

RICHARD CROOKES CONSTRUCTIONS

ESD REPORT

ALEX AVENUE PUBLIC SCHOOL

JANUARY 2019



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ESD Report Alex Avenue Public School

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EXECUTIVE SUMMARY

This report provides a summary of the Ecologically Sustainable Development (ESD) strategy for the proposed Alex Avenue Public School development at 34-38 Schofields Road, Schofields on the corner of Farmland Drive and future realignment of Pelican Road, Schofields, NSW.

The proposed design includes a number of sustainability initiatives which align with the sustainability objectives of the Secretary's Environmental Assessment Requirements and the Blacktown City Council Development Control Plan 2015.

Key Issue 8 in the Alex Avenue Public School Secretary's Environmental Assessment Requirements (SEARs) identifies ESD responses to be addressed.

- 1 Incorporation of ESD Principles into the design and ongoing operation.
- 2 Meeting industry best practice.
- 3 Measures to minimise consumption of Resources, Water (including Water Sensitive Urban Design) and Energy.
- 4 Incorporation of initiatives responding to climate change impacts.

To satisfy the Alex Avenue Public School SEARs, the proposed development will target the following:

ESD Principles

- Design is consistent with the requirements of Blacktown City Council Development Control Plan 2015 (DCP)

Best practice

- The proposed design has been benchmarked against the Green Star Performance v1.2 tool.

NCC Section J Compliance

The architectural scheme provided in earlier project stages has been assessed for compliance with the thermal performance requirements of Section J of the NCC 2019. GSA architects are in the process of amending the design to allow for modular building construction. The proposed construction materials of the modular building construction exceed the thermal performance requirements of the early stage Section J assessment. The proposed design alterations by GSA therefore have the potential to meet Section J requirements under Part J1 Fabric and Glazing of the NCC 2019 provided the ratio of glass to shading and solid wall is not exceeded. The compliance of the design against the requirements of Part J1 of the NCC 2019 will be assessed at the construction certificate stage of the project.

ESD measures to minimise consumption of resources, water and energy

- Resources
 - Use of certified/best practice materials for steel, timber and permanent formwork.
 - Consideration of characteristics including durability, recycled content, location, embodied carbon and toxicity where feasible for other materials selection such as plasterboard, AFS or FSC certified timber and concrete with supplementary cementitious materials.
- Energy
 - building envelope performance – efficient building fabric and glazing selection to reduce thermal comfort demands
 - efficient systems selection to reduce operational energy consumption
 - effective control strategies
 - reduction in peak demand and grid electricity consumption through onsite renewable energy generation
- Water

- Rainwater harvesting for use in irrigation and toilet flushing, to reduce use of drinking water in non-potable applications.
- Selection of high efficiency fittings and fixtures to reduce operational consumption of potable water.
- Air cooled heat rejection system has been designed for the new development.
- Implement water sensitive urban design (WSUD) initiatives to improve the water quality of stormwater and reduce peak flow and runoff
- Plant species selected for the site will be native or have a low irrigation demand.

ESD recommendations responding to climate change impacts

- Temperature increase and greater heatwave frequency
 - High performance building envelope
 - High SRI building envelope and hard surface materials
 - Increase in vegetated area
 - Retractable shading fabrics
 - Shaded electrical and mechanical assets
- Extended drought periods
 - Efficient fittings and fixtures
 - Drought resistant vegetation
 - Oversize rainwater collection
- Increased intensity of extreme rainfall events
 - Oversize drainage
 - Oversize water detention
- Increased fire risk
 - Non-flammable structure and cladding
 - Operational fire management plan
- Higher wind gusts
 - Underground electrical assets

1 PROJECT BACKGROUND

1.1 INTRODUCTION

This report has been prepared by WSP on behalf of the Schools Infrastructure NSW (the Applicant). It accompanies an Environmental Impact Statement (EIS) in support of State Significant Development Application (SSD 18_9368) for the new Alex Avenue Public School at the corner of Farmland Drive and future realignment of Pelican Road in Schofields (the site). The site is legally described as proposed Lots 1 and 2, being part of existing Lot 4 in DP1208329 and Lot 121 in DP1203646.

The new school will cater for approximately 1,000 primary school students and 70 full-time staff upon completion. The proposal seeks consent for:

- Construction of a 2-storey library, administration and staff building (Block A) comprising:
 - School administrative spaces including reception;
 - Library with reading nooks, makers space and research pods;
 - Staff rooms and offices;
 - Special programs rooms;
 - Amenities;
 - Canteen;
 - Interview rooms; and
 - Presentation spaces.
- Construction of four 2-storey classroom buildings (Block B) containing 40 homebases comprising:
 - Collaborative learning spaces;
 - Learning studios;
 - Covered outdoor learning spaces;
 - Practical activity areas; and
 - Amenities.
- Construction of a single storey assembly hall (Block C) with a performance stage and integrated covered outdoor learning area (COLA). The assembly hall will have OOSH facilities, store room areas and amenities;
- Associated site landscaping and open space including associated fences throughout and games courts;

All proposed school buildings will be connected by a covered walkway providing integrated covered outdoor learning areas (COLAs).

1.1.1 SCOPE

This report outlines an ESD plan for the proposed development at Alex Avenue Public School. A holistic approach will be taken to respond to the ESD issues of the Secretary's Environmental Assessment Requirements (SEARs), the Blacktown City Council Development Control Plan 2015 (DCP) and the principles of ecologically sustainable development as defined by clause 7(4) of Schedule 2 of the Environmental Planning and Assessment Regulation 2000.

This report addresses the energy efficiency, energy consumption and water consumption requirements of section 6.5: Ecologically Sustainable Development, Blacktown City Council Growth Centre Precincts DCP 2016.

1.1.2 SUSTAINABILITY OBJECTIVES

The SEARs requirement for ESD in relation to this project are outlined below:

ECOLOGICALLY SUSTAINABLE DEVELOPMENT (ESD)	REPORT LOCATION
<i>Detail how ESD principles (as defined in clause 7(4) of Schedule 2 of the Environmental Planning and Assessment Regulation 2000) will be incorporated in the design and ongoing operation phases of the development.</i>	Sections 2, 3 and 4
<i>Include preliminary consideration of building performance and mitigation of climate change, including consideration of Green Star Performance</i>	Climate Change in Section 5. Green Star in Section 7
<i>Include a description of the measures that would be implemented to minimise consumption of resources, water (including water sensitive urban design) and energy</i>	Sections 2, 3 and 4
<i>Provide a statement regarding how the design of the future development is responsive to the CSIRO projected impacts of climate change. Specifically:</i> <ul style="list-style-type: none"> <i>o hotter days and more frequent heatwave events;</i> <i>o extended drought periods;</i> <i>o more extreme rainfall events;</i> <i>o gustier wind conditions; and</i> <i>o how these will inform material selection and social equity aspects (respite/shelter areas).</i> 	Section 5

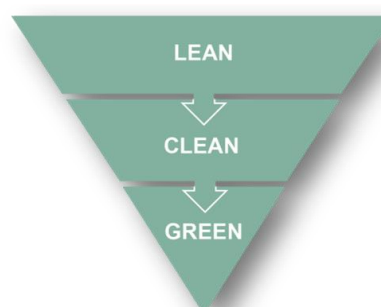
The following sustainable design initiatives have been captured to inform the design of the development at Alex Avenue Public School. These targets have been put in place as a framework to meet the objectives of the SEARs and Blacktown City Council DCP.

- Benchmarked against the Green Star Performance v1.2.
- Reduction in potable water consumption through rainwater harvesting, high efficiency fixtures and fittings and reuse of rain water for non-potable water uses (e.g. landscape irrigation and toilet flushing).
- Materials selected in the development are to be certified/best practice materials for steel, timber and permanent formwork.
- Operational waste facilities to collect and separate distinct waste streams (e.g. general waste, recyclables, organics).
- Onsite renewable energy generation.
- Mixed mode/natural ventilation strategy.

1.1.3 ESD APPROACH

The approach recommended for the ESD strategy is to:

- Be lean, i.e. reduce energy through passive design
- Be clean, i.e. use energy efficient services
- Be green, i.e. incorporate renewable technologies.



1.1.4 NCC VOLUME 1 2019 BCA SECTION J

School and office developments are required to meet the requirements set out by Section J in Volume 1 of the National Construction Code (NCC). Section J Energy Efficiency sets mandatory requirements for:

- The design of the building envelope and services, and provision of equipment and appliances to minimise energy use.
- The design of the building envelope to maximise thermal comfort performance.
- The provision of fixtures and appliances to minimise water use.
- The provision of adequate facilities for energy monitoring.

The architectural scheme provided in earlier project stages has been assessed for compliance with the thermal performance requirements of Section J of the NCC 2019. GSA architects are in the process of amending the design to allow for modular building construction. The proposed construction materials of the modular building construction exceed the thermal performance requirements of the early stage Section J assessment. The proposed design alterations by GSA therefore have the potential to meet Section J requirements under Part J1 Fabric and Glazing of the NCC 2019 provided the ratio of glass to shading and solid wall is not exceeded. The compliance of the design against the requirements of Part J1 of the NCC 2019 will be assessed at the construction certificate stage of the project.

1.1.5 GREEN STAR

The design benchmarking approach has followed the environmental categories set out in the Green Star Performance v1.2 rating tool, including management, indoor environment quality (IEQ), energy, materials, water, transport, land use and ecology, emissions and innovation. A proposed pathway for achieving a 4 Star rating is provided in Appendix A-3. Green Star Performance was selected as the most appropriate tool as it assesses the ongoing sustainability performance of a development. Green Star Performance rates buildings against a scale of one to six stars. Buildings can achieve between zero and six star ratings as follows:

OVERALL SCORE	RATING	CONSIDERED
0-9	Zero Star	“Assessed”
10-19	One Star	“Minimum Practice”
20-29	Two Star	“Average Practice”
30-44	Three Star	“Good Practice”
45-59	Four Star	“Best Practice”
60-74	Five Star	“Australian Excellence”
75+	Six Star	“World Leader”

The proposed building has the ability to achieve a Green Star Performance v1.2 - 4 Star rating in line with the Green Star Performance scorecard provided.

1.1.6 SOURCES OF INFORMATION

- Secretary’s Environmental Assessment Requirements SSD 9368 – Alex Avenue Public School, 22/06/2018
- Architectural drawings - Hayball 28/11/2018
- National Construction Code Building Code of Australia 2019 draft Volume 1 Section J.
- Green Star Performance Tool v1.2.

2 ENERGY EFFICIENCY

SEARs Key Issue 8 (ESD) seeks input for practical opportunities to minimise consumption of energy generated from non-renewable sources, and implementation of effective energy efficiency measures.

The project will aim to minimise the electricity use in the development, through application of passive design and performance envelope principles in conjunction with efficient systems selection and effective control strategies. These strategies will be used to reduce energy consumption for HVAC and lighting when not required.

Efficiency and reduced consumption of energy will be achieved through:

- Optimised façade design.
- Efficient HVAC selection.
- High efficiency LED fittings.
- Timer switches and daylight sensing to reduce unnecessary energy consumption.

The CO₂ emissions of the project can be further reduced by use of on-site renewable energy – see also On-site Renewable Energy below.

2.1.1 HVAC STRATEGY

A key environmental initiative for the building is the use of an energy efficient HVAC system. The system will be specifically designed based on the final design of the school buildings.

A balance of natural ventilation and mechanical cooling and heating in a mixed mode system is proposed for the development. The system will be designed with appropriate controls and metering to allow for ongoing performance efficiency.

2.1.2 LIGHTING STRATEGY

High efficiency LED fittings will be selected for general use throughout the building. To further reduce lighting energy consumption, it is recommended that controls are used on the lights to ensure they are not being used unnecessarily.

Options for appropriate controls in the spaces include:

Time switches

- A time switch on the lights which switches off all lights after hours and in meeting rooms and classrooms, after a pre-set time.

Daylight sensors

- Daylight sensors can be used to dim or turn lights off when daylighting levels within the classroom and office are sufficient.
- Lights should be controlled in separate zones, such that the perimeter lights can switch off if daylight is sufficient, while the centre lights stay on if needed.

Motion sensors

- Motion sensors can be used in meeting rooms, corridors, classrooms and offices spaces to turn off lighting when unoccupied.

3 ON-SITE RENEWABLE ENERGY

The inclusion of a grid connected photovoltaic (PV) solar system on the roof of the development can have the following significant benefits:

- Reduced CO₂ emissions associated with the development through the use of renewable energy as a percentage of consumption.
- Increase points achieved under the Energy category in the Green Star Design and As Built or Performance tools.
- Reduced operational electricity bills.
- Reduced peak grid electricity demand

Further performance improvements can be achieved through the addition of battery storage. Due to the electrical demand profile of the development the benefits of battery storage are unlikely to be substantial, however the system will be capable of providing the following benefits:

- Potential peak electricity load reduction when correctly managed
- On-site electrical back-up in case of grid disconnection.
- Reduced grid dependence when coupled with PV generation

Battery storage provides the most benefit when day time generation capacity exceeds demand, resulting in a surplus of energy to be stored for use during the night. As the schools electrical demand profile is heavily dominant in day time use, there may not be sufficient surplus energy for storage. A more detailed analysis would be required to determine if there is financial viability in investing in batteries for limited return on night time energy consumption.

4 WATER

SEARs Key Issue 8 also seeks input for sustainability initiatives that will reduce the demand for drinking water including any proposed alternative water supply, proposed end uses of drinking and non-drinking water, demonstration of water sensitive urban design and any proposed water conservation measures.

4.1 POTABLE WATER USE REDUCTION

Measures to use drinking water efficiently and measures to use alternative water supplies for non-potable uses where appropriate are proposed for the development.

Efficient Fixtures and Fittings

Compared to standard practice, significant reductions in potable water use can be achieved by specifying efficient fixtures with high WELS ratings.

Table 4.1 describes the proposed fixture WELS ratings.

Table 4.1 Proposed water fixtures and fittings WELS ratings compared to standard practice

FIXTURE	PROPOSED FIXTURES	STANDARD PRACTICE
Toilets	5 Star (4 / 3L dual flush)	4 Star (4.5 / 3L dual flush)
Hand basins	6 Star (4.5L/min)	4 Star (7L / min)
Kitchen sink taps	6 Star (4.5L / min)	4 Star (7L / min)
Showers	3 star (7.5 L / min)	3 star (9 L / min)

Use of the proposed fixture efficiencies represents approximately 25% reduction in potable water consumption compared to the standard practice case.

Rainwater Capture and Reuse

It is recommended that 65kL of rainwater storage be installed on site. The rainwater storage, collecting from approximately 2,360m² roof area, can be connected for landscaping irrigation and for toilet flushing, reducing the need to use potable water supply for these non-drinking water uses.

The final capacity of the rainwater tank or tanks will be dependent on the final roof drainage design and whether or not underground storage will be included. The rainwater can be collected in either one centralised underground tank or several above ground tanks. If collection is to be divided among multiple above ground tanks, an increased total capacity will be required to allow for the diversity of use from each tank.

5 CLIMATE CHANGE IMPACTS

Climate change is having worldwide impacts on society, the economy and the environment. In Australia, the *CSIRO Climate Change in Australia 2015* publication, states that: “Observed climate information indicates that Australian average surface air temperature has increased by 0.9°C since 1910, and many heat-related records have been broken in recent years. Sea level has risen about 20cm over the past century.”

Specifically, for the Metropolitan Sydney Region it is estimated temperatures will increase by an average of 0.7°C by 2039 along with increased hot days, extended droughts and more frequent extreme rainfall events. These specific climate change projections for the area have been established by the NSW and ACT Regional Climate Modelling (NARClIM) project and a snapshot of the impacts can be seen below in Figure 5.1.

Projected temperature changes	
Maximum temperatures are projected to increase in the near future by 0.3–1.0°C	Maximum temperatures are projected to increase in the far future by 1.6–2.5°C
Minimum temperatures are projected to increase in the near future by 0.4–0.8°C	Minimum temperatures are projected to increase in the far future by 1.4–2.5°C
The number of hot days will increase	The number of cold nights will decrease
Projected rainfall changes	
Rainfall is projected to decrease in spring and winter	Rainfall is projected to increase in summer and autumn
Projected Forest Fire Danger Index (FFDI) changes	
Average fire weather is projected to increase in spring by 2070	Severe fire weather days are projected to increase in summer and spring by 2070

Figure 5.1 Snapshot of climate change projections established by the NARClIM Project.

5.1 SITE ASSESMENT

The Alex Avenue Public School development site has been qualitatively assessed against the climate change impacts stated in SEARs Key Issue 8 for the development in conjunction with the NARClIM project projections and the Blacktown Local Environment Plan (BLEP) 2015. The results of this assessment are listed below in Table 5.1.

Table 5.1 Table of climate change impacts for Alex Avenue Public School development.

CLIMATE CHANGE IMPACT	RISK TO SITE
Temperature increase and greater heatwave frequency	High
Extended drought periods	High
Increased intensity of extreme rainfall events	Medium
Increased fire risk	Medium
Higher wind gusts	Negligible

5.2 CLIMATE CHANGE RESPONSIVE SUSTAINABILITY INITIATIVES

To ensure the development is resilient to these climate change impacts we recommend the following initiatives be pursued to ensure the future development is responsive to the CSIRO projected impacts of climate change based on the site assessment for the following climate change impacts.

5.2.1 *TEMPERATURE INCREASE AND GREATER HEATWAVE FREQUENCY*

The risk to the development of temperature increase and greater heatwave frequency is high therefore the following sustainability initiatives are recommended:

- High-performance building envelope. Provide a building envelope performance above the minimum requirements set out by the BCA.
- High SRI building envelope and hard surface materials. Specify building cladding, roof finishes and hard surface materials use a high SRI finish avoiding undesirable heat gain. Meeting the following requirements from Green Star Design & As Built v1.2 Credit 25:
 - Roof materials including shading structures:
 - For roof pitched $<15^{\circ}$ - a three year SRI of minimum 64; or
 - For roof pitched $>15^{\circ}$ - a three year SRI of minimum 34
 - Unshaded hard-scaping elements with a three year SRI of minimum 34.
- Increase in vegetated area. Provide an increase in the landscaped area of the development including providing additional natural shading.
- Shaded electrical and mechanical assets. Provide shades to electrical and mechanical assets ensuring they maintain optimal efficiency in hotter events.

5.2.2 *EXTENDED DROUGHT PERIODS*

The risk to the development of extended drought periods is high therefore the following sustainability initiatives are recommended:

- Efficient fittings and fixtures. Provide efficient fittings and fixtures as recommended in section 4.1 throughout the development minimising potable water demand.
- Drought resistant vegetation. Specify planting drought resistant vegetation to landscaped areas minimising the irrigation demand of the development and providing further longevity of the vegetation against such events.
- Oversize rainwater collection. Provide a rainwater tank exceeding the current recommended allowance facilitating onsite provision of water further into the drought event.

5.2.3 *INCREASED INTENSITY OF EXTREME RAINFALL EVENTS*

The risk to the development of increased intensity of extreme rainfall events is medium due to the site existing outside of existing flood risk areas. Therefore, the following sustainability initiatives are recommended:

- Oversize drainage. Oversize drainage and downpipes to cope with more extreme weather events - the current hydraulic design has provided gutters and downpipes sized to meet the 1 in 100 year storm. This is more than required to meet code compliance and thus oversizes the system to allow for an increase in intensity of extreme rainfall events.
- Oversize water detention. Specify water detention systems to manage more extreme weather events reducing impact on municipal stormwater systems including effective utilisation of overland flow paths and rainwater

gardens. As discussed above, the final rainwater tank sizing will be addressed during design development. Options for increasing the capacity of the rainwater storage will be investigated at that stage.

5.2.4 *INCREASED FIRE RISK*

The risk to the development of increased fire risk is medium due to the site location being bound by a bushfire buffer zone to the north and south. Therefore, the following sustainability initiatives are recommended:

- Non-flammable structure and cladding. Specify structure, cladding and envelope materials are all non-flammable.
- Operational fire management plans. Implement operational fire management plans reducing the risk of fire associated with the development.

5.2.5 *HIGHER WIND GUSTS*

The risk to the development of higher wind gusts is considered negligible due to the location away from the coast. Therefore, business as usual initiatives responding to wind will satisfy this impact. However, the following best practice initiative is still recommended:

- Underground electrical assets. Locate all electrical cabling onsite underground between buildings removing the risk of damage due to wind.

