOR – Hydraulic)
- Glenn McIntosh (McIntosh & Phelps – Landscape Architecture)
- Tom Meggit (Norman Disney & Young – Electrical)
- Laukik Rane (School Infrastructure NSW)
- Michael Romanous (Robert Bird – Structural and Civil)
- Magdalena Socha (ACOR - Hydraulic)
- Marsia Sidoti (Jacobs)
- Marcus Trimble (Bennett and Trimble Architecture)
- Nicholas La Porta (Norman Disney & Young – Mechanical)
- Bill Vertsonis (School Infrastructure NSW)
- Chris Waite (Robert Bird – Structural and Civil)
- Cameron Walbran (Norman Disney & Young – Acoustics)
- Nick Woolley (Bennett and Trimble Architecture)

Facilitators:

- Claudia Burbidge (Norman Disney & Young – Sustainability)
- Justin Peberdy (Norman Disney & Young – Sustainability)
- Emily Howell (Norman Disney & Young – Sustainability)

All participants were provided with quantitative and descriptive information on the climate change scenarios and data produced by NDY's analysis.

The workshop generated a list of risks directly related to the site-specific data and project risks associated with climate change. These risks were then evaluated using knowledge of existing controls that are already designed to mitigate these risks, the consequences of the risks identified as well as the likelihood of their occurrence for this site. This, in turn, informed the priority rating for each risk identified in Table 12. The workshop included a brainstorming exercise to identify additional risk controls or future measures to reduce the risk of hazards at the site.

4.5 Step 3: After the Workshop

The risk register established for the project was circulated to all attendees and project stakeholders for comment on 12th April 2022. All outstanding items were collated by Claudia Burbidge at NDY and closed out and agreed by the project stakeholders by 20 April 2022.

As a result, the final table of risk items was identified and evaluated as the project-specific Climate Change Risk Register.

No 'High' or 'Extreme' risks were identified during the assessment.

All risk items identified had design elements and/or policies in place prior to this assessment to mitigate the risks identified.

4.6 Design Life of Asset

It is important to select a timeline relevant to the design life of the infrastructure components and one that is appropriate to cover the asset investment horizon, such as leasing tenure, as this will affect the climate projections used, the level of climate risk the asset may potentially be exposed to and the climate Adaptation response.

Where local data is available, it has been used in preference to larger-scale regional data. The time frame for the 'near future' is 2030, and for 'far future' are 2070 and 2090 depending on the available climate data.

4.6.1 5.2.2.1 Design Life

Design life is defined as the period within which an element of the works must continue to meet the performance and technical requirements for the project and remain within specified limits of reliability, availability and maintainability without major renewal beyond normal cyclic maintenance activities. It also benchmarks the requirements for durability.

The preliminary design life of asset elements are defined below.

Table 11 Design life of asset elements

Asset Type	Design Lifespan (Years)
Structure	50
Drainage (Civil and Hydraulic)	50
Building Pavement (Civil and Hydraulic)	50
Road pavement (Civil and Hydraulic)	15
Critical infrastructure systems – security & communications	25
HVAC	25
Façade	30
Materials and Finishes (Architectural elements)	20

4.7 Identifying Adaptation Actions and Reassessing Risk

Once climate risk ratings have been applied to potential climate change risks, adaptation actions are identified to reduce the risk rating of extreme, high, medium and low risk rated climate risks.

Generally, there are four possible approaches in responding to climate change:

- Avoid: Avoid locating assets in vulnerable areas or ignore and replace when required
- Adapt: Design systems and adaption measures to operate in predicted future climate conditions. There are two approaches: 1. Respond Now (future proof through current measures), OR Anticipate and Respond Later (enable future adaptive measures)
- Defend: Install defenses at or around critical infrastructure
- Retreat: Develop and implement plans to relocate from the vulnerable area.

The project has looked to incorporate the above 'Adapt' measures where risks to the project have been identified. These have either been through design considerations or through future-proofing the asset to allow for flexible responses that will allow for adaptive measures to be implemented in the future. To address potential climate change impacts and inform further design development and operational considerations, the mitigation measures are detailed in the Climate Change Risk Register spreadsheet (Table 12).

4.8 Green Star Requirements

A climate change risk assessment was undertaken as per AS 5334-2013 and Green Star Design & As Built v1.3 requirements using CSIRO projections for the East Coast (South) sub-cluster to identify expected impacts from climate change. A stakeholder workshop was undertaken to seek input from the design and construction team members to identify the likely risks associated with a changing climate and how these changes would impact on the project. Design mitigation strategies were developed to reduce the risks highlighted and design the building to be more resilient to future climate change. A climate change risk analysis was produced and identified no 'High' or 'Extreme' risks due to climate change impacts after design elements were considered for this project. Therefore, the credit criteria under Green Star' Adaptation and Resilience (Credit 3) is deemed as met.

