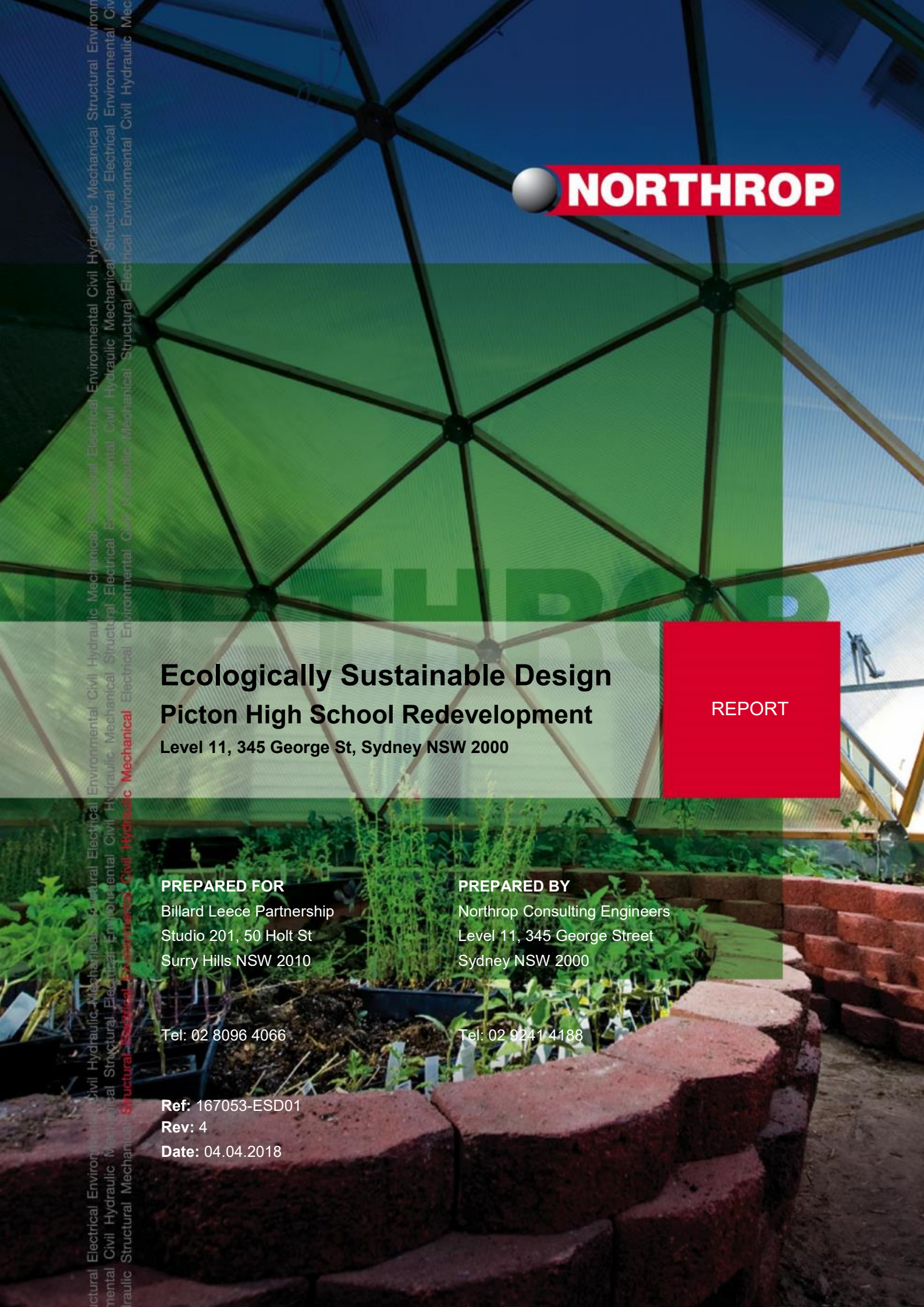

NORTHROP

# Ecologically Sustainable Design

## Picton High School Redevelopment

**Level 11, 345 George St, Sydney NSW 2000**

REPORT


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# SUSTAINABILITY – ESD REPORT

## Activity Schedule

| Date | Revision | Issue | Prepared By | Approved By |
|---|---|---|---|---|
| 16.05.2017 | 1 | Preliminary | BF | IVE |
| 12.01.2018 | 2 | Schematic Design | BF | IVE |
| 22.03.2018 | 3 | Section J Update | BF | IVE |
| 04.04.2018 | 4 | Final Issue | BF | IVE |
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# EXECUTIVE SUMMARY

This ESD report outlines how the proposed redevelopment for Picton High School has incorporated economic, social and environmental sustainability measures to produce progressive learning spaces that ensure the wellbeing and comfort of students and occupants.

The project is required to meet the design principles of the Educational Facilities Standards Guidelines (EFSG) and, consequently, targets a 5-star Green Star Design Review & As Built v1.1 (self-assessed) Rating.

This report outlines the sustainability initiatives that are being implemented to address the EFSG requirements and Green Star pathway. The significant design initiatives to be implemented include:

- A strong commitment to energy efficiency with the project design to demonstrate a 40% energy reduction over a standard construction building of its type;
- A highly efficient façade system designed to minimise heat gain into the building while promoting the entry of daylight into classroom spaces;
- Selection of low impact material and of certified materials;
- The use of highly efficient water fixtures and fittings, alongside a waterless heat rejection system;
- Implementation of renewable energy source in the form of solar PV cells to reduce peak electricity demand and reduce energy costs;
- Integration of the site into the surrounding bushland and community; and
- Conditioning spaces through naturally ventilation and an energy efficient in slab heating system, ensuring good indoor air quality and mitigating the health risks that come with water-based heat rejection.

Overall, the integration of these initiatives demonstrate the sites strong commitment to social, environmental and economic sustainability of the project.

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# 1. INTRODUCTION

## 1.1 Site Description

Picton High School is an educational facility located at 480 Argyle St (Old Hume Highway), Picton NSW 2571 within the Wollondilly Shire Council area. The school in its current stage is made up of separate buildings, demountables, sporting fields and agricultural land. The school has been gradually expanded at different stages since 1958 to accommodate the growing student cohort. There are approximately 1,000 students presently enrolled in between years 7-12.

The site is amidst a range of land uses, with residential housing to its North, commercial buildings to the South and rural land to the West.


***Figure 1:*** *Site Location*

## 1.2 Proposed Redevelopment

The proposed redevelopment of Picton High School is intended to accommodate 1,500 students with a capacity for the core facilities to serve 2,000 students for potential future growth. The preliminary masterplan concept suggests a progressive layout of the school to be organised in specific disciplinary and resource hubs. This is to be achieved through the development of new buildings, refurbishment of retained buildings and transforming aspects of the landscape and accessibility.

## 1.3 Sustainability Objectives

This report outlines measures to be taken to incorporate Ecologically Sustainable Design (ESD) principles into the school's redevelopment. However, the ESD strategy is expected to evolve and adapt over time as the design develops, and as such the assessed ESD credentials of the project may change.

The project has included the design principles of the Educational Facilities Standards and Guidelines (EFSG), which is further detailed in Section 2.

## 1.4 Disclaimer

Due care and skill has been exercised in the preparation of this advice.

No responsibility or liability to any third party is accepted for any loss or damage arising out of the use of this report by any third party. Any third party wishing to act upon any material contained in this report should first

# 2. EFSG SUSTAINABILITY TARGETS

## 2.1 Overview

The Educational Facilities Standards and Guidelines (EFSG) have been developed by the NSW Department of Education (DoE), to assist the management, planning, design, construction and maintenance of new and refurbished school facilities. The EFSG is to be treated as a reference guide that also provides a consistent standard of deliverables across various types of school developments.

The EFSG Design Guide considers a framework incorporating several aspects of design including extensive Ecologically Sustainable Development (DG02) requirements. The following categories are covered within the EFSG DG02 Design Guide:

- NSW Government Resource Efficiency Policy (GREP)
- Environmental Design Policies
- Environmental Design Features of Educational Facilities
- Insulation
- Ventilation
- Pesticides
- Water Conservation

The following sections outline how the project addresses each of the requirements of the EFSG DG02 Design Guideline, highlighting where targeted Green Star credits will address EFSG ESD policies.

## 2.2 NSW Government Resource Efficiency Policy

The NSW Government Resource Efficiency Policy's aim is to ensure that Government agencies minimise energy, water, waste resources and reduce harmful air emissions. By incorporating of the design principles of a 5 Star Green Star Design & As-Built rating the project exceeds the desired outcomes of this policy.

## 2.3 Environmental Design Policies

### 2.3.1 Green Building Design and Green Star

The EFSG DG02 Design Guide requires new buildings on an existing school site to achieve a minimum 4 Green Star – Education v1 Design & As- Built rating for assessing new school sustainable design principles. Since the development of the guideline, the Green Star – Education v1 Design & As-Built rating tool has been exhausted. The project is targeting a 5 Star Green Star – Design & As-Built v1.1 rating which has replaced the previous tool and is most applicable for this type of development.

### 2.3.2 Green Star Requirements

The project is targeting a 5 Star Design & As-Built v1.1 rating, exceeding the advised 4 Star rating in the EFSG DG02 Design Guide. Refer to Section 3 and Appendix A which outline the initiatives targeted under the Green Star Design & As-Built v1.1 rating tool for this project.

### 2.3.3 Environmental Management Plan

A site specific Environmental Management Plan (EMP) is required prior to the commencement of the relevant site works and is to be a condition of contract. The intent of this requirement is addressed under the following target revised Green Star credits under the new Design & As-Built v1.1 tool:

- Construction Environmental Management - 7.0 Environmental Management
- Construction Environmental Management - 7.1 Formalised Environmental Management Plan
- Responsible Building Materials – 20.3 Permanent Formwork, Pipes, Flooring, Blinds and Cables

### 2.3.4 Timber

The project will endeavour to support sustainably sourced timber that aligns to the below commitments:

- No Rainforest timbers to be used unless plantation grown
- No timbers from high conservation forests
- Use only recycled timber, engineered and glued timber composite products, timber from plantations or from sustainably managed regrowth forests.

Additionally, the Responsible Building Materials – 20.2 Timber Products is to be targeted under the Green Star Design & As-Built v1.1 rating tool which will complement the above initiatives, as discussed in Section 3.10.2.1.

### 2.3.5 Ecologically Sustainable Development

The ecologically sustainable development outcomes provided by the EFSG DG02 Design Guide are as follows:

- Ensure the preservation, maintenance and sustainable use of the community's natural and material assets.
- Protect and support biological and ecological diversity
- Restrict the flow of pollutants into our natural environment.

The development has proposed to address these ecological outcomes through the planting of native vegetation and promoting improved interaction with the natural environment. The project team aims to increase connectivity with the surrounding bushland and the nearby creeks. A subsurface stormwater retention system is also being sized to reduce dissolved pollutants from being discharged from the site.

### 2.3.6 Environmentally Friendly Materials/Products

Environmentally friendly materials and products are encouraged to be used on site. The project is targeting the use of materials and products which:

- Adequately and economically perform their intended functions, and also have lower adverse environmental impacts throughout their life cycle.
- Contain reduced or no hazardous substances (Low VOC)
- Reduce the demand for rare or non-renewable resources
- Are made from or contain recycled materials or can be recycled at the end of their useful life.

This policy is addressed in the Green Star Design and As-Built v1.1 rating tool under serval targeted credits including:

- Indoor Pollutants – 13.1 Paints, Adhesives, Sealants and Carpets (low VOC)
- Indoor Pollutants – 13.2 Engineered Wood Products (low formaldehyde)
- Life Cycle Impacts – 19B.1 Concrete (30% reduction in Portland cement)
- Life Cycle Impacts – 19B.3 Building Reuse
- Responsible Building Materials - 20.2 Timber Products

- Responsible Building Materials – 20.3 Permanent Formwork, Pipes, Flooring, Blinds and Cables

### 2.3.7 Conservation of Biological Diversity

The project aims to conserve for future generations, the biological diversity of genetic materials, species and ecosystem. The project is also to assess purchasing impacts on the natural environment during all project phases and adopt a precautionary approach where risk is high.

Conservation of biodiversity is a repeated focus throughout the initiatives proposed for the project.

### 2.3.8 Pesticide

It is proposed that no chemical pesticides and termiticide are to be used on site, which will be included in project Environmental Management Plan. For existing buildings in the redevelopment, chemicals are to be used only as a last resort for the eradication of infestations, and only with chemicals approved by the National Registration Authority and applied by a Pest Control Operator licensed by Workcover.

### 2.3.9 Waste

The EFSG DG02 requires consideration to eliminate unnecessary waste by better planning and more efficient use of natural and manufactured resources. The project is targeting several waste initiatives as part of the Picton High School Redevelopment sustainability strategy. This includes the associated materials and waste credits targeted in the Green Star Design & As-Built tool.

Effective waste management throughout demolition, construction and operation of the site will help to promote resource efficiency and minimise the adverse environmental impacts of the project. The following are being implemented as part of the design:

- Dedicated waste recycling spaces;
- Provision of accessible water sources for drinking water to reduce the use of bottled water on site;
- Provision of waste education resources linking with waste companies;
- Minimisation of construction and demolition waste sent to landfill; and
- Provision of separated waste streams for recycling and general waste.

## 2.4 Environmental Design Features of Education Facilities

To achieve favourable indoor environmental quality and comfort conditions with minimal energy consumption, the following design solutions are to be incorporated into the project.

### 2.4.1 Natural Light

The following design solutions are to be considered as part of the proposed design for Picton High School in effort to incorporate energy conservation principles into the development. The intention of incorporating good daylighting into the project is to minimise energy consumption and ongoing running costs and ultimately provide natural light for students. The project is to include:

- Natural daylight improves the indoor environmental quality of spaces and encourages beneficial learning.
- Natural daylight is to be provided to all teaching spaces unless identified otherwise.
- Natural daylight can be provided via windows, skylights, rooflights and the like. Where a room is required to have a brownout function, rooflights and skylights will need to include a method to sufficiently adjust light levels.