6 SECTION J - BUILDING ENVELOPE

6.1.1 PURPOSE OF REPORT

WSP has carried out a Performance Solution assessment of the architectural scheme provided in earlier project stages using Verification Method JV3 under Section J Energy Efficiency, Volume 1 of the National Construction Code (NCC) 2019 Public Comment Draft Version 1.2 for the Blocks A, B02A, B02B, B02C, and Block C development of Alex Avenue Public School at 34-38 Schofields Road, Schofields, NSW. GSA architects are in the process of amending the design to allow for modular building construction. The proposed construction materials of the modular building construction exceed the thermal performance requirements of the early stage Section J assessment. The proposed design alterations by GSA therefore have the potential to meet Section J requirements under Part J1 Fabric and Glazing of the NCC 2019 provided the ratio of glass to shading and solid wall is not exceeded. The compliance of the design against the requirements of Part J1 of the NCC 2019 will be assessed at the construction certificate stage of the project. This section outlines the assessment provided in the previous stage of the project.

Verification Method JV3 requires a comparison between a Reference Building – constructed in accordance with the deemed-to-satisfy (DTS) provisions detailed in the Parts of Section J – and the Proposed Building – constructed in accordance with the design intent. The following simulations have been carried out:

- Reference Building + Reference Services—modelling of the building with the building envelope and services meeting the DTS provisions
- Proposed Building + Reference Services—modelling of the building with the building envelope meeting the design intent and the services meeting the DTS provisions

This report presents the methodology used for the JV3 modelling and the results of the simulations undertaken.

6.1.2 PERFORMANCE REQUIREMENTS

Volume One of the NCC Series 2019 Public Comment Draft Version 1.2 Clause A0.7 Requirements

The relevant DTS Provisions considered in the Reference Building and the Proposed Building are as follows:

- Section J Part J0 Energy Efficiency
- Section J Part J1 Building Fabric and Glazing
- Section J Part J3 Building Sealing
- Section J Part J5 Air Conditioning and Ventilation System
- Section J Part J6 Artificial Lighting and Power

There are no performance requirements from other Sections or Parts of Volume One of the NCC Series 2016 that are relevant to any aspects of the Reference Building and the Proposed Building or that are affected by the application of the DTS provisions that are the subject of the Reference Building and the Proposed Building.

Volume One of the NCC Series 2019 Public Comment Draft Version 1.2 JP1 Requirements

A building, including its services, must have features that facilitate the efficient use of energy appropriate to:

- The function and use of the building and its services; and
- The level of human comfort required for the building use; and
- For a building with a conditioned space, achieving an hourly regulated energy consumption averaged over all hours of operation in a year, of not more than
 - For a Class 2 common area, Class 5, 6, 7b, 8 or 9a building, or a Class 9b school, 30 kJ/m².hr; and
 - For all other building classifications, 8 kJ/m².hr

6.2 METHODOLOGY

6.2.1 ASSESSMENT METHOD AND BUILDING CLASSIFICATION

Clause A2.0 of Volume One of the NCC Series 2019 Public Comment Draft Version 1.2 stipulates that compliance with the NCC is achieved by complying with:

- The Governing Requirements of the NCC; and
- The Performance Requirements. The Performance Requirements are satisfied by one of the following solutions as described in clause A2.1:
 - a) A Performance Solution
 - b) A Deemed-to-Satisfy Solution.
 - c) A combination of (a) and (b).

Clause A2.2 of Volume One of the NCC Series 2019 Public Comment Draft Version 1.2 stipulates that a Performance Solution is achieved by demonstrating compliance with all appropriate Performance Requirements or a solution is at least equivalent to the Deemed-to-Satisfy Provisions.

A Performance Solution must comply with the Performance Requirements through one or a combination of the following:

- Evidence to support that the use of a material, form of construction or design meets a Performance Requirement or a Deemed-to-Satisfy provision as described in A2.1
- Verification Methods such as the Verification Methods in the NCC; or such other Verification Methods as the appropriate authority accepts for determining compliance with the Performance Requirements
- Expert judgement
- Comparison with the Deemed-to-Satisfy provisions

The development seeks to demonstrate compliance with JP1 by using:

- Evidence to support that the use of a material, form of construction or design meets a Performance Requirement or a Deemed-to-Satisfy provision as described in A2.1
- Verification Method JV3; determining that the annual energy consumption of the Proposed Building is not more than the annual energy consumption of the Reference Building for the school development.

In accordance with Part A6 of NCC Volume 1, the proposed building comprises spaces with the following classifications:

- Class 9b – School
- Class 5 – Office
- The site is located within Climate Zone 6.

6.2.2 MODEL INFORMATION

6.2.2.1 SOFTWARE

The computer package used for the thermal simulation was Tas version 9.4.3 by Environmental Design Solutions Limited. It is an EN ISO 13791 validated dynamic simulation modelling (DSM) software tool and is approved under the *ABCB Protocol for Building Energy Analysis Software, Version 2006.1*.

6.2.2.2 SOURCES OF INFORMATION

The following sources of information were used to generate the thermal model:

- Parts J1 – J3, Section J, Volume One of the NCC Series 2019 Public Comment Draft Version 1
- Australian Building Codes Board (ABCB) glazing calculator 2014 (current version)
- Glazing candidates: products listed on online WERS glazing database.
- Architectural drawings: Hayball Architecture “Preliminary SSDA Issue” dated 28/11/2018

6.2.2.3 EQUIPMENT LOADS

The simulations apply the following air conditioning parameters, per Volume One of the NCC Series 2019 Public Comment Draft Version 1, including:

- Specification JVC Table 2b, 2c and 2i for the appliances and equipment schedule
- Specification JVC Table 2k for equipment loads

6.2.2.4 MECHANICAL SERVICES

The simulations apply the following air conditioning parameters, as per Volume One of the NCC Series 2019 Public Comment Draft Version 1, including:

- Specification JVC Table 2b, 2c and 2i for the air conditioning operational schedule
- Specification JVb clause 2 Reference Building, sub clause (c) (i) (B) for the air conditioning temperature range
- Minimum fan operating efficiency, as per part J5.4, sub clause (b) (ii)
- Minimum EER for heat pump, as per part J5.11 sub clause (b) (ii)

6.2.2.5 OCCUPANCY LOADS

The simulations apply the following air conditioning parameters, as per Volume One of the NCC Series 2019 Public Comment Draft Version 1, including:

- Specification JVC Table 2b, 2c and 2i for the occupancy schedule
- Specification JVC, Table 2m, dining room restaurant or café (a) for sensible and latent heat gain in café and dining areas and other applications (a) for sensible and latent occupancy heat gain in all other areas.
- Table D1.13 for occupant density

6.2.2.6 LIGHTING LOADS

The simulations apply the following air conditioning parameters, as per Volume One of the NCC Series 2019 Public Comment Draft Version 1, including:

- Specification JVC Table 2b, 2c and 2i for artificial lighting schedule
- Table J6.2a for maximum illumination power density

6.3 BUILDING FABRIC PERFORMANCE PARAMETERS

This section summarises the building fabric as modelled for the JV3 analysis. It details changes to the building elements currently specified to achieve compliance.

Table 6.1 lists the building fabric performance parameters used in the reference and the proposed building. The R-value listed shows the total system R-value, see Appendix A-2 for drawings showing where the total construction values need to be applied. The markup of Appendix A reflects the parameters used for the modeling.

The BCA Section J1 Building Fabric and Glazing assesses the building envelope only. Therefore, the following values are only applicable between typical conditioned spaces that adjoin an unconditioned space or the outside.

Table 6.1: Building Fabric Performance Parameters

BUILDING FABRIC ELEMENT	REFERENCE BUILDING	PROPOSED BUILDING
Slab on ground	R 2.0 m ² .K/W	None
Suspended Floor	R 2.0 m ² .K/W – to the outside or enclosed space with more than 1.5 air changes per hour.	As constructed – no additional insulation required
External walls	R 2.5 m ² .K/W Solar Absorptance of no more than 0.6	As per the Reference building <i>Can be achieved through the addition of R2.5 insulation with thermal breaks installed at all required locations</i>
Envelope walls other than external walls	R 1.8 m ² .K/W – where the non-conditioned space has mechanical ventilation of more than 1.5 air changes per hour of outside air during occupied hours.	As per the Reference building <i>Can be achieved through the addition of R1.5 insulation with thermal breaks installed at all required locations</i>
Ceilings to unconditioned areas	R 3.2 m ² .K/W Downwards.	As per the Reference building <i>Can be achieved through the addition of R3.2 insulation with thermal breaks installed at all required locations</i>
Roof	R 3.2 m ² .K/W Downwards. Solar Absorptance of no more than 0.45	R 3.2 m ² .K/W Downwards. Solar Absorptance of 0.73 <i>Can be achieved through the addition of R3.2 insulation</i>

6.4 BUILDING GLAZING PERFORMANCE PARAMETERS

The reference building glazing is developed in compliance with the National Construction Code Glazing Calculators (Volume One) using available glazing products.

Refer to Appendix A-1 for the completed Glazing Calculators and Table 6.2 which summarises the glazing parameters used for the proposed building in the JV3 analysis.

Table 6.2: Proposed Building Glazing Parameters

ORIENTATION	LEVEL	REFERENCE BUILDING (Whole of System Values)	PROPOSED BUILDING (Whole of System Values)
All	All	Per the glazing calculators in Appendix A-1 Aluminum Frame	Viridian Comfort Plus Neutral 6.38mm U-Value = 4.40, SHGC = 0.40 Aluminium Frame

Note: The benchmark glazing products nominated in Table 2 are presented for information only. These demonstrate that the glazing performance requirements detailed are achievable with commercial glazing products. It is the responsibility of the architect or contractor to select glazing products which meet the stated U-value and Solar Heat Gain Coefficient (SHGC) performance requirements.

6.5 THERMAL COMFORT

This section summaries the thermal comfort level of the proposed developed expressed as a PMV sensation scale in accordance with ANSI/ASHRAE Standard 55. JV3 Verification Method (a) (ii) specifies a performance requirement of a thermal comfort level of between a across not less than 95% of the floor area of PMV ± 1 not less than 98% of operating hours.

The simulation has undertaken the thermal comfort assessment with the following assumptions:

- Air Speed: Winter 0.15m/s, Summer 0.30m/s/
- Clothing Value: Winter 0.95, Summer 0.6.
- Metabolic Rate 130W/person.
- Mechanical Conditioning between 21°C - 24°C

Figure 6.1, Figure 6.2, Figure 6.3, Figure 6.4, Figure 6.5 & Figure 6.6 below demonstrates the results of the Thermal Comfort Assessment and compliance with performance requirement JV3 (a) (ii) as 100% of the conditioned spaces achieve a PMV of ± 1 not less than 99% of operating hours.

