124085
Our Lady of Sion College – STEAM D
1065 Whitehorse Rd, Box Hill, VIC,3128
NCC 2019 JV3 Verification Report

4th April 2022

Revision: 01
Document No: ESD-01

Prepared For:

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Document Amendments

Rev.	Description	Date	Author	Checked
01	For Town Planning	04/04/2021	BP	TP

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1. Executive Summary

Meinhardt was engaged to assess whether the proposed building works at Our Lady of Sion College – STEAMD and Administration development located at 1065 Whitehorse Rd, Box Hill, VIC,3128 meet the performance requirements of NCC Section J 2019. The assessment has been undertaken using verification method JV3.

This assessment was required due to:

- The proposed building roof colour not complying with the deemed-to-satisfy (DTS) provisions of section J (part J1).
- The proposed wall/fabric construction thermal performance not complying with the deemed-to-satisfy (DTS) provisions of section J (part J1).
- The requirements of the Built Environment Sustainability Scorecard (BESS) v6

Compliance requirements for Section J (J1 and J3) of the NCC 2019 for the building works have been outlined within this report and summarised in Table 1. The alterations generally comply with the applicable requirements provided that the recommendations within this report are considered and implemented.

Table 1: Building Overview

BUILDING OVERVIEW			
Location:	1065 Whitehorse Rd, Box Hill, VIC,3128	**NCC Climate Zone:**	6
Class:	Class 9b		
NCC Version:	NCC 2019 Amdt 1		

Table 2: Relevant Fabric Performance Requirements – Compliance Requirements

LEGEND	
YES	Reference documentation shows compliance
YES	Compliance achieved provided recommendations within this report are integrated
NO	Compliance not yet achieved
TBC	Further information required

GLAZING				
Glazing Type	**U-Value Frame + Glass**	**SHGC Frame + Glass**	**Compliant**	**Action**
General New Fixed Glazing*	≤ 2.8	≤ 0.4	YES	-
New Glazed Door*	≤ 2.8	≤ 0.4	YES	-
* Refer to Section 3.4 for explanation of the difference between Compliance and Advised Targets				
WALLS				
Wall Type	**Total R-Value incl thermal bridge**	**Additional Insulation**	**Compliant**	**Action**
New Wall	≥ R1.5	≥ R2.5	YES	Wall Build-up TBC. Total R-Value inclusive of spandrel elements.
SKYLIGHT				
Skylight Type	**U-Value Frame + Glass**	**SHGC Frame + Glass**	**Compliant**	**Action**
General	≤ 2.8	≤ 0.4	YES	-

ROOF				
Roof Type	**Total R-Value**	**Additional Insulation**	**Compliant**	**Action**
L2 courtyard Colour:Concrete; SA ≤ 0.5	≥ R3.2 up	≥ R3.0	YES	Rigid board Soffit insulation
General Roof Colour: Off white; SA ≤ 0.45	≥ R4.0 up	≥ R3.5	YES	Roof Blanket with appropriate proprietary spacers
		Roof Colour:	YES	-
FLOOR				
Floor Type	**U-Value**	**Additional Insulation**	**Compliant**	**Action**
Slab on Ground	≤ 2.0	Nil	YES	

The analysis demonstrates that the Proposed Building complies with the limits set in the JV3 verification method as detailed in the Tables below.

Table 3. Summary of Annual CO2 Emission

		Reference Building	Proposed Building (Reference Services)	Proposed Building (Services as Specified)
Annual GHG Emission	kgCO2e/yr.	**175,128**	163,854	TBC
	kgCO2e/yr. (Incl PV Offset)*		-	TBC
	kgCO2e /m²/yr.	50	47	31
			✓ Section J Compliant	

Compliance with Section J of the NCC 2019 has been shown by verification method JV3. The annual energy consumption of the proposed building fabric is less than the DTS reference building, when modelled with both the reference building services and the proposed building services.

2. Methodology

2.1 Location and Use

The development comprises of a three (3) level administration and general Learning block with significant shading elements.