- Include daylight sensors to rooms to reduce light output or turn off lights when sufficient daylight is provided within the space.
- When the space is large, it is recommended that perimeter lighting is adjacent to windows be on a separate zone to make maximum use of daylight.

### 2.4.2 Sun Shading

External shading is to be incorporated as part of the building design to provide a good sense of thermal comfort to the building occupants and increase the energy efficiency of the building by minimising heat gain and the need for cooling energy.

### 2.4.3 Period Bells

To reduce luminaire energy consumption and running costs, period bells switching systems are to be incorporated where possible. Initiatives to encourage the use of Period Bells include:

- Period Bell Light switching systems in new buildings, major conversions and additions.
- All luminaires in rooms are to automatically turn off five minutes after the period bell has rung and all students have left the room. Alternatively include systems to turn off lights when the room is not in use
- A conscious decision is required to turn the lights on again

### 2.4.4 Appliances and Equipment

Minimum standards for new electrical appliances and equipment is to be compliant with the NSW Government Resource Efficiency Policy Part E3 and must have the minimum Greenhouse and Energy Minimum Standards (GEMS) star ratings as stipulated in the Policy.

### 2.4.5 Air Cooling and Heating Systems

Air cooling and heating systems proposed for the development are to incorporate the following:

- Timed or sensor operation functionality for all Air Cooling systems
- Centralised control of mechanical systems with programmable schedules for the school year
- Consideration of one single infrastructure for heating and cooling where it demonstrates whole life cycle cost savings.

As the school is being designed to be naturally ventilated, passive design principles are being utilised to achieve these objectives.

### 2.4.6 Electricity Meters

Electricity metering requirements of the Green Star Design and As-Built Rating tool are more stringent than what is suggested in the EFSG DG02 Guide. Therefore the project satisfies this requirement which assists lower electricity meter maintenance costs through selecting a fit for purpose meter and better access to energy consumption data at the school. Electricity meters (where provided) will be linked to an EMS System that will be able to provide real-time monitoring, useful for collecting and displaying data to facilities management and the building occupants.

### 2.4.7 Renewable Energy Generation

The project is sizing an optimal PV array within the project. Currently in consideration is a 50kW system with an allowance for up to 100kW. A PV system will provide onside renewable energy and will reduce the sites electricity consumption from the grid.

Building integrated PV that is applied as shading devices and building elements is also being investigated as an option for expanding the size of the onsite generation.

### 2.4.8 Insulation

Insulation is to be compliant with the Building Code of Australia under Section J, Part J1 Building Fabrics of the National Construction Code. The associated minimum compliance requirements of the development will be provided at a later stage of the development in the form of a Section J Assessment. Ultimately, the project aims to utilise passive building elements such as insulation to; keep heat out of classrooms in summer and provide warmth in winter.

An assessment of high performing building materials and insulation will assist to maximise the projects energy efficiency while managing acoustic and thermal comfort considerations.

### 2.4.9 Ventilation

Currently no artificial cooling has been proposed and the development is to be designed to be fully naturally ventilated. This is intended to maintain good environmental air quality through all school areas whilst minimising ongoing running costs and removing the requirement for specialists to operate and maintain a mechanical plant system.

### 2.4.10 Pesticides

As stated in Section 2.3.8 above no pesticides and termiticide are to be used on site in the proposed development.

### 2.4.11 Water Conservation

Practical water conservation measures, as outlined by the EFSG, have been incorporated into the project that also aligns with the Green Star credits concerning potable water use, as discussed in Section 3.9. These initiatives include:

- Implementing water efficient fixtures and fixtures with the highest WELS Star rating.
- Internal Flow Controllers to minimise water usage and wastage for staff amenities.
- Taps with timed flow for student amenities.
- Dual Flushing Cisterns and manual flushing.
- Waterless urinals where possible.
- Rainwater retention and reuse.
- Water-less heat rejection system.

# 3. GREEN STAR DESIGN & AS BUILT

## 3.1 Overview

The Green Star rating system is a comprehensive rating system for assessing environmental performance of Australian buildings.

The Green Star environmental rating system for buildings was created for the property industry in order to:

- Establish a common language;
- Set a standard of measurement for green buildings;
- Promote integrated, whole-building design;
- Recognise environmental leadership;
- Identify building life-cycle impacts; and
- Raise awareness of green building benefits.

The Green Star framework incorporates ESD principles which are grouped into nine categories. Points are awarded across each category for credits that are incorporated into the project to improve (or potentially improve) its environmental performance. These categories and associated credits are summarised in Section 3.2.

As stated in the EFSG's Ecologically Sustainable Development (DG02) guidelines, DoE requires any existing or new site to be able to achieve a minimum 4 Star Green Star rating and potentially be benchmarked to achieve a 5 Star Green Star rating.

Northrop Consulting Engineers has been engaged to provide ESD advice throughout the project to ensure that the design principles of a 5 star equivalent Green Star rating are incorporated into the building design. Section 3.3 to 3.12 outlines the strategies implemented into the Picton High School Redevelopment project to achieve the principles of a 5 Star rating under the Green Star Design and As Built v1.1 Submission Guidelines.

## 3.2 Rating Bands and Categories

Green Star awards achievement at 3 levels, depending on the points achieved after assessment by the independent panel:

- 4 Star – 45-59 points, recognising industry "Best Practice"
- 5 Star – 60-74 points, recognising "Australian Excellence"
- 6 Star – 75+ points, recognising the project as a "World Leader"

The Green Star rating systems is made up of the following credit categories:

***Table 1:*** *Green Star Environmental Categories*

| Category | Category Reference Code | Available Points |
|---|---|---|
| Management | Man | **14** |
| Indoor Environment Quality | IEQ | **17** |
| Energy | Ene | **22** |
| Transport | Tra | **10** |
| Water | Wat | **12** |
| Materials | Mat | **14** |
| Land Use and Ecology | Eco | **6** |
| Emissions | Emi | **5** |
| Innovation | Inn | **10** |

These categories are divided into individual credits, each of which addresses an initiative that improves or has the potential to improve a design, project or building's environmental performance. Points are awarded in each credit for actions that demonstrate the project has met the overall objectives for Green Star and the specific aims of the rating tool.

All credits are assessed for each category and the percentage score for the category is calculated. A weighting factor is then applied to each of the category scores to reach a single weighted score. Each category is weighted in line with current knowledge and industry practice to produce a rating that appropriately reflects ESD achievements obtained in a project.

## 3.3 Green Star Targeted Credits

The redevelopment is targeting 60.5 weighted points for a 5 Star Green Star rating which covers initiatives outlined in the credit categories listed below.

| LIST OF GREEN STAR CREDITS | | |
|---|---|---|
| **CATEGORY**/Credit | Available Points | Targeted Points |
| **MANAGEMENT** | | |
| Green Star Accredited Professional | 1 | 1 |
| Commissioning and Tuning | 4 | 3 |
| Adaptation and Resilience | 2 | 2 |
| Building Information | 2 | 2 |
| Commitment to Performance | 2 | 1 |
| Metering and Monitoring | 1 | 0 |
| Construction Environmental Management | 1 | 1 |
| Operational Waste | 1 | 1 |
| **INDOOR ENVIRONMENT QUALITY** | | |
| Indoor Air Quality | 4 | 4 |
| Acoustic Comfort | 3 | 1 |
| Lighting Control | 3 | 3 |
| Visual Comfort | 3 | 2 |
| Indoor Pollutants | 2 | 2 |
| Thermal Comfort | 2 | 1 |
| **ENERGY** | | |
| Greenhouse Gas Emissions | 20 | 10 |
| Peak Electricity Demand Reduction | 2 | 1 |
| **TRANSPORT** | | |
| Sustainable Transport | 10 | 2 |
| **WATER** | | |
| Potable Water | 6 | 4 |
| **MATERIALS** | | |
| Life cycle Impacts | 7 | 3 |
| Responsible Building Materials | 3 | 2 |
| Sustainable Products | 3 | 0 |
| Construction and Demolition Waste | 1 | 1 |
| **LAND USE AND ECOLOGY** | | |
| Ecological Value | 3 | 0 |
| Sustainable Sites | 2 | 1 |
| Heat Island Effect | 1 | 1 |

| | | |
|---|---|---|
| **EMISSIONS** | | |
| Stormwater | 2 | 2 |
| Light Pollution | 1 | 1 |
| Microbial Control | 1 | 1 |
| Refrigerant Impacts | 1 | 1 |
| **INNOVATION** | | |
| Innovation | 10 | 6 |
| | | |
| **TOTAL** | Available Points | Targeted Points |
| **Core Points** | 99 | 54.0 |
| **Category Percentage Score** | | 54.0 |
| **Innovation points** | 10 | 6.0 |
| **Total Score** | | 60.5 |

## 3.4 Management

The Management category promotes an integrated environmental management approach to all project stages including inception, design and construction phases, commissioning, tuning and operation of the building and its systems. The following credits will be targeted;

### 3.4.1 Accredited Professional

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

This will be achieved via the engagement of Northrop Consulting Engineers.

### 3.4.2 Commissioning and Tuning

#### 3.4.2.1 *Environmental Performance Targets*

To qualify for points under this credit the project team must set and document environmental performance targets for the project.

This will be demonstrated through the development (early in the design phase) of a design intent report or an owner's project requirements (OPR) document. This document must be prepared by the design team at the design phase stage and outline at least the following items:

- Description of the basic functions, operations, and maintenance of the nominated building systems including:
  - A description of its intended operation and maintenance requirements; and
  - A list of what the main components are (including controls), their operation and the importance of their efficient use.
- The targets for the project energy and water consumption and energy and water budgets for all nominated building systems.
- Description of how energy, water, and aspects of indoor environment quality are metered and monitored. This includes a meter diagram that illustrates how energy and water budgets are confirmed in operation.

### 3.4.3 Services and Maintainability Review

One point is awarded where a project team can demonstrate that a comprehensive services and maintainability review has been conducted, led by the head contractor or the owner's representative (or the Independent Commissioning Agent) during the design stage and prior to construction.

The services and maintainability review is to facilitate input from the design team, the facilities manager and operations staff (if known), and any relevant suppliers and subcontractors (if engaged). The review will address the following aspects for all nominated building systems:

- Commissionability;
- Controllability;
- Maintainability;
- Operability, including 'Fitness for Purpose'; and
- Safety

The services and maintainability review and its outcomes will be summarised in a 'Service and Maintainability Report'. This report will be agreed and signed off by the involved parties. Action items resulting from this review will be incorporated in the Design Intent Report or the Owner's Project Requirements document.

### 3.4.4 Building Commissioning

One point is awarded when a project team can demonstrate that the pre-commissioning and commissioning activities have been performed based on the approved standards and guidelines. To demonstrate compliance, the following must be documented:

- Commissioning specification – nominating design parameters for each system, required commissioning activities, how each system is intended to operate and acceptable tolerances during commissioning.
- Commissioning plan – outlining objectives or basis of the design, scope of the commissioning plan, individual responsibilities, sequence of commissioning, commissioning procedures, witnessing requirements, commissioning program and requirements for subcontractor commissioning manuals.

This will be demonstrated through the development of the commissioning documentation with the design team and the head contractor.

### 3.4.5 Building Systems Tuning

One point is awarded where, following practical completion and prior to occupation, the owner/client has formally committed to a tuning process for all nominated building systems. At a minimum, the commitment must include quarterly adjustments and measurement for the first 12 months after occupation and a review of building system manufacturer warranties. The scope of the tuning works will determine the relevant tuning period.

## 3.5 Adaption and Resilience

### 3.5.1 Implementation of a Climate Action Plan

To achieve two points in this credit, the project is to demonstrate how potential risks are being addressed, including the following:

- **Flooding**

  The project is to undergo a Flood Risk Assessment and ensure that allowances for extreme weather events are included in the design. Flood risks are to be managed with the incorporation of subsurface

stormwater retention and other landscaping considerations. The school area may also serve as a basin for the nearby residential housing and community.

- **Bushfires**

  The risk of bushfires is also to be considered given the neighbouring bushland. Given the proximity of residential housing, it is likely that the existing fire services would also mitigate risk of bushfires concerning the school site.

### 3.5.2 Building Information

#### *3.5.2.1 Building Operations and Maintenance Information*

One point is awarded where the project team can demonstrate that comprehensive building operation and maintenance information is available to the facilities management team. Compliance will be demonstrated with one document that includes Operations and Maintenance Information and the Building Log book, or by two separate documents that contain the same information.

#### *3.5.2.2 Building User Information*

One point is awarded where the project team can demonstrate that current building user information is available to all relevant stakeholders in accordance with the following requirements.

- Building user information is a source of up-to-date, relevant information for the 'building user' and made available in a digital format; and
- All building user information must be available to the building owner and facility management at the time of practical completion of the project.

### 3.5.3 Commitment to Performance

#### *3.5.3.1 Environmental Building Performance*

One point is awarded if at least 80% of the project's gross floor area (GFA), excluding car parking areas is covered with a commitment to set measure and report on its environmental performance. Compliance shall be demonstrated by providing a commitment to set, measure and report on two building performance metrics out of the following:

- Greenhouse Gas Emissions or Energy Targets
- Potable Water Targets
- Operational Waste Targets
- Indoor Environment Quality Targets.

The results of the performance monitoring shall be reported to relevant stakeholders, at least on a quarterly basis. The project team shall define all relevant stakeholders and the most appropriate reporting methods for each stakeholder group.

### 3.5.4 Construction Environmental Management

#### *3.5.4.1 Environmental Management Plan*

To qualify for points in this credit a project-specific best practice EMP must be developed and implemented, to assist the Principal/Head Contractor and its service providers manage environmental performance, conditions, and impacts arising from excavation, demolition and construction. The EMP must cover environmental impacts arising from construction works, and it must be site-specific.