4.8.1 Summary of initial and reassessed risks

Figure 9 Number of Risks Identified

Risk Rating	Year	Low	Medium	High	Extreme	Total
Number of risks based on existing controls	2030	12	6	0	0	18
	2070	8	10	0	0	18
Number of risks following adaptation measures	2030	15	3	0	0	18
	2070	13	5	0	0	18

4.8.2 Green Star Submission Requirements

Figure 10 Green Star Submission Requirements

Requirement	Design Review Submission	As Built Submission
Climate Adaptation Plan — Details of the two risk items that have been addressed by a specific design response — Details of any 'high' or 'extreme' risks	✓ This report	✓ This report
CV of professional that developed the Climate Adaptation Plan	✓ This report (Appendix A)	✓ This report (Appendix A)
Drawings and specifications demonstrating design responses to the Climate Adaptation Plan	✓ Design/construction phase documentation only	✓ As-Built drawings to be provided at Practical Completion
Commissioning report or other technical document demonstrating design responses to the Climate Adaptation Plan	Not applicable	✓ To be provided at Practical Completion

4.9 Review

As a minimum the Climate Adaptation Plan should be reviewed whenever the base information utilised to develop site specific climate change scenarios has been updated or every five (5) years, as good practice.

Table 12 Climate Change Risk Register (Adaptation Measures and Residual Risks Omitted)

Description of Hazard (Cause & Effect)	Aspect	Discipline	Project Design Responses	Timeframe 2030 @ RCP8.5			Timeframe 2090 @ RCP8.5		
				Conseq.	Likel.	Risk	Conseq.	Likel.	Risk
Surrounding sewer / stormwater infrastructure impacted by storm surge.	Extreme Rainfall	Civil, Architectural, Landscaping	Floor level to be a minimum of 500mm above the design 1-in-100 year flood levels. This will be reflected in the design development. Council requires 500mm freeboard - includes an adequate allowance for an increase in extreme rainfall intensity into 2070. Design is to meet ARR (Aus Rainfall and Runoff) Guidelines 2019, and council requirements. Increased rainfall has been taken into account in this area. A risk assessment for riparian corridor will be incorporated, with discharge points for sites to existing channels. Regarding surrounding sewer, Sydney Water operates externals in accordance with WSAA. Design is to be in line with the allowance for the % of surface water. The project team has an obligation to prevent surface water / stormwater from entering the system (AS3500). Ponding will be localised and intermittent / unpredictable. An overflow release gully is connected to existing site, so little concern for buildings.	Insignificant	Unlikely	Low	Insignificant	Possible	Low

Description of Hazard (Cause & Effect)	Aspect	Discipline	Project Design Responses	Timeframe 2030 @ RCP8.5			Timeframe 2090 @ RCP8.5		
				Conseq.	Likel.	Risk	Conseq.	Likel.	Risk
Structural stability of buildings and foundation systems affected by water table height increase causing changes to ground structure.	Extreme Rainfall Extreme Wind	Structural	Structural elements with potential flood exposure risk to be designed for a 1% AEP plus 500mm flood depth (max flood potential). The ground structure below has 1.5-8m of clay underlain by shale (sedimentary rock). New structure will be piered down to shale to avoid risk of heaving and shrinkage. A geotechnical engineer will be engaged to review the groundwater. Any characteristics (i.e salinity/pH) that may impact durability will be catered for in the concrete / steel / timber specifications. A wind code climate change factor will be applied, relating design around wind speeds and stability. The structure can be designed for future increase in wind loads due to climate change, by application of the climate change factor is AS1170.2.	Major	Rare	Low	Major	Rare	Low
Extended blackouts due to transmission infrastructure failure or capacity being exceeded.	Bushfire Extreme Wind Extreme Rainfall Extreme Temperature	Electrical & Comms, Mechanical	There is currently no generator on site. Potential provision to include a generator connection point which could double up as a permanent battery connection point back up may be explored. This is generally only required if the school will be used for community purposes.	Major	Possible	Medium	Major	Possible	Medium

Description of Hazard (Cause & Effect)	Aspect	Discipline	Project Design Responses	Timeframe 2030 @ RCP8.5			Timeframe 2090 @ RCP8.5		
				Conseq.	Likel.	Risk	Conseq.	Likel.	Risk
Health and pupil/staff performance impacts (e.g. heat stroke, lack of concentration) due to warmer temperatures / heatwaves / HVAC not maintaining internal conditions.	Extreme Temperature Extreme Rainfall	Mechanical	Use of light coloured materials, passive design elements, heat purging, and natural ventilation are all aspects that will be explored as a means to reduce both internal and external heat gains, and reduce HVAC cooling load. Shading on the facade will be designed to reduce direct solar load. Equipment life is 15-20 years so will be replaced by 2070. Current external design conditions are 32.5degC DB/20.1degC WB. Specification for heat rejection equipment requires plant to operate up to 45oC at derated capacity. Design implements outdoor air modulation that will reduce outdoor air load on the space. Balancing efficiency on the average day compared to meeting peak demands. Shading of play areas is to be implemented - looking into COLAs and provision for shaded water points. Sheltered play areas to be considered for rain days.	Insignificant	Likely	Medium	Insignificant	Almost Certain	Medium