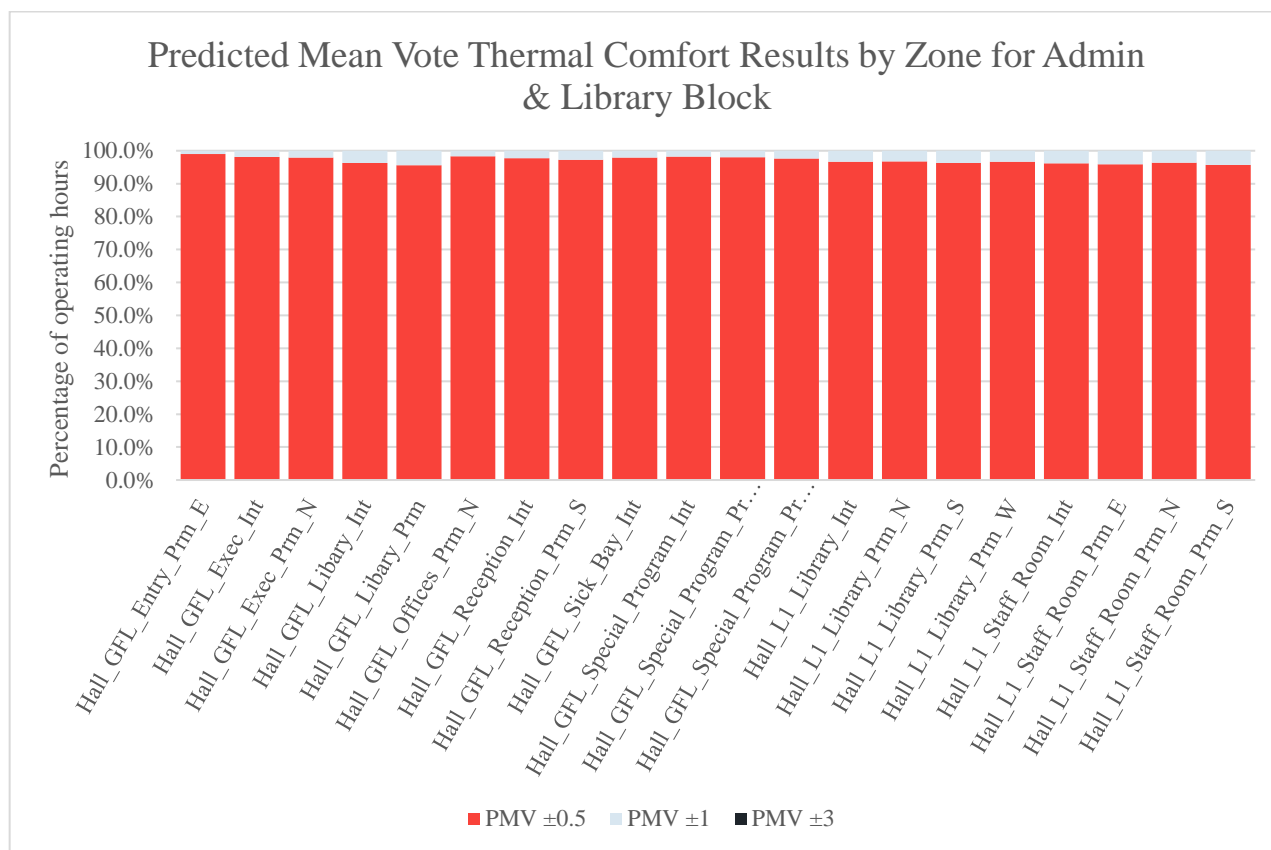


Figure 6.1 PMV Results for Admin & Library Block

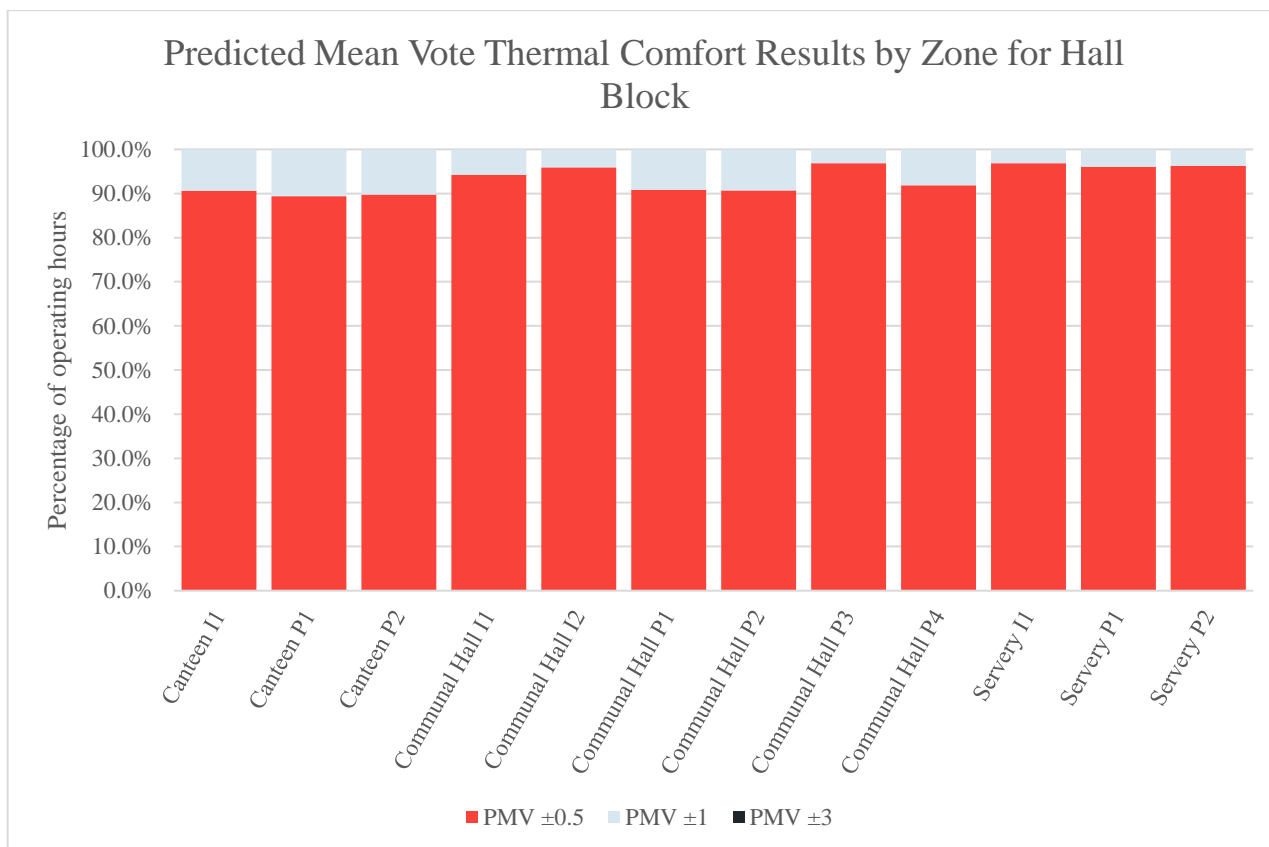


Figure 6.2 PMV Results for Hall Block

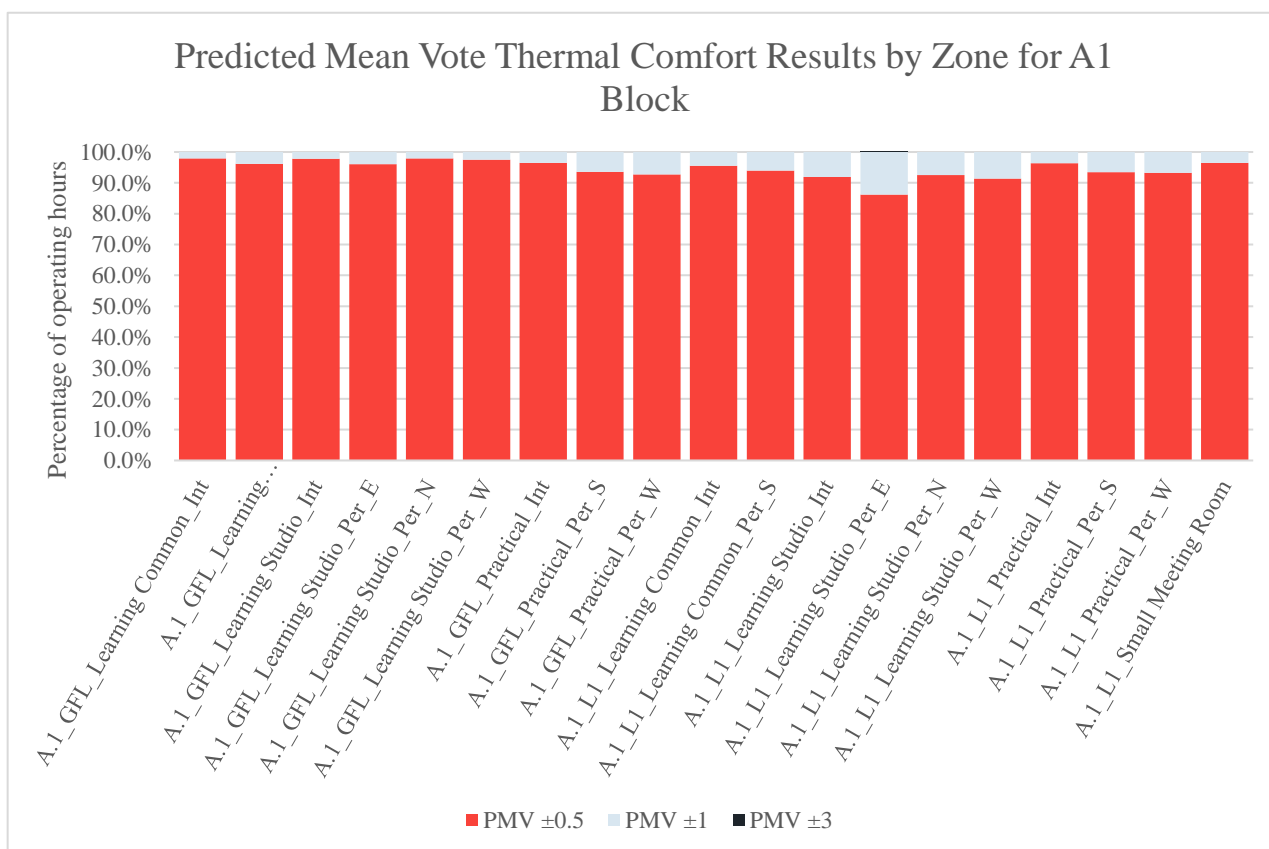


Figure 6.3 PMV Results for A1 Block

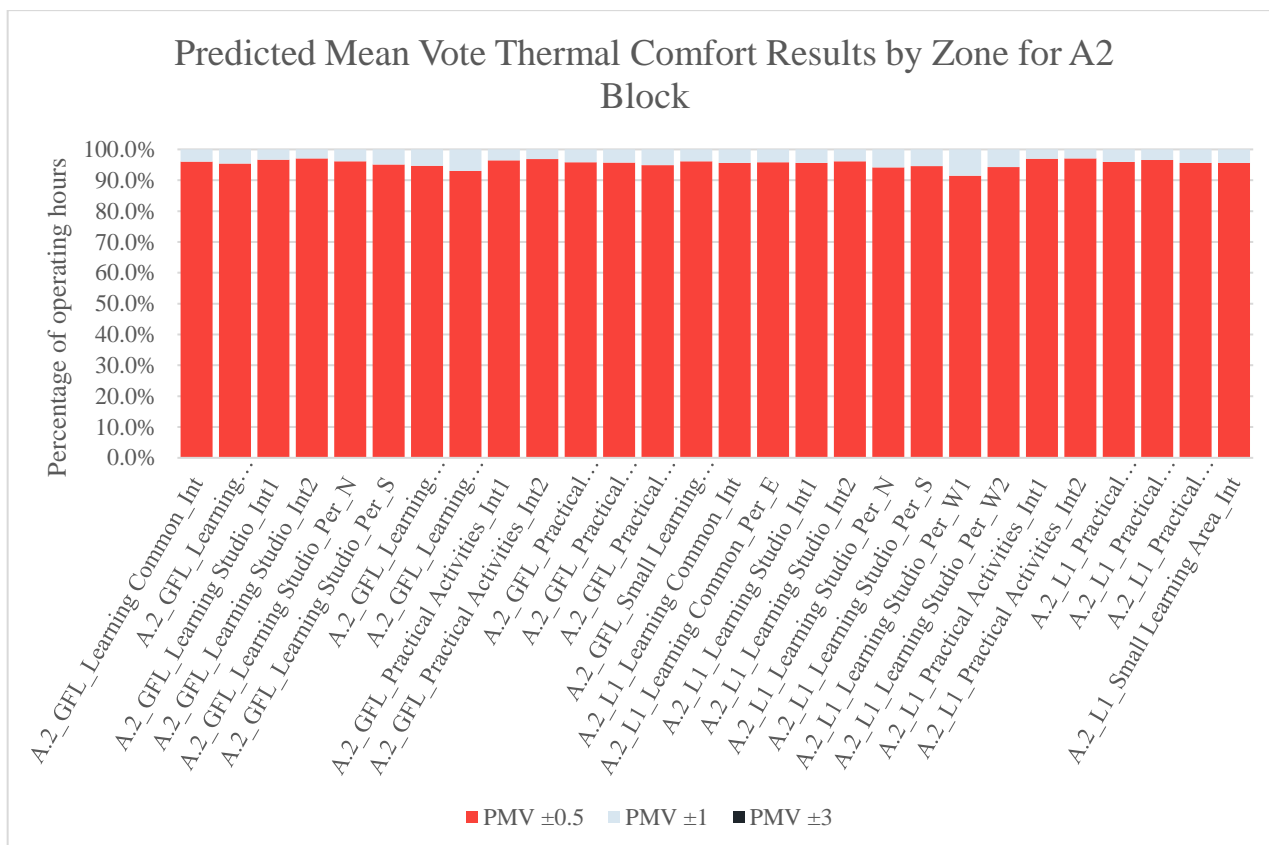


Figure 6.4 PMV Results for A2 Block

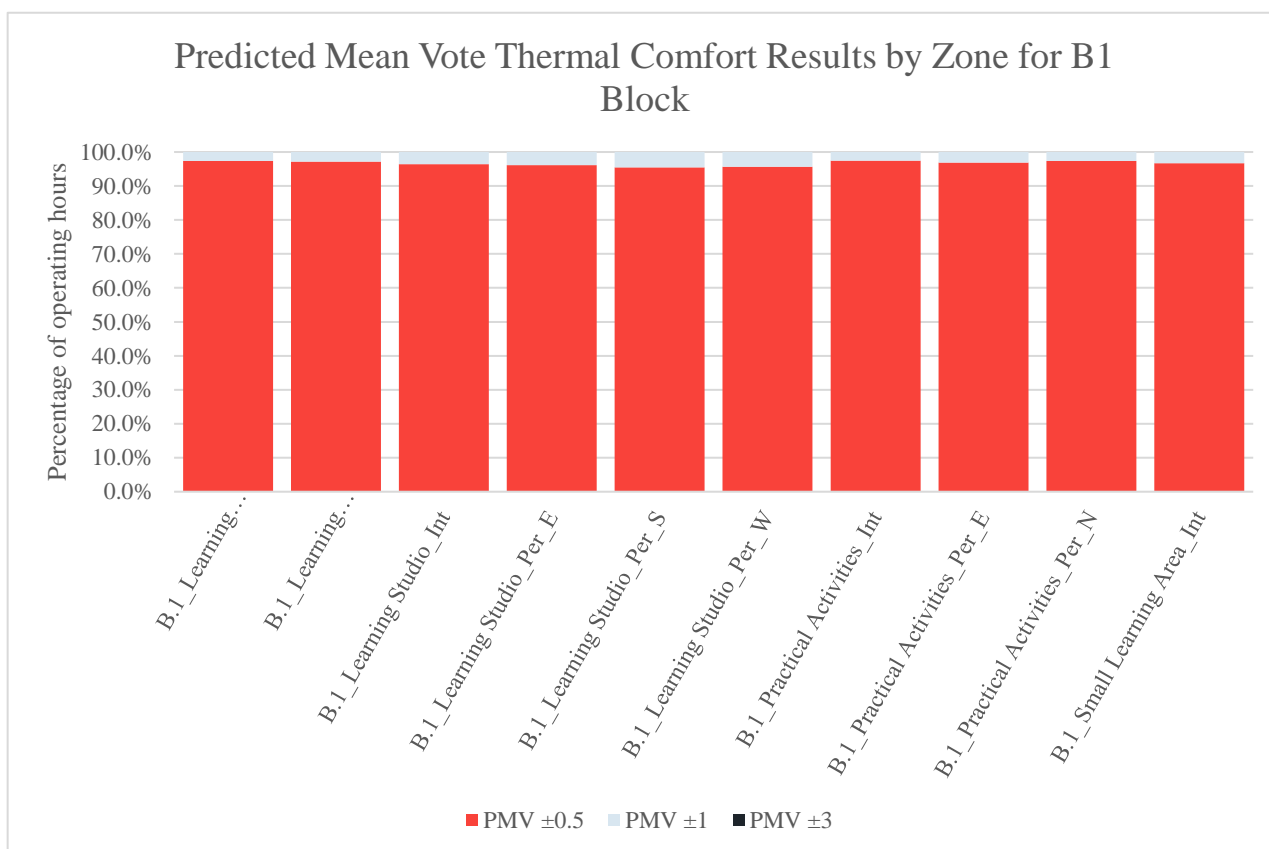


Figure 6.5 PMV Results for B1 Block

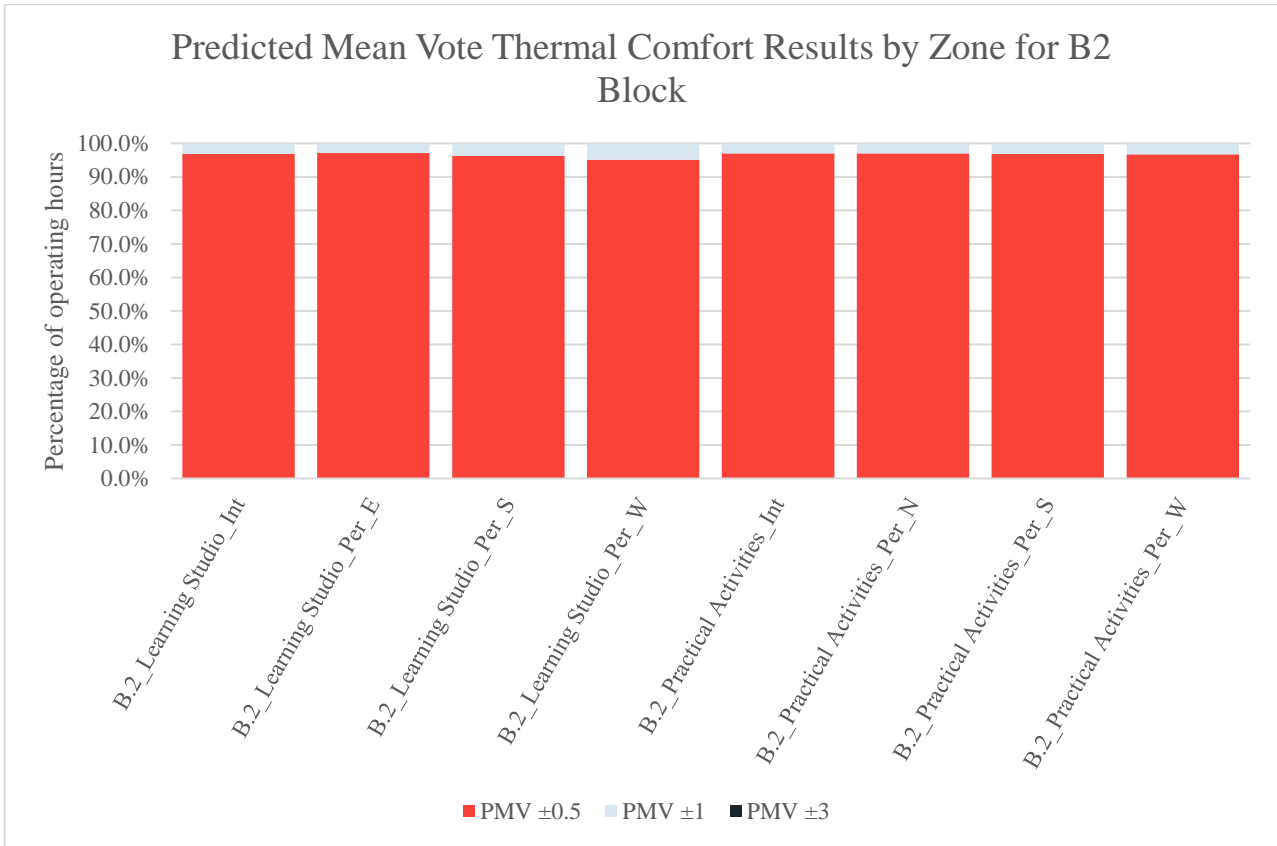


Figure 6.6 PMV Results for B2 Block

6.6 RESULTS

The following simulations have been carried out:

- Reference Building + Reference Services—modelling of the building with the building envelope and services meeting the DTS provisions.
- Proposed Building + Reference Services—modelling of the building with the building envelope meeting the design intent and the services meeting the DTS provisions.

Table 6.3 and Figure 6.7 demonstrate the predicted annual energy consumption for the simulations performed.

Based on the modelling performed, the proposed building envelope has the potential to comply with the performance requirements. The calculated annual energy consumption of the Proposed Building is 1.65% less than the Reference Building.

Table 6.3: Simulation Results

BUILDING		ANNUAL ENERGY CONSUMPTION (KWH/YEAR)					
		Heating	Cooling	Equipment	Lighting	Total	Pass/Fail
Block B02A	Reference Building + Reference Services	48,842	116,261	24,390	40,110	229,603	Pass: 1.16%
	Proposed Building + Reference Services	48,681	113,758	24,390	40,110	226,939	
Block B02B	Reference Building + Reference Services	48,553	109,459	23,736	39,589	221,336	Pass: 2.15%
	Proposed Building + Reference Services	50,020	103,222	23,736	39,589	216,567	
Building A: Admin	Reference Building + Reference Services	15,533	61,766	34,382	29,153	140,835	Pass: 0.83%
	Proposed Building + Reference Services	15,726	60,400	34,382	29,153	139,662	
Building C: Hall	Reference Building + Reference Services	8,919	53,073	11,379	15,302	88,673	Pass: 3.5%
	Proposed Building + Reference Services	9,036	49,844	11,379	15,302	85,561	
Total Development	Reference Building + Reference Services	97,395	225,720	48,126	79,699	450,939	Pass: 1.65%
	Proposed Building + Reference Services	98,701	216,980	48,126	79,699	443,506	

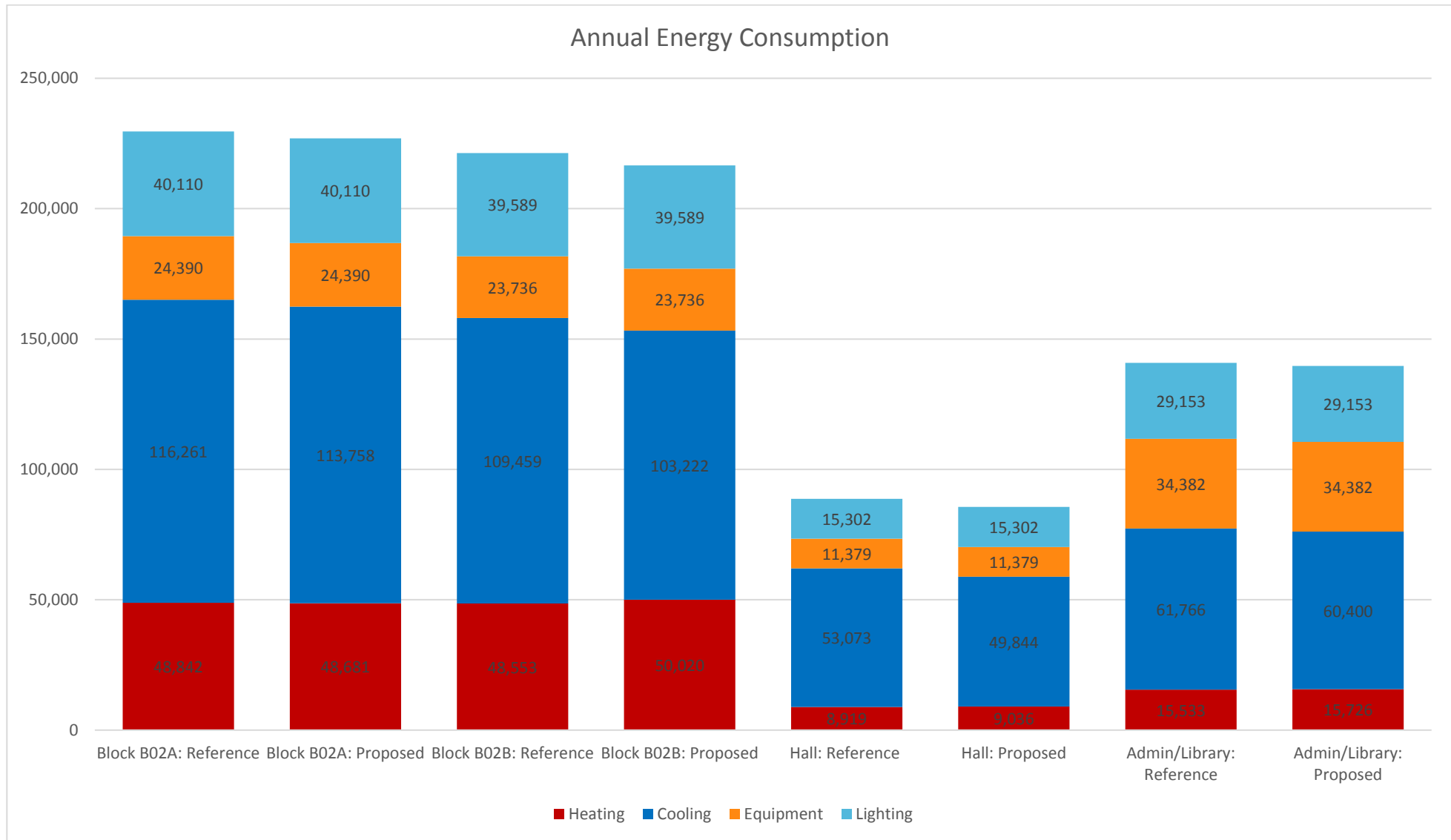


Figure 6.7: Simulation Results

7 SUSTAINABILITY INITIATIVES

The initiatives that follow support benchmarking the proposed design against the Green Star Performance v1.2 tool, and are ordered by the categories used in the Green Star tool. It is understood that formal certification will not be sought at this stage.

The scorecard provided in Appendix A-3 is the result of benchmarking the proposed design against the Green Star Performance tool.

MANAGEMENT

- Engaging a Green Star Accredited Professional to ensure effective sustainability outcomes are achieved under the Green Star certification.
- Distributing relevant and current operation and maintenance information to management staff.
- Providing accessible metering to monitor building energy and water consumption.
- Provide ongoing and comprehensive building tuning to further optimise the operation of building systems
- Develop an Environmental Management Plan
- Develop a green cleaning policy for operational cleaning of all areas.
- Develop environmental performance targets to benchmark against the development and provide regular progress reports.
- Develop policy to minimise construction waste from end of life of interior fitouts

INDOOR ENVIRONMENT QUALITY

The development will provide high levels of indoor environment quality for the occupants, this will be achieved by:

- Preventing the entry of outdoor air pollutants through good design and advanced filtration techniques.
- Maintaining lighting fixture performance so that all lights are flicker-free, accurately address the perception of colour and eliminate glare from bare lamps.
- Ensuring a high level of lighting comfort through the application of appropriate lighting levels and the installation of appropriate luminaires.
- Ensuring occupants have a clear line of sight to high quality views.
- Ensuring that the internal ambient noise levels within a space are suitable and relevant to the activity type.
- Issue occupant satisfaction surveys to occupants as part of ongoing site management.

ENERGY

The following key initiatives can be further developed to improve the energy efficiency of the development:

- Highly efficient building envelope, including Insulation and Glazing.
- Efficient lighting design and control with high efficacy luminaires.
- High efficiency plant with optimised staging.
- Variable speed drives on all primary and secondary pumps, and primary fans.
- Installation of renewable energy on site.

SUSTAINABLE TRANSPORT

Active transport improvements can include:

- Policy and initiatives encouraging active transport for occupants and visitors.
- Policy and initiatives encouraging public transport for occupants and visitors.
- Implementing a transport modes survey assessing the transport options utilised in the development.

WATER

Water efficiency can be achieved in the following ways:

- Installation of efficient fixtures and fittings.
- Water sensitive landscape and irrigation design.
- Water reuse initiatives (e.g. onsite rainwater collection used for irrigation and toilet flushing).
- Air cooled heat rejection, as opposed to water cooled heat rejection.
- Regular and appropriate testing of fire protection system equipment and diversion of all fire test water away from discharge to sewer.

SUSTAINABLE MATERIALS

The following sustainable material initiatives will also be targeted:

- Establishment of sustainable procurement framework
- Sustainable procurement of 75% of the 'top 3 consumables' in accordance with the highest level of the sustainable procurement framework.
- Establishment of operational waste management plan.
- Design on site operational waste facilities to collect and separate distinct waste streams diverting at least 40% of waste from landfill.
- Develop a Waste Management Plan for refurbishments of the development

LAND USE AND ECOLOGY

- Establish operational requirements for the maintenance of biodiversity on site.
- Establish best practice site maintenance procedures for landscaped and hard areas on site.

EMISSIONS

- Creation of a stormwater management plan identifying short term and long term objectives and measurement protocols.
- Minimising light pollution arising from external lighting
- Installing time controlled lighting minimising light pollution resulting from internal lighting.
- Air cooled system proposed for the site, this will remove the risk of legionella on site.