#### *3.5.4.2 Formalised Environmental Management System*

The formalised Environmental Management System in use on site must have been certified by a third party organisation that provides independent verification of system compliance to ISO standards (or equivalent Australian Standards) and are members of the International Accreditation Forum. The Environmental Management System must be certified against one of the following standards: AS/NZS ISO 14001, BS 7750 or the European Community's EMAS.

A Principal/Head contractor which holds the accreditation is an acceptable method of demonstrating compliance for this requirement. In this case, the Principal/Head Contractor for each building and/or piece of infrastructure in the project site area must have a valid certificate before and throughout construction. All subcontractors must be required to adhere to the EMP conditions, and monitored for compliance.

In addition, project teams must report any nonconformities recorded by the EMS during construction. Where nonconformities with the EMS have been recorded, corrective and preventive actions must also be demonstrated to have been applied, in order for credit compliance to be achieved. Where there haven't been any nonconformities recorded, the project team must state so, supported by audit records, inspection reports or other equivalent documentation that forms part of the EMS.

### 3.5.5 Operational Waste – Facilities

One point is awarded where project teams meet the following three requirements:

- **Separation of waste streams:** Collection bins or storage containers shall be provided for building occupant use that allow for separation of all applicable waste streams. Separate bins or containers must be provided for general waste, paper and cardboard, glass, plastic, and at least one other waste stream.
- **Dedicated waste storage area:** A dedicated sufficiently sized area for the storage and collection of the applicable waste streams, shall be provided.

  The storage area must be sized to accommodate all bins or containers, for all applicable waste streams, for at least one collection cycle. The calculations used to demonstrate that the area provided is adequately sized to handle the recyclable waste streams specified must be based on waste generated by project and collection frequency for each waste stream.
- **Access to waste storage area:** Access requirements for waste collection areas must adhere to best practices outlined within third-party best practice guidelines.

## 3.6 Indoor Environment Quality

### 3.6.1 Indoor Air Quality

#### *3.6.1.1 Ventilation System Attributes*

One point is available where project teams can demonstrate that all of the following conditions are met:

- The entry of outdoor air pollutants is mitigated - The building services must be designed to comply with ASHRAE Standard 62.1:2013 in regards to minimum separation distances between pollution sources and outdoor air intakes.
- The system is designed for ease of maintenance and cleaning; and
- The system has been cleaned prior to occupation and use.

#### *3.6.1.2 Provision of Outdoor Air*

One point is awarded where outdoor air is provided at a rate 50% greater than the minimum required by AS 1668.2:2012, or CO2 concentrations are maintained below 800ppm.

An additional point is awarded where the outdoor air is provided at a rate 100% greater than the minimum require by AS 1668.2:2012, or CO2 concentrations are maintained below 700ppm.

As a fully naturally ventilated system has been proposed, the full two credit points are being targeted.

#### *3.6.1.3 Exhaust or Elimination of Pollutants*

A dedicated exhaust riser must be provided for photocopy rooms, kitchens and cooking equipment, and carpark exhausts. These exhausts must not recirculate air through spaces and must exhaust to outside. All exhaust facilities must be designed in accordance with AS 1668.2-2012.

### 3.6.2 Acoustic Comfort

#### *3.6.2.1 Internal Noise Levels*

One point is awarded where project teams demonstrate that internal ambient noise levels, in the nominated area, are no more than 5dB (A) above the “satisfactory” sound levels provided in Table 1 of AS/NZS 2107:2000.

The noise measurement and documentation must be provided by a qualified acoustic consultant in accordance with AS/NZS 2107:2000.

### 3.6.3 Lighting Comfort

#### *3.6.3.1 Minimum Lighting Comfort*

To qualify for points in this credit project teams must demonstrate that all lights in the nominated area are flicker free and accurately address the perception of colour in the space.

- Flicker-free lighting refers to luminaires that have either:
- A minimum Class A1 & A2 ballast;
- High frequency ballasts for all fluorescent lamps, or
- Electronic ballasts in High Intensity Discharge (HID) lighting.

#### *3.6.3.2 General Illuminance and Glare Reduction*

One point is awarded where project teams can demonstrate that, in the nominated area, lighting levels comply with best practice guidelines for Office Spaces; corresponding to Table 3.1 of AS 1680.2.

In addition glare is to be eliminated in accordance with Prescriptive Pathway A where; all bare light sources must be fitted with baffles, louvers, translucent diffusers, ceiling design, or other means that obscures the direct light source from all viewing angles of occupants, including looking directly upwards.

#### *3.6.3.3 Surface Illuminance*

One point is awarded where project teams can demonstrate that, in the nominated area, a combination of lighting and surfaces improve uniformity of lighting to give visual interest. To achieve compliance, all the spaces in the nominated area must have:

- An average surface reflectance for ceilings of at least 0.75 for at least 90 percent of the ceiling; and
- A direct/indirect lighting system is present such that the ceiling area has an average surface illuminance of at least 30% of the lighting levels on the working plane.

#### 3.6.3.4 *Localised lighting Control*

One point is awarded where the project teams can demonstrate that, in a nominated area, occupants have the ability to control the lighting in their immediate environment. This included turning the lights on and off and adjusting their light levels.

LED lighting has been proposed with dimmable and switchable control integrated with daylight availability and occupancy of spaces. All old luminaires from retained existing buildings will be upgraded.

Improved lighting energy also reduces the heat loads within the spaces and, consequently, lower the energy used to condition the classroom areas.

### 3.6.4 Visual Comfort

#### *3.6.4.1 Glare Reduction*

To qualify for points in this credit project teams must demonstrate that glare from sunlight through all viewing façades in the nominated area is reduced through a combination of blinds, screens, fixed devices, or other means.

#### *3.6.4.2 Daylight*

One point has been targeted in this credit, where project teams are required to demonstrate that 40% of the nominated area receives high levels of daylight during 80 percent of the nominated occupied hours.

#### *3.6.4.3 Views*

One point is available where project teams can demonstrate that at least 60% of the nominated area has a clear line of sight to a high quality internal or external view. All floor areas within 8m from a compliant window, atrium, or view can be considered to meet this credit criterion.

This objective aligns with the intention to increase the connection of the development with the surrounding landscape and also improve visibility for security reasons.

### 3.6.5 Indoor Pollutants

#### *3.6.5.1 Paints, Adhesives, Sealants and Carpets*

One point is available where at least 95% of all internally applied paints, adhesives, sealants and carpets meet stipulated 'Total VOC Limits' (TVOC), or, where no paints, adhesives, sealants or carpets are used in the building.

Maximum TVOC limits for paints, adhesives and sealants are detailed in Table 2 below:

***Table 2:*** *Maximum TVOC Limits for Paints, Adhesives and Sealants*

| **Product Category** | **Max TVOC content in grams per litre (g/L) of ready to use product** |
|---|---|
| General purpose adhesives and sealants | 50 |
| Interior wall and ceiling paint, all sheen levels | 16 |
| Trim, varnishes and wood stains | 75 |
| Primers, sealers and prep coats | 65 |
| One and two pack performance coatings for floors | 140 |
| Acoustic sealants, architectural sealant, waterproofing membranes and sealant, fire retardant sealants and adhesives | 250 |
| Structural glazing adhesive, wood flooring and laminate adhesives and sealants | 100 |

To demonstrate compliance for the use of carpets all products will be certified under a recognised Product Certification Scheme or other recognised standards. The product certificate will be current at the time of specification.

#### *3.6.5.2 Engineered Wood Products*

One point is available where at least 95% of all engineered wood products including: particleboard, plywood, Medium Density Fibreboard (MDF), Laminated Veneer Lumber (LVL), High-Pressure Laminate (HPL), Compact Laminate and decorative overlaid wood panels meet stipulated formaldehyde limits or no new engineered wood products are used in the building.

All engineered wood products used in the building will meet the relevant limits specified in the table below as per the specified test protocol, or have product specific evidence that it contains no formaldehyde.

***Table 3:*** *Formaldehyde Emission Limit Values for Engineered Wood Products*

| **Test Protocol** | **Emission Limit/Unit of Measurement** |
|---|---|
| AS/NZS 2269:2004, testing procedure AS/NZS 2098.11:2005 method 10 for Plywood | ≤1mg/ L |
| AS/NZS 1859.1:2004 - Particle Board, with use of testing procedure AS/NZS 4266.16:2004 method 16 | ≤1.5 mg/L |
| AS/NZS 1859.2:2004 - MDF, with use of testing procedure AS/NZS 4266.16:2004 method 16 | ≤1mg/ L |
| AS/NZS 4357.4 - Laminated Veneer Lumber (LVL) | ≤1mg/ L |
| Japanese Agricultural Standard MAFF Notification No.701 Appendix Clause 3 (11) - LVL | ≤1mg/ L |
| JIS A 5908:2003- Particle Board and Plywood, with use of testing procedure JIS A 1460 | ≤1mg/ L |
| JIS A 5905:2003 - MDF, with use of testing procedure JIS A 1460 | ≤1mg/ L |
| JIS A1901 (not applicable to Plywood, applicable to high pressure laminates and compact laminates) | ≤0.1 mg/m²hr* |
| ASTM D5116 (applicable to high pressure laminates and compact laminates) | ≤0.1 mg/m²hr |
| ISO 16000 part 9, 10 and 11 (also known as EN 13419), applicable to high pressure laminates and compact laminates | ≤0.1 mg/m²hr (at 3 days) |
| ASTM D6007 | ≤0.12mg/m³** |
| ASTM E1333 | ≤0.12mg/m³*** |
| EN 717-1 (also known as DIN EN 717-1) | ≤0.12mg/m³ |
| EN 717-2 (also known as DIN EN 717-2) | ≤3.5mg/m²hr |

*mg/m²hr may also be represented as mg/m²/hr.

**The test report must confirm that the conditions of Table 3 comply for the particular wood product type, the final results must be presented in EN 717-1 equivalent (as presented in the table) using the correlation ratio of 0.98.

***The final results must be presented in EN 717-1 equivalent (as presented in the table), using the correlation ratio of 0.98.

### 3.6.6 Thermal Comfort

One point is awarded where project teams demonstrate that, for 95% of the nominated area and 98% of the year, a high degree of thermal comfort is provided. For naturally ventilated spaces, the project team will demonstrate that internal temperatures in each space are within 80% of Acceptability Limit 1 of ASHRAE Standard 55-2013, in accordance with 14.1.1.

## 3.7 Energy

Through the 'Energy' category, Green Star - Design & As Built aims to facilitate reductions in greenhouse gas emissions by facilitating efficient energy usage and encouraging the utilisation of energy generated by low-emission sources.

### 3.7.1 Greenhouse Gas Emissions – Comparison to a Reference Building Pathway

Up to 20 points are available where it is demonstrated that there is a specified reduction in the predicted energy consumption and GHG emissions of the proposed building.

Points are awarded based both on improvements to the building's façade, and on the project's predicted ability to reduce its energy consumption and emissions towards 'net zero'.

Prediction of the building performance against this benchmark is assessed using building performance modelling that assesses potential energy use for building services systems including:

- Mechanical Services
- Electrical Services
- Communications, AV and security systems
- Hydraulic Services
- Vertical Transportation Systems

The project will be targeting 10 points which correlates to a reduction of 20% improvement on building fabric and 40% reduction for the building overall.

### 3.7.2 Peak Electricity Demand Reduction – Reference Building

One point is awarded where it is demonstrated that on-site generation sources reduces the peak electricity demand by at least 15%.

Peak electricity demand is the predicted annual peak calculated as the sum of all distribution boards (to include all miscellaneous loads) relevant to the building as shown in the as-installed electrical schematics.

Peak electricity demand must be calculated in line with the below requirements:

- In accordance with AS/NZS 3000:2007 (or as subsequently amended);
- As the absolute design capacity of the system, after the application of diversity factors, but prior to the application of contingency factors as required for utility agreements (the value is likely to be about 30% less than that for the utility agreement); and
- To include all building end-use loads, except process loads, in the peak demand assessment.

## 3.8 Sustainable Transport

Sustainable transport criteria aims to provide design and operational measures that reduce the carbon emissions arising from occupant travel to and from the project, when compared to a benchmark building.

### 3.8.1 Access by Public Transport

In the site plans, efforts to create a more efficient and safer school bus stop are intended to encouraging the use of school buses and increasing the capacity for potentially more buses given that there is an expected growth in students. One point is available in this credit given that this can be demonstrated.

### 3.8.2 Reduced Car Parking Provision

One point is available where there is a reduction in the number of car parking spaces in the proposed building when compared to a standard practice building. Minimal car parking will be provided, including a reduction in parking spaces prior to development. A max ratio of 1:30 for peak building occupancy to car parking spaces is to be demonstrated.

## 3.9 Water

The aim of the credit is to encourage building design that minimises potable water consumption in operations. The potable water credit will be addressed as follows;

### 3.9.1 Sanitary Fixture Efficiency

One point is awarded where all fixtures are within one star of the WELS rating stated in the table below:

***Table 4:*** *Sanitary Fixture Efficiencies*

| Fixture / Equipment Type | WELS Rating |
|---|---|
| Taps | 6 Star |
| Urinals | 6 Star |
| Toilet | 5 Star |
| Showers | 3 Star (> 4.5 but <= 6.0) |
| Clothes Washing Machines | 5 Star |
| Dishwashers | 6 Star |

The project aims to use fixtures that are in line with the above table.

### 3.9.2 Rainwater Reuse

One point is awarded when a rainwater tank is installed to collect and reuse rainwater, within the project's site boundary, and the total harvested rainwater storage capacity is circa 100kL for the development. Existing rainwater tanks can be reused for this purpose. Reuse of harvested stormwater runoff can also be included in the total storage. This harvested water is intended to supply non-potable uses such as toilet flushing, irrigation and appropriate agricultural purposes.