Description of Hazard (Cause & Effect)	Aspect	Discipline	Project Design Responses	Timeframe 2030 @ RCP8.5			Timeframe 2090 @ RCP8.5		
				Conseq.	Likel.	Risk	Conseq.	Likel.	Risk
Accelerated material deterioration (colour fading or failure) due to solar radiation / higher temperatures.	Solar Radiation	Architectural	Light coloured materials utilised for building facades and roofing. Non-painted materials will be explored (galvanised sheeting). Specification of any painted materials will be investigated in detailed design phases to ensure selections are appropriate with respect to material deterioration due to solar radiation.	Moderate	Unlikely	Low	Moderate	Unlikely	Low
Water/hail entering ground floor or playing surfaces, or building flooding, as a result of overland flow / heavier rainfall events / localised flooding. Resulting water ingress due to surface runoffs and winds during extreme events.	Extreme Rainfall Sea Level Rise	Electrical & Comms, Civil, Architectural	The proposed design will be analysed against flood modelling. The site is located near a high point, with swales considered on lower points of site to reduce flood risk. Design to direct grades and water away from buildings. Minimisation of hardscape on the site is proposed. Cut off drains will also be used to safely discharge surface runoff to channels.	Moderate	Possible	Medium	Moderate	Possible	Medium

Description of Hazard (Cause & Effect)	Aspect	Discipline	Project Design Responses	Timeframe 2030 @ RCP8.5			Timeframe 2090 @ RCP8.5		
				Conseq.	Likel.	Risk	Conseq.	Likel.	Risk
Soft landscaping damage due to scouring or hail, or planting dieback due to extended periods of drought.	Extreme Rainfall Droughts	Landscape	Endemic planting to be utilised on site. Irrigation to be considered as part of the maintenance plans during extended periods of drought. Detail on provision of subsoil drip irrigation system and strategies to replace soft landscaping in the event of dieback to be explored in future design phases.	Minor	Possible	Medium	Minor	Possible	Medium
Smoke / dust impacting upon air quality, or accidentally shutting down air handling units that have smoke detectors. Airborne dust soiling ventilation filters more quickly than maintenance regimes allow for cleaning.	Dust Storms Bushfire	Mechanical	Manual operation of natural ventilation will be an option. In terms of mechanical systems, a management plan to ensure the filter is changed after an event will be put into place. These systems must also have the ability to be manually switched off to prevent smoke being introduced to the space. A bushfire consultant will review ingress protection for the A/C systems. Design will prioritise building sealing/air tightness is also to be a priority.	Major	Possible	Medium	Major	Possible	Medium

Description of Hazard (Cause & Effect)	Aspect	Discipline	Project Design Responses	Timeframe 2030 @ RCP8.5			Timeframe 2090 @ RCP8.5		
				Conseq.	Likel.	Risk	Conseq.	Likel.	Risk
Lightning strike due to increased intensity of storm events.	Hail / Snow / Lightning	Electrical	There will be surge protection to the main switchboard. Risk assessment to be undertaken to confirm whether lightning protection is required under AS for the site.	Catastrophic	Rare	Low	Catastrophic	Rare	Low
Roofing / roof-mounted equipment damaged by hail / lightning	Hail / Snow / Lightning	Mechanical	Condensers will not be located on the roof. If condenser fins are damaged, they can be combed back to remove dents. The buildings will utilise materials with a high level of durability / resilience such as metal deck roofing. Façade materials will be carefully selected for durability.	Moderate	Unlikely	Low	Moderate	Unlikely	Low
Façade damage by hail / lightning	Hail / Snow / Lightning	Architectural, Façade	Any glazed façades will be protected by covered walkways, large COLA's and sun shading screens will protect from hail and lighting. All other façade elements are prefinished CFC. Any sheet metal façade elements will be articulated to a recess in the facade and protected by first floor overhangs and sun shading screens. No glazed awnings are proposed.	Minor	Possible	Medium	Minor	Possible	Medium