APPENDIX A-1

GLAZING CALCULATORS

Building Name
Homebase A.1

Story
GF

Requirements of Roof, Floor and Wall per orientation

Element	R-Value (m2k/W)	Direction of Heat Flow	Solar Absorptance
Roof	3.20	Downward	0.4
Floor	2.00	Downward	
Wall > 20% Glazing	1.00		0.6
Wall < 20% Glazing			

Requirements Wall-Glazing of more than 20% glazing per orientation

Parameter	Eastern Façade	Northern Façade	Southern Façade	Western Façade
U-Value	2.00	2.00	2.00	2.00
SHGC	0.13	0.13	0.13	0.13
Solar Absorptance	0.6	0.6	0.6	0.6

Number of Rows Required

25

Building Class
Other

Climate Zone
6

In slab heating or cooling system
No

Display Glazing
No

Results

	Eastern Façade	Northern Façade	Southern Façade	Western Façade
Façade Areas	74.07	85.29	84.73	73.37
Glazing Areas	23.36	33.70	32.33	18.17
Wall Area	50.71	51.58	52.40	55.20
Wall R Value	1.91	2.50	1.81	2.50
Percentage	191%	250%	181%	250%
U-Value Total	2.00	1.98	1.98	1.98
Percentage	100%	101%	101%	101%
Result	Pass	Pass	Pass	Pass
SHGC Total	0.13	0.13	0.13	0.13
Percentage	101%	100%	101%	101%
Result	Pass	Pass	Pass	Pass
WWR	32%	40%	38%	25%

Overall Result

Pass

Façade Wall-Glazing Calculation

Element					Size			Performance			Shading					Multiplier	Variables Used				Results	
ID	Description	Type	Orientation	Orientation Part	Height (m)	Width (m)	Area (m2)	R-Value (m2k/W)	U-Value (W/m2k)	SHGC	P (m)	H (m)	P/H	G (m)	G/H	Shading Multiplier	Type	Window Type	Used Area	Used U-Value (W/m2k)	Heat Transfer (W/K)	Element SHGC Total
1	N.GF.Wa.Ex.01	Wall	N	1	3.7	23.05		2.5					0.0	-3.7	0.0	1.00	N 1		85.285	0.4	20.63	0.00
2	N.GF.Wi.Ex.01	Window	N	1	3.66	1.75			4.4	0.41	0.65	3.66	0.2	0	0.0	0.80	N 1		6.405	4.4	28.18	2.10
3	N.GF.Wi.Ex.02	Window	N	1	3.7	1.79			4.4	0.41	0.65	3.7	0.2	0	0.0	0.80	N 1		6.623	4.4	29.14	2.17
4	N.GF.Wi.Ex.03	Window	N	1	3.69	2.7			4.4	0.41	0.65	3.69	0.2	0	0.0	0.80	N 1		9.963	4.4	43.84	3.27
5	N.GF.Dr.Ex.01	Window	N	1	3.7	1.89			4.4	0.41	0.65	3.7	0.2	0	0.0	0.80	N 1		6.993	4.4	30.77	2.29
6	N.GF.Dr.Ex.02	Window	N	1	3.68	1.01			4.4	0.41	0.65	3.68	0.2	0	0.0	0.80	N 1		3.7168	4.4	16.35	1.22
7	E.GF.Wa.Ex.01	Wall	E	1	3.7	13.62		2.5					0.0	-3.7	0.0	1.00	E 1		50.394	0.4	10.81	0.00
8	E.GF.Wi.Ex.01	Window	E	1	3.65	2.76			5.2	0.41	-		0.0	-3.65	0.0	1.00	E 1		10.074	5.2	52.38	4.13
9	E.GF.Wi.Ex.02	Window	E	1	3.65	0.97			5.2	0.41	-		0.0	-3.65	0.0	1.00	E 1		3.5405	5.2	18.41	1.45
10	E.GF.Wi.Ex.03	Window	E	1	3.65	2.67			5.2	0.41	-		0.0	-3.65	0.0	1.00	E 1		9.7455	5.2	50.68	4.00
11	E.GF.Wa.In.01	Wall	E	2	3.7	2.76		1.5					0.0	-3.7	0.0	1.00	E 2		10.212	0.7	6.81	0.00
12	E.GF.Wa.In.02	Wall	E	3	3.7	3.64		1.5					0.0	-3.7	0.0	1.00	E 3		13.468	0.7	8.98	0.00
13	S.GF.Wa.Ex.01	Wall	S	1	3.7	7.07		2.5					0.0	-3.7	0.0	1.00	S 1		26.159	0.4	4.80	0.00
14	S.GF.Wi.Ex.01	Window	S	1	1.91	4.52			4.3	0.7	10	2.84	1.0	0.93	0.3	0.57	S 1		8.6332	4.3	37.12	3.44
15	S.GF.Dr.Ex.01	Window	S	1	2.8	1			4.3	0.7	10	3.73	1.0	0.93	0.2	0.47	S 1		2.8	4.3	12.04	0.92
16	S.GF.Dr.Ex.02	Window	S	1	2.81	0.97			4.3	0.7	10	3.74	1.0	0.93	0.2	0.47	S 1		2.7257	4.3	11.72	0.90
17	S.GF.Wa.Ex.02	Wall	S	2	3.7	7.75		2.5					0.0	-3.7	0.0	1.00	S 2		28.675	0.4	4.20	0.00
18	S.GF.Wi.Ex.02	Window	S	2	2.48	4.74			4.3	0.7	8.56	2.93	1.0	0.45	0.2	0.47	S 2		11.7552	4.3	50.55	3.87
19	S.GF.Dr.Ex.03	Window	S	2	3.29	1.95			4.3	0.7	8.56	3.74	1.0	0.45	0.1	0.40	S 2		6.4155	4.3	27.59	1.80
20	S.GF.Wa.In.01	Wall	S	3	3.7	5.33		1.5					0.0	-3.7	0.0	1.00	S 3		19.721	0.7	13.15	0.00
21	S.GF.Wa.In.02	Wall	S	4	3.7	2.75		1.5					0.0	-3.7	0.0	1.00	S 4		10.175	0.7	6.78	0.00
22	W.GF.Wa.Ex.01	Wall	W	1	3.7	19.83		2.5					0.0	-3.7	0.0	1.00	W 1		73.371	0.4	22.08	0.00
23	W.GF.Wi.Ex.01	Window	W	1	3.67	2.95			6.8	0.65	0.65	3.67	0.2	0	0.0	0.80	W 1		10.8265	6.8	73.62	5.63
24	W.GF.Dr.Ex.01	Window	W	1	3.67	1			6.8	0.65	0.65	3.67	0.2	0	0.0	0.80	W 1		3.67	6.8	24.96	1.91
25	W.GF.Dr.Ex.02	Window	W	1	3.67	1			6.8	0.65	0.65	3.67	0.2	0	0.0	0.80	W 1		3.67	6.8	24.96	1.91

Building Name
Homebase A.1

Story
FF

Requirements of Roof, Floor and Wall per orientation

Element	R-Value (m2k/W)	Direction of Heat Flow	Solar Absorptance
Roof	3.20	Downward	0.4
Floor	2.00	Downward	
Wall > 20% Glazing	1.00		0.6
Wall < 20% Glazing			

Requirements Wall-Glazing of more than 20% glazing per orientation

Parameter	Eastern Façade	Northern Façade	Southern Façade	Western Façade
U-Value	2.00	2.00	2.00	2.00
SHGC	0.13	0.13	0.13	0.13
Solar Absorptance	0.6	0.6	0.6	0.6

Number of Rows Required

25

Building Class
Other

Climate Zone
6

In slab heating or cooling system
No

Display Glazing
No

Results

	Eastern Façade	Northern Façade	Southern Façade	Western Façade
Façade Areas	73.29	64.57	82.15	68.41
Glazing Areas	20.64	39.84	37.31	20.84
Wall Area	52.65	24.73	44.84	47.57
Wall R Value	1.94	2.50	1.74	2.50
Percentage	194%	250%	174%	250%
U-Value Total	1.97	1.94	1.99	1.98
Percentage	101%	103%	100%	101%
Result	Pass	Pass	Pass	Pass
SHGC Total	0.13	0.13	0.13	0.13
Percentage	100%	102%	102%	102%
Result	Pass	Pass	Pass	Pass
WWR	28%	62%	45%	30%

Overall Result

Pass

Façade Wall-Glazing Calculation

Element					Size			Performance			Shading					Multiplier	Variables Used				Results	
ID	Description	Type	Orientation	Orientation Part	Height (m)	Width (m)	Area (m2)	R-Value (m2k/W)	U-Value (W/m2k)	SHGC	P (m)	H (m)	P/H	G (m)	G/H	Shading Multiplier	Type	Window Type	Used Area	Used U-Value (W/m2k)	Heat Transfer (W/K)	Element SHGC Total
1	N.FF.Wa.Ex.01	Wall	N	1	2.81	22.98		2.5					0.0	-2.81	0.0	1.00	N 1		64.5738	0.4	9.89	0.00
2	N.FF.Wi.Ex.01	Window	N	1	2.71	5			2.9	0.28	0.56	2.71	0.2	0	0.0	0.80		N 1	13.55	2.9	39.30	3.04
3	N.FF.Wi.Ex.02	Window	N	1	1.35	4.55			2.9	0.28	0.56	1.35	0.4	0	0.0	0.64		N 1	6.1425	2.9	17.81	1.10
4	N.FF.Wi.Ex.03	Window	N	1	2.8	4.01			2.9	0.28	0.56	2.8	0.2	0	0.0	0.80		N 1	11.228	2.9	32.56	2.52
5	N.FF.Wi.Ex.04	Window	N	1	1.35	6.61			2.9	0.28	0.56	1.35	0.4	0	0.0	0.64		N 1	8.9235	2.9	25.88	1.60
6	E.FF.Wa.Ex.01	Wall	E	1	3.575	14.15		2.5					0.0	-3.575	0.0	1.00	E 1		50.58625	0.4	11.98	0.00
7	E.FF.Wi.Ex.01	Window	E	1	3.08	2.76			5.7	0.46	0	3.08	0.0	0	0.0	1.00		E 1	8.5008	5.7	48.45	3.91
8	E.FF.Wi.Ex.02	Window	E	1	3.08	0.99			5.7	0.46	0	3.08	0.0	0	0.0	1.00		E 1	3.0492	5.7	17.38	1.40
9	E.FF.Wi.Ex.03	Window	E	1	3.08	2.95			5.7	0.46	0	3.08	0.0	0	0.0	1.00		E 1	9.086	5.7	51.79	4.18
10	E.FF.Wa.In.01	Wall	E	2	3.575	3.56		1.5					0.0	-3.575	0.0	1.00	E 2		12.727	0.7	8.48	0.00
11	E.FF.Wa.In.02	Wall	E	3	3.575	2.79		1.5					0.0	-3.575	0.0	1.00	E 3		9.97425	0.7	6.65	0.00
12	S.FF.Wa.Ex.01	Wall	S	1	3.575	7.04		2.5					0.0	-3.575	0.0	1.00	S 1		25.168	0.4	4.40	0.00
13	S.FF.Wi.Ex.01	Window	S	1	1.91	4.52			3.7	0.56	10	2.15	1.0	0.24	0.1	0.40		S 1	8.6332	3.7	31.94	1.93
14	S.FF.Dr.Ex.01	Window	S	1	2.8	1			3.7	0.56	5.72	3.26	1.0	0.46	0.1	0.40		S 1	2.8	3.7	10.36	0.63
15	S.FF.Dr.Ex.02	Window	S	1	2.81	0.97			3.7	0.56	10	2.81	1.0	0	0.0	0.35		S 1	2.7257	3.7	10.09	0.53
16	S.FF.Wa.Ex.02	Wall	S	2	3.575	7.7		2.5					0.0	-3.575	0.0	1.00	S 2		27.5275	0.4	1.75	0.00
17	S.FF.Wi.Ex.02	Window	S	2	1.91	4.79			3.7	0.56	8.37	1.73	1.0	-0.18	-0.1	0.35		S 2	9.1489	3.7	33.85	1.79
18	S.FF.Dr.Ex.03	Window	S	2	2.8	1.89			3.7	0.56	10	1.89	1.0	-0.91	-0.5	0.35		S 2	5.292	3.7	19.58	1.04
19	S.FF.Wi.Ex.03	Window	S	2	1.14	7.64			3.7	0.56	0.4	1.54	0.3	0.4	0.3	0.94		S 2	8.7096	3.7	32.23	4.58
20	S.FF.Wa.In.01	Wall	S	3	3.575	5.36		1.5					0.0	-3.575	0.0	1.00	S 3		19.162	0.7	12.77	0.00
21	S.FF.Wa.In.02	Wall	S	4	3.575	2.88		1.5					0.0	-3.575	0.0	1.00	S 4		10.296	0.7	6.86	0.00
22	W.FF.Wa.Ex.01	Wall	W	1	3.45	19.83		2.5					0.0	-3.45	0.0	1.00	W 1		68.4135	0.4	19.03	0.00
23	W.FF.Wi.Ex.01	Window	W	1	2.99	2.98			5.6	0.42	0	2.99	0.0	0	0.0	1.00		W 1	8.9102	5.6	49.90	3.74
24	W.FF.Wi.Ex.02	Window	W	1	2.99	1			5.6	0.42	0	2.99	0.0	0	0.0	1.00		W 1	2.99	5.6	16.74	1.26
25	W.FF.Wi.Ex.03	Window	W	1	2.99	2.99			5.6	0.42	0	2.99	0.0	0	0.0	1.00		W 1	8.9401	5.6	50.06	3.75

Building Name
Homebase A.2

Story
GF

Requirements of Roof, Floor and Wall per orientation

Element	R-Value (m2k/W)	Direction of Heat Flow	Solar Absorptance
Roof	3.20	Downward	0.4
Floor	2.00	Downward	
Wall > 20% Glazing	1.00		0.6
Wall < 20% Glazing			

Requirements Wall-Glazing of more than 20% glazing per orientation

Parameter	Eastern Façade	Northern Façade	Southern Façade	Western Façade
U-Value	2.00	2.00	2.00	2.00
SHGC	0.13	0.13	0.13	0.13
Solar Absorptance	0.6	0.6	0.6	0.6

Number of Rows Required

26

Building Class
Other

Climate Zone
6

In slab heating or cooling system
No

Display Glazing
No

Results

	Eastern Façade	Northern Façade	Southern Façade	Western Façade
Façade Areas	136.60	79.40	78.40	136.80
Glazing Areas	38.77	21.73	18.60	64.57
Wall Area	97.83	57.67	59.80	72.24
Wall R Value	2.07	2.50	2.50	2.50
Percentage	207%	250%	250%	250%
U-Value Total	1.99	1.99	1.99	1.95
Percentage	100%	101%	101%	102%
Result	Pass	Pass	Pass	Pass
SHGC Total	0.13	0.12	0.13	0.13
Percentage	100%	112%	101%	102%
Result	Pass	Pass	Pass	Pass
WWR	28%	27%	24%	47%

Overall Result

Pass

Façade Wall-Glazing Calculation

Element					Size			Performance			Shading					Multiplier	Variables Used				Results	
ID	Description	Type	Orientation	Orientation Part	Height (m)	Width (m)	Area (m2)	R-Value (m2k/W)	U-Value (W/m2k)	SHGC	P (m)	H (m)	P/H	G (m)	G/H	Shading Multiplier	Type	Window Type	Used Area	Used U-Value (W/m2k)	Heat Transfer (W/K)	Element SHGC Total
1	N.GF.Wa.Ex.01	Wall	N	1	4	19.85		2.5					0.0	-4	0.0	1.00	N 1		79.4	0.4	23.07	0.00
2	N.GF.Wi.Ex.01	Window	N	1	2.12	4.8			6.2	0.8	device		0.0	-2.12	0.0	0.35		N 1	10.176	6.2	63.09	2.85
3	N.GF.Wi.Ex.02	Window	N	1	3	2			6.2	0.8			0.0	-3	0.0	1.00		N 1	6	6.2	37.20	4.80
4	N.GF.Dr.Ex.01	Window	N	1	3	1.85			6.2	0.8	device		0.0	-3	0.0	0.35		N 1	5.55	6.2	34.41	1.55
5													0.0	0	0.0	1.00			0	0.0	0.00	0.00
6	E.GF.Wa.Ex.01	Wall	E	1	4	19.2		2.5					0.0	-4	0.0	1.00	E 1		76.8	0.4	22.74	0.00
7	E.GF.Wi.Ex.01	Window	E	1	1.35	10.25			5.8	0.69	2.38	2.75	0.9	1.4	0.5	0.83		E 1	13.8375	5.8	80.26	7.92
8	E.GF.Dr.Ex.01	Window	E	1	3.3	1.85			5.8	0.69	0.38	3.7	0.1	0.4	0.1	0.95		E 1	6.105	5.8	35.41	4.00
9	E.GF.Wa.Ex.02	Wall	E	2	4	7.3		2.5					0.0	-4	0.0	1.00	E 2		29.2	0.4	4.15	0.00
10	E.GF.Wi.Ex.02	Window	E	2	2.4	5.3			5.8	0.69	4.88	2.9	1.0	0.5	0.2	0.47		E 2	12.72	5.8	73.78	4.13
11	E.GF.Dr.Ex.02	Window	E	2	3.3	1.85			5.8	0.69	4.88	3.7	1.0	0.4	0.1	0.40		E 2	6.105	5.8	35.41	1.68
12	E.GF.Wa.In.01	Wall	E	3	4	7.65		1.5					0.0	-4	0.0	1.00	E 3		30.6	0.7	20.40	0.00
13													0.0	0	0.0	1.00			0	0.0	0.00	0.00
14	S.GF.Wa.Ex.01	Wall	S	1	4	17.1		2.5					0.0	-4	0.0	1.00	S 1		68.4	0.4	19.92	0.00
15	S.GF.Wi.Ex.01	Window	S	1	3	6.2			7.1	0.54			0.0	-3	0.0	1.00		S 1	18.6	7.1	132.06	10.04
16	S.GF.Wa.Ex.02	Wall	S	2	4	2.5		2.5					0.0	-4	0.0	1.00	S 2		10	0.4	4.00	0.00
17									7.1	0.54			0.0	0	0.0	1.00			0	7.1	0.00	0.00
18	W.GF.Wa.Ex.01	Wall	W	1	4	34.2		2.5					0.0	-4	0.0	1.00	W 1		136.8	0.4	28.89	0.00
19	W.GF.Wi.Ex.01	Window	W	1	3.7	3.7			3.7	0.31	0.4	4.65	0.1	0.95	0.2	0.98		W 1	13.69	3.7	50.65	4.16
20	W.GF.Dr.Ex.01	Window	W	1	3.7	3.4			3.7	0.31	0.4	4.65	0.1	0.95	0.2	0.98		W 1	12.58	3.7	46.55	3.82
21	W.GF.Wi.Ex.02	Window	W	1	3.7	1.8			3.7	0.31	1.29	3.8	0.3	0.1	0.0	0.72		W 1	6.66	3.7	24.64	1.49
22	W.GF.Dr.Ex.02	Window	W	1	3.7	1.9			3.7	0.31	0.58	3.8	0.2	0.1	0.0	0.80		W 1	7.03	3.7	26.01	1.74
23	W.GF.Wi.Ex.03	Window	W	1	3.7	0.9			3.7	0.31	1.03	3.8	0.3	0.1	0.0	0.72		W 1	3.33	3.7	12.32	0.74
24	W.GF.Dr.Ex.03	Window	W	1	3.7	1.9			3.7	0.31	0.78	3.7	0.2	0	0.0	0.80		W 1	7.03	3.7	26.01	1.74
25	W.GF.Wi.Ex.04	Window	W	1	3.7	1.15			3.7	0.31			0.0	-3.7	0.0	1.00		W 1	4.255	3.7	15.74	1.32
26	W.GF.Wi.Ex.05	Window	W	1	3.7	2.7			3.7	0.31	0.78	3.7	0.2	0	0.0	0.80		W 1	9.99	3.7	36.96	2.48

Building Name
Homebase A.2

Story
FF

Requirements of Roof, Floor and Wall per orientation

Element	R-Value (m2k/W)	Direction of Heat Flow	Solar Absorptance
Roof	3.20	Downward	0.4
Floor	2.00	Downward	
Wall > 20% Glazing	1.00		0.6
Wall < 20% Glazing			

Requirements Wall-Glazing of more than 20% glazing per orientation

Parameter	Eastern Façade	Northern Façade	Southern Façade	Western Façade
U-Value	2.00	2.00	2.00	2.00
SHGC	0.13	0.13	0.13	0.13
Solar Absorptance	0.6	0.6	0.6	0.6

Number of Rows Required

31

Building Class
Other

Climate Zone
6

In slab heating or cooling system
No

Display Glazing
No

Results

	Eastern Façade	Northern Façade	Southern Façade	Western Façade
Façade Areas	139.42	69.10	63.74	120.44
Glazing Areas	58.67	19.62	15.00	53.60
Wall Area	80.76	49.48	48.74	66.85
Wall R Value	2.08	2.50	2.50	2.50
Percentage	208%	250%	250%	250%
U-Value Total	1.98	1.99	1.98	1.96
Percentage	101%	101%	101%	102%
Result	Pass	Pass	Pass	Pass
SHGC Total	0.13	0.08	0.13	0.13
Percentage	101%	164%	100%	102%
Result	Pass	Pass	Pass	Pass
WWR	42%	28%	24%	45%