### 3.9.3 Heat Rejection Water

Two points are awarded where no water is used for heat rejection. No water-based mechanical plant or artificial cooling has been proposed for the development, with the objective to rely on natural ventilation.

To claim that the project is naturally ventilated, it must be demonstrated that the building is naturally ventilated in accordance with AS1668.4-2012 The use of ventilation and air-conditioning in buildings – Part 4: Natural Ventilation of buildings. To claim that no water based heat rejection system is used it must be demonstrated that the air conditioning needs of the project are met by means other than water based heat rejection.

## 3.10 Materials

The aim of the materials credits is to reward projects that include building materials that are responsibly sourced or have a sustainable supply chain.

### 3.10.1 Life Cycle Impacts

#### *3.10.1.1 Concrete*

Portland cement content reductions, measured by mass across all concrete used in the project compared to the reference case, rewards one points for a 30% reduction and two points for 40%.

One point is available where the mix water for all concrete mixes used in the project contains at least 50% captured or reclaimed water, and one of the following criteria is met:

- At least 40% of coarse aggregate in the concrete is crushed slag aggregate or another alternative materials (measured by mass across all concrete mixes in the project), provided that use of such materials does not increase the use of Portland cement by over five kilograms per cubic meter of concrete; or,

- At least 25% of fine aggregate (sand) inputs in the concrete are manufactured sand or other alternative materials (measured by mass across all concrete mixes in the project), provided that use of such materials does not increase the use of Portland cement by over five kilograms per cubic meter of concrete.

#### *3.10.1.2 Steel*

To achieve one point in this credit, the project team will demonstrate that there is a reduction in the mass of steel framing used when compared to standard practice. The reduced mass of steel framing can be demonstrated if 95% of the steel used is graded as high strength steel, verified by manufacturer's specifications.

#### *3.10.1.3 Building Reuse*

Existing buildings are being retained and refurbished from the site where the building fabric or structure is being reused. It will be demonstrated that over 40% in Gross Floor Area of the site is being repurposed or upgraded to achieve one point in this credit.

### 3.10.2 Responsible Building Materials

#### *3.10.2.1 Timber Products*

One point is available where at least 95% (by cost) of all timber used in the building and construction works is either:

- Certified by a forest certification scheme that meets the GBCA's 'Essential' criteria for forest certification; or
- Is from a reused source.

#### *3.10.2.2 Permanent Formwork, Pipes, Flooring, Blinds and Cables*

One point is available where 90% (by cost) of all cables, pipes, flooring and blinds in a project either:

- Do not contain PVC and have an Environmental Product Declaration (EPD); or
- Meet Best Practice Guidelines for PVC.

### 3.10.3 Construction and Demolition Waste – Percentage Benchmark

This project will meet the credit criteria for one point via a percentage benchmark approach, where one point is awarded where project teams can demonstrate that 90% of the waste generated during construction and demolition has been diverted from landfill. Waste is to be reported in kilograms of waste per square meter of GFA as well as a percentage. Compliance verification summaries of the waste contractor and waste processing facilities must be provided.

## 3.11 Land Use and Ecology

The Green Star - Design & As Built 'Land Use & Ecology' category aims to reduce the negative impacts on sites' ecological value as a result of urban development and reward projects that minimise harm and enhance the quality of local ecology.

### 3.11.1 Sustainable Sites

At date of option contract, the site did not include an old growth forest or wetland of 'High National Importance' and did not impact on 'Matters of National Significance', thus compliant to achieve points in this credit.

#### *3.11.1.1 Reuse of Land*

One point is awarded as 75 percent of the site was previously developed land, consisting of the existing school currently to be redeveloped.

### 3.11.2 Heat Island Effect Reduction

One point is awarded where at least 75% of the whole site area (when assessed in plan view) comprises of one or a combination of the following:

- Vegetation;
- Green roofs;
- Roofing materials, including shading structures, having the following:
    - For roof pitched <15°– a three year SRI >64; or
    - For roof pitched >15°– a three year SRI >34.
- Only where the three year Solar Reflectance Index (SRI) for products is not available, use the following:
    - For roof pitched <15°– an initial SRI > 82; or
    - For roof pitched >15°– an initial SRI > 39.
- Unshaded hard-scaping elements with a three year SRI > 34 or an initial SRI > 39;
- Hard-scaping elements shaded by overhanging vegetation or roof structures, including solar hot water panels and photovoltaic panels;
- Areas directly to the south of vertical building elements, including green walls and areas shaded by these elements at the summer solstice.

## 3.12 Emissions

The Green Star - Design & As Built 'Emissions' category aims to assess the environmental impacts of 'point source' pollution generated by projects. Negative impacts commonly associated with buildings include damage to the environment through refrigerant leaks or disturbances to native animals and their migratory patterns as a result of light pollution.

### 3.12.1 Stormwater

#### *3.12.1.1 Reduced Peak Discharge*

One point is available where the post-development peak event discharge from the site does not exceed the pre-development peak event discharge using the design Average Recurrence Interval (ARI) that corresponds to the associated flooding risk identified in the Climate Change and Adaption Assessment undertaken as part of the Adaption and Resilience credit.

#### *3.12.1.2 Reduced Pollution Targets*

An additional point is available if the Reduced Peak Discharge criterion is achieved and if it can be demonstrated that all stormwater discharged from the site meets the pollution reduction targets in Table 5.

***Table 5:** Minimum Pollution Reduction Targets*

| Pollutant | Reduction Target (% of the Typical Urban Annual Load) |
|---|---|
| Total Suspended Solids (TSS) | 80% |
| Gross Pollutants | 85% |
| Total Nitrogen (TN) | 30% |
| Total Phosphorus (TP) | 30% |
| Total Petroleum Hydrocarbons | 60% |
| Free Oils | 90% |

### 3.12.2 Light Pollution

#### *3.12.2.1 Light Pollution to Neighbouring Bodies*

To qualify for points under this credit project teams must demonstrate that all outdoor lighting on the project complies with AS 4282:1997. The conditions shall be applied to all inhabited boundaries, apart from boundaries with roads.

#### *3.12.2.2 Light Pollution to Night Sky*

One point is awarded where it can be demonstrated that one of the following specified reductions in light pollution has been achieved by the project.

- Control of upward light output ratio (ULOR) by demonstrating that no external luminaire on the project has a ULOR that exceeds 5%, relative to its actual mounted orientation; or
- Control of direct luminance- demonstrate that direct illuminance from external luminaries on the project produces a maximum initial point illuminance value no greater than:
  - 0.5 Lux to the site boundary, and
  - Lux to 4.5 metres beyond the site into the night sky.

### 3.12.3 Microbial Control - Legionella Impacts from Cooling Systems

One point is awarded in this credit point as it relies on natural ventilation rather than a water-based cooling system, mitigating risks from Legionella.

### 3.12.4 Refrigerant Impacts

This project adopts a building system that not does employ refrigerants, achieving one point in this credit.

## 3.13 Innovation

The Green Star – Design & As Built 'Innovation' category aims to recognise the implementation of innovative practices, processes and strategies that promote sustainability in the built environment.

### 3.13.1 Innovative Technology or Process

**Hydronic Heating**

The implementation of Natural Ventilation with in slab heating linked to a heat pump hot water system is an innovative system that has not been implemented in a public educational facilities in the past. It represents a significant change from the traditional use of in room un-flued gas heaters and will result in significant energy savings as well as major improvements in the health and wellbeing of students within the spaces.

### 3.13.2 Market Transformation

**Hub-based Learning Spaces**

Through the use of hub based learning the school will provide support for new learnings techniques and will provide support for an industry transformation around the benefits of clustered education. The Hub Based learning style allows students to learn at a variety of rates creating a collegiate atmosphere and encourages collaboration in an open learning environment.

### 3.13.3 Improving on Green Star Benchmarks

**Stormwater**

Through the use of onsite detention and stormwater treatment the site will likely exceed the targets for stormwater quality within the Green Star Pollution Reduction Benchmarks. One point can be achieved by meeting the Pollution Reduction Targets in Table 6:

***Table 6:*** *Increased Pollution Reduction Targets*

| Pollutant | Reduction Target (% of the Typical Urban Annual Load) |
|---|---|
| Total Suspended Solids (TSS) | 80% |
| Gross Pollutants | 90% |
| Total Nitrogen (TN) | 45% |
| Total Phosphorus (TP) | 60% |
| Total Petroleum Hydrocarbons | 90% |
| Free Oils | 90% |

### 3.13.4 Innovation Challenge – Financial Transparency

The costs of the sustainable measures implemented in this project will be disclosed to the industry to provide clear information about the value proposition and benefits of sustainable building practices with the intention to encourage the uptake of such practices.

### 3.13.5 Innovation Challenge – Contractor Education

Contractors and subcontractors will be educated about the benefits and outcomes of sustainable practices, and develop their skills in delivering such benefits. This will be pertinent to cleaning staff, waste collection staff builders and other key contractors, who will be trained on the site-specific protocols for sustainable operations.

### 3.13.6 Innovation Challenge – On-site Renewable Energy

Low energy consumption has been is expected with no mechanical plant present for artificial cooling. With solar PV arrays to be implemented on site, there is potential for over 5% of the site's energy use to be directly fed from the collected solar energy.

# 4. BCA SECTION J

## 4.1 Overview

In accordance with the Building Code of Australia (BCA), the proposed development is to meet the energy efficiency performance requirements outlined in Section J of the National Construction Code (NCC) 2016. Section 4 of this report addresses the performance requirements for Building Fabric (J1) and Glazing (J2) only.

There are two methods of achieving BCA Section J compliance. The building can be assessed against the Deemed-to-Satisfy (DTS) provisions or an alternative JV3 performance based solution. The project will be targeting compliance via JV3 verification method, to assess the performance requirements (JP1 & JP3) of Section J using a reference building.

The JV3 solution is to be determined through two models of the building that simulate the annual energy use of the proposed building design;

- ***Reference Building***: Comprises Deemed-to-Satisfy (DTS) building fabric and glazing and building services
- ***Proposed Building***: Comprises the proposed building fabric and glazing and DTS building services

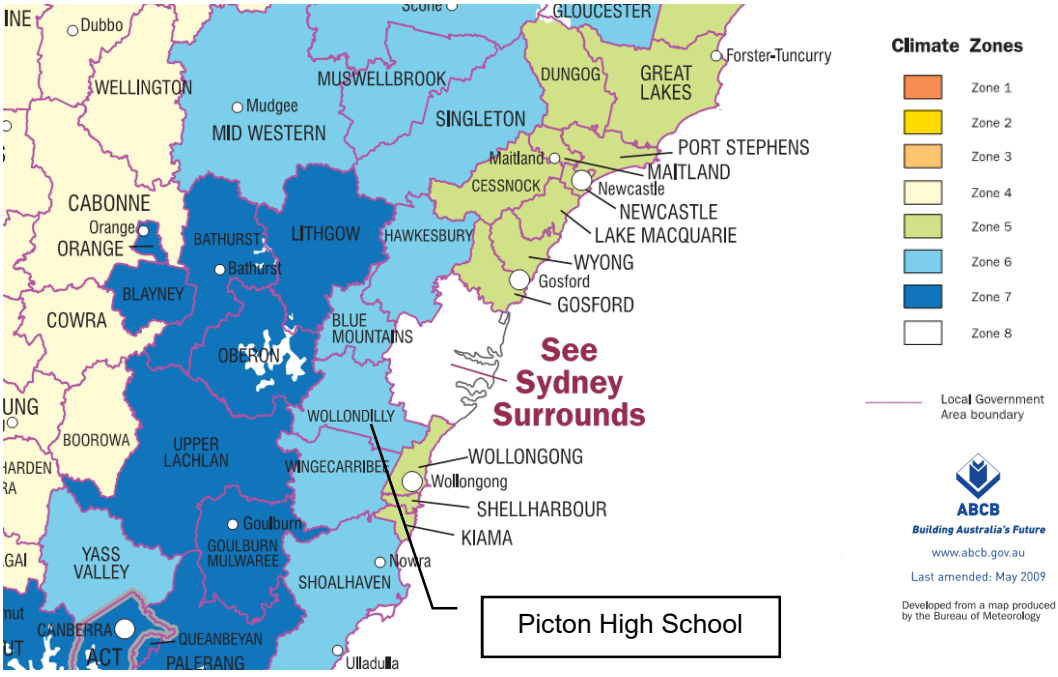
By demonstrating that the annual energy consumption of the proposed building is not more than the reference building we can confirm that the design intent of the proposed building meets NCC requirements. Any modifications to construction materials required must be implemented and installed to meet, if not exceed, the energy performance of the reference building.

In addition to identifying the thermal performance requirements, it is expected that the head contractor is familiar with the mandatory construction requirements of BCA section J. A copy of those requirements has been included in Appendix B.

## 4.2 Building Fabric (J1)

At the current schematic design stage of the project, the Deemed-to-Satisfy (DTS) requirements according to Section J of the NCC 2016 has been used as an indication of the compliant building fabric performance.

The buildings have been assessed as Class 9b School located within Climate Zone 6 as per the NCC.



| Location | Total R-Value |
|---|---|
| External Walls | 2.8 |
| South Facing External Walls | 2.3 |
| Internal Walls to non-conditioned spaces | 1.8 |
| Suspended Floors to external | 2.0 |
| Floor/ ceilings to enclosed non-conditioned spaces | 1.0 |
| Roof | 3.2 |

Please refer to Appendix C for marked up schematic design stage floor plans demonstrating the requirements for the building envelope.

The following tables show example construction breakdowns of compliant building fabric elements.