Description of Hazard (Cause & Effect)	Aspect	Discipline	Project Design Responses	Timeframe 2030 @ RCP8.5			Timeframe 2090 @ RCP8.5		
				Conseq.	Likel.	Risk	Conseq.	Likel.	Risk
Fire protection system performance affected by reduced water supply pressure.	Bushfire	Fire Protection	Water for fire protection will be sourced from Sydney Water supply mains. Test results show acceptable flow rate, but low water supply pressure. No water storage tanks, so site is reliant on water agency supply. There are no water reliability concerns. The project team cannot control this as it is the water agency remit. Any on-site water storage will be subject to governance and additional funding.	Major	Rare	Low	Major	Unlikely	Medium
External materials being stained by settling of airborne ash (ember attack).	Bushfire	Architectural	Site is within bushfire-prone land and is being designed to comply with Bushfire Attack Level 12.5 requirements, AS 3959:2009. Maintainability and ease of cleaning will be considered in material selection.	Moderate	Unlikely	Low	Moderate	Unlikely	Low
Water needs of the site not met due to reduced rainfall and prolonged periods of drought.	Extreme Rainfall Droughts	Hydraulic, Landscaping, Architectural	Low flow, WELS rated tapware to be implemented. No reliance on rainfall for water needs. Landscape design includes a mandate to achieve irrigation supply from rainwater reuse. RWTs being implemented for irrigation purposes only. Endemic planting that is suitable to tolerate climatic conditions to be used.	Moderate	Unlikely	Low	Moderate	Possible	Medium

Description of Hazard (Cause & Effect)	Aspect	Discipline	Project Design Responses	Timeframe 2030 @ RCP8.5			Timeframe 2090 @ RCP8.5		
				Conseq.	Likel.	Risk	Conseq.	Likel.	Risk
Gutters, downpipes and inground stormwater network unable to handle the increase in 1-20 year rainfall event.	Extreme Rainfall	Hydraulic, Civil	No box butters planned. Eave gutters to be used. These have a front overflow to prevent water discharge falling back onto the building. There will be consideration of hail barriers 1-2m upstream along the pitch of the gutters. Some structural bracing would be required for this. Gutter sizing will meet AS3500 requirements.	Moderate	Possible	Medium	Moderate	Possible	Medium
Risk of any exposed or sub-soil hydraulic pipework cracking due to increased extreme weather conditions or soil changes	Extreme Temperature	Hydraulics, Civil	A geotechnical assessment of the current ground condition will be undertaken. Design likely to implement flexible pipe adaptors which allows expansion and nominal 12deg rotation where pipework goes from building to external.	Moderate	Unlikely	Low	Moderate	Possible	Medium
Extreme winds and dry weather could cause some trees to fall onto buildings or people.	Extreme Wind	Landscape, Architectural	A review of existing trees on site that may suffer heat stress and limb drop will be undertaken. The design team will avoid placing any high risk species near gathering spaces.	Major	Rare	Low	Moderate	Unlikely	Low

Description of Hazard (Cause & Effect)	Aspect	Discipline	Project Design Responses	Timeframe 2030 @ RCP8.5			Timeframe 2090 @ RCP8.5		
				Conseq.	Likel.	Risk	Conseq.	Likel.	Risk
Extreme temperature negatively impacting on the structural integrity of the buildings.	Extreme Temperature	Structural	The foundation level is acceptable. The project will investigate kit of parts and designing for re-use. Prefabrication off-site / in a warehouse may be considered to reduce risk. The project team will consider how changes in temperature may impact structural elements.	Moderate	Unlikely	Low	Moderate	Unlikely	Low

5 ASSUMPTIONS AND LIMITATIONS

The key assumptions underpinning this risk assessment are as follows:

- The purpose of the risk assessment is to highlight the potential for climate change induced risks and inform the decision-making process, which in turn enables the design and operation of climate resilient infrastructure
- Risk assessment and mitigation is a dynamic and iterative process for the duration of the asset's life cycle. This report is the first step in the process as described in the Green Star Requirements section
- The assessment of risks and possible adaptation measures is qualitative and not quantitative
- The climate change projections adopted are those that have been reasonably predicted for future climatic conditions. It should be noted that some projections currently involve a considerable degree of uncertainty
- The climate projections are regional, not localised (climate change modelling would be required to provide more localised data, which was not considered necessary for the purposes of this risk assessment), so their accuracy is limited and subject to the uncertainties of scientific and technical research; but sufficient for the purposes of this assessment with recommendations representing professional judgement.

6 RECOMMENDATIONS

The climate change risk assessment process has assessed the above risks, including existing controls, as being either 'low' or 'medium.' This is a reflection on the fact that the designers of the project have already incorporated a number of adaptation measures into the design.

The credit requirements of Green Star require that all high and extreme risks are identified and addressed by specific design responses however, no high and extreme risks were identified. The following table outlines the residual risk assessment following implemented adaptation measures.