Table 4. Building Overview

BUILDING OVERVIEW			
Location:	1065 Whitehorse Rd, Box Hill, VIC,3128	**NCC Climate Zone:**	6
Class:	Class 9b		
NCC Version:	NCC 2019 Amdt 1		

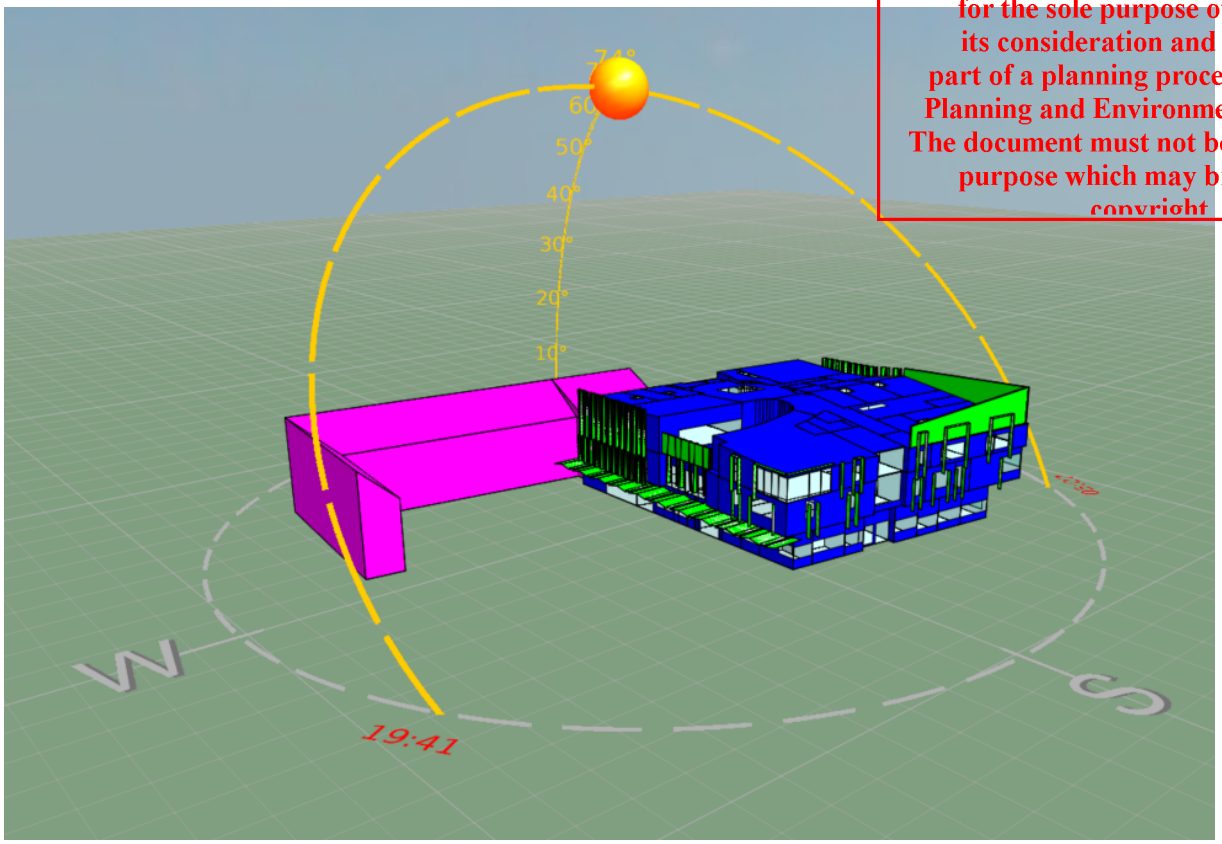
2.2 Software

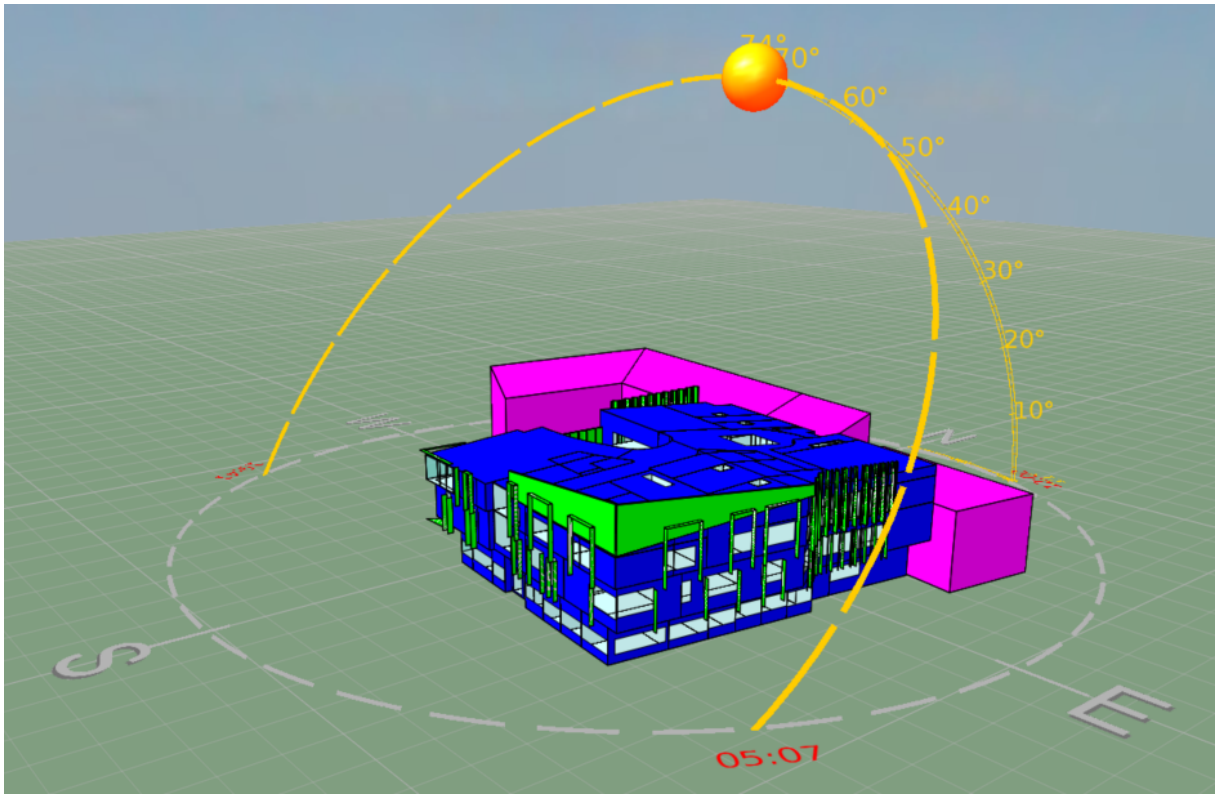
The energy modelling was carried out using IES-VE 2021.

The software integrates site specific climate data with dynamic thermal simulation and custom-built HVAC systems to provide a powerful energy analysis tool. The dynamic simulation engine of the software suite is accredited with ANSI/ASHRAE standard 140-2001, “Standard Method of Test for Evaluation of Building Energy Analysis Computer Programs”.

As this was an energy modelling exercise, some intricacies of the architectural design were simplified. Where simplifications were necessary, every effort was made to retain the neutral thermal impact on both Reference Building and Proposed Building.

Figure 1 - Model View of the Proposed Building





2.3 Modelling Assumptions

Verification was carried out based on the procedures and parameters detailed in JV3 verification method of NCC 2019 Section J.

2.3.1 Climate File

Table 5. Summary of climate File

Climate File	Distance From Site (km)
MelbourneIWEC.fwt	10

2.3.2 Limitations

The assumptions were based on review of the design documents as follows:

Table 6. Reference Documentation List

Drawing No.	Drawing Name	Revision	Date
TP-205	PROPOSED FLOOR PLAN -GROUND	TP	21-03-2022
TP-206	PROPOSED FLOOR PLAN -LEVEL 1	TP	21-03-2022
TP-207	PROPOSED FLOOR PLAN -LEVEL 2	TP	21-03-2022