Overall Result

Pass

Façade Wall-Glazing Calculation

Element					Size			Performance			Shading					Multiplier	Variables Used				Results	
ID	Description	Type	Orientation	Orientation Part	Height (m)	Width (m)	Area (m2)	R-Value (m2k/W)	U-Value (W/m2k)	SHGC	P (m)	H (m)	P/H	G (m)	G/H	Shading Multiplier	Type	Window Type	Used Area	Used U-Value (W/m2k)	Heat Transfer (W/K)	Element SHGC Total
1	N.FF.Wa.Ex.01	Wall	N	1	2.8	19.85		2.5					0.0	-2.8	0.0	1.00	N 1		55.58	0.4	14.38	0.00
2	N.FF.Wi.Ex.01	Window	N	1	1.9	4.8			6	0.8	device		0.0	-1.9	0.0	0.35		N 1	9.12	6.0	54.72	2.55
3	N.FF.Dr.Ex.01	Window	N	1	2.8	0.9			6	0.8	device		0.0	-2.8	0.0	0.35		N 1	2.52	6.0	15.12	0.71
4	N.FF.Dr.Ex.02	Window	N	1	2.8	1.85			6	0.8	device		0.0	-2.8	0.0	0.35		N 1	5.18	6.0	31.08	1.45
5	N.FF.Dr.Ex.03	Window	N	1	2.8	1			6	0.8	device		0.0	-2.8	0.0	0.35		N 1	2.8	6.0	16.80	0.78
6	N.FF.Wa.Ex.02	Wall	N	2	0.4		6.76	2.5					0.0	-0.4	0.0	1.00	N 2		6.76	0.4	2.70	0.00
7	N.FF.Wa.Ex.03	Wall	N	2	3	0.6	6.76	2.5					0.0	-3	0.0	1.00	N 2		6.76	0.4	2.70	0.00
8													0.0	0	0.0	1.00			0	0.0	0.00	0.00
9	E.GF.Wa.Ex.01	Wall	E	1	5.17	7.75		2.5					0.0	-5.17	0.0	1.00	E 1		40.0675	0.4	7.01	0.00
10	E.GF.Wi.Ex.01	Window	E	1	1.35	4.75			4	0.4	3.7	2.38	1.0	1.03	0.4	0.68		E 1	6.4125	4.0	25.65	1.74
11	E.GF.Wi.Ex.01_Upper	Window	E	1	1.5	7.3			4.1	0.4	1.95	2.38	0.8	0.88	0.4	0.77		E 1	10.95	4.1	44.90	3.37
12	E.GF.Dr.Ex.01	Window	E	1	2.8	1.85			4.1	0.4	4.75	2.38	1.0	-0.42	-0.2	0.35		E 1	5.18	4.1	21.24	0.73
13	E.GF.Wa.Ex.02	Wall	E	2	3.25	11.45		2.5					0.0	-3.25	0.0	1.00	E 2		37.2125	0.4	10.92	0.00
14	E.GF.Wi.Ex.02	Window	E	2	1.35	7.35			4	0.4	1.8	2.38	0.8	1.03	0.4	0.77		E 2	9.9225	4.0	39.69	3.06
15	E.GF.Wa.Ex.03	Wall	E	3	5.17	7.3		2.5					0.0	-5.17	0.0	1.00	E 3		37.741	0.4	4.62	0.00
16	E.GF.Wi.Ex.03	Window	E	3	1.9	5.3			4	0.4	3.85	4.88	0.8	2.98	0.6	0.86		E 3	10.07	4.0	40.28	3.46
17	E.GF.Wi.Ex.03_Upper	Window	E	3	1.5	7.3			4.1	0.4	1.95	4.88	0.4	3.38	0.7	0.97		E 3	10.95	4.1	44.90	4.25
18	E.GF.Dr.Ex.02	Window	E	3	2.8	1.85			4.1	0.4	4.75	4.88	1.0	2.08	0.4	0.68		E 3	5.18	4.1	21.24	1.41
19	E.GF.Wa.In.01	Wall	E	4	3.19	7.65		1.5					0.0	-3.19	0.0	1.00	E 4		24.4035	0.7	16.27	0.00
20													0.0	0	0.0	1.00			0	0.0	0.00	0.00
21	S.FF.Wa.Ex.01	Wall	S	1	2.8	17.85		2.5					0.0	-2.8	0.0	1.00	S 1		49.98	0.4	13.99	0.00
22	S.FF.Wi.Ex.01	Window	S	1	3	5			7.1	0.55			0.0	-3	0.0	1.00		S 1	15	7.1	106.50	8.25
23	S.FF.Wa.Ex.02	Wall	S	2	2.8	2.5		2.5					0.0	-2.8	0.0	1.00	S 2		7	0.4	2.80	0.00
24	S.FF.Wa.Ex.02	Wall	S	3	0.4		6.76	2.5					0.0	-0.4	0.0	1.00	S 3		6.76	0.4	2.70	0.00
25													0.0	0	0.0	1.00			0	0.0	0.00	0.00
26	W.FF.Wa.Ex.01	Wall	W	1	3.25	26.55		2.5					0.0	-3.25	0.0	1.00	W 1		86.2875	0.4	21.90	0.00
27	W.FF.Wi.Ex.01	Window	W	1	1.35	9			3.9	0.35	0.55	1.35	0.4	0	0.0	0.64		W 1	12.15	3.9	47.39	2.72
28	W.FF.Wi.Ex.02	Window	W	1	2.75	7.05			3.9	0.35	0.7	2.75	0.3	0	0.0	0.72		W 1	19.3875	3.9	75.61	4.89
29	W.FF.Wa.Ex.02	Wall	W	2	4.95	6.9		2.5					0.0	-4.95	0.0	1.00	W 2		34.155	0.4	4.84	0.00
30	W.FF.Wi.Ex.03	Window	W	2	3.1	4			3.9	0.35			0.0	-3.1	0.0	1.00		W 2	12.4	3.9	48.36	4.34
31	W.FF.Wi.Ex.04	Window	W	2	1.4	6.9			3.9	0.35			0.0	-1.4	0.0	1.00		W 2	9.66	3.9	37.67	3.38

Building Name
Block B.1 - Teaching Space

Story
GF

Requirements of Roof, Floor and Wall per orientation			
Element	R-Value (m2k/W)	Direction of Heat Flow	Solar Absorptance
Roof	3.20	Downward	0.4
Floor	2.00	Downward	
Wall > 20% Glazing	1.00		0.6
Wall < 20% Glazing	1.40		0.6

Requirements Wall-Glazing of more than 20% glazing per orientation					
Parameter	Eastern Façade	Northern Façade	Southern Façade	Western Façade	
U-Value	2.00	2.00	2.00	2.00	2.00
SHGC	0.13	0.13	0.13	0.13	0.13
Solar Absorptance	0.6	0.6	0.6	0.6	0.6

Number of Rows Required 25

Building Class
Other

Climate Zone
6

In slab heating or cooling system
No

Display Glazing
No

Results					
	Eastern Façade	Northern Façade	Southern Façade	Western Façade	
Façade Areas	79.36	134.49	136.80	79.36	
Glazing Areas	21.10	38.77	43.29	14.80	
Wall Area	58.26	95.72	93.51	64.56	
Wall R Value	2.50	2.09	2.50	2.50	
Percentage	250%	209%	250%	179%	
U-Value Total	1.89	1.98	1.98	1.82	Overall
Percentage	106%	101%	101%		
Result	Pass	Pass	Pass	Pass	Pass
SHGC Total	0.13	0.13	0.13	0.13	
Percentage	101%	100%	101%	101%	
Result	Pass	Pass	Pass	Pass	Pass
WWR	27%	29%	32%	19%	

Overall Result
Pass

Façade Wall-Glazing Calculation

Element					Size			Performance			Shading					Multiplier	Variables Used				Results	
ID	Description	Type	Orientation	Orientation Part	Height (m)	Width (m)	Area (m2)	R-Value (m2k/W)	U-Value (W/m2k)	SHGC	P (m)	H (m)	P/H	G (m)	G/H	Shading Multiplier	Type	Window Type	Used Area	Used U-Value (W/m2k)	Heat Transfer (W/K)	Element SHGC Total
1	N.GF.Wa.Ex.01	Wall	N	1	4	7.3		2.5					0.0	-4	0.0	1.00	N 1		29.2	0.4	4.15	0.00
2	N.GF.Wi.Ex.01	Window	N	1	2.4	5.3			5.7	0.77	4.9	2.8	1.0	0.4	0.1	0.40		N 1	12.72	5.7	72.50	3.92
3	N.GF.Dr.Ex.01	Window	N	1	3.3	1.85			5.7	0.77	4.9	3.7	1.0	0.4	0.1	0.40		N 1	6.105	5.7	34.80	1.88
4	N.GF.Wa.Ex.02	Wall	N	2	4	19.2		2.5					0.0	-4	0.0	1.00	N 2		76.8	0.4	22.74	0.00
5	N.GF.Wi.Ex.02	Window	N	2	1.35	10.25			5.7	0.77	2.4	2.65	0.9	1.3	0.5	0.83		N 2	13.8375	5.7	78.87	8.84
6	N.GF.Dr.Ex.02	Window	N	2	3.3	1.85			5.7	0.77	2.4	3.7	0.6	0.4	0.1	0.59		N 2	6.105	5.7	34.80	2.77
7	N.GF.Wa.In.01	Wall	N	3	3.7	7.7		1.5					0.0	-3.7	0.0	1.00	N 3		28.49	0.7	18.99	0.00
8													0.0	0	0.0	1.00			0	0.0	0.00	0.00
9	E.GF.Wa.Ex.01	Wall	E	1	4	19.84		2.5					0.0	-4	0.0	1.00	E 1		79.36	0.4	23.30	0.00
10	E.GF.Wi.Ex.01	Window	E	1	2.12	4.8			6	0.73			0.0	-2.12	0.0	1.00		E 1	10.176	6.0	61.06	7.43
11	E.GF.Dr.Ex.01	Window	E	1	3	1.85			6	0.73	device		0.0	-3	0.0	0.35		E 1	5.55	6.0	33.30	1.42
12	E.GF.Wi.Ex.02	Window	E	1	2.8	1			6	0.73	device		0.0	-2.8	0.0	0.35		E 1	2.8	6.0	16.80	0.72
13	E.GF.Dr.Ex.02	Window	E	1	2.8	0.92			6	0.73	device		0.0	-2.8	0.0	0.35		E 1	2.576	6.0	15.46	0.66
14									6	0.73			0.0	0	0.0	1.00			0	6.0	0.00	0.00
15	S.GF.Wa.Ex.01	Wall	S	1	4	34.2		2.5					0.0	-4	0.0	1.00	S 1		136.8	0.4	37.40	0.00
16	S.GF.Wi.Ex.01	Window	S	1	3.7	4.5			5.4	0.48	0.75	3.7	0.2	0	0.0	0.80		S 1	16.65	5.4	89.91	6.39
17	S.GF.Wi.Ex.02	Window	S	1	3.7	1.8			5.4	0.48	0.37	4.65	0.1	0.95	0.2	0.98		S 1	6.66	5.4	35.96	3.13
18	S.GF.Wi.Ex.03	Window	S	1	3.7	0.9			5.4	0.48	1.01	3.8	0.3	0.1	0.0	0.72		S 1	3.33	5.4	17.98	1.15
19	S.GF.Wi.Ex.04	Window	S	1	3.7	1.8			5.4	0.48	1.26	3.8	0.3	0.1	0.0	0.72		S 1	6.66	5.4	35.96	2.30
20	S.GF.Wi.Ex.05	Window	S	1	3.7	2.7			5.4	0.48	0.37	4.65	0.1	0.95	0.2	0.98		S 1	9.99	5.4	53.95	4.70
21													0.0	0	0.0	1.00			0	0.0	0.00	0.00
22	W.GF.Wa.Ex.01	Wall	W	1	4	19.84		2.5					0.0	-4	0.0	1.00	W 1		79.36	0.4	25.82	0.00
23	W.GF.Wi.Ex.01	Window	W	1	3.7	4			8	0.69			0.0	-3.7	0.0	1.00		W 1	14.8	8.0	118.40	10.21
24													0.0	0	0.0	1.00			0	0.0	0.00	0.00
25													0.0	0	0.0	1.00			0	0.0	0.00	0.00

Building Name
Block B.1 - Teaching Space

Story
FF

Requirements of Roof, Floor and Wall per orientation

Element	R-Value (m2k/W)	Direction of Heat Flow	Solar Absorptance
Roof	3.20	Downward	0.4
Floor	2.00	Downward	
Wall > 20% Glazing	1.00		0.6
Wall < 20% Glazing			

Requirements Wall-Glazing of more than 20% glazing per orientation

Parameter	Eastern Façade	Northern Façade	Southern Façade	Western Façade
U-Value	2.00	2.00	2.00	2.00
SHGC	0.13	0.13	0.13	0.13
Solar Absorptance	0.6	0.6	0.6	0.6

Number of Rows Required 30

Building Class
Other

Climate Zone
6

In slab heating or cooling system
No

Display Glazing
No

Results

	Eastern Façade	Northern Façade	Southern Façade	Western Façade	
Façade Areas	65.41	138.71	123.08	65.92	
Glazing Areas	22.48	56.17	53.19	15.00	
Wall Area	42.93	82.54	69.89	50.92	
Wall R Value	2.50	1.02	2.50	2.50	
Percentage	250%	102%	250%	250%	
U-Value Total	1.98	1.60	2.00	1.99	Overall
Percentage	101%	125%	100%	100%	
Result	Pass	Pass	Pass	Pass	Pass
SHGC Total	0.10	0.13	0.13	0.13	
Percentage	135%	101%	102%	100%	
Result	Pass	Pass	Pass	Pass	Pass
WWR	34%	40%	43%	23%	

Overall Result

Pass

Façade Wall-Glazing Calculation

Element					Size			Performance			Shading					Multiplier	Variables Used				Results	
ID	Description	Type	Orientation	Orientation Part	Height (m)	Width (m)	Area (m2)	R-Value (m2k/W)	U-Value (W/m2k)	SHGC	P (m)	H (m)	P/H	G (m)	G/H	Shading Multiplier	Type	Window Type	Used Area	Used U-Value (W/m2k)	Heat Transfer (W/K)	Element SHGC Total
1	N.FF.Wa.Ex.01	Wall	N	1	5.15	7.3		2.5					0.0	-5.15	0.0	1.00	N 1		37.595	0.4	4.56	0.00
2	N.FF.Wi.Ex.01	Window	N	1	1.9	5.3			2.5	0.5	5.05	3.8	1.0	1.9	0.5	0.79		N 1	10.07	2.5	25.18	3.98
3	N.FF.Wi.Ex.01_Upper	Window	N	1	1.5	7.3			2.5	0.5	5.05	1.95	1.0	0.45	0.2	0.47		N 1	10.95	2.5	27.38	2.57
4	N.FF.Dr.Ex.01	Window	N	1	2.8	1.85			2.5	0.5	5.05	4.75	1.0	1.95	0.4	0.68		N 1	5.18	2.5	12.95	1.76
5	N.FF.Wa.Ex.02	Wall	N	2	3.2	11.45		2.5					0.0	-3.2	0.0	1.00	N 2		36.64	0.4	10.69	0.00
6	N.FF.Wi.Ex.02	Window	N	2	1.35	7.35			2.5	0.5	2.6	1.8	1.0	0.45	0.3	0.57		N 2	9.9225	2.5	24.81	2.83
7	N.FF.Wa.Ex.03	Wall	N	3	5.15	7.75		2.5					0.0	-5.15	0.0	1.00	N 3		39.9125	2.5	49.67	0.00
8	N.FF.Wi.Ex.03	Window	N	3	1.35	2.9			2.5	0.5	2.6	3.65	0.7	2.3	0.6	0.90		N 3	3.915	2.5	9.79	1.76
9	N.FF.Wi.Ex.03_Upper	Window	N	3	1.5	7.3			2.5	0.5	2.6	1.95	1.0	0.45	0.2	0.47		N 3	10.95	2.5	27.38	2.57
10	N.FF.Dr.Ex.02	Window	N	3	2.8	1.85			2.5	0.5	2.6	4.75	0.5	1.95	0.4	0.90		N 3	5.18	2.5	12.95	2.33
11	N.FF.Wa.In.01	Wall	N	4	3.19	7.7		1.5					0.0	-3.19	0.0	1.00	N 4		24.563	0.7	16.38	0.00
12													0.0	0	0.0	1.00			0	0.0	0.00	0.00
13	E.FF.Wa.Ex.01	Wall	E	1	3.2	19.84		2.5					0.0	-3.2	0.0	1.00	E 1		63.488	0.4	16.40	0.00
14	E.FF.Wi.Ex.01	Window	E	1	1.9	4.8			5	0.8	device		0.0	-1.9	0.0	0.35		E 1	9.12	5.0	45.60	2.55
15	E.FF.Dr.Ex.01	Window	E	1	2.8	1.85			5	0.8	device		0.0	-2.8	0.0	0.35		E 1	5.18	5.0	25.90	1.45
16	E.FF.Wi.Ex.02	Window	E	1	2.8	1			5	0.8	device		0.0	-2.8	0.0	0.35		E 1	2.8	5.0	14.00	0.78
17	E.FF.Dr.Ex.02	Window	E	1	2.8	0.92			5	0.8	device		0.0	-2.8	0.0	0.35		E 1	2.576	5.0	12.88	0.72
18	E.FF.Dr.Ex.03	Window	E	1	2.8	1			5	0.8	device		0.0	-2.8	0.0	0.35		E 1	2.8	5.0	14.00	0.78
19	E.FF.Wa.Ex.02	Wall	E	2	3.2	0.6		2.5					0.0	-3.2	0.0	1.00	E 2		1.92	0.4	0.77	0.00
20													0.0	0	0.0	1.00			0	0.0	0.00	0.00
21	S.FF.Wa.Ex.01	Wall	S	1	4.95	7.7		2.5					0.0	-4.95	0.0	1.00	S 1		38.115	0.4	6.59	0.00
22	S.FF.Wi.Ex.01	Window	S	1	3.1	4			4.1	0.36			0.0	-3.1	0.0	1.00		S 1	12.4	4.1	50.84	4.46
23	S.FF.Wi.Ex.01_Upper	Window	S	1	1.35	6.85			4.1	0.36			0.0	-1.35	0.0	1.00		S 1	9.2475	4.1	37.91	3.33
24	S.FF.Wa.Ex.02	Wall	S	2	3.2	26.55		2.5					0.0	-3.2	0.0	1.00	S 2		84.96	0.4	21.37	0.00
25	S.FF.Wi.Ex.02	Window	S	2	1.35	9			4.1	0.36	0.55	1.35	0.4	0	0.0	0.64		S 2	12.15	4.1	49.82	2.80
26	S.FF.Wi.Ex.03	Window	S	2	2.75	7.05			4.1	0.36	0.7	2.75	0.3	0	0.0	0.72		S 2	19.3875	4.1	79.49	5.03
27													0.0	0	0.0	1.00			0	0.0	0.00	0.00
28	W.FF.Wa.Ex.01	Wall	W	1	3.2	18.1		2.5					0.0	-3.2	0.0	1.00	W 1		57.92	0.4	17.17	0.00
29	W.FF.Wi.Ex.01	Window	W	1	3	5			7.4	0.57			0.0	-3	0.0	1.00		W 1	15	7.4	111.00	8.55
30	W.FF.Wa.Ex.02	Wall	W	2	3.2	2.5		2.5			device		0.0	-3.2	0.0	0.35	W 2		8	0.4	3.20	0.00

Building Name
Block B.2 - Teaching Space

Story
GF

Requirements of Roof, Floor and Wall per orientation			
Element	R-Value (m2k/W)	Direction of Heat Flow	Solar Absorptance
Roof	3.20	Downward	0.4
Floor	2.00	Downward	
Wall > 20% Glazing	1.00		0.6
Wall < 20% Glazing			

Requirements Wall-Glazing of more than 20% glazing per orientation					
Parameter	Eastern Façade	Northern Façade	Southern Façade	Western Façade	
U-Value	2.00	2.00	2.00	2.00	2.00
SHGC	0.13	0.13	0.13	0.13	0.13
Solar Absorptance	0.6	0.6	0.6	0.6	0.6

Number of Rows Required 26

Building Class
Other

Climate Zone
6

In slab heating or cooling system
No

Display Glazing
No

Results				
	Eastern Façade	Northern Façade	Southern Façade	Western Façade
Façade Areas	73.93	84.18	85.10	73.41
Glazing Areas	24.24	28.04	29.79	17.17
Wall Area	49.69	56.14	55.32	56.24
Wall R Value	1.91	1.85	2.50	2.50
Percentage	191%	185%	250%	250%
U-Value Total	1.99	1.99	1.98	1.99
Percentage	100%	100%	101%	100%
Result	Pass	Pass	Pass	Pass
SHGC Total	0.13	0.13	0.13	0.13
Percentage	102%	101%	100%	101%
Result	Pass	Pass	Pass	Pass
WWR	33%	33%	35%	23%