Table 13: Residual Risk Following Adaptation Measures

Description of Hazard (Cause & Effect)	Aspect	Adaptation Measures	Residual 2030			Residual BAU 2070 @ RCP8.5		
			Conseq.	Likel.	Risk	Conseq.	Likel.	Risk
Gutters, downpipes and inground stormwater network unable to handle the increase 1-in-20 year rainfall event.	Extreme Rainfall	Consideration will be given to oversizing gutters to cater for potential rainfall intensity increase in the future.	Moderate	Unlikely	Low	Moderate	Possible	Medium
Health and pupil/staff performance impacts (e.g. heat stroke, lack of concentration) due to warmer temperatures / heatwaves / HVAC not maintaining internal conditions.	Extreme Temperature Extreme Rainfall	Addition of shaded water points and sheltered play areas to be incorporated into the design.	Insignificant	Possible	Medium	Insignificant	Likely	Medium
Water/hail entering ground floor or playing surfaces, or building flooding, as a result of overland flow / heavier rainfall events / localised flooding. Resulting water ingress due to surface runoffs and winds during extreme events.	Extreme Rainfall Sea Level Rise	Cut off drains to be incorporated to safely discharge surface runoff to channels. Swales to be implemented on lower points of site to reduce flood risk.	Minor	Unlikely	Low	Minor	Unlikely	Low
Fire protection system performance affected by reduced water supply pressure	Bushfire	Diesel-powered fire pressure pump to be located on site. Future provision of on-site storage supply to be investigated with respect to appropriate sizing and cost.	Major	Rare	Low	Major	Unlikely	Low

Smoke / dust entering facilities and impacting air quality. For conditioned spaces, smoke / dust accidentally shutting down air handling units that have smoke detectors, and airborne dust soiling ventilation filters more quickly than maintenance regimes allow for cleaning.	Dust Storms Bushfire	Building sealing/ envelope air tightness will be prioritised in design. Manual operation for natural ventilation. School to ensure policy/ procedure on dust storm or bushfire events is appropriate e.g. students and staff sent home, control strategy to shut off outside air, frequency of filter inspections and replacement, system cleaning relating to extreme or unusual weather events.	Major	Unlikely	Medium	Major	Unlikely	Medium
Extended blackouts due to transmission infrastructure failure or capacity being exceeded.	Bushfire Extreme Wind Extreme Rainfall Extreme Temperature	Addition of a generator connection point that could double as a permanent battery connection point to be included in the design.	Major	Rare	Low	Major	Unlikely	Medium
Extreme temperature negatively impacting on the structural integrity of the buildings.	Extreme Temperature	Structural analysis to ascertain the effect of temperature (incl. future temperature levels) on the structure.	Minor	Unlikely	Low	Minor	Unlikely	Low

NDY recommends that this adaption plan should be reviewed on a regular basis (every five years). This should include:

- Review of previous climate data and comparison with potential new climate predictions at the site
- Review of previously identified risks against the new climate projections, and evaluation of any new potential adaptation actions to mitigate any risks identified as unacceptable.

7 ASSUMPTIONS AND LIMITATIONS

The key assumptions underpinning this risk assessment are as follows:

- The purpose of the risk assessment is to highlight the potential for climate change induced risks and inform the decision-making process, which enables the design and operation of climate-resilient infrastructure.
- Risk assessment and mitigation is a dynamic and iterative process for the duration of the asset's life cycle. This report is the first step in the process
- The assessment of risks and possible adaptation measures is qualitative and not quantitative.
- The climate change projections adopted are those that have been reasonably predicted for future climatic conditions. It should be noted that some projections currently involve a considerable degree of uncertainty.
- The climate projections are regional, not localised, so their accuracy is limited and subject to the uncertainties of scientific and technical research. They are however sufficient for the purposes of this assessment with recommendations representing professional judgement.

8 APPENDIX A: CV

CLAUDIA BURBIDGE | SUSTAINABILITY ENGINEER

Claudia is a key member of the Sydney and NDY global sustainability group with experience in delivering end-to-end sustainability services across the built environment.

Claudia's experience in front-end strategy and advisory services is supported by her multi-disciplinary expertise in delivering sustainable building design solutions. Her knowledge covers sustainability strategy, carbon neutrality, ESG reporting, social risk analysis, Life Cycle Assessment, climate change adaptation, sustainability rating tools and occupant health and wellbeing. Motivated by holistic sustainability solutions, Claudia prioritises clear communication and stakeholder management to align with project aspirations and client objectives.

ARS EXPERIENCE

5 +

EXPERTISE

Sustainability Strategy
Carbon Neutrality
Social Risk Analysis
Sustainability Rating Tools
Life Cycle Assessment
Master planning
Healthy Buildings

QUALIFICATIONS

Bachelor of Engineering (Civil and Environmental),
WELL Accredited Professional,
Green Star Accredited Professional

PROFESSIONAL AFFILIATIONS

Green Star Accredited Professional (Design & As Built)
WELL Accredited Professional

OFFICE LOCATION

Sydney, New South Wales, Australia

EDUCATION

Westmead Public School, Westmead, New South Wales, Australia (2022)

Claudia has worked in a technical advisory role, delivering the climate change adaptation workshop, risk assessment, and climate adaptation plan for the project.