TP-208	PROPOSED FLOOR PLAN -LEVEL 3	TP	21-03-2022
TP-209	PROPOSED FLOOR PLAN -LEVEL 4	TP	21-03-2022
TP-209.5	PROPOSED FLOOR PLAN -LEVEL 5	TP	21-03-2022
TP-210	PROPOSED FLOOR PLAN -LEVEL 6	TP	21-03-2022
TP-211	PROPOSED FLOOR PLAN - TERRACE	TP	21-03-2022
TP-301	WEST ELEVATION	TP	21-03-2022
TP-302	SOUTH ELEVATION	TP	21-03-2022
TP-303	EAST ELEVATION	TP	21-03-2022
TP-304	NORTH ELEVATION	TP	21-03-2022
TP-401	SECTION 01	TP	21-03-2022
TP-402	SECTION 02	TP	21-03-2022
TP-403	SECTION 03	TP	21-03-2022

Computer building simulation provides an estimate of building performance only. This estimate is based on a necessarily simplified and idealized version of the building that does not and cannot fully represent all the intricacies of the building once built. As a result, simulation results only represent an interpretation of the potential performance of the building. No guarantee or warranty of building performance can be based on simulation results alone.

2.3.3 Walls

The thermal performance for each total wall construction (including Thermal Bridging) for reference and proposed buildings is modelled as follows;

Table 7. Modelled Wall Thermal Values

Total Construction	Reference Building	Proposed Building
External Wall (Includes Thermal Bridging)	**Rt0.93**	**Rt1.5**
External Wall Solar Absorbtance	**0.6**	**0.65**
Internal Wall – Conditioned to Conditioned	**Rt1.0**	**Rt1.0**

The solar absorbtance (SA) of the Reference Building walls has been modelled at SA=0.6.
The solar absorbtance (SA) of the Proposed Building walls has been modelled at SA=0.65.