Overall Result
Pass

Façade Wall-Glazing Calculation

Element					Size			Performance			Shading					Multiplier	Variables Used				Results	
ID	Description	Type	Orientation	Orientation Part	Height (m)	Width (m)	Area (m2)	R-Value (m2k/W)	U-Value (W/m2k)	SHGC	P (m)	H (m)	P/H	G (m)	G/H	Shading Multiplier	Type	Window Type	Used Area	Used U-Value (W/m2k)	Heat Transfer (W/K)	Element SHGC Total
1	N.GF.Wa.Ex.01	Wall	N	1	3.7	7.6		2.5					0.0	-3.7	0.0	1.00	N 1		28.12	0.4	4.11	0.00
2	N.GF.Wi.Ex.01	Window	N	1	2.5	4.7			4.9	0.77	4.9	2.8	1.0	0.3	0.1	0.40		N 1	11.75	4.9	57.58	3.62
3	N.GF.Dr.Ex.01	Window	N	1	3.3	1.85			4.9	0.77	4.9	3.7	1.0	0.4	0.1	0.40		N 1	6.105	4.9	29.91	1.88
4	N.GF.Wa.Ex.02	Wall	N	2	3.7	7.2		2.5					0.0	-3.7	0.0	1.00	N 2		26.64	0.4	6.58	0.00
5	N.GF.Wi.Ex.02	Window	N	2	1.35	2.9			4.9	0.77	2.4	2.65	0.9	1.3	0.5	0.83		N 2	3.915	4.9	19.18	2.50
6	N.GF.Dr.Ex.02	Window	N	2	3.3	1.9			4.9	0.77	2.4	3.7	0.6	0.4	0.1	0.59		N 2	6.27	4.9	30.72	2.85
7	N.GF.Wa.In.01	Wall	N	3	3.7	5.35		1.5					0.0	-3.7	0.0	1.00	N 3		19.795	0.7	13.20	0.00
8	N.GF.Wa.In.02	Wall	N	4	3.7	2.6		1.5					0.0	-3.7	0.0	1.00	N 4		9.62	0.7	6.41	0.00
9													0.0	0	0.0	1.00			0	0.0	0.00	0.00
10	E.GF.Wa.Ex.01	Wall	E	1	3.7	13.73		2.5					0.0	-3.7	0.0	1.00	E 1		50.801	0.4	10.63	0.00
11	E.GF.Wi.Ex.01	Window	E	1	3.7	6.55			5	0.39			0.0	-3.7	0.0	1.00		E 1	24.235	5.0	121.18	9.45
12	E.GF.Wa.In.01	Wall	E	2	3.7	3.75		1.5					0.0	-3.7	0.0	1.00	E 2		13.875	0.7	9.25	0.00
13	E.GF.Wa.In.02	Wall	E	3	3.7	2.5		1.5					0.0	-3.7	0.0	1.00	E 3		9.25	0.7	6.17	0.00
14													0.0	0	0.0	1.00			0	0.0	0.00	0.00
15	S.GF.Wa.Ex.01	Wall	S	1	3.7	23		2.5					0.0	-3.7	0.0	1.00	S 1		85.1	0.4	22.13	0.00
16	S.GF.Wi.Ex.01	Window	S	1	3.7	2.65			4.9	0.37			0.0	-3.7	0.0	1.00		S 1	9.805	4.9	48.04	3.63
17	S.GF.Wi.Ex.02	Window	S	1	3.7	2.7			4.9	0.37			0.0	-3.7	0.0	1.00		S 1	9.99	4.9	48.95	3.70
18	S.GF.Wi.Ex.03	Window	S	1	3.7	0.9			4.9	0.37			0.0	-3.7	0.0	1.00		S 1	3.33	4.9	16.32	1.23
19	S.GF.Wi.Ex.04	Window	S	1	3.7	1.8			4.9	0.37			0.0	-3.7	0.0	1.00		S 1	6.66	4.9	32.63	2.46
20									4.9	0.37			0.0	0	0.0	1.00			0	4.9	0.00	0.00
21									4.9	0.37			0.0	0	0.0	1.00			0	4.9	0.00	0.00
22	W.GF.Wa.Ex.01	Wall	W	1	3.7	19.84		2.5					0.0	-3.7	0.0	1.00	W 1		73.408	0.4	22.50	0.00
23	W.GF.Wi.Ex.01	Window	W	1	1.92	4.8			7.2	0.55			0.0	-1.92	0.0	1.00		W 1	9.216	7.2	66.36	5.07
24	W.GF.Wi.Dr.01	Window	W	1	2.8	0.92			7.2	0.55			0.0	-2.8	0.0	1.00		W 1	2.576	7.2	18.55	1.42
25	W.GF.Wi.Ex.02	Window	W	1	2.8	0.92			7.2	0.55			0.0	-2.8	0.0	1.00		W 1	2.576	7.2	18.55	1.42
26	W.GF.Wi.Dr.02	Window	W	1	2.8	1			7.2	0.55			0.0	-2.8	0.0	1.00		W 1	2.8	7.2	20.16	1.54

Building Name
Block B.2 - Teaching Space

Story
FF

Requirements of Roof, Floor and Wall per orientation

Element	R-Value (m2k/W)	Direction of Heat Flow	Solar Absorptance
Roof	3.20	Downward	0.4
Floor	2.00	Downward	
Wall > 20% Glazing	1.00		0.6
Wall < 20% Glazing			

Requirements Wall-Glazing of more than 20% glazing per orientation

Parameter	Eastern Façade	Northern Façade	Southern Façade	Western Façade
U-Value	2.00	2.00	2.00	2.00
SHGC	0.13	0.13	0.13	0.13
Solar Absorptance	0.6	0.6	0.6	0.6

Number of Rows Required 28

Building Class
Other

Climate Zone
6

In slab heating or cooling system
No

Display Glazing
No

Results

	Eastern Façade	Northern Façade	Southern Façade	Western Façade
Façade Areas	65.92	87.90	86.87	65.12
Glazing Areas	20.10	33.48	47.55	17.07
Wall Area	45.82	54.42	39.32	48.05
Wall R Value	1.94	1.91	2.50	2.50
Percentage	194%	191%	250%	250%
U-Value Total	1.97	1.96	1.97	2.00
Percentage	101%	102%	101%	100%
Result	Pass	Pass	Pass	Pass
SHGC Total	0.13	0.13	0.13	0.07
Percentage	102%	102%	101%	177%
Result	Pass	Pass	Pass	Pass
WWR	30%	38%	55%	26%

Overall Result

Pass

Façade Wall-Glazing Calculation

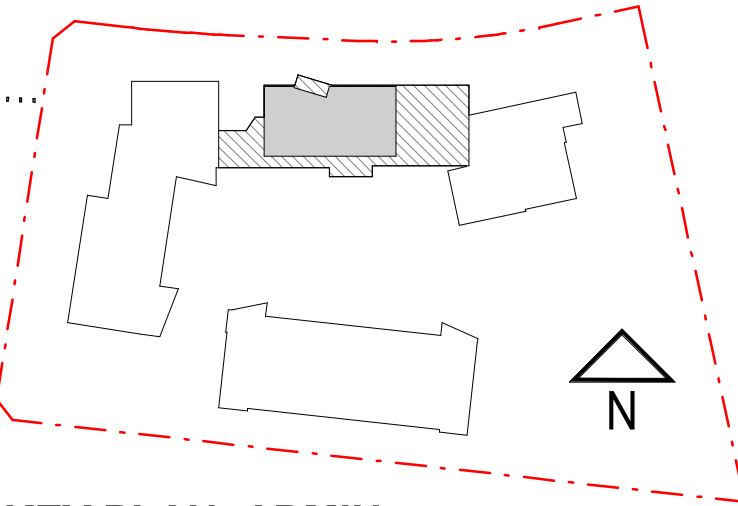
Element					Size			Performance			Shading					Multiplier	Variables Used				Results	
ID	Description	Type	Orientation	Orientation Part	Height (m)	Width (m)	Area (m2)	R-Value (m2k/W)	U-Value (W/m2k)	SHGC	P (m)	H (m)	P/H	G (m)	G/H	Shading Multiplier	Type	Window Type	Used Area	Used U-Value (W/m2k)	Heat Transfer (W/K)	Element SHGC Total
1	N.FF.Wa.Ex.01	Wall	N	1	5.15	7.6		2.5					0.0	-5.15	0.0	1.00	N 1		39.14	0.4	5.90	0.00
2	N.FF.Wi.Ex.01	Window	N	1	1.9	4.7			4.3	0.6	5.05	3.8	1.0	1.9	0.5	0.79		N 1	8.93	4.3	38.40	4.23
3	N.FF.Wi.Ex.01_Upper	Window	N	1	1.5	6.85			4.3	0.6	5.05	1.95	1.0	0.45	0.2	0.47		N 1	10.275	4.3	44.18	2.90
4	N.FF.Dr.Ex.01	Window	N	1	2.8	1.85			4.3	0.6	5.05	4.75	1.0	1.95	0.4	0.68		N 1	5.18	4.3	22.27	2.11
5	N.FF.Wa.Ex.02	Wall	N	2	3.25	7.2		2.5					0.0	-3.25	0.0	1.00	N 2		23.4	0.4	5.72	0.00
6	N.FF.Wi.Ex.02	Window	N	2	1.35	2.9			4.3	0.6	2.6	1.35	1.0	0	0.0	0.35		N 2	3.915	4.3	16.83	0.82
7	N.FF.Dr.Ex.02	Window	N	2	2.8	1.85			4.3	0.6	2.6	2.8	0.9	0	0.0	0.38		N 2	5.18	4.3	22.27	1.18
8	N.FF.Wa.In.01	Wall	N	3	3.19	5.35		1.5					0.0	-3.19	0.0	1.00	N 3		17.0665	0.7	11.38	0.00
9	N.FF.Wa.In.02	Wall	N	4	3.19	2.6		1.5					0.0	-3.19	0.0	1.00	N 4		8.294	0.7	5.53	0.00
10													0.0	0	0.0	1.00			0	0.0	0.00	0.00
11	E.FF.Wa.Ex.01	Wall	E	1	3.2	14.35		2.5					0.0	-3.2	0.0	1.00	E 1		45.92	0.4	10.33	0.00
12	E.FF.Wi.Ex.01	Window	E	1	3	6.7			5.3	0.42			0.0	-3	0.0	1.00		E 1	20.1	5.3	106.53	8.44
13	E.FF.Wa.In.01	Wall	E	2	3.2	3.75		1.5					0.0	-3.2	0.0	1.00	E 2		12	0.7	8.00	0.00
14	E.FF.Wa.In.02	Wall	E	3	3.2	2.5		1.5					0.0	-3.2	0.0	1.00	E 3		8	0.7	5.33	0.00
15													0.0	0	0.0	1.00			0	0.0	0.00	0.00
16	W.FF.Wa.Ex.01	Wall	W	1	3.2	19.95		2.5					0.0	-3.2	0.0	1.00	W 1		63.84	0.4	18.71	0.00
17	W.FF.Wi.Ex.01	Window	W	1	1.9	4.8			6.5	0.8	device		0.0	-1.9	0.0	0.35		W 1	9.12	6.5	59.28	2.55
18	W.FF.Dr.Ex.01	Window	W	1	2.8	0.92			6.5	0.8	device		0.0	-2.8	0.0	0.35		W 1	2.576	6.5	16.74	0.72
19	W.FF.Wi.Ex.02	Window	W	1	2.8	1			6.5	0.8	device		0.0	-2.8	0.0	0.35		W 1	2.8	6.5	18.20	0.78
20	W.FF.Dr.Ex.02	Window	W	1	2.8	0.92			6.5	0.8	device		0.0	-2.8	0.0	0.35		W 1	2.576	6.5	16.74	0.72
21	W.FF.Wa.Ex.02	Wall	W	2	3.2	0.4		2.5					0.0	-3.2	0.0	1.00	W 2		1.28	0.4	0.51	0.00
22													0.0	0	0.0	1.00			0	0.0	0.00	0.00
23	S.FF.Wa.Ex.01	Wall	S	1	4.95	7.4		2.5					0.0	-4.95	0.0	1.00	S 1		36.63	0.4	5.99	0.00
24	S.FF.Wi.Ex.01	Window	S	1	3.1	4			4.6	0.33			0.0	-3.1	0.0	1.00		S 1	12.4	4.6	57.04	4.09
25	S.FF.Wi.Ex.01_Upper	Window	S	1	1.35	6.85			4.6	0.33			0.0	-1.35	0.0	1.00		S 1	9.2475	4.6	42.54	3.05
26	S.FF.Wa.Ex.02	Wall	S	2	3.2	15.7		2.5			0.55	1.35	0.4	-1.85	-1.4	0.64	S 2		50.24	0.4	9.74	0.00
27	S.FF.Wi.Ex.02	Window	S	2	1.35	9			4.6	0.33	0.52	2.75	0.2	1.4	0.5	1.00		S 2	12.15	4.6	55.89	4.01
28	S.FF.Wi.Ex.03	Window	S	2	2.75	5							0.0	-2.75	0.0	1.00		S 2	13.75	0.0	0.00	0.00

APPENDIX A-2

BUILDING FABRIC MARKUP

FLOOR PLAN GENERAL NOTES:

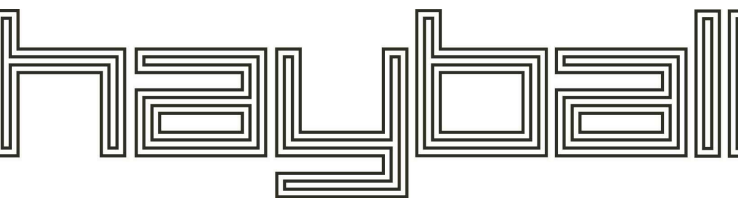
- ALL FFE AND ICT LAYOUTS ARE INDICATIVE. REFER TO DOCUMENTATION FOR ALLOWANCE
- REFER ACCOMPANYING CONSULTANT DRAWINGS AND REPORTS FOR STRUCTURAL, SERVICES, LANDSCAPE AND OTHER REQUIREMENTS.
- REFER SHEET 02.A00.00 FOR ROOM FINISHES
- REFER 2141.02, TECHNICAL REFERENCE SCHEDULE FOR EXTERNAL MATERIALS, FIXTURES, DOORS, WINDOWS, CEILINGS, FENCES, GATES AND SIGNAGE



KEY PLAN- ADMIN

3	ISSUE FOR INFORMATION	28/11/2018
2	ISSUE FOR INFORMATION	23/11/2018
1	DWG ISSUE '1'	22/10/2018
0	ISSUE FOR INFORMATION	21/09/2018
Rev	Description	Date

PRELIMINARY ISSUE



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NSW Nominated Architects:
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Builders/Contractors shall verify job dimensions before any job commences. Figured dimensions shall take precedence over scaled work. Work shall also conform to the specification, other drawings and job dimensions. All shop drawings shall be submitted to the Architect/Consultant and manufacture shall not commence prior to the return of inspected shop drawings signed by the Architect/Consultant. © Copyright 2008 All rights reserved.

Client:



Alex Avenue Primary School

BLOCK A04

Farmland Drive, Schofields, NSW 2762

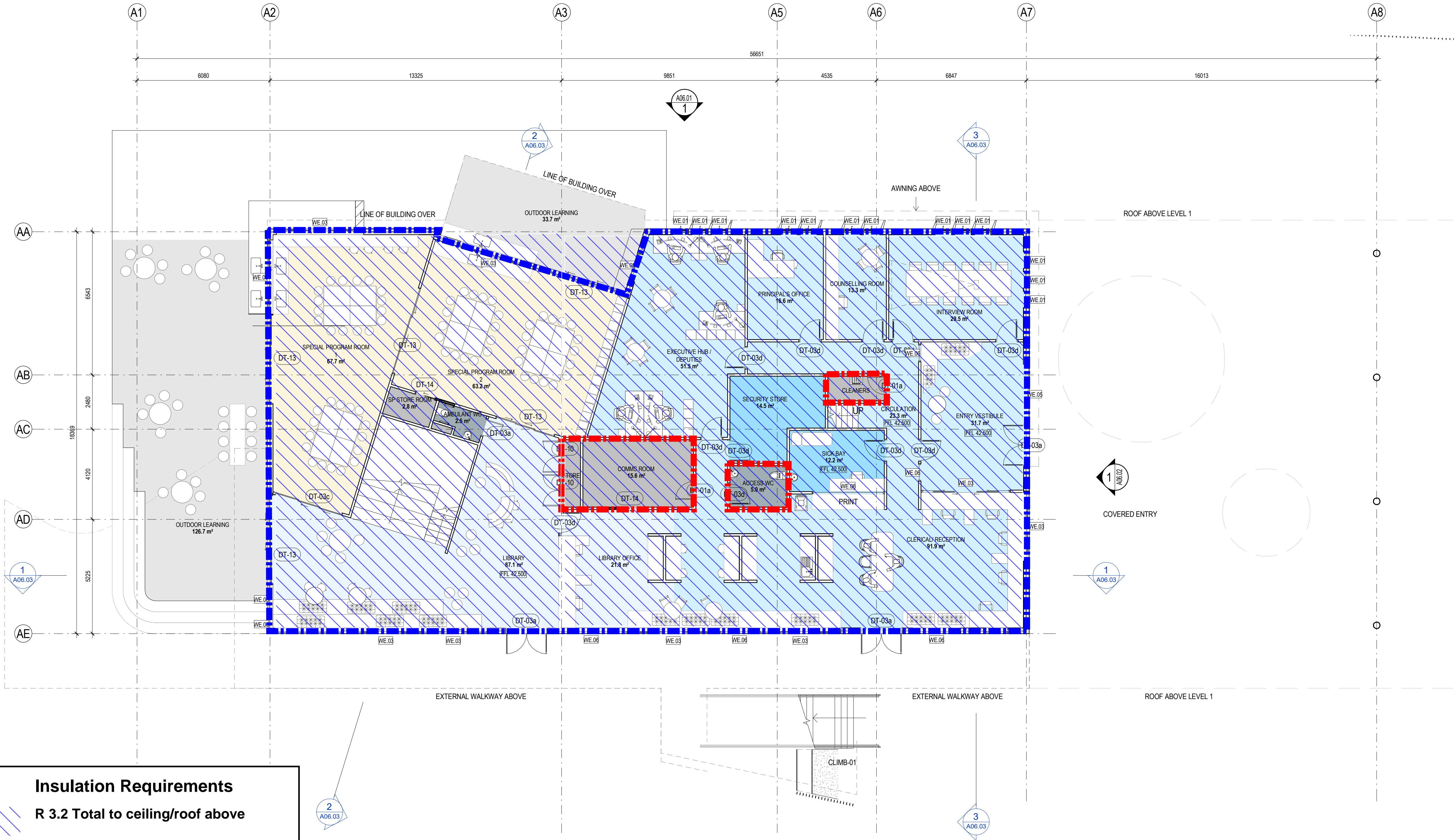
DRAWING TITLE
GROUND FLOOR PLAN

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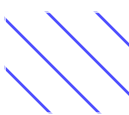
PROJECT NUMBER DWG NO REVISION

2141.04 A04.A03.01

3



Insulation Requirements



R 3.2 Total to ceiling/roof above



No R-value requirement in floor below
- as constructed



R 2.5 Total in opaque external walls
- can be achieved through the addition of R2.5 insulation.

Transparent window opening requirements:

- U-Value: 4.40
- SHGC 0.40



R 1.8 Total in internal walls

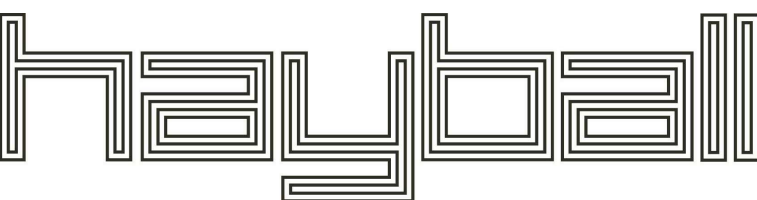
- can be achieved through the addition of R1.5 insulation.