**a) R3.2 Metal Deck Roof and Ceiling construction example**

| Item Description | R-Value | |
|---|---|---|
| Outdoor Air Film (7m/s) | 0.04 | |
| Metal Deck Roofing | 0.00 | |
| R3.0 Insulation (with a layer of foil)* | 3.00 | |
| 13mm Plasterboard | 0.08 | |
| Indoor Air Film | 0.12 | Required |
| *Total R-Value* | *3.24* | *3.2* |

*Equates to 155mm Fletcher R3.0 Pink Batts

A roof that has metal sheet roofing fixed to metal purlins, metal rafters or metal battens; and does not have a ceiling lining or has a ceiling lining fixed directly to those metal purlins, metal rafters or metal battens, must have a thermal break, consisting of material with an R-Value of not less than R0.2, installed between the metal sheet roofing and its supporting metal purlins, metal rafters or metal battens.

**b) R2.8 External Walls (Brickwork) construction example**

| Item Description | R-Value | |
|---|---|---|
| Outdoor Air Film | 0.04 | |
| 110mm Brickwork | 0.18 | |
| R2.5 Insulation* | 2.5 | |
| 13mm Plasterboard | 0.08 | |
| Indoor Air Film | 0.12 | Required |
| *Total R-Value* | *2.92* | *2.8* |

* Equates to 90mm Fletcher R2.5HD Wall++ Pink Batts Insulation

**c) R2.3 External Walls (Brickwork) construction example**

| Item Description | R-Value | |
|---|---|---|
| Outdoor Air Film | 0.04 | |
| 110mm Brickwork | 0.18 | |
| R2.0 Insulation* | 2.0 | |
| 13mm Plasterboard | 0.08 | |
| Indoor Air Film | 0.12 | Required |
| *Total R-Value* | *2.42* | *2.3* |

* Equates to 70mm Fletcher R2.0HD Wall Pink Batts Insulation

A wall that has lightweight external cladding such as weatherboards, fibre-cement or metal sheeting fixed to a metal frame; and does not have a wall lining or has a wall lining that is fixed directly to the same metal frame, must have a thermal break, consisting of a material with an R-Value of not less than R0.2, installed between the external cladding and the metal frame.

**d) R1.8 Insulated Internal Wall Plasterboard Partition construction example**

| Item Description | R-Value | |
|---|---|---|
| Indoor Air Film | 0.12 | |
| 13mm Plasterboard | 0.08 | |
| R1.5 Insulation* | 1.5 | |
| 13mm Plasterboard | 0.08 | |
| Indoor Air Film | 0.12 | Required |
| *Total R-Value:* | *1.9* | *1.8* |

* Equates to 70mm R1.5 Fletcher Pink Batts Wall Insulation

**e) R2.0 Exposed Suspended Floor construction example**

| Item Description | R-Value | |
|---|---|---|
| Outdoor Air Film (7m/2) | 0.04 | |
| 150mm Concrete Slab | 0.1 | |
| R1.9 Insulation* | 1.9 | |
| 19mm Timber Floor | 0.12 | |
| Indoor Air Film | 0.12 | Required |
| *Total R-Value* | *2.28* | *2.0* |

* Equates to 40mm R1.9 Kingspan Kooltherm K10 FM Soffit Board

**f) R1.0 Floor and ceiling to non-conditioned area construction example**

| Item Description | R-Value | |
|---|---|---|
| Indoor Air Film | 0.12 | |
| 150mm Concrete Slab | 0.10 | |
| R0.7 Insulation* | 0.7 | |
| 13mm Plasterboard | 0.08 | |
| Indoor Air Film | 0.12 | Required |
| *Total R-Value:* | *1.12* | *1.0* |

* Equates to 25mm R0.7 Bradford Multitel Insulation Blanket

## 4.3 Glazing (J2)

As the glazing and shading designs are undergoing design changes and the details of the mechanical systems are still being finalised, the building envelope performance requirements are difficult to determine. Overall the project will aim to provide an alternative compliant solution under a JV3 assessment with the aim of aligning with the current design.

Within the current design, there are two areas of concern with regards to glazing. These are:

1. The large Northern facing glazed elements
2. The large high level glazing in the Food Tech

To maintain the window-to-wall ratio on the Northern façade of Level 1, it is advised that horizontal or overhanging shading devices are adopted on the Northern façade, to achieve a more opaque glazing solution equivalent to a grey or neutral colour. Additionally, the heavily glazed Northern façade of the circulation spaces should be naturally ventilated in order to ensure that these areas do not negatively affect the energy consumption of these buildings.

The elevated roof of the Food Tech building warrants a higher performance glazing system. As this is a Southern façade it would also benefit from a higher insulating performance, therefore a high U-value typical of double glazing. Northrop suggests the use of a polycarbonate solution, such as a Danpalon system (http://danpal.com.au/applications/facade-solutions/) for these high level windows which would assist with achieving the required thermal performance.

The expected glazing for the remainder of the buildings is expected to be in line with a performance single glazing (circa U-value = 4.2 MJ/m$^2$ and SHGC = 0.45), given that adequate use of shading devices remain incorporated into the design. An indicative glazing product example is a 6.38mm Comfort Plus Grey glazing in a Capral 400 Series frame. Glazing performance details are to be confirmed with the development of the glazing and shading details and the final determination of the mechanically conditioned areas within the buildings.

# APPENDIX A: GREEN STAR SCORECARD

## Green Star - Design & As Built Scorecard

| | |
|---|---|
| **Project:** | **Picton High School Redevelopment** |
| **Targeted Rating:** | **5 Star - Australian Excellence** |

| Core Points Available | Total Score Targeted |
|---|---|
| 99 | 60.5 |

| CATEGORY / CREDIT | AIM OF THE CREDIT / SELECTION | CODE | CREDIT CRITERIA | POINTS AVAILABLE | POINTS TARGETED | ASSESSMENT 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 | Green Star Accredited Professional – Design & As Built (GSAP), has been contractually engaged. Northrop fulfils this roll. |
| **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 | The Project must set targets for the environmental performance of the project. This can be documented through the production of a design intent report or an owner's project requirements to be prepared by the design team at the design phase stage and outline at least the following items:<br><br>• Description of the basic functions, operations, and maintenance of the nominated building systems<br>• The targets for the project energy and water consumption and energy and water budgets for all nominated building systems.<br>• Description of how energy, water, and aspects of indoor environment quality are metered and monitored. Including a meter diagram that illustrates how energy and water budgets are confirmed in operation |
| | | 2.1 | Services and Maintainability Review | 1 | 1 | A maintainability design review must occur pre tender and preconstruction that seeks input from the design team, the facilities manager and operations staff (if known), and any relevant suppliers and subcontractors (if engaged) for a design review.<br><br>The review must address the following aspects for all nominated building systems:<br><br>• Commissionability;<br>• Controllability;<br>• Maintainability;<br>• Operability, including 'Fitness for Purpose'; and<br>• Safety |
| | | 2.2 | Building Commissioning | 1 | 1 | The following must be documented:<br>• Commissioning specification – nominating design parameters, required commissioning activities, how each system is intended to operate and acceptable tolerances during commissioning.<br>• Commissioning plan – outlining objectives, or basis, of the design, scope of the commissioning plan, individual responsibilities, sequence of commissioning, commissioning procedures, witnessing requirements, commissioning program and requirements for subcontractor commissioning manuals. |
| | | 2.3 | Building Systems Tuning | 1 | 1 | Formal commitment to a tuning process for all nominated building systems.<br><br>At a minimum, the commitment must include quarterly adjustments and measurement for the first 12 months after occupation and a review of building system manufacturer warranties.<br>Commitment must include:<br><br>• O&M manuals<br>• building tuning plan<br>• building tuning team<br>• Owner has engaged parties to tune the system |
| | | 2.4 | Independent Commissioning Agent | 1 | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Adaptation and Resilience** | To encourage and recognise projects that are resilient to the impacts of a changing climate and natural disasters. | 3.1 | Implementation of a Climate Adaptation Plan | 2 | 2 | A project specific Climate adaption plan has been developed in accordance with a recognised standard and solutions have been included within the building design and construction that specifically address the risk assessment component of the adaption plan.<br>- Flood Risk Assessment and allowances for extreme weather events within the design |
| **Building Information** | To recognise the development and provision of building information that facilitates understanding of a building's systems, operation and maintenance requirements, and environmental targets to enable the optimised performance. | 4.1 | Building Operations and Maintenance Information | 1 | 1 | Demonstrate that comprehensive building operation and maintenance information is available to the facilities management team.<br>O&M manuals and Building Log Book required |
| | | 4.2 | Building User Information | 1 | 1 | Demonstrate that current building user information is available to all relevant stakeholders in accordance with the following requirements:• Building user information is a source of up-to-date, relevant information for the 'building user'; and• All building user information must be available to the building owner and facility management at the time of practical completion of the project. |
| **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 | There must be a commitment to set targets and measure results for the environmental performance of the building. |
| | | 5.2 | End of Life Waste Performance | 1 | | At leased 80% of the projects GFA has a formal commitment in place to reduce demolition waste at the end of life of an interior fit out or base building component. This should take the form of a contractual agreement and can be included as part of the lease clauses. |
| **Metering and Monitoring** | To recognise the implementation of effective energy and water metering and monitoring systems. | 6.0 | Metering | - | Complies | Metering shall be provided to allow for monitoring of the relevant areas or functions of the project. In most cases floor by floor metering will suffice if the entire floor has a single use.<br><br>Where a load for a single item exceeds 5% of the total energy use for the building, or 100kW, it must be independently metered. |
| | | 6.1 | Monitoring Systems | 1 | | |
| **Construction Environmental Management** | To reward projects that use best practice formal environmental management procedures during construction. | 7.0 | Environmental Management Plan | - | Complies | A project-specific best practice EMP must be developed and implemented, to assist the Principal/Head Contractor and its service providers manage environmental performance, conditions, and impacts arising from excavation, demolition and construction. |
| | | 7.1 | Formalised Environmental Management System | 1 | 1 | Demonstrate that a formalised systematic and methodical approach to planning, implementing and auditing is in place during construction, to ensure compliance with the EMP |
| **Operational Waste** | Prescriptive Pathway | 8A | Performance Pathway - Specialist Plan | - | | |
| | | 8B | Prescriptive Pathway - Facilities | 1 | 1 | Facilities are in place to collect and separate distinct waste streams within facilities that meet best practice requirements for collection by the relevant waste contractor. |
| **Total** | | | | **14** | **11** | |

| **Indoor Environment Quality** | | | | **17** | | |
|---|---|---|---|---|---|---|
| **Indoor Air Quality** | To recognise projects that provide high air quality to occupants. | 9.1 | Ventilation System Attributes | 1 | 1 | • The entry of outdoor air pollutants is mitigated - The building services must be designed to comply with ASHRAE Standard 62.1:2013 in regards to minimum separation distances between pollution sources and outdoor air intakes.<br>• The system is designed for ease of maintenance and cleaning; and<br>• The system has been cleaned prior to occupation and use.<br><br>Naturally ventilated |
| | | 9.2 | Provision of Outdoor Air | 2 | 2 | 2 points are available where outdoor air is provided at a rate 100% greater than the minimum required by AS 1668.2:2012, or CO2 concentrations are maintained below 700ppm |
| | | 9.3 | Exhaust or Elimination of Pollutants | 1 | 1 | A dedicated exhaust riser must be provided for photocopy rooms, kitchens and cooking equipment, and carpark exhausts. These exhausts bust not recirculate air through spaces and must exhaust to outside. |
| **Acoustic Comfort** | To reward projects that provide appropriate and comfortable acoustic conditions for occupants. | 10.1 | Internal Noise Levels | 1 | 1 | Internal ambient noise levels, in the nominated area, are no more than 5dB(A) above the "satisfactory" sound levels provided in Table 1 of AS/NZS 2107:2000. |
| | | 10.2 | Reverberation | 1 | | |
| | | 10.3 | Acoustic Separation | 1 | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Lighting Comfort** | To encourage and recognise well-lit spaces that provide a high degree of comfort to users. | 11.0 | Minimum Lighting Comfort | - | Complies | Flicker-free lighting refers to luminaires that have either:<br>• A minimum Class A1 & A2 ballast;<br>• High frequency ballasts for all fluorescent lamps, or<br>• Electronic ballasts in High Intensity Discharge (HID) lighting. |
| | | 11.1 | General Illuminance and Glare Reduction | 1 | 1 | Best practice lighting levels for each task within each space type is defined as lighting with a maintained illuminance that meets the levels recommended in the relevant Standard. For an office this standard is table 3.1 of AS1680.2<br>AND<br>All bare light sources must be fitted with baffles, louvers, translucent diffusers, ceiling design, or other means that obscures the direct light source from all viewing angles of occupants, including looking directly upwards. |
| | | 11.2 | Surface Illuminance | 1 | 1 | In the nominated area, a combination of lighting and surfaces improve uniformity of lighting to give visual interest. This can be done by ensuring uniformity in design and an average reflectance of 0.75 for ceilings, or through a modelled approach. |
| | | 11.3 | Localised Lighting Control | 1 | 1 | Dimmable and switchable control integrated in conjunction with Period Bell automated system. |
| **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 | Glare in the nominated area from sunlight through all viewing façades is reduced through a combination of blinds, screens, fixed devices, or other means. |
| | | 12.1 | Daylight | 2 | 1 | 40% (1 point) of the nominated area receives high levels of daylight during 80% of the nominated occupied hours. |
| | | 12.2 | Views | 1 | 1 | at least 60% of the nominated area has a clear line-of-sight to a high quality internal or external view. All floor areas within 8m from a<br>compliant view can be considered to meet this credit criterion. |
| **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 | At least 95% of all internally applied paints, adhesives, sealants and carpets meet stipulated 'Total VOC Limits', or, where no paints, adhesives, sealants or carpets are used in the building. |
| | | 13.2 | Engineered Wood Products | 1 | 1 | At least 95% of all engineered wood products meet stipulated formaldehyde limits or no new engineered wood products are used in the building. |
| **Thermal Comfort** | To encourage and recognise projects that achieve high levels of thermal comfort. | 14.1 | Thermal Comfort | 1 | 1 | 1 point is available where a high degree of thermal comfort is provided to occupants in the space, equivalent to 80% of all occupants being<br>satisfied in the space. |
| | | 14.2 | Advanced Thermal Comfort | 1 | | |
| **Total** | | | | **17** | **12** | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Energy** | | | | **22** | | |
| **Greenhouse Gas Emissions** | E. Modelled Performance Pathway | 15A.0 | Conditional Requirement: Prescriptive Pathway | - | | |
| | | 15A.1 | Building Envelope | - | | |
| | | 15A.2 | Glazing | - | | |
| | | 15A.3 | Lighting | - | | |
| | | 15A.4 | Ventilation and Air-conditioning | - | | |
| | | 15A.5 | Domestic Hot Water Systems | - | | |
| | | 15A.6 | Building Sealing | - | | |
| | | 15A.7 | Accredited GreenPower | - | | |
| | | 15B.0 | Conditional Requirement: NatHERS Pathway | - | | |
| | | 15B.1 | NatHERS Pathway | - | | |
| | | 15C.0 | Conditional Requirement: BASIX Pathway | - | | |
| | | 15C.1 | BASIX Pathway | - | | |
| | | 15D.0 | Conditional Requirement: NABERS Pathway | - | | |
| | | 15D.1 | NABERS Energy Commitment Agreement Pathway | - | | |
| | | 15E.0 | Conditional Requirement: Reference | - | Complies | The Proposed Building greenhouse gas (GHG) emissions are less than those of the equivalent Benchmark Building. |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | Building Pathway | | | |
| | | 15E.1 | Comparison to a Reference Building Pathway | 20 | 10 | Improving on the building's fabric and systems against a Reference Building (4 points), and for reducing emissions against the Benchmark Building (16 points).<br><br>The more points the more costs associated with energy improvements or the purchase of long term contracts for green power. |
| **Peak Electricity Demand Reduction** | Performance Pathway | 16A | Prescriptive Pathway - On-site Energy Generation | - | | |
| | | 16B | Performance Pathway - Reference Building | 2 | 1 | One point is awarded where it is demonstrated that on-site generation sources reduces the peak electricity demand by at least 15%. |
| **Total** | | | | **22** | **11** | |