Please refer to appendix A for a sketch representation. Please note that these mark-ups meet JV3 modelling requirements only, and do not represent any acoustic and / or fire safety requirement.

2.3.4 Floors

The total floor construction thermal performance for both, reference and proposed buildings is as follows;

Table 8. Modelled Floor Thermal Values

Total Construction	Reference Building	Proposed Building
Floor Slab	R2.0, Slab only, Nil Additional Insulation	

Please refer to appendix A for a sketch representation. Please note that these mark-ups meet JV3 modelling requirements only, and do not represent any acoustic and / or fire safety requirement.

2.3.6 Roofs

The total roof construction thermal performance for both, reference and proposed buildings is as follows;

Table 9. Modelled Roof Thermal Values

Total Construction	Reference Building	Proposed Building
Conditioned to Unconditioned – Roof Level	**R-3.2 SA=0.45**	**R-4.0 SA=0.73 (Monument Matt)**
Conditioned to Unconditioned – L1 Soffit under Courtyard	**R-3.2 SA=0.45**	**R-3.2 SA=0.5 (Concrete)**

2.3.7 External Glazing

The total glazing and frame construction thermal performance for both, reference and proposed buildings is as follows;

Table 10. Modelled Wall/Glazing Thermal Values

<table>
<tr><th>Total Construction</th><th colspan="2">Reference Building</th><th>Proposed Building</th></tr>
<tr><td rowspan="2">External Windows</td><td>All Glazing</td><td>U4.06 SHGC 0.41</td><td rowspan="2">Refer to Table 11.</td></tr>
<tr><td colspan="2">Note that the above values relate to the theoretical Reference model. Refer to Appendix B deemed-to-satisfy NCC 2019 Section J1 façade calculator.</td></tr>
</table>

Table 11. Proposed Building Glazing Performance (Typical)

	THERMAL PERFORMANCE REQUIREMENT	
Glazing	**Total System U-Value (Frame + Glazing)**	**Total System SHGC (Frame + Glazing)**
General Glazing	**< U2.8**	**< 0.4**

2.3.8 Shading

External shading due to horizontal projections and adjacent building overshadows is considered in both reference and proposed building. Additional shading has not been applied to the proposed building. No internal shading has been allowed for in the analysis.

2.3.9 Occupancy, Air Conditioning, Lighting and Internal Heat Gain Profiles

All models use the building operation profiles within NCC 2019 Specification JV for occupancy, air-conditioning, lighting and internal heat gains. Note that the profiles used may deviate from the actual class of the space where another modelling profile is deemed to be better suited to the actual building operation.

Table 12. Modelled Usage Profiles

Building Section	Profiles as per NCC Specification JV
Admin Offices Meeting Rooms	 NCC2019 Table 2c;d – Class 5, 6, 7, 8, 9a NCC2019 Table 2i – Class 9b Conference
General Learning Areas	NCC2019 Table 2j – Class 9b School

2.3.10 Infiltration

Table 13. Modelled Infiltration Rates

Infiltration (ACH, A/C On)	Infiltration (ACH, A/C Off)
0.35	**0.70**

2.3.11 Internal Design Conditions

- Winter : 22°C DB, RH Uncontrolled
- Summer : 23°C DB, RH 40-60%, Controlled via coil performance only

2.3.12 Lighting

Maximum lighting power density to NCC 2019 Part J6 has been used for all models.

2.3.13 HVAC

In line with Mechanical services design, the reference and proposed services are modelled as an air-cooled VRF heat pump system to provide cooling and space heating for all conditioned areas. The performance parameters of heat pump for proposed and reference services are tabulated below.

The proposed services intend to meet at least the minimum DTS efficiency and energy usage requirements. We note that the design team to not intend to use any efficiency gains in the building fabric to offset against non-DTS compliant services.

Table 14. Modelled HVAC Performance

Item	Reference Building	Proposed Building with the same services as the Reference Building	Proposed Building with Proposed Services
Chilled Water Cooling (Air to Air) - EER	3.1	3.1	TBC
Heating (Air to Air) - COP	3.1	3.1	TBC

2.3.14 Ventilation Fans

Ventilation fan flowrates and efficiencies are deemed to be equivalent in all models and have been omitted from the calculation.

2.3.15 Greenhouse Gas Emission Factor

Simulated results provide output on the energy usage of the building. In order to convert energy usage to emission rates, Greenhouse Gas emission factors are used according to NCC2019 Specification JVb Table 3a.