Matthew Pierce Public School, Baulkham Hills, New South Wales, Australia (2022)

Claudia has worked in a technical advisory role, delivering the climate change adaptation workshop, risk assessment, and climate adaptation plan for the project.

Darcy Road Public School, Wentworthville, New South Wales, Australia (2022)

Claudia has worked in a technical advisory role, delivering the climate change adaptation workshop, risk assessment, and climate adaptation plan for the project.

Castle Hill School, Castle Hill, New South Wales, Australia (2022)

Claudia has worked in a technical advisory role, delivering the climate change adaptation workshop, risk assessment, and climate adaptation plan for the project.

Oran Park Public School, Oran Park, New South Wales, Australia (2022)

Claudia has worked in a technical advisory role, delivering the climate change adaptation workshop, risk assessment, and climate adaptation plan for the project.

Gregory Hills Public School, Gregory Hills, New South Wales, Australia (2022)

Claudia has worked in a technical advisory role, delivering the climate change adaptation workshop, risk assessment, and climate adaptation plan for the project.

Bungendore High School, Bungendore, New South Wales, Australia (2021)

Claudia has worked in a technical advisory role, delivering the climate change adaptation workshop, risk assessment, and climate adaptation plan for the project.

Jerrabomberra High School, Jerrabomberra, New South Wales, Australia (2021)

Claudia has worked in a technical advisory role, delivering the climate change adaptation workshop, risk assessment, and climate adaptation plan for the project.

Richmond High School, Jerrabomberra, New South Wales, Australia (2021)

Claudia has worked in a technical advisory role, delivering the climate change adaptation workshop, risk assessment, and climate adaptation plan for the project.

Hawkesbury Centre of Excellence in Agricultural Education, Hawkesbury, New South Wales, Australia (2021)

Claudia has worked in a technical advisory role, delivering the climate change adaptation workshop, risk assessment, and climate adaptation plan for the project.

Mulgoa Rise Public School, Mulgoa Rise, New South Wales, Australia (2021)

Claudia has worked in a technical advisory role, delivering the climate change adaptation workshop, risk assessment, and climate adaptation plan for the project.

The University of Sydney, Camperdown Campus, Sydney, New South Wales, Australia

Custom Lighting Design Strategy

The University of Sydney, Sydney, New South Wales, Australia

Green Star Volume Certification.

9 APPENDIX B: PRE-WORKSHOP CONSULTANT ADVICE NOTE

CONSULTANT ADVICE

Project:	SINSW – Cluster F – Schools Projects			CAN No:	G-001[1.0]
Date:	1 April 2022	Project No:	40398 - 001	Pages:	4

Name	Company	Email
To:	All workshop attendees	

SUSTAINABILITY – CLIMATE CHANGE ADAPTATION: PRE-WORKSHOP NOTES

The purpose of this memorandum is to provide information to all stakeholders that will attend NDY's climate change adaptation workshop to facilitate the consultation process for establishing the Climate Adaptation Plans for the Schools Infrastructure NSW Cluster F schools projects. Information in this memorandum has been prepared for the Gregory Hills Public School and Oran Park Public School projects. Please familiarise yourself with this information before the workshop scheduled for **Tuesday 5th April 2022.**

Climate change adaptation is something quite distinct from climate change mitigation:

- Mitigation is about making climate change less severe
- Adaptation accepts that there will be some degree of climate change no matter how successful our combined mitigation efforts are - and looks to design buildings that are resilient to it. This will be the focus of our workshop.

This memorandum consists of the following parts:

- Climate Change Projections
- Consequence Scale for Risk Assessment
- Likelihood Scale for Risk Assessment.

The two 'time slices' that will be referenced throughout the risk assessment and adaptation planning process are +/-2030 (~Practical Completion + 10 years) and 2070 (+~50 year building life). The United Nations Intergovernmental Panel on Climate Change (IPCC) Representative Concentration Pathways (RCP) correspond to different greenhouse gas (GHG) concentration trajectories with each level based on different assumptions. RCP8.5 is representative of a high-emissions scenario, assuming that emissions continue to rise throughout the 21st century.

Climate change projection and baseline data has been sourced from CCIA (a joint BoM and CSIRO initiative), and baseline data has been sourced from BoM for the Camden area. Full references will be included in the final report.

The priorities for the workshop will be two-fold:

- Identify and describe risks posed by climate change to the development and rate the consequence and likelihood of each
- Identify and evaluate potential adaptation actions and/or design strategies to mitigate those risks which are deemed unacceptable.