| **Transport** | | | | **10** | | |
|---|---|---|---|---|---|---|
| **Sustainable Transport** | Prescriptive Pathway | 17A.1 | Performance Pathway | 0 | | |
| | | 17B.1 | Access by Public Transport | 3 | 1 | Improving bus stop capacity and efficiency. Ensuring safety for roads and students. |
| | | 17B.2 | Reduced Car Parking Provision | 1 | 1 | Minimal car parking will be provided, only retaining private staff car parking. Max Ratio of Peak building occupancy to car parking spaces is 1:30. |
| | | 17B.3 | Low Emission Vehicle Infrastructure | 1 | | |
| | | 17B.4 | Active Transport Facilities | 1 | | |
| | | 17B.5 | Walkable Neighbourhoods | 1 | | |
| **Total** | | | | **7** | **2** | |

| **Water** | | | | **12** | | |
|---|---|---|---|---|---|---|
| **Potable Water** | Prescriptive Pathway | 18A.1 | Potable Water - Performance Pathway | 0 | | |
| | | 18B.1 | Sanitary Fixture Efficiency | 1 | 1 | Sanitary fixtures are within 1 Star of the following:<br>*Taps 6 Stars<br>* Urinals 6 Stars<br>* Toilets 5 Stars<br>* Showers 3 Stars (>4.5 but <=6.0)<br>* Clothes Washers 5 Stars<br>* Dishwashers 6 Star |
| | | 18B.2 | Rainwater Reuse | 1 | 1 | A circa 100kL rainwater retention capacity to collect and reuse rainwater. Implementation of the subsurface water storage could be used to contribute to this criteria |
| | | 18B.3 | Heat Rejection | 2 | 2 | HVAC system must not use water for heat rejection. |
| | | 18B.4 | Landscape Irrigation | 1 | | |
| | | 18B.5 | Fire System Test Water | 1 | 1 | *** The fire protection system does not expel water for testing;** or<br>* The fire protection system includes temporary storage for 80% of the routine fire protection system test water and maintenance drain-downs for reuse on-site. If sprinkler systems are installed, each floor must be fitted with isolation valves or shut-off points for floor-by-floor testing. |
| **Total** | | | | **6** | **5** | |

| **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 | 1 | * The Portland cement content is reduced by 40%, measured by mass across all concrete used in the project compared to the reference case.<br>* the mix water for all concrete used in the project contains at least 50% captured or reclaimed water (measured across all concrete mixes in the project). AND<br>* At least 40% of coarse aggregate in the concrete is crushed slag aggregate or another alternative materials (measured by mass across all concrete mixes in the project), provided that use of such materials does not increase the use of Portland cement by over five kilograms per cubic meter of concrete;<br>OR<br>At least 25% of fine aggregate (sand) inputs in the concrete are manufactured sand or other alternative materials (measured by mass across all concrete mixes in the project), provided that use of such materials does not increase the use of Portland cement by over five kilograms per cubic meter of concrete. |
| | | 19B.2 | Steel | 1 | 1 | At least 95% of the building's steel is sourced from a Responsible Steel Maker. |
| | | 19B.3 | Building Reuse | 4 | 1 | Refurbishment of existing buildings and existing facades. |
| **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 | | |
| | | 20.2 | Timber Products | 1 | 1 | At least 95% (by cost) of all timber used in the building and construction works is either:<br>• Certified by a forest certification scheme that meets the GBCA's 'Essential' criteria for forest certification; or<br>• Is from a reused source. |
| | | 20.3 | Permanent Formwork, Pipes, Flooring, Blinds and Cables | 1 | 1 | At least 90% (by cost) of all permanent formwork, cables, pipes, flooring and blinds in a project is sources from a manufacturer that meet Best Practice Guidelines for PVC production or does not contain PVC (and have an Environmental Product Declaration). |
| **Sustainable Products** | To encourage sustainability and transparency in product specification. | 21.1 | Product Transparency and Sustainability | 3 | | |
| **Construction and Demolition Waste** | Percentage Benchmark | 22A | Fixed Benchmark | - | | |
| | | 22B | Percentage Benchmark | 1 | 1 | 90% of the waste generated during construction and demolition has been diverted from landfill. |
| **Total** | | | | **12** | **6** | |

| **Land Use & Ecology** | | | | **5** | | |
|---|---|---|---|---|---|---|
| **Ecological Value** | To reward projects that improve the ecological value of their site. | 23.0 | Endangered, Threatened or Vulnerable Species | - | Complies | The project must demonstrate that no critically endangered, endangered, or vulnerable species, or ecological communities were present on the site at time of purchase. |
| | | 23.1 | Ecological Value | 3 | | |
| **Sustainable Sites** | To reward projects that choose to develop sites that have limited ecological value, re-use previously developed land and remediate contaminate land. | 24.0 | Conditional Requirement | - | Complies | At the date of site purchase or date of option contract, the project site did not include old growth forest or wetland of 'High National Importance', or did not impact on 'Matters of National Significance'. |
| | | 24.1 | Reuse of Land | 1 | 1 | 75% of the site was Previously Developed Land |
| | | 24.2 | Contamination and Hazardous Materials | 0 | | The site, or an existing building, was previously contaminated and the site has been remediated in accordance with a best practice remediation strategy. Would be applicable if the site contains Asbestos, lead or PCBs<br>**To confirm if any Asbestos present on site.** |
| **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 | Where at least 75% of the total project site area comprises of solar reflectance index levels greater than SRI 82 for a roof pitch < 15o |
| **Total** | | | | **5** | **2** | |

| **Emissions** | | | | **5** | | |
|---|---|---|---|---|---|---|
| **Stormwater** | To reward projects that minimise peak stormwater flows and reduce pollutants entering public sewer infrastructure. | 26.1 | Reduced Peak Discharge | 1 | 1 | The post-development peak event discharge from the site does not exceed the pre-development event discharge using the local Council ARI requirements<br>- Look to have on site stormwater retention basin - potentially underground cellular storage |
| | | 26.2 | Reduced Pollution Targets | 1 | 1 | The Stormwater discharge from the site meets the required pollution targets within the Green Star Technical Manual.<br>-Stormwater retention to have treatment |
| **Light Pollution** | To reward projects that minimise light pollution. | 27.0 | Light Pollution to Neighbouring Bodies | - | Complies | Demonstrate that all outdoor lighting on the project complies with AS 4282:1997. |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | 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 | Must demonstrate one of following:<br>A. Naturally ventilated buildings; or<br>B. Waterless heat-rejection systems; or<br>C. Water-based heat rejection systems that include measure for Legionella control and Risk Management. |
| **Refrigerant Impacts** | To encourage operational practices that minimise the environmental impacts of refrigeration equipment. | 29.0 | Refrigerants Impacts | 1 | 1 | 1 point is awarded where one of the following criteria is achieved:<br>- The combined Total System Direct Environmental Impact (TSDEI) of the refrigerant systems in the building is less than 15; or<br>- The combined TSDEI of the refrigerant systems is between 15 and 35, AND a leak detection system ||with automated refrigerant recovery is in place ||R1.29.01; or<br>- All refrigerants in the project have an ozone depletion potential of zero, and a global warming potential of 10 or less; or<br>- Where there are no refrigerants employed by nominated building systems, this point is awarded. |
| **Total** | | | | **5** | **5** | |

| **Innovation** | | | | **10** | | |
|---|---|---|---|---|---|---|
| **Innovative Technology or Process** | The project meets the aims of an existing credit using a technology or process that is considered innovative in Australia or the world. | 30A | Innovative Technology or Process | | 1 | Hydronic Heating/ GSHP |
| **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 | | 1 | New learning environments, Hub-based learning |
| **Improving on Green Star Benchmarks** | The project has achieved full points in a Green Star credit and demonstrates a substantial improvement on the benchmark required to achieve full points. | 30C | Improving on Green Star Benchmarks | 10 | 1 | Exceeding Green Star Benchmarks – Stormwater Pollution Targets<br>Up to two additional points may be awarded where projects can demonstrate achieving Pollution Reduction Targets from column B (1 point) as stated in Green Star Design & As Built Guidelines - Table 26.1. |
| **Innovation Challenge** | Where the project addresses an sustainability issue not included within any of the Credits in the existing Green Star rating tools. | 30D | Innovation Challenge | | 3 | Financial transparency<br>Contractor Education<br>On-site renewable for >5% of site energy use |
| **Global Sustainability** | Project teams may adopt an approved credit from a Global Green Building Rating tool that addresses a sustainability issue that is currently outside the scope of this Green Star rating tools. | 30E | Global Sustainability | | | |
| **Total** | | | | **10** | **7** | |

| **TOTALS** | **AVAILABLE** | **TARGETED** |
|---|---|---|
| **CORE POINTS** | **99** | **54.0** |
| **CATEGORY PERCENTAGE SCORE** | | **54.5** |
| **INNOVATION POINTS** | **10** | **6.0** |
| **TOTAL SCORE TARGETED** | | **60.5** |

# APPENDIX B: SECTION J OTHER REQUIREMENTS

## J3 Building Sealing

Deemed to satisfy provisions of Section J, Part J3 Building Sealing sets the requirements for a Class 2 to Class 9 Building in order to prevent unwanted air infiltration. The proposed development is to be designed in accordance with the following applicable clauses as stipulated in the NCC 2016:

***Chimneys and flues***

The chimney or flue of an open solid-fuel burning appliance must be provided with a damper or flap that can be closed to seal the chimney or flue.

***Roof lights***

(a) A roof light must be sealed, or capable of being sealed, when serving—

(i) a conditioned space; or

(ii) a habitable room in climate zones 4, 5, 6, 7 or 8.

(b) A roof light required by (a) to be sealed, or capable of being sealed, must be constructed with—

(i) an imperforate ceiling diffuser or the like installed at the ceiling or internal lining level; or

(ii) a weatherproof seal; or

(iii) a shutter system readily operated either manually, mechanically or electronically by the occupant.

***Windows and doors***

(a) A seal to restrict air infiltration must be fitted to each edge of a door, openable window or the like forming part of—

(i) the envelope of a conditioned space; or

(ii) the external fabric of a habitable room or public area in climate zones 4, 5, 6, 7 or 8.

(b) The requirements of (a) do not apply to—

(i) a window complying with AS 2047; or

(ii) a fire door or smoke door; or

(iii) a roller shutter door, roller shutter grille or other security door or device installed only for out-of-hours security.

(c) A seal required by (a)—

for the bottom edge of an external swing door, must be a draft protection device; and

(ii) for the other edges of an external door or the edges of an openable window or other such opening, may be a foam or rubber compression strip, fibrous seal or the like.

(d) An entrance to a building, if leading to a conditioned space must have an airlock, selfclosing door, revolving door or the like, other than—

(i) where the conditioned space has a floor area of not more than 50 m2; or

(ii) where a café, restaurant, open front shop or the like has—

(A) a 3 m deep un-conditioned zone between the main entrance, including an open front, and the conditioned space; and

(B) at all other entrances to the café, restaurant, open front shop or the like, selfclosing doors.

***Exhaust fans***

A miscellaneous exhaust fan, such as a bathroom or domestic kitchen exhaust fan, must be fitted with a sealing device such as a self-closing damper or the like when serving—

(a) a conditioned space; or

(b) a habitable room in climate zones 4, 5, 6, 7 or 8.

***Construction of roofs, walls and floors***

(a) Roofs, ceilings, walls, floors and any opening such as a window frame, door frame, roof light frame or the like must be constructed to minimise air leakage in accordance with (b) when forming part of—

(i) the envelope; or

(ii) the external fabric of a habitable room or a public area in climate zones 4, 5, 6, 7 or 8.