Table 15 - Greenhouse Gas Emission Factors (kgCO2-e/GJ)

Energy Source	ACT	NSW	NT	QLD	SA	Tas	Vic	WA
Electricity	-	256	201	256	170	61	232	207
Natural Gas	-	51.53						

Table 16 - Greenhouse Gas Emission Factors (kgCO2-e/kWh)

Energy Source	ACT	NSW	NT	QLD	SA	Tas	Vic	WA
Electricity	-	0.922	0.724	0.922	0.612	0.220	1.163	0.745
Natural Gas	-	0.186						

3. Results

The results of the modelling exercise are as follows:

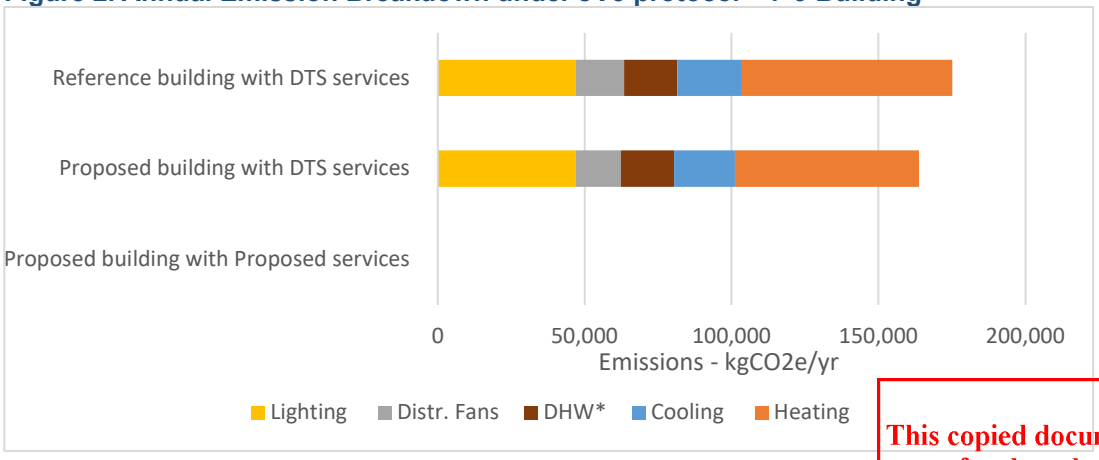
Table 17. Summary of Annual CO2 Emission

		Reference Building	Proposed Building (Reference Services)	Proposed Building (Services as Specified)
Annual GHG Emission	kgCO2e/yr.	**175,128**	163,854	0
	kgCO2e/yr. (Incl PV Offset)*		-	TBC
	kgCO2e /m²/yr.	50	47	0
			✓ Section J Compliant	

Table 18. Summary of Annual Emissions per Usage under JV3 protocol

	Emissions - kgCO2e/yr					
	Heating	Cooling	Distr. Fans	Lighting	DHW*	Total
Reference building with DTS services	71,560	22,047	16,530	46,899	18,093	175,128
Proposed building with DTS services	62,754	20,642	15,468	46,899	18,093	163,854
Proposed building with Proposed services	0	0	0	0	0	0
					Result	**PASS**

Figure 2. Annual Emission Breakdown under JV3 protocol – 7-9 Building



4. Building Sealing Summary

4.1 Windows and Doors

The following requirements are necessary to meet Section J3.4 – Windows and Doors

Table 19. Window and Door Sealing

Requirement	Construction Makeup
An entrance to a building, if leading to a conditioned space must have an airlock, self-closing door, revolving door or the like.	All entrance doors Must be a self-closing door, or revolving door
A seal to restrict air infiltration must be fitted to each edge of a door, openable window or the like forming part of the envelope to the conditioned space.	All swing entrance doors Must be fitted with a draft protection device (brush strip seal or equivalent) to bottom of door to restrict air movement and draught. The other edges of an external door may be a foam or rubber compression strip, fibrous seal or the like. All sliding and revolving entrance doors Must be fitted with a sealing device (brush strip seal or equivalent) to head, jamb and bottom of door to restrict air movement and draught. All operable glazing The edges of an openable window or other such opening, are to be provided with a foam or rubber compression strip, fibrous seal or the like.

4.2 Exhaust Fans

The following requirements are necessary to meet Section J3.5 – Exhaust Fans

Table 20. Exhaust Fan Sealing

Requirement	Construction Makeup
A miscellaneous exhaust fan, such as a bathroom or domestic kitchen exhaust fan, must be fitted with a sealing device such as a self-closing damper or the like when serving a conditioned space.	All miscellaneous exhaust fans Must be provided with self-closing dampers.