CLIMATE CHANGE PROJECTIONS – CAMDEN AIRPORT AWS (STATION NO. 068192) SYDNEY EAST COAST (SOUTH) SUB CLUSTER

Climate Variable		Baseline	2030 @ RCP8.5	2070 @ RCP8.5	Commentary
Average Maximum Temperature	Summer	28.97° C	29.97° C *(+1° C)*	31.22° C *(+2.25° C)*	There is *very high confidence* in continued **substantial increases** in projected **mean, maximum and minimum temperatures**. By latein the century (2090), there is a large difference between scenarios. The projected range of warming is 1.3 to 2.5°C above the climate of 1986-2005 for RCP4.5 and 2.7 to 4.7°C for RCP8.5.
	Autumn	23.83° C	24.83° C *(+1° C)*	26.08° C *(+2.25° C)*	
	Winter	18.10° C	19.10° C *(+1° C)*	21.6° C *(+2.25° C)*	
	Spring	24.30° C	25.30° C *(+1° C)*	26.55° C *(+2.25° C)*	
Maximum Recorded Temperature		46.4° C *(18th Jan 2013)*	47.4° C *(+1° C)*	48.65° C *(+2.25° C)*	More hot days and warm spells are projected with *very high confidence*. Extreme temperatures are projected to increase at a similar rate to mean temperature, with **a substantial increase in the temperature reached on hot days, the frequency of hot days, and the duration of warm spells** *(very high confidence)*.
Number of Hot Days (over 35°C)		3.1 days	4.3 days **2030 RCP4.5*	11 days **2090 RCP8.5*	
Number of Hot Days (over 40°C)		0.3 days	0.5 days **2030 RCP4.5*	2.0 days **2090 RCP8.5*	
Average Rainfall	Summer	80.67 mm	72.6 mm *(-10%)*	68.57 mm *(-15%)*	Annual rainfall shows no long-term trend, however there has been prolonged periods of extensive drying throughout the 20th Century to the present, particularly in winter and spring. **Decreasing winter rainfall** is projected with medium confidence based on good understanding of the contributing underlying physical mechanisms driving this change (relating to a southward shift of winter storm systems).
	Autumn	70.53 mm	little change	59.95 mm *(-15%)*	
	Winter	47.17 mm	40.09 mm *(-15%)*	40.09 mm *(-15%)*	
	Spring	59.10 mm	53.19 mm *(-10%)*	50.24 mm *(-15%)*	
Highest Daily Rainfall		181.6mm *(10th Feb 2020)*	199.76 mm *(+10%)*	217.92 mm *(+20%)*	Increased intensity of extreme rainfall events is projected, with high confidence. Even though annual mean rainfall is projected to decrease in the region, projections indicate increases in extreme rainfall.
Time in Drought (%)		40%	50%	55%	**Time spent in drought** is projected to increase (low confidence) over the course of the century.
Fire Weather (Severe Fire Danger Days FFDI >50)		1.1 days	1.53 days 40% increase	2.3 days 110% increase **2090 RCP8.5*	There is high confidence that climate change will result in **a harsher fire-weather climate** in the future. However, there is low confidence in the magnitude of the change, though predicted to be extreme, as this is strongly dependent on rainfall projections, which as we have seen are declining in almost all seasons.
Sea Level Rise *Change relative to 1986-2005*		-	14cm above baseline	66cm above baseline **2090 RCP8.5*	There is very high confidence in future sea-level rise**. Mean sea level will continue to rise and height of extreme sea-level events will also increase** (very high confidence).
Yearly Average Daily Solar Radiation		16.1 MJ/m²	16.27 MJ/m² *(+1.08%)*	16.27 MJ/m² *(+1.08%)*	**Little change is projected for solar radiation** (high confidence), except for winter and spring increases.
Yearly Average 3pm Humidity		49% RH	little change	little change	A tendency for a decline in relative humidity away from coasts although changes in the near term will be small (high confidence).
Yearly Average 3pm Wind Speed		15.9 km/h	little change	little change	There is high confidence in little change.