(b) Construction required by (a) must be—

(i) enclosed by internal lining systems that are close fitting at ceiling, wall and floor junctions; or

(ii) sealed by caulking, skirting, architraves, cornices or the like.

(c) The requirements of (a) do not apply to openings, grilles or the like required for smoke hazard management.

***Evaporative coolers***

An evaporative cooler must be fitted with a self-closing damper or the like when serving—

(a) a heated space; or
(b) a habitable room or a public area of a building in climate zones 4, 5, 6, 7 or 8.

## J5 Air-conditioning and Ventilation Systems

### *J5.2 Air-conditioning Systems*

(a) **Control** —

(i) An air-conditioning system—

(A) must be capable of being deactivated when the building or part of a building served by that system is not occupied; and

(B) when serving more than one air-conditioning zone or area with different heating or cooling needs, must—

(aa) thermostatically control the temperature of each zone or area; and

(bb) not control the temperature by mixing actively heated air and actively cooled air; and

(cc) limit reheating to not more than—

(AA) for a fixed supply air rate, a 7.5 K rise in temperature; and

(BB) for a variable supply air rate, a 7.5 K rise in temperature at the nominal supply air rate but increased or decreased at the same rate that the supply air rate is respectively decreased or increased; and

(C) which provides the required mechanical ventilation, other than in process-related applications where humidity control is needed, must have an outdoor air economy cycle—

(aa) in climate zones 2 or 3, when the air-conditioning system capacity is more than 50 kWr; or

(bb) in climate zones 4, 5, 6, 7 or 8, when the air-conditioning system capacity is more than 35 kWr; and

(D) which contains more than one water heater, chiller or coil, must be capable of stopping the flow of water to those not operating; and

(E) except for a packaged air-conditioning system, must have a variable speed fan when its supply air quantity is capable of being varied; and

(F) when serving a sole-occupancy unit in a Class 3 building, must not operate when any external door of the sole-occupancy unit that opens to a balcony or the like, is open for more than one minute.

(ii) When an air-conditioning system is deactivated, any motorised outside air and return dampers must close.

(iii) Compliance with (i) must not adversely affect—

(A) smoke hazard management measures required by Part E2; and

(B) ventilation required by Part E3 and Part F4.

(b) **Fans** — Fans of an air-conditioning system must comply with Specification J5.2a.

(c) **Pumps** —

(i) An air-conditioning system, where water is circulated by pumping at more than 2 L/s, must be designed so that the maximum pump power to the pump complies with Table J5.2.

(ii) An air-conditioning system pump that is rated at more than 3 kW of pump power and circulates water at more than 2 L/s must be capable of varying its speed in response to varying load.

(iii) A spray water pump of an air-conditioning system's closed circuit cooler or evaporative condenser must not use more than 150 W of pump power for each L/s of spray water circulated.

(d) **Insulation** —

(i) The ductwork of an air-conditioning system must be insulated and sealed in accordance with Specification J5.2b.

(ii) Piping, vessels, heat exchangers and tanks containing heating or cooling fluid that are part of an air-conditioning system, other than those with insulation levels covered by MEPS, must be insulated in accordance with Specification J5.2c.

(e) **Space heating** — A heater used for air-conditioning or as part of an air-conditioning system must comply with Specification J5.2d.

(f) **Energy efficiency ratios** —

(i) refrigerant chillers used as part of an air-conditioning system; and

(ii) packaged air-conditioning equipment,

must comply with Specification J5.2e.

(g) **Time switches** —

(i) A time switch complying with Specification J6 must be provided to control—

(A) an air-conditioning system of more than 10 kWr; and

(B) a heater of more than 10 kWheating used for air-conditioning.

(ii) The requirements of (i) do not apply to—

(A) an air-conditioning system that serves—

(aa) only one sole-occupancy unit in a Class 2 or 3 building; or

(bb) a Class 4 part of a building; or

(cc) only one sole-occupancy unit in a Class 9c building; or

(B) a building where air-conditioning is needed for 24 hour occupancy.

***J5.3 Mechanical Ventilation Systems***

(a) **Control** —

(i) A mechanical ventilation system, including one that is part of an air-conditioning system, except where the mechanical system serves only one sole-occupancy unit in a Class 2 building or serves only a Class 4 part of a building, must—

(A) be capable of being deactivated when the building or part of the building served by that system is not occupied; and

(B) when serving a conditioned space—

(aa) not exceed the minimum outdoor air quantity required by Part F4, where relevant, by more than 20%; and

(bb) in other than climate zone 2, where the number of square metres per person is not more than 1 as specified in D1.13 and the air flow rate is more than 1000 L/s, have—

(AA) an energy reclaiming system that preconditions outside air; or

(BB) the ability to automatically modulate the mechanical ventilation required by Part F4 in proportion to the number of occupants.

(ii) The requirements of (a)(i)(B)(aa) do not apply where—

(A) additional unconditioned outside air is supplied for free cooling or to balance process exhaust; or

(B) additional exhaust ventilation is needed to balance the required mechanical ventilation; or

(C) an energy reclaiming system preconditions all the outside air.

(iii) Compliance with (a)(i) must not adversely affect—

(A) smoke hazard management measures required by Part E2; and

(B) ventilation required by Part E3 and Part F4.

(b) **Fans** — Fans of a mechanical ventilation system covered by (a) must comply with Specification J5.2a.

(c) **Time switches** —

(i) A time switch complying with Specification J6 must be provided to control a mechanical ventilation system with an air flow rate of more than 1000 L/s.

(ii) The requirements of (i) do not apply to—

(A) a mechanical ventilation system that serves—

(aa) only one sole-occupancy unit in a Class 2 or 3 building; or

(bb) a Class 4 part of a building; or

(cc) only one sole-occupancy unit in a Class 9c building; or

(B) a building where mechanical ventilation is needed for 24 hour occupancy.

***J5.4 Miscellaneous exhaust systems***

(a) A miscellaneous exhaust system with an air flow rate of more than 1000 L/s, that is associated with equipment having a variable demand, must—

(i) be capable of stopping the motor when the system is not needed; and

(ii) have a variable speed fan or the like.

(b) The requirements of (a) do not apply—

(i) to a miscellaneous exhaust system in—

(A) a sole-occupancy unit in a Class 2, 3 or 9c building; or

(B) a Class 4 part of a building; or

(ii) where additional exhaust ventilation is needed to balance the required outside air for ventilation.

## J6 Artificial Lighting and Power

### *J6.2 Artificial lighting*

(a) In a sole-occupancy unit of a Class 2 building or a Class 4 part of a building—

(i) the lamp power density or illumination power density of artificial lighting must not exceed the allowance of—

(A) 5 W/m2 within a sole-occupancy unit; and

(B) 4 W/m2 on a verandah, balcony or the like attached to a sole-occupancy unit; and

(ii) the illumination power density allowance in (i) may be increased by dividing it by the illumination power density adjustment factor for a control device in Table J6.2b as applicable; and

(iii) when designing the lamp power density or illumination power density, the power of the proposed installation must be used rather than nominal allowances for exposed batten holders or luminaires; and

(iv) halogen lamps must be separately switched from fluorescent lamps.

(b) In a building other than a sole-occupancy unit of a Class 2 building or a Class 4 part of a building—

(i) for artificial lighting, the aggregate design illumination power load must not exceed the sum of the allowances obtained by multiplying the area of each space by the maximum illumination power density in Table J6.2a; and

the aggregate design illumination power load in (i) is the sum of the design illumination power loads in each of the spaces served; and

(iii) in determining the design illumination power load for (ii) the following must be used:

(A) Where there are multiple lighting systems serving the same space—

(aa) the total illumination power load of all systems; or

(bb) for a control system that permits only one system to operate at a time, the design illumination power load is—

(AA) based on the highest illumination power load; or

(BB) determined by the formula—

[H x T/2 + P x (100 - T/2)] / 100

Where:

H= the highest illumination power load; and

T= the time for which the maximum illumination power load will occur, expressed as a percentage; and

P= the predominant illumination power load.

(B) Where there is adjustable position lighting such as trapeze lighting or track lighting other than trunking systems that accept fluorescent lamps—

(aa) the rating of the circuit breaker protecting the track; or

(bb) of extra low voltage, 80% of the power rating of the transformer; or

(cc) of mains voltage, 100 W per metre of track.

(c) The requirements of (a) and (b) do not apply to the following:

(i) Emergency lighting in accordance with Part E4.

(ii) Signage and display lighting within cabinets and display cases that are fixed in place.

(iii) Lighting for accommodation within the residential part of a detention centre.

(iv) A heater where the heater also emits light, such as in bathrooms.

(v) Lighting of a specialist process nature such as in an operating theatre, fume cupboard or clean workstation.

(vi) Lighting of performances such as theatrical or sporting.

(vii) Lighting for the permanent display and preservation of works of art or objects in a museum or gallery other than for retail sale, purchase or auction.

## J6.3. Interior artificial lighting and power control

(a) Artificial lighting of a room or space must be individually operated by a switch or other control device.

(b) An occupant activated device, such as a room security device, a motion detector in accordance with Specification J6, or the like, must be provided in the sole-occupancy unit of a Class 3 building, other than where providing accommodation for people with a disability or the aged, to cut power to the artificial lighting, air-conditioner, local exhaust fans and bathroom heater when the sole-occupancy unit is unoccupied.

(c) An artificial lighting switch or other control device in (a) must—

(i) if an artificial lighting switch, be located in a visible position—

(A) in the room or space being switched; or

(B) in an adjacent room or space from where the lighting being switched is visible; and

(ii) for other than a single functional space such as an auditorium, theatre, swimming pool, sporting stadium or warehouse—

(A) not operate lighting for an area of more than 250 m2 if in a Class 5 building or a Class 8 laboratory; or

(B) not operate lighting for an area of more than—

(aa) 250 m2 for a space of not more than 2000 m2; or

(bb) 1000 m2 for a space of more than 2000 m2,

if in a Class 3, 6, 7, 8 (other than a laboratory) or 9 building.

(d) 95% of the light fittings in a building or storey of a building, other than a Class 2 or 3 building or a Class 4 part of a building, of more than 250 m2 must be controlled by—

(i) a time switch in accordance with Specification J6; or

(ii) an occupant sensing device such as—

(A) a security key card reader that registers a person entering and leaving the building; or

(B) a motion detector in accordance with Specification J6.

(e) In a Class 5, 6 or 8 building of more than 250 m2, artificial lighting in a natural lighting zone adjacent to windows must be separately controlled from artificial lighting not in a natural lighting zone in the same storey except where—

(i) the room containing the natural lighting zone is less than 20 m2; or

(ii) the room's natural lighting zone contains less than 4 luminaires; or

(iii) 70% or more of the luminaires in the room are in the natural lighting zone.

The requirements of (a), (b), (c), (d) and (e) do not apply to the following:

(i) Emergency lighting in accordance with Part E4.

(ii) Where artificial lighting is needed for 24 hour occupancy such as for a manufacturing process, parts of a hospital, an airport control tower or within a detention centre.

(g) The requirements of (d) do not apply to the following:

(i) Artificial lighting in a space where the sudden loss of artificial lighting would cause an unsafe situation such as in a patient care area in a Class 9a building or in a Class 9c building.

(ii) A heater where the heater also emits light, such as in bathrooms.

***J6.4 Interior decorative and display lighting***

(a) Interior decorative and display lighting, such as for a foyer mural or art display, must be controlled—

(i) separately from other artificial lighting; and

(ii) by a manual switch for each area other than when the operating times of the displays are the same in a number of areas such as in a museum, art gallery or the like, in which case they may be combined; and

(iii) by a time switch in accordance with Specification J6 where the display lighting exceeds 1 kW.

(b) Window display lighting must be controlled separately from other display lighting.

***J6.5 Artificial lighting around the perimeter of a building***

(a) Artificial lighting around the perimeter of a building, must—

(i) be controlled by—

(A) a daylight sensor; or

(B) a time switch that is capable of switching on and off electric power to the system at variable pre-programmed times and on variable pre-programmed days; and

(ii) when the total perimeter lighting load exceeds 100 W—

(A) have an average light source efficacy of not less than 60 Lumens/W; or

(B) be controlled by a motion detector in accordance with Specification J6; and

(iii) when used for decorative purposes, such as facade lighting or signage lighting, have a separate time switch in accordance with Specification J6.

(b) The requirements of (a)(ii) do not apply to the following:

(i) Emergency lighting in accordance with Part E4.

Lighting around a detention centre.

### *J6.6 Boiling water and chilled water storage units*

Power supply to a boiling water or chilled water storage unit must be controlled by a time switch in accordance with Specification J6.

## J7 Heated Water Supply And Swimming Pool And Spa Pool Plant

### *J7.2 Heated water supply*

A heated water supply system for food preparation and sanitary purposes must be designed and installed in accordance with Part B2 of NCC Volume Three – Plumbing Code of Australia.

### *J7.3 Swimming pool heating and pumping*

(a) Heating for a swimming pool must be by—

(i) a solar heater not boosted by electric resistance heating; or

(ii) a heater using reclaimed energy; or

(iii) a gas heater; or

(iv) a heat pump; or

(v) a combination of (i) to (iv).

(b) Where some or all of the heating required by (a) is by a gas heater or a heat pump, the swimming pool must have—

(i) a cover unless located in a conditioned space; and

(ii) a time switch in accordance with Specification J6 to control the operation of the heater.

(c) A time switch must be provided in accordance with Specification J6 to control the operation of a circulation pump for a swimming pool.

(d) For the purpose of J7.3, a swimming pool does not include a spa pool.

### *J7.4 Spa pool heating and pumping*

(a) Heating for a spa pool that shares a water recirculation system with a swimming pool must be by—

(i) a solar heater; or

(ii) a heater using reclaimed energy; or

(iii) a gas heater; or

(iv) a heat pump; or

(v) a combination of (i) to (iv).