FLOOR PLAN GENERAL NOTES:

- ALL FFE AND ICT LAYOUTS ARE INDICATIVE. REFER TO DOCUMENTATION FOR ALLOWANCE
- REFER ACCOMPANYING CONSULTANT DRAWINGS AND REPORTS FOR STRUCTURAL, SERVICES, LANDSCAPE AND OTHER REQUIREMENTS.
- REFER SHEET 02.A00.00 FOR ROOM FINISHES
- REFER 2141.02, TECHNICAL REFERENCE SCHEDULE FOR EXTERNAL MATERIALS, FIXTURES, DOORS, WINDOWS, CEILINGS, FENCES, GATES AND SIGNAGE

3	ISSUE FOR INFORMATION	28/11/2018
2	ISSUE FOR INFORMATION	23/11/2018
1	DWG ISSUE '1'	22/10/2018
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PRELIMINARY ISSUE



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NSW Nominated Architects:
Tom Jordan 7521, Richard Leonard 7522, David Tordoff 8028
ABN 84 006 394 261

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Client:



Alex Avenue Primary School
BLOCK A04
Farmland Drive, Schofields, NSW 2762

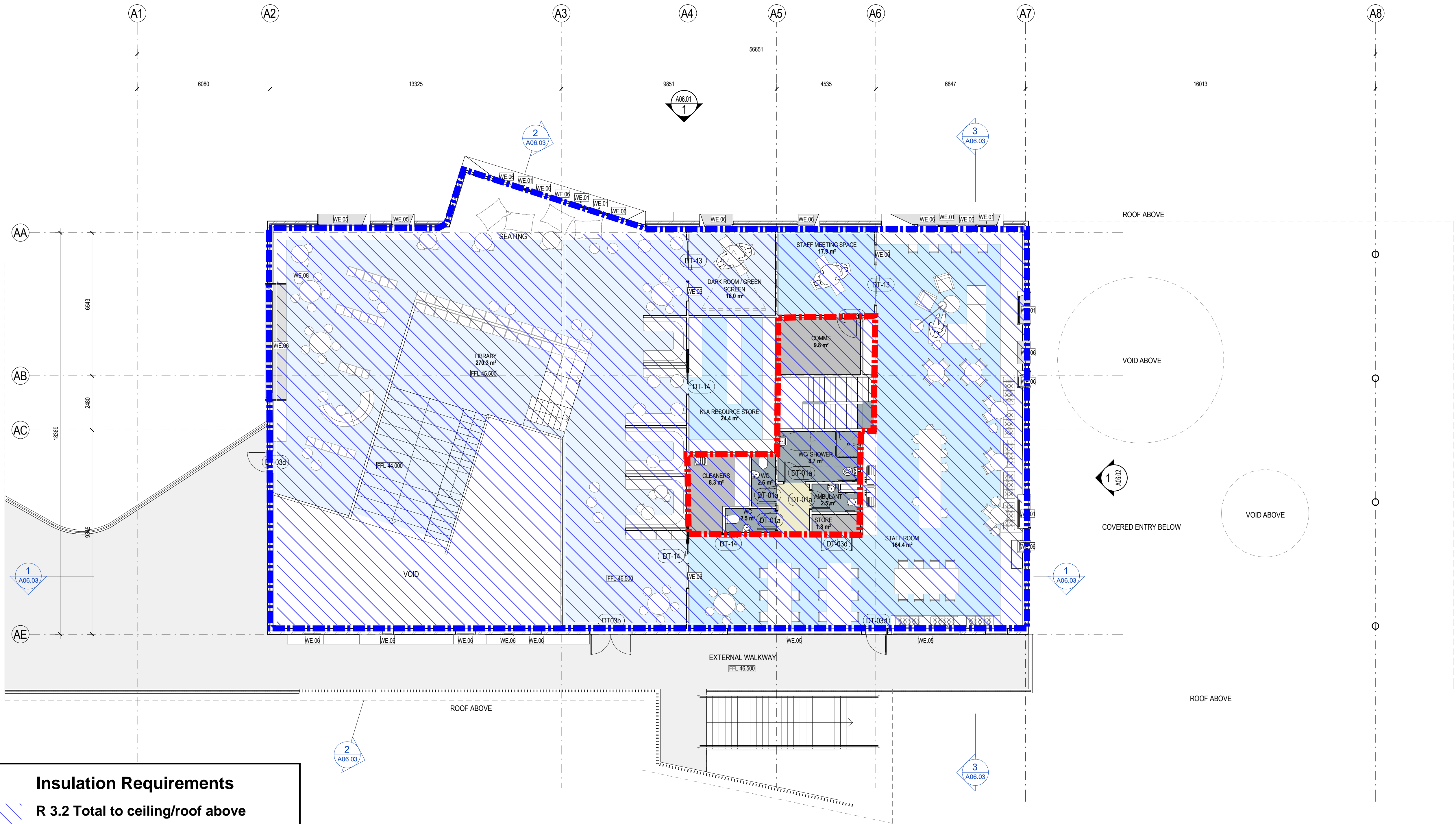
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FIRST FLOOR PLAN

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DATE PRINTED	28/11/2018 3:24:17 PM
SCALE	1 : 100@A1



PROJECT NUMBER DWG NO REVISION

2141.04 A04.A03.02 3



Insulation Requirements

R 3.2 Total to ceiling/roof above



No R-value requirement in floor below
- as constructed



R 2.5 Total in opaque external walls

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Transparent window opening requirements:

- U-Value: 4.40

- SHGC 0.40

R 1.8 Total in internal walls

- can be achieved through the addition of R1.5 insulation.



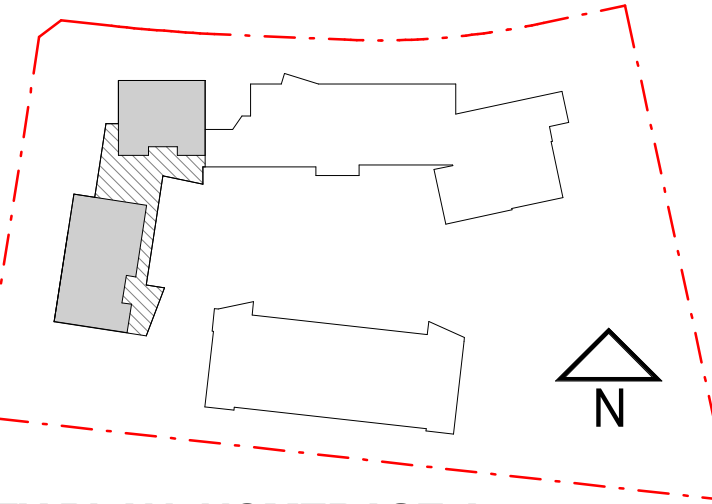
FLOOR PLAN GENERAL NOTES

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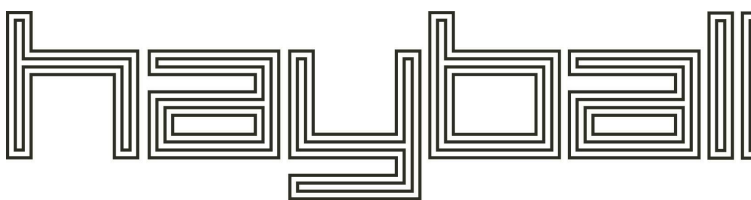
REFER 2141.02. TECHNICAL REFERENCE SCHEDULE FOR EXTERNAL MATERIALS, FIXTURES, DOORS, WINDOWS, CEILINGS, FENCES, GATES AND SIGNAGE



KEY PLAN- HOMEBASE A

3	ISSUE FOR INFORMATION	28/11/2018
2	ISSUE FOR INFORMATION	23/11/2018
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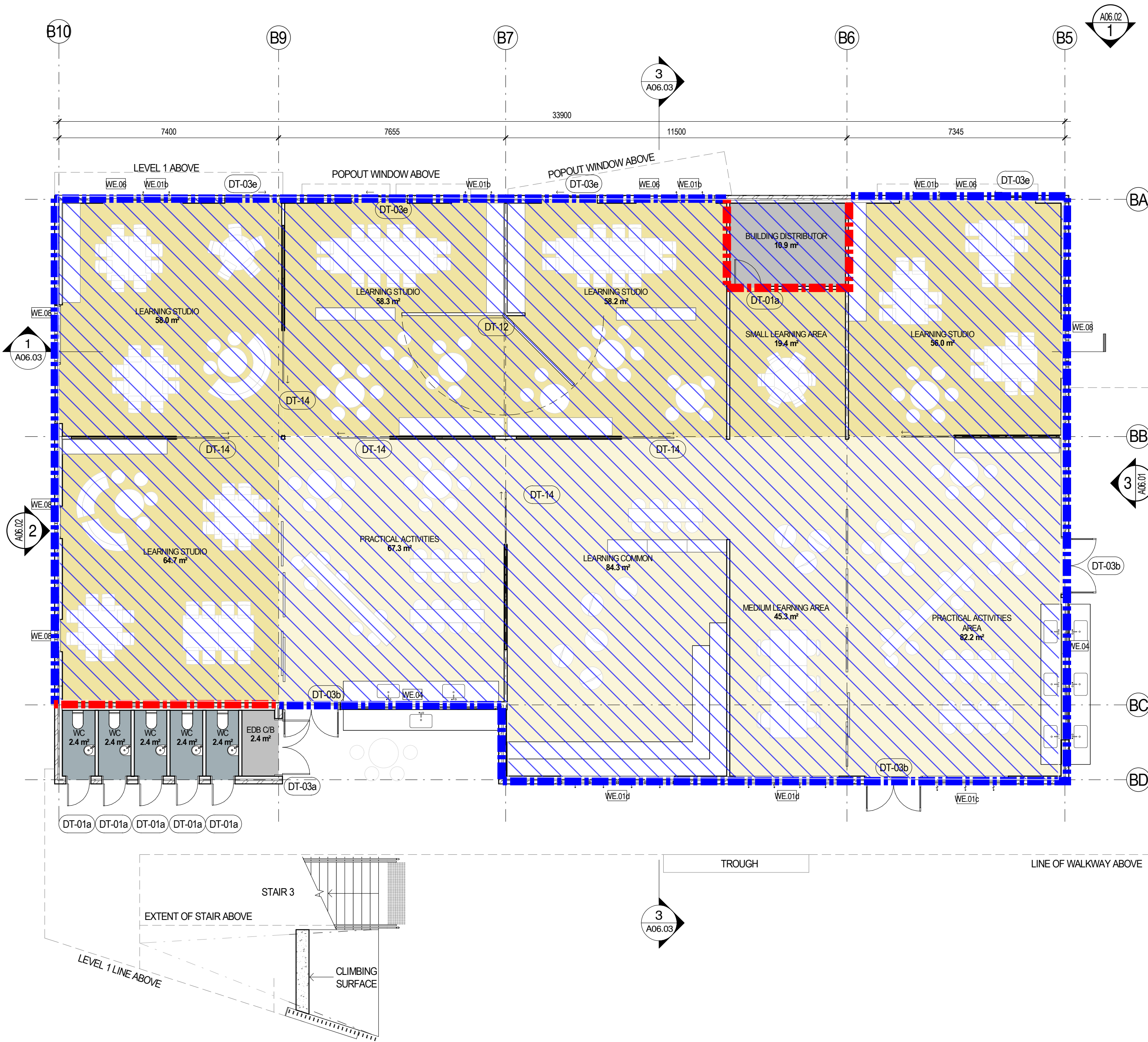


Alex Avenue Primary School
BLOCK B04A
Farmland Drive, Schofields, NSW 2762

DRAWING TITLE
FLOORPLAN - GROUND FLOOR

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PROJECT NUMBER DWG NO REVISION
2141.04 B04A.A03.01 3



1 GROUND FLOOR PLAN
A06.01 1:100

Insulation Requirements

R 3.2 Total to ceiling/roof above

No R-value requirement in floor below
- as constructed

R 2.5 Total in opaque external walls

- can be achieved through the addition of R2.5 insulation.

Transparent window opening requirements:

- U-Value: 4.40

- SHGC 0.40

R 1.8 Total in internal walls

- can be achieved through the addition of R1.5 insulation.



North

FLOOR PLAN GENERAL NOTES

ALL FFE AND ICT LAYOUTS ARE INDICATIVE. REFER TO DOCUMENTATION FOR ALLOWANCE

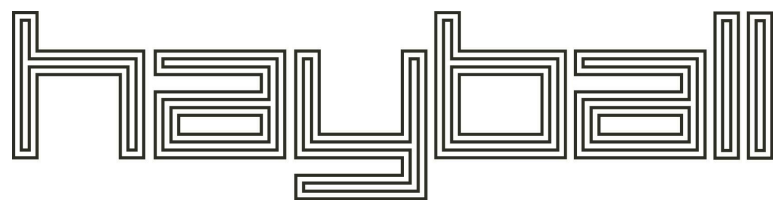
REFER ACCOMPANYING CONSULTANT DRAWINGS AND REPORTS FOR STRUCTURAL, SERVICES, LANDSCAPE AND OTHER REQUIREMENTS.

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Client:



Education

Alex Avenue Primary School

BLOCK B04A

Farmland Drive, Schofields, NSW 2762

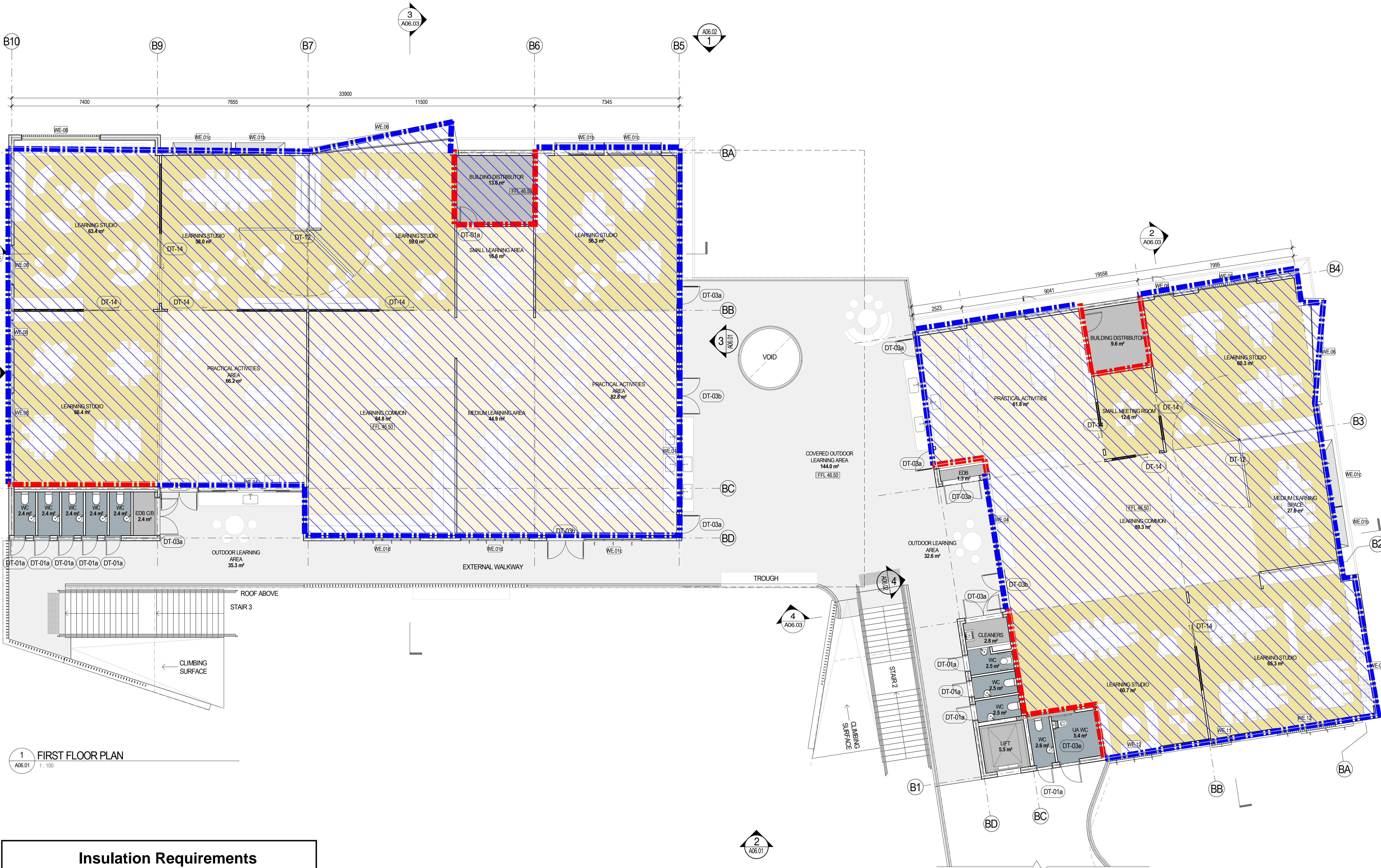
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FLOORPLAN - FIRST FLOOR

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SCALE 1 : 100@A1

PROJECT NUMBER DWG NO REVISION

2141.04 B04A.A03.02

3



Insulation Requirements

R 3.2 Total to ceiling/roof above

No R-value requirement in floor below
- as constructed

R 2.5 Total in opaque external walls

- can be achieved through the addition of R2.5 insulation.

Transparent window opening requirements:

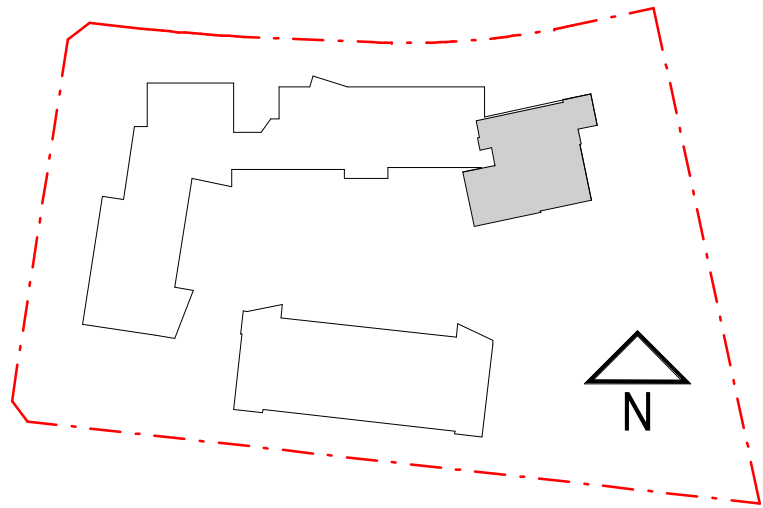
- U-Value: 4.40

- SHGC 0.40

R 1.8 Total in internal walls

- can be achieved through the addition of R1.5 insulation.

REFER 2141.02 TECHNICAL REFERENCE SCHEDULE
FOR EXTERNAL MATERIALS, FIXTURES, DOORS,
WINDOWS, CEILINGS, FENCES, GATES AND SIGNAGE



- ☐ AMENITIES
- ☐ CANTEEN
- ☐ CIRCULATION
- ☐ HALL
- ☐ HALL STORE
- ☐ OOSH
- ☐ STORE
- ☐ Calculating...

ISSUE FOR INFORMATION	28/11/2018
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 N 84 006 394 261

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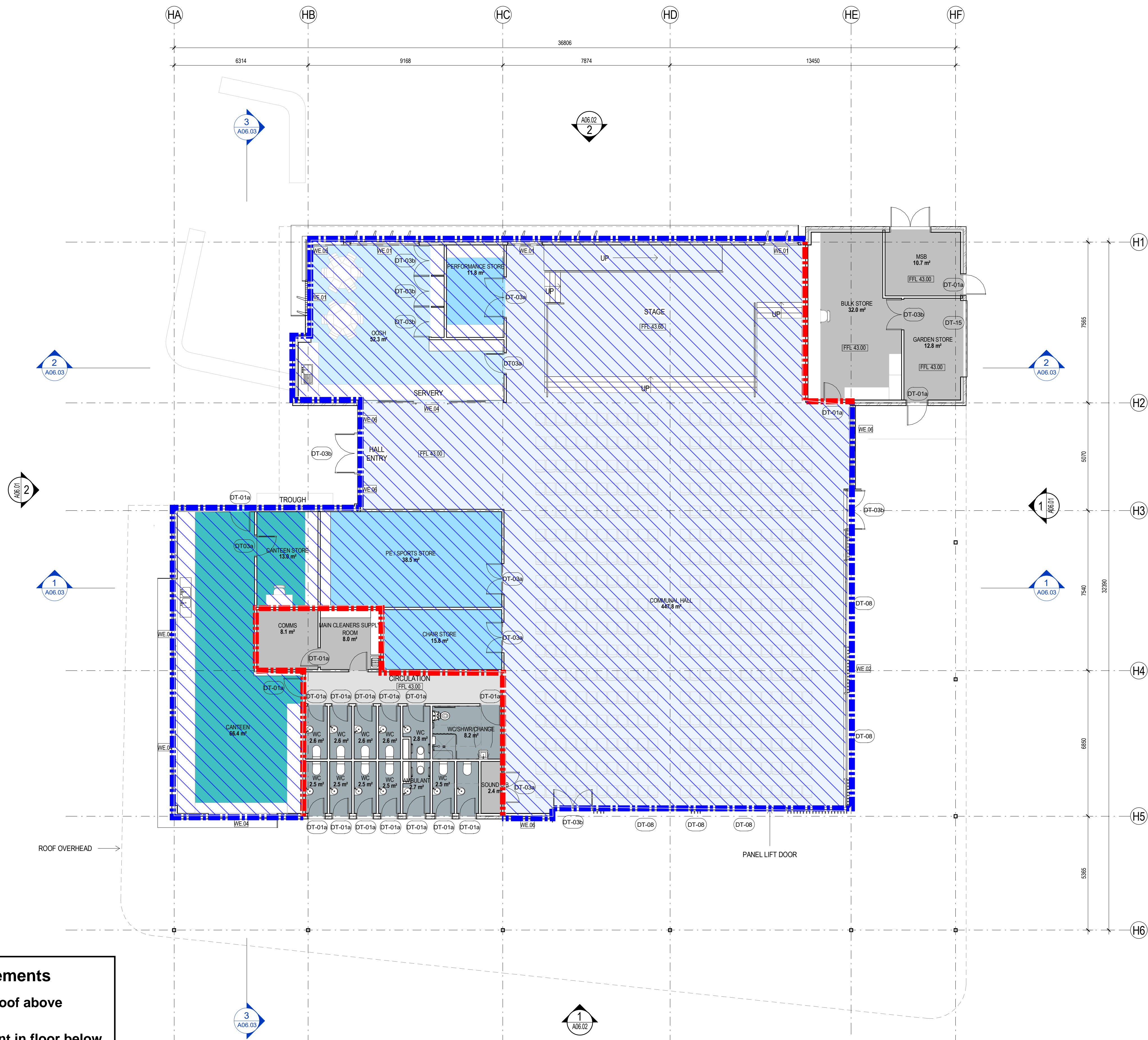


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PROJECT NUMBER	DWG NO	REVISION
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141.04 H04.A03.01



R 1.8 Total in internal walls
- can be achieved through the addition of R1.5 insulation.