4.3 Construction of roofs, walls and floors

The following requirements are necessary to meet Section J3.6 – Construction of roofs, walls and floors

Table 21. Construction Sealing

Requirement
(a) Roofs, ceilings, walls, floors and any opening such as a window frame, door frame, roof light frame or the like must be constructed to minimise air leakage in accordance with (b) when forming part of— (i) the envelope; or (ii) the external fabric of a habitable room or a public area in climate zones 4, 5, 6, 7 or 8.
(b) Construction required by (a) must be— (i) enclosed by internal lining systems that are close fitting at ceiling, wall and floor junctions; or (ii) sealed by caulking, skirting, architraves, cornices or the like.
(c) The requirements of (a) do not apply to openings, grilles or the like required for smoke hazard management.

5. Conclusion

Compliance with Section J1 of the NCC 2019 for Our Lady of Sion College – STEAMD and Administration development located at 1065 Whitehorse Rd, Box Hill, VIC,3128 has been shown by verification method JV3.

The annual energy consumption of the proposed building fabric is less than the DTS reference building(s), when modelled with both the reference building services and the proposed building services.

We can therefore advise that the building works generally comply with the requirements of Section J1 and J3 of NCC2019 provided that the recommendations within this report are considered and implemented.

We note that it is the responsibility of the contractor to provide a compliant final installation, including appropriate additional insulation to meet the requirements according to the final wall and roof construction build-up.

This report makes no comment to the combustibility of external wall systems, including any membranes, insulation, finishing system, wall panelling, cladding or façade material, which are to be assessed for compliance by the Relevant Building Surveyor and Fire Safety Engineer.

DISCLAIMER

This energy model provides an estimate of the base building's energy performance. This estimate is based on a necessarily simplified and idealised version of the building that does not and cannot fully represent all the intricacies of the building and its operation. As a result, the energy model results only represent an interpretation of the potential performance of the building. No guarantee or warranty of building performance in practice can be based on energy modelling results alone.

It should be noted that the figures generated in this report are based on the specific proforma noted in this report and should not be considered a true reflection of the operational profile of either the proposed or reference buildings. The intent of these proforma are to allow one to compare the annual energy consumption figures for the building in question with those of a reference building and therefore determine if a specific building can provide equivalent or better energy efficiency.