Where some or all of the heating required by (a) is by a gas heater or a heat pump, the spa pool must have—

(i) a cover; and

(ii) a push button and a time switch in accordance with Specification J6 to control the operation of the heater.

(c) A time switch must be provided in accordance with Specification J6 to control the operation of a circulation pump for a spa pool having a capacity of 680 L or more.

## J8 Facilities For Energy Monitoring

### *J8.3 Facilities for energy monitoring*

(a) A building or sole-occupancy unit with a floor area of more than 500 m2 must have the facility to record the consumption of gas and electricity.

(b) A building with a floor area of more than 2,500 m must have the facility to record individually the energy consumption of—

(i) air-conditioning plant including, where appropriate, heating plant, cooling plant and air handling fans; and

(ii) artificial lighting; and

(iii) appliance power; and

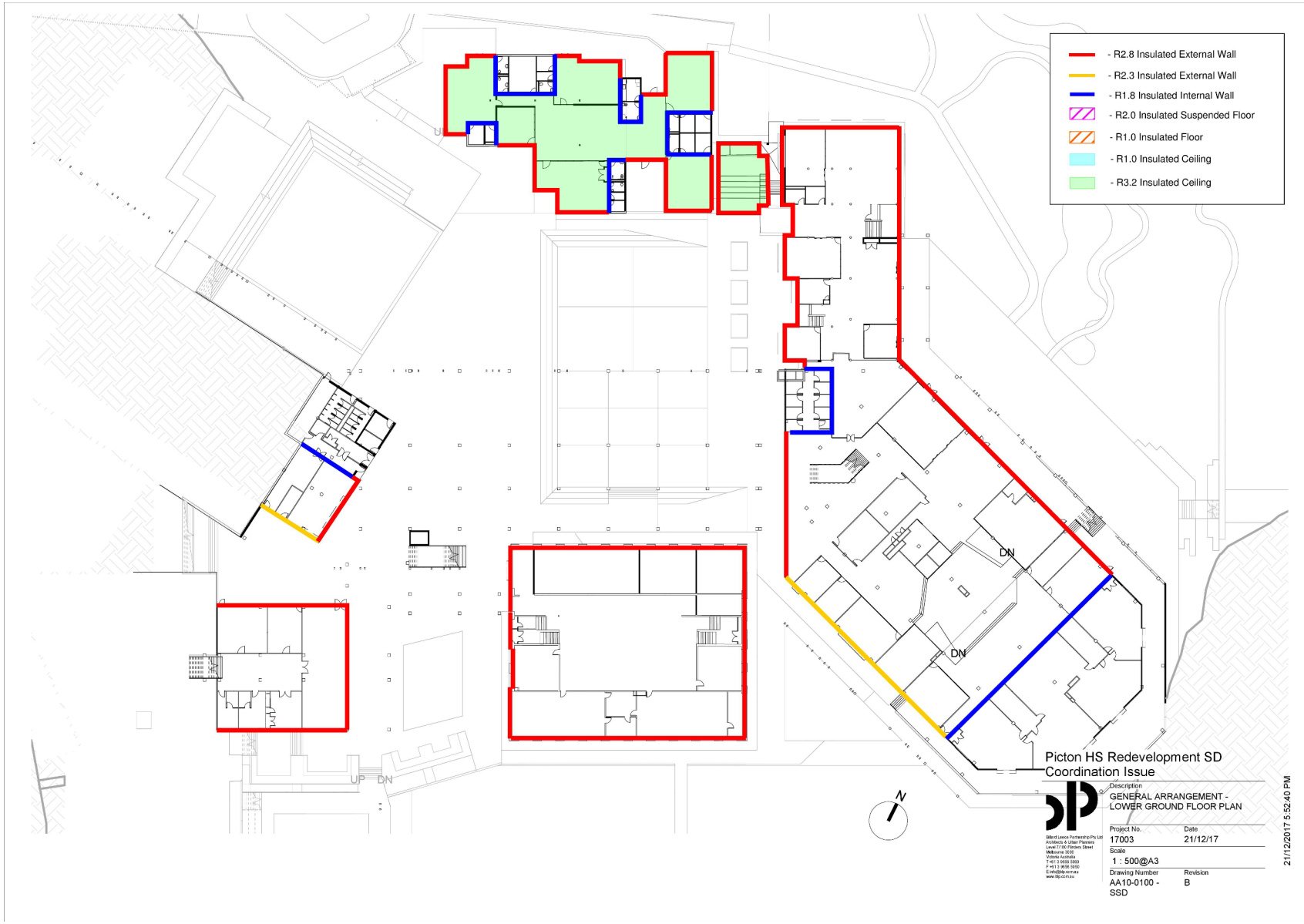
(iv) central hot water supply; and

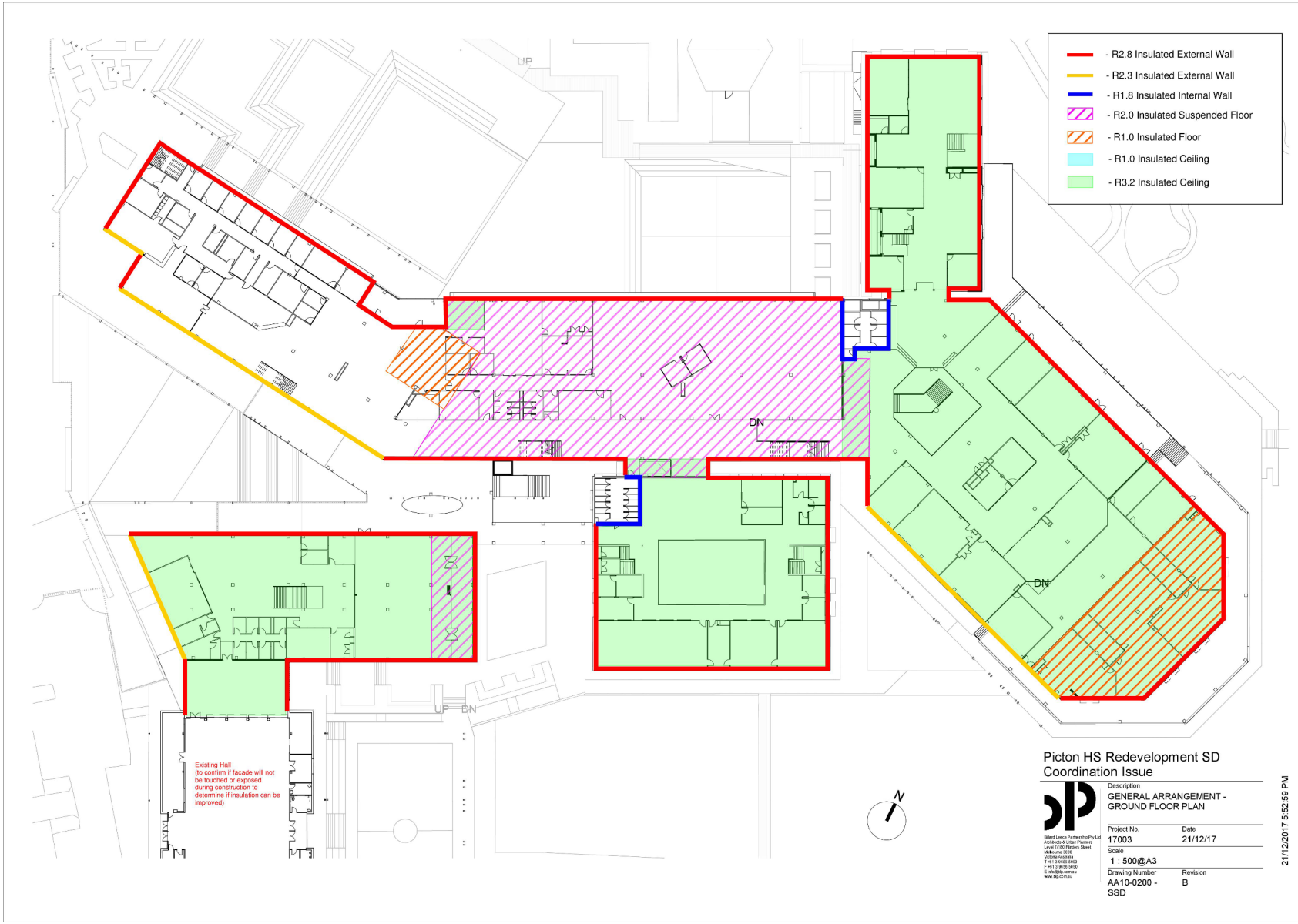
(v) internal transport devices including lifts, escalators and travelators where there is more than one serving the building; and

(vi) other ancillary plant.

(c) The provisions of (b) do not apply to a Class 2 building with a floor area of more than 2,500 m2 where the total area of the common areas is less than 500 m2

# APPENDIX C: MARKED UP PLANS FOR INSULATION

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- R2.3 Insulated External Wall
- R1.8 Insulated Internal Wall
- R2.0 Insulated Suspended Floor
- R1.0 Insulated Floor
- R1.0 Insulated Ceiling
- R3.2 Insulated Ceiling
UP
DN
Existing Hall
(to confirm if facade will not be touched or exposed during construction to determine if insulation can be improved)
Picton HS Redevelopment SD
Coordination Issue
Description
GENERAL ARRANGEMENT - GROUND FLOOR PLAN
Project No.
17003
Date
21/12/17
Scale
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Drawing Number
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Revision
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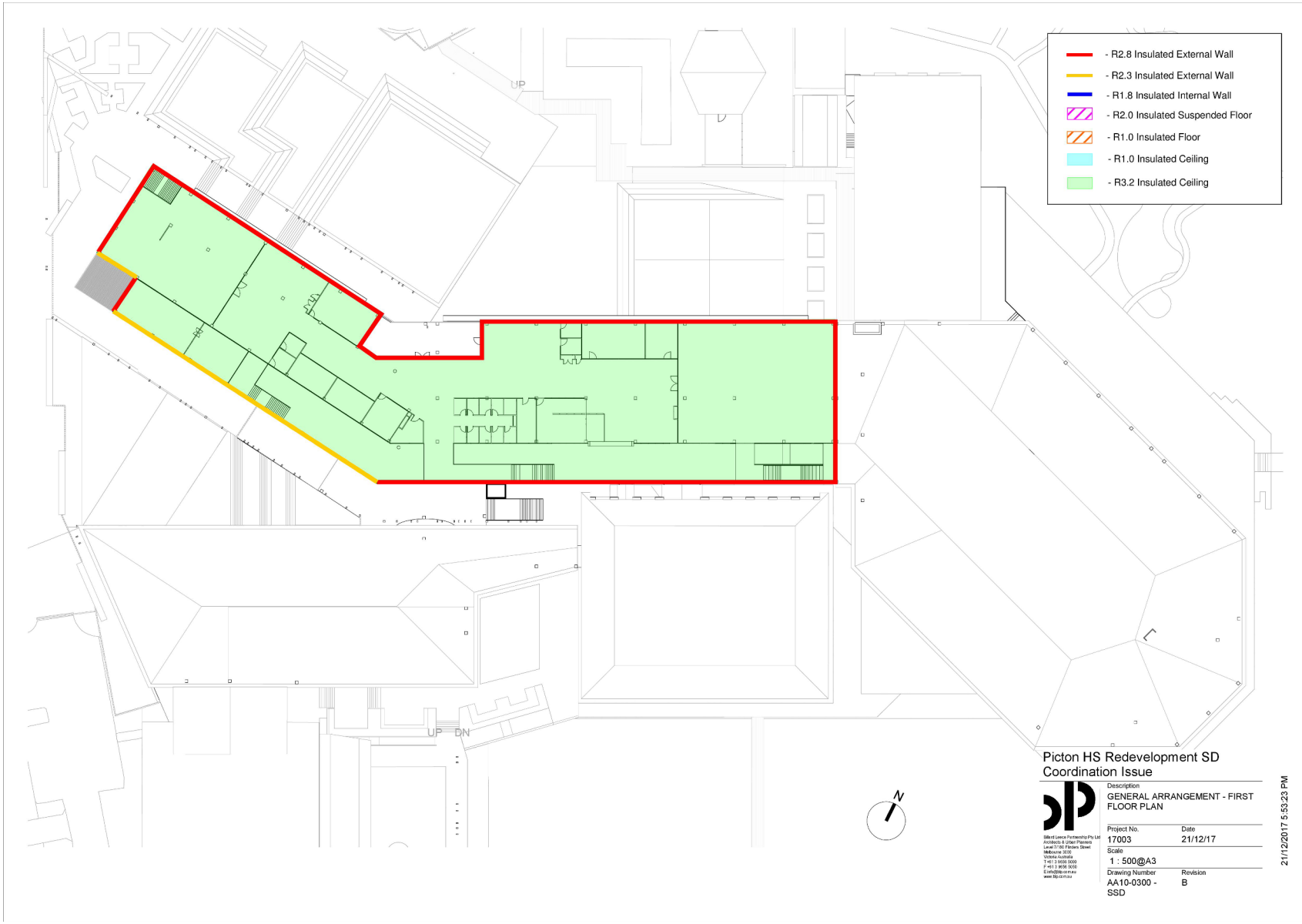
- R2.8 Insulated External Wall
- R2.3 Insulated External Wall
- R1.8 Insulated Internal Wall
- R2.0 Insulated Suspended Floor
- R1.0 Insulated Floor
- R1.0 Insulated Ceiling
- R3.2 Insulated Ceiling
UP
UP DN
N
Picton HS Redevelopment SD
Coordination Issue
Description
GENERAL ARRANGEMENT - FIRST FLOOR PLAN
Project No.
17003
Date
21/12/17
Scale
1 : 500@A3
Drawing Number
AA10-0300 - SSD
Revision
B
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