1 GROUND FLOOR PLAN
A06.01 1:100

A06.01 1:100

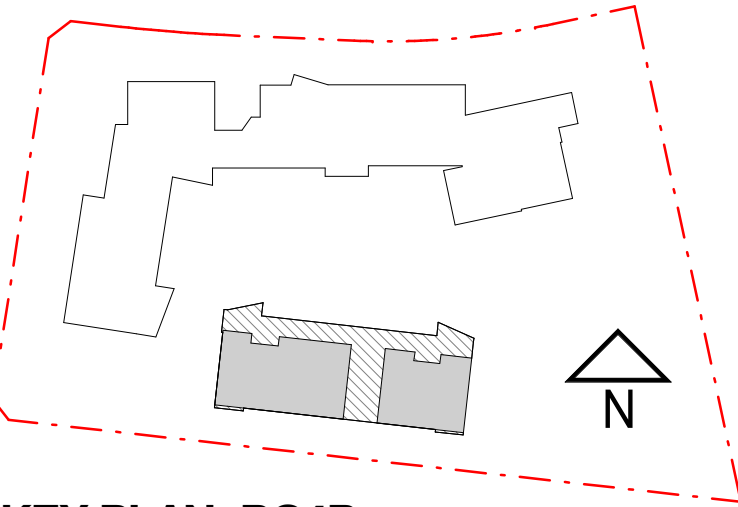
FLOOR PLAN GENERAL NOTES

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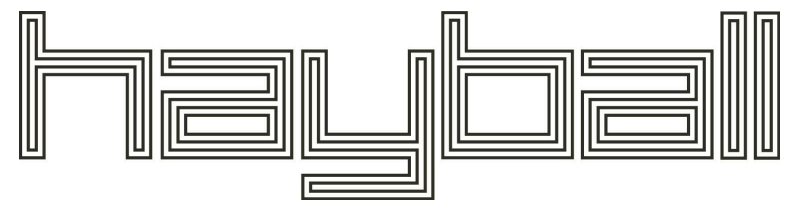
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KEY PLAN- B04B

Rev	Description	Date
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2	ISSUE FOR INFORMATION	23/11/2018
1	DWG ISSUE '1'	22/10/2018
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ABN 84 006 394 261

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Client:



Alex Avenue Primary School
BLOCK B04B
Farmland Drive, Schofields, NSW 2762

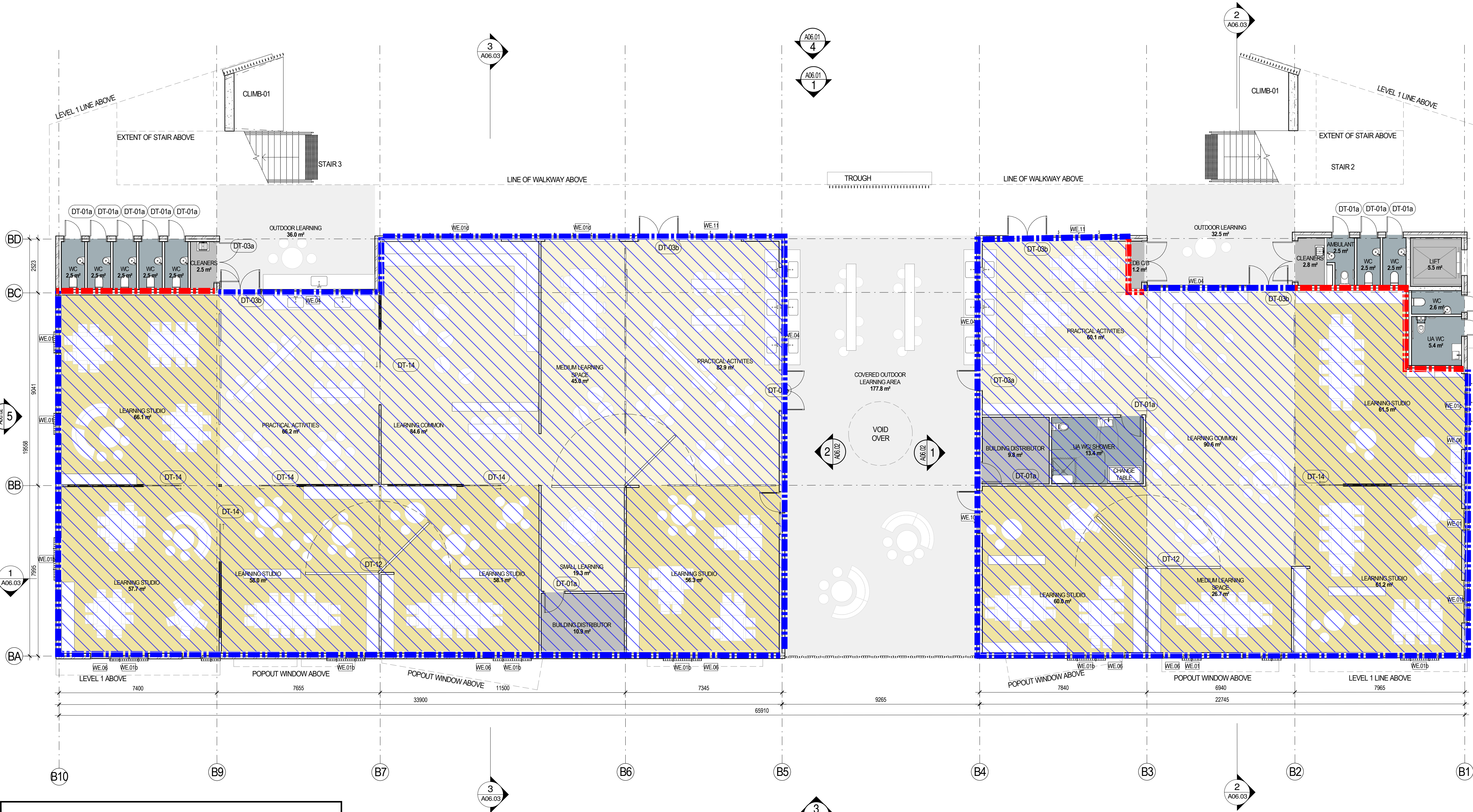
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DATE PRINTED 11/28/2018 3:34:32 PM
SCALE As indicated@A1

PROJECT NUMBER DWG NO REVISION

2141.04 B04B.A03.01

3



Insulation Requirements

R 3.2 Total to ceiling/roof above

No R-value requirement in floor below
- as constructed

R 2.5 Total in opaque external walls
- can be achieved through the addition of R2.5 insulation.
Transparent window opening requirements:
- U-Value: 4.40
- SHGC 0.40

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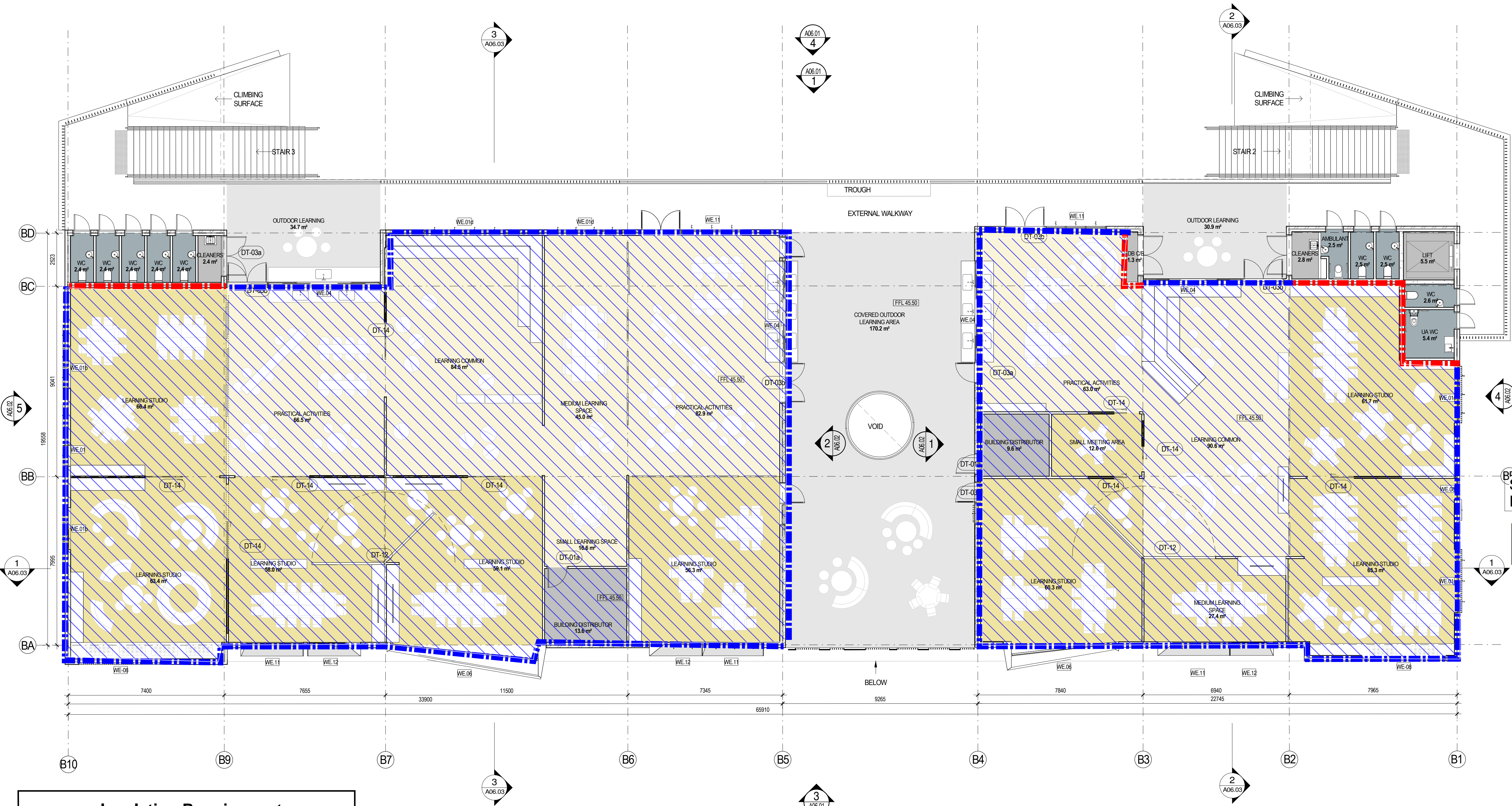
FLOOR PLAN GENERAL NOTES

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Client:

NSW GOVERNMENT Education
Alex Avenue Primary School
BLOCK B04B
Farmland Drive, Schofields, NSW 2762

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FLOORPLAN - FIRST FLOOR

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2141.04 B04B.A03.02 3

Insulation Requirements

R 3.2 Total to ceiling/roof above

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Transparent window opening requirements:

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APPENDIX A-3 GREEN STAR SCORECARD

Green Star - Performance

Project:	Alex Avenue Public School
Targeted Rating:	4 Star - Australian Best Practice
Performance Period	
Certification Period	Select the Certification Period

Core Points Available	Total Score Targeted
100	47.8

Total Points Awarded	Total Points TBC
0.0	0.0

NA	CREDIT	AIM OF THE CREDIT / PATHWAY SELECTION	CODE	TYPE	CREDIT CRITERIA	POINTS AVAILABLE	POINTS TARGETED
Management							
Green Star Accredited Professional	To encourage and recognise the involvement of Green Star Accredited Professionals in the facilities management and operations of premises.	1.1	Action	GSAP - Performance	1	1	
		2.1	Action	Operation and Maintenance Information	1	1	
Building Information	To recognise the provision of information describing a building's systems, operations and maintenance requirements and environmental targets for optimum holistic performance.	2.2	Action	Occupant and User Information	1	1	
		3.1	Building	Metering	1	1	
Metering and Monitoring	To recognise the operational practices which facilitate the effective ongoing monitoring of water and energy consumption.	3.2	Action	Monitoring Systems	1		
		4.1	Action	Comprehensive Tuning Process	1	1	
Tuning and Commissioning	To recognise the ongoing tuning processes (as well as effective commissioning, recommissioning or retro-commissioning) that ensure building systems operate to their optimum performance.	4.2	Action	Commissioning, Recommissioning or Retro-commissioning	1	1	
		5.1	Policy	Environmental Management Plan	1	1	
Environmental Management	To recognise the adoption of a formal system of environmental management, in line with established leading practice guidelines for the operation of facilities.	5.2	Action	Formalised Management System	1		
		5.3	Action	Third-party Certification of Management System	1		
		6.1	Policy	Green Cleaning Policy	1	1	
Green Cleaning	To encourage green cleaning services that prevent the use of contaminants that impact on indoor environment quality, occupant health and the natural environment.	6.2	Action	Green Cleaning Implementation in Common Areas	1	1	
		6.3	Action	Green Cleaning Implementation in All Areas	1	1	
Commitment to Performance	To recognise operational practices that allow and encourage building owners, building occupants and facilities management teams to set targets and monitor environmental performance in a collaborative way.	7.1	Policy	Environmental Building Performance	2	2	
		7.2	Policy	End-of-life Waste Performance	1	1	
		7.3	Policy	Best Practice Procedures for Indoor Environment	1		
Total						17	13

POINTS AWARDED	POINTS TBC	ASSESSMENT OUTCOME	ASSESSMENT COMMENTS
0	0		
0		0	

Indoor Environment Quality							
Indoor Air Quality	To recognise operational practices that provide occupants with high quality indoor air.	8.1	Action	HVAC Maintenance, Cleaning and Hygiene	1	1	
		8.2	Action	Outdoor Pollutant Control: Carbon Monoxide Concentration	1		
		8.3	Data	Indoor Pollutant Control: Carbon Dioxide Concentration	2		
Hazardous Materials	To recognise operational practices and actions that reduce health risks to occupants associated with the presence of hazardous materials in buildings.	9.1	Action	Location Assessment	1		
		9.2	Action	Refurbishment and Demolition Assessment	1		
Lighting Comfort	To recognise the operational practices providing occupants with a high degree of lighting comfort.	10.1	Action	Lighting Fixture Performance	1	1	
		10.2	Data	General Illuminance	1	1	
Daylight & Views	To recognise naturally lit spaces providing occupants with access to appropriate daylight and views for the activities being performed during the performance period.	11.1	Building	Daylight Access	1	1	
		11.2	Building	Views and Lines of Sight	1	1	
Thermal Comfort	A. Measurement	12A.1	Data	Indoor Temperature	2		
		12A.2	Data	Relative Humidity	1		
		12B.1	Data	NABERS IE Annual Monitoring	0		
		12B.2	Data	NABERS IE Spot Measurements	0		
Acoustic Comfort	To encourage operational practices that monitor and maintain internal noise levels from building systems and outside sources at an appropriate and comfortable level.	13.1	Data	Internal Noise Levels	1	1	
Occupant Satisfaction	To encourage the assessment of thermal comfort, acoustics, indoor air quality, lighting and any other comfort issues for building occupants.	14.1	Action	Occupant Satisfaction Survey	1	1	
		14.2	Data	Occupant Satisfaction Levels	3		
Total						16	7

0	0		
0		0	

Energy						
Greenhouse Gas Emissions	B. Building Energy Baselines	15A	Data	NABERS Energy	0	
		15B	Data	Building Energy Baselines	23	5
		15C	Data	Peer Group of Comparable Buildings	0	
		15D	Data	Longitudinal Benchmarking	0	
Peak Electricity Demand	A. Peer Group of Comparable Buildings	16A	Data	Peer Group of Comparable Buildings	1	
		16B	Data	Longitudinal Benchmarking	0	
		16C	Data	Preliminary Benchmark for Commercial Buildings	0	
Total					24	5

0	0		
0		0	

Transport							
	Sustainable Transport Program	To recognise initiatives promoting and facilitating the use of alternative transport for commuting, reducing impacts from conventional single-occupant vehicles.	17.1	Policy	Sustainable Transport Policy - Regular Occupants	1	1
			17.2	Policy	Sustainable Transport Policy - Visitors	1	1
			17.3	Action	Sustainable Transport Initiatives - Regular Occupants	1	1

		17.4	Action	Sustainable Transport Initiatives - Visitors	1	1
Transport Modes	To recognise the outcomes of initiatives that support commuting via sustainable transport modes and in so doing reduce the impacts of vehicles carrying a single occupant.	18.1	Action	Transport Modes Survey	1	1
		18.2	Data	Improved Transport Modes Performance	2	
		Total				7

0	0
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Water						
Potable Water	B. Potable Water Benchmarks	19A	Data	NABERS Water	0	
		19B	Data	Potable Water Benchmarks	10	3
		19C	Data	Peer Group of Comparable Buildings	0	
		19D	Data	Longitudinal Benchmarking	0	
Fire Protection Testing Water	To encourage operational practices that reduce consumption of potable water for the testing of fire protection systems.	20.1	Action	Testing Regimen	1	1
		20.2	Building	Potable Water Use for Testing	1	1
Total					12	5

0	0
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Materials						
Procurement and Purchasing	To encourage the measurement and reduction of the environmental impacts of materials used in building operations, maintenance and upgrades.	21.1	Policy	Sustainable Procurement Framework	1	1
		21.2	Data	Consumable Materials	1	1
		21.3	Data	Refurbishment Materials	1	
Waste from Operations	To reward operational practices that reduce the amount of landfill waste from typical building operations.	22.1	Policy	Operational Waste Management Plan	1	1
		22.2	Data	Waste to Landfill Reduction	3	1
Waste from Refurbishments	To reward operational practices that reduce the amount of landfill waste from refurbishments, construction or demolition works.	23.1	Policy	Waste Management Plan	1	1
		23.2	Data	Waste Diverted from Landfill	2	
Total					10	5

0	0
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Land Use & Ecology						
Ecological Value	To recognise practices that preserve the ecological value of an occupied site and enhance its natural diversity.	24.1	Policy	Operational Requirements for Biodiversity	1	1
		24.2	Building	Natural Diversity	2	
Groundskeeping	To encourage environmentally sensitive landscape, hard surface and building exterior maintenance practices that reduce environmental impacts and improve ecological value.	25.1	Policy	Site Maintenance Procedures	1	1
		25.2	Action	Landscape	1	1
		25.3	Action	Hard Surfaces and Building Exterior	1	
Total					6	3

0	0
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Emissions						
Stormwater	To encourage the minimisation of peak stormwater flows, the minimisation of pollutants in stormwater run-off and to minimise subsequent environmental impacts.	26.1	Policy	Stormwater Management Plan	1	1
		26.2	Action	Stormwater Runoff Pollutants	1	
Light Pollution	To recognise operational practices that minimise direct and indirect night-time light pollution during the performance period.	27.1	Action	External Lighting	1	1
		27.2	Action	Internal Lighting	1	1
Refrigerant Impacts	To encourage operational practices that minimise the environmental impacts of refrigeration equipment.	28.1	Building	Refrigerant Impacts	1	
Microbial Control	To encourage and recognise building systems that minimise the risk of Legionella.	29.1	Action	Microbial Control	1	1
Total					6	4

0	0
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Innovation						
Innovation	To recognise and encourage pioneering initiatives in sustainable design, process, operational practices or advocacy.	30A	All	Innovative Technology or Process	10	
		30B	All	Market Transformation		
		30C	All	Improving on Green Star Benchmarks		
		30D	All	Innovation Challenges		
		30E	All	Global Sustainability		
Total					10	0

0	0
---	---

TOTALS	AVAILABLE	TARGETED
POINTS	100	47.0
INNOVATION POINTS	10	0.0
TOTAL SCORE TARGETED		47.0

AWARDED	TBC
0.0	0.0