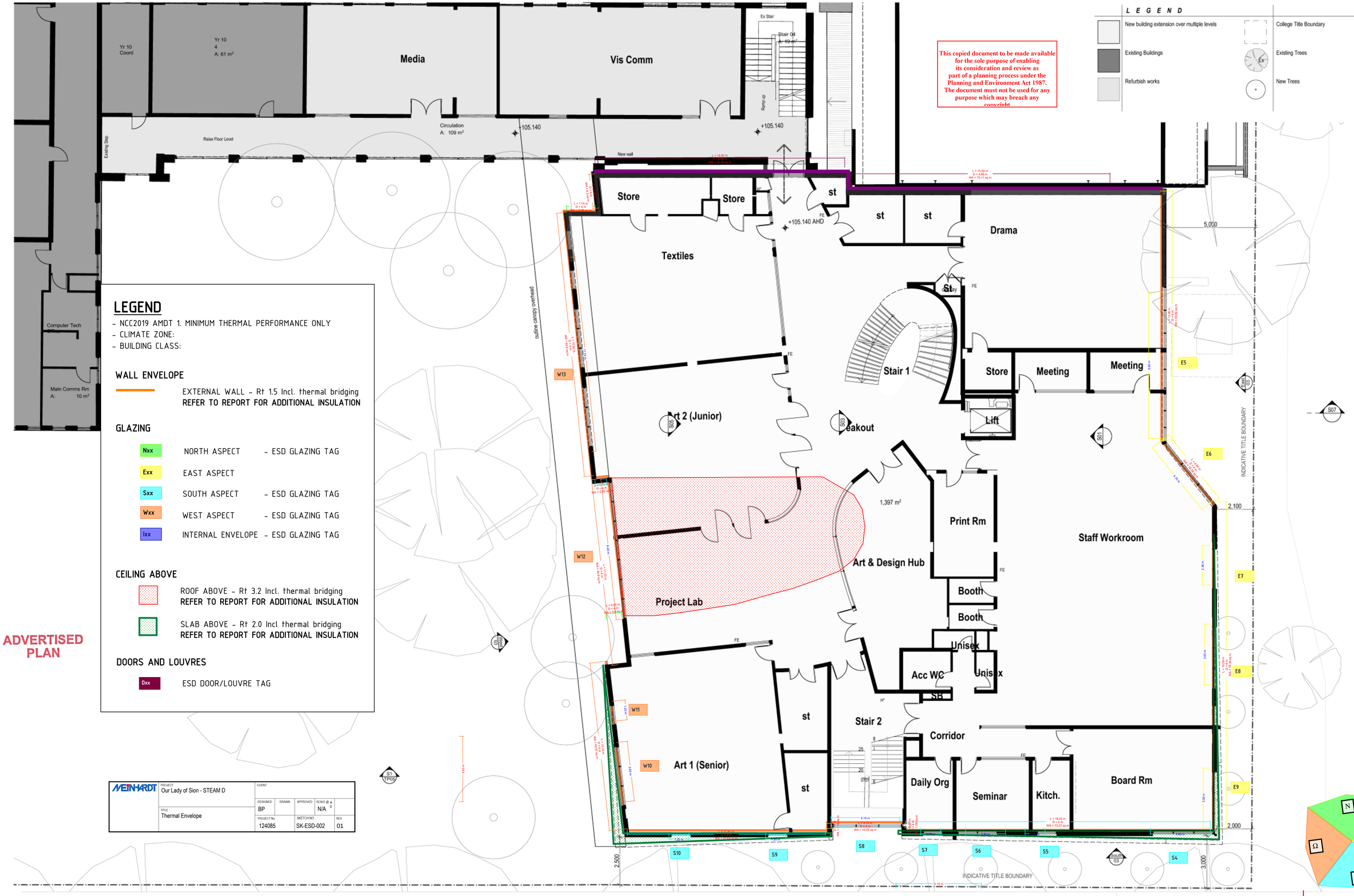
6. Appendix A – Thermal Envelope

williamsross

OLSC STEAMD & Administration Centre

STEAMD & Administration
L1 Floor Plan

MARCH 2022
1:100, 1:1
2107
TP09



LEGEND

- NCC2019 AMDT 1. MINIMUM THERMAL PERFORMANCE ONLY
- CLIMATE ZONE:
- BUILDING CLASS:

WALL ENVELOPE

EXTERNAL WALL - Rt 1.5 Incl. thermal bridging
REFER TO REPORT FOR ADDITIONAL INSULATION

GLAZING

Nxx	NORTH ASPECT	- ESD GLAZING TAG
Exx	EAST ASPECT	
Sxx	SOUTH ASPECT	- ESD GLAZING TAG
Wxx	WEST ASPECT	- ESD GLAZING TAG
Ixx	INTERNAL ENVELOPE	- ESD GLAZING TAG

CEILING ABOVE

ROOF ABOVE - Rt 3.2 Incl. thermal bridging
REFER TO REPORT FOR ADDITIONAL INSULATION

SLAB ABOVE - Rt 2.0 Incl thermal bridging
REFER TO REPORT FOR ADDITIONAL INSULATION

DOORS AND LOUVRES

Dxx ESD DOOR/LOUVRE TAG

ADVERTISED PLAN

MEINHARDT	PROJECT: Our Lady of Sion - STEAM D	CLIENT			
	TITLE: Thermal Envelope	DESIGNED: BP	DRAWN	APPROVED	SCALE @ A: N/A
		PROJECT No: 124085	SKETCH NO: SK-ESD-002		REV: 01