CONSEQUENCE SCALE FOR RISK ASSESSMENT

Descriptor	Service Quality	Compliance	Infrastructure	Financial
Insignificant	Minor deficiencies in principle that would pass without comment	Concerns about compliance would be resolved without special attention	No infrastructure damage, little change to infrastructure service	Little financial loss or increase in operating expenses
Minor	Services would be regarded as satisfactory but personnel would be aware of deficiencies	Minor perceived or actual breaches of compliance would be resolved	Localised infrastructure service disruption, no permanent damage. Some minor restoration work required. Early renewal of infrastructure by 10-20%. Need for new/modified equipment	Additional operational costs. Financial loss is small <10%.
Moderate	Services would be regarded as barely satisfactory by the general public and the organisation's personnel	Formal action would be required to answer perceived breaches or charges of compliance failure	Limited infrastructure damage and loss of service. Damage recoverable by maintenance and minor repair. Early renewal of infrastructure by 20-50%	Moderate financial loss 10-50%
Major	The general public would regard the organisation's services as unsatisfactory	Significant amounts of management and advisers' effort would be required to answer charges of compliance failures	Extensive infrastructure damage requiring major repair. Major loss of infrastructure service. Early renewal of infrastructure by 50-90%	Major financial loss 50-90%
Catastrophic	Services would fall well below acceptable standards and this would be clear to all	Obvious and proven breaches of legal and regulatory requirements with the prospect of corporate or individual penalties	Significant permanent damage and/or complete loss of the infrastructure and infrastructure service. Loss of infrastructure support and translocation of service to other sites. Early renewal of infrastructure by >90%	Extreme financial loss >90%

LIKELIHOOD SCALE FOR RISK ASSESSMENT

Rating	Descriptor	Recurrent or event risks	Long term risks
Almost Certain	Could occur several times per year	Has happened several times in the past year and in each of the previous 5 years *or* Could occur several times per year	Has a greater than 90% chance of occurring in the identified time period if the risk is not mitigated
Likely	May arise about once per year	Has happened at least once in the past year and in each of the previous 5 years *or* May arise about once per year	Has a 60-90% chance of occurring in the identified time period if the risk is not mitigated
Possible	Maybe a couple of times in a generation	Has happened during the past 5 years but not in every year *or* May arise once in 25 years	Has a 40-60% chance of occurring in the identified time period if the risk is not mitigated
Unlikely	Maybe once in a generation	May have occurred once in the last 5 years *or* May arise once in 25 to 50 years	Has a 10-30% chance of occurring in the future if the risk is not mitigated
Rare	Maybe once in a lifetime	Has not occurred in the past 5 years *or* Unlikely during the next 50 years	May occur in exceptional circumstances, i.e. less than 10% chance of occurring in the identified time period if the risk is not mitigated

Should you have any queries or would like further information prior to the workshop please do not hesitate to contact me.

Regards,

NORMAN DISNEY & YOUNG

Emily Howell | Sustainability Graduate
E.Howell@ndy.com

10 INFORMATION SOURCES AND REFERENCES

Australia, Department of Environment and ABCB. (2016 (Amendment 1)). National Construction Code - Building Code of Australia. Australia: The Australian Building Codes Board.

Australia, Department of Climate Change. (2009). Climate Change 2009: Faster Change and More Serious Risks. Canberra.

ABCB. (2019). National Construction Code - Building Code of Australia. The Australian Building Codes Board.

ABCB, et al. (2005). International Fire Engineering Guidelines. The Australian Building Codes Board.

ACTFB. (2006). FS-02 Policy - Fire Engineered Alternative Design Solutions. Australian Capital Territory Fire Brigade.

Bradstock, R. A. (2010). A biogeographic model of fire regimes in Australia: current and future implications. In Global Ecology and Biogeography (pp. 145-158).

Built Environment Branch. (2013). GL-15 Fire Safety Engineered Alternative Solutions. Department of Fire & Emergency Services.

CSIRO. (2015). CSIRO Climate Change in Australia Projections.

CSIRO. (2015). CSIRO Climate Change in Australia Projections, East Coast Cluster Report.

IPCC AR4 (2007). IPCC, 2007: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M.Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

IPCC. (2013). Summary for Policymakers. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

IPCC. (2014). IPCC Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi,

Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1132 pp.

IPCC. (2014). IPCC WGII AR5 Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B:

MFB & CFA. (2011). GL-33 Performance Based Design within the Built Environment. MFB & CFA.

NIST. (2017). Fire Dynamics Simulator User's Guide. National Institute of Standards and Technology.

QFES. (2010). Guide to the Referral of Alternative Solutions. Queensland Fire and Emergency Service.

PMSEIC (2007). PMSEIC Independent Working Group 2007, Climate Change in Australia: Regional Impacts and Adaptation - Managing the Risk for Australia, Report Prepared for the Prime Minister's Science, Engineering and Innovation Council, Canberra, June.

Regional Aspects: Australasia. Reisinger, A., R.L. Kitching, F. Chiew, L. Hughes, P.C.D. Newton, S.S. Schuster, A. Tait, and P. Whetton, 2014: Australasia. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Barros, V.R., C.B. Field, D.J. Dokken, M.D. Mastrandrea, K.J. Mach, T.E. Bilir, M.

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NDY QA SYSTEM

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Project Leader:	Nicholas La Porta
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Description:	For SSDA

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Client Contact:	Alastair Burdon-Jones
Project Leader:	Jarrad Underwood
Editor:	Justin Peberdy

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