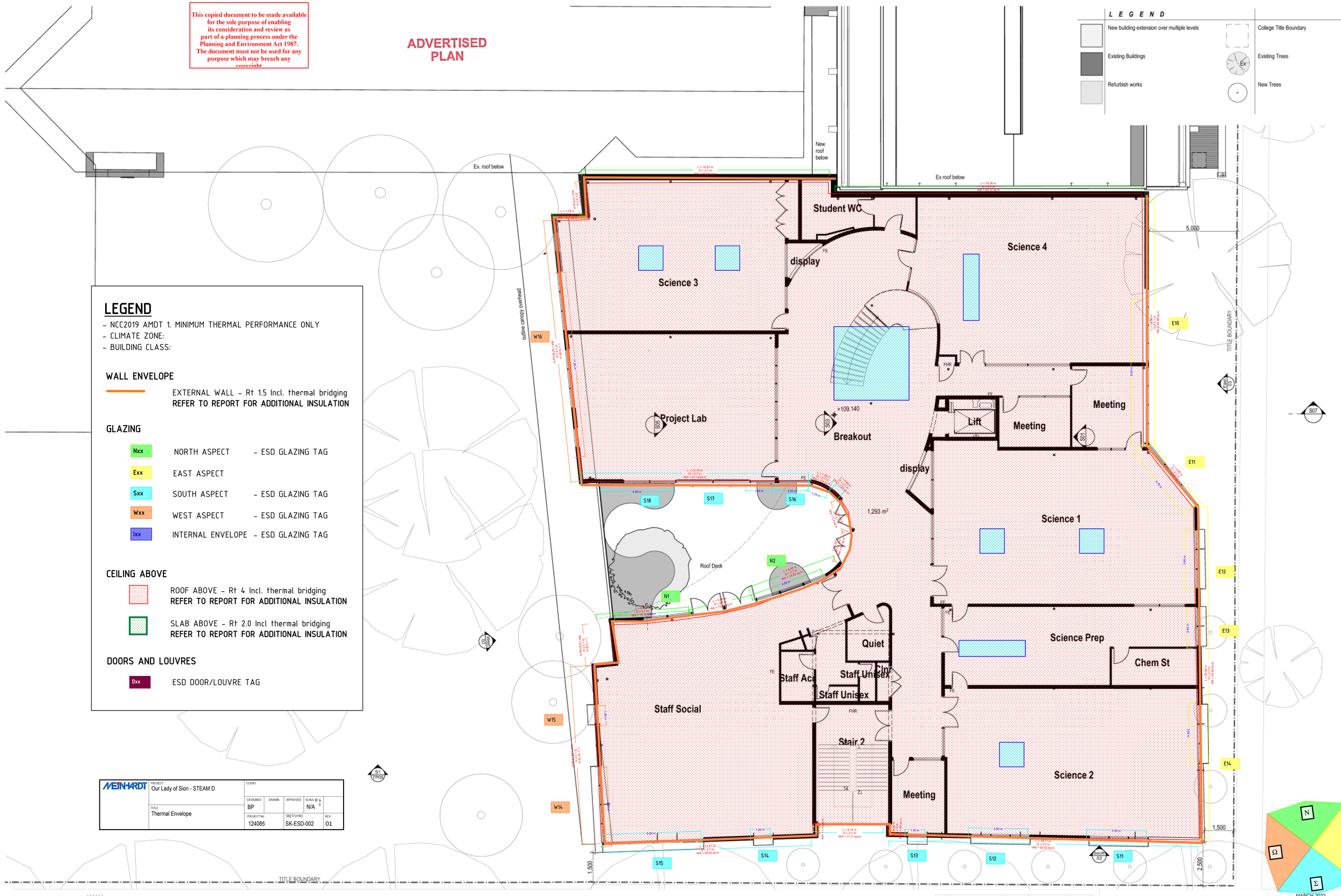
williamsross

OLSC STEAMD & Administration Centre

STEAMD & Administration
L2 Floor Plan

MARCH 2022
1:100, 1:1
2107
TP10

ADVERTISED PLAN



LEGEND

- NCC2019 AMDT 1. MINIMUM THERMAL PERFORMANCE ONLY
- CLIMATE ZONE:
- BUILDING CLASS:

WALL ENVELOPE

EXTERNAL WALL - Rt 1.5 Incl. thermal bridging
REFER TO REPORT FOR ADDITIONAL INSULATION

GLAZING

Nxx	NORTH ASPECT	- ESD GLAZING TAG
Exx	EAST ASPECT	
Sxx	SOUTH ASPECT	- ESD GLAZING TAG
Wxx	WEST ASPECT	- ESD GLAZING TAG
Ixx	INTERNAL ENVELOPE	- ESD GLAZING TAG

CEILING ABOVE

ROOF ABOVE - Rt 4 Incl. thermal bridging
REFER TO REPORT FOR ADDITIONAL INSULATION

SLAB ABOVE - Rt 2.0 Incl thermal bridging
REFER TO REPORT FOR ADDITIONAL INSULATION

DOORS AND LOUVRES

Dxx ESD DOOR/LOUVRE TAG

MEINHARDT

PROJECT: Our Lady of Sion - STEAM D			CLIENT		
TITLE: Thermal Envelope	DESIGNED: BP	DRAWN	APPROVED	SCALE @ A: N/A	0
	PROJECT No: 124085		SKETCH NO: SK-ESD-002	REV: 01	

williamsross

OLSC STEAMD & Administration Centre

STEAMD & Administration
L3 Floor Plan

MARCH 2022
1:100, 1:1
2107
TP11

7. Appendix B – Reference NCC2019 Fabric Calculator

Façade

Report

Calculator

Project Summary

Date
5/04/2022

Name
Brendon Pitt

Company
Meinhardt

Position
ESD Engineer

Building Name / Address
Our Lady of Sion College - Whitehorse Rd
0

Building State
VIC

Climate Zone
Climate Zone 6 - Mild temperate

Building Classification
Class 9b - schools

Storeys Above Ground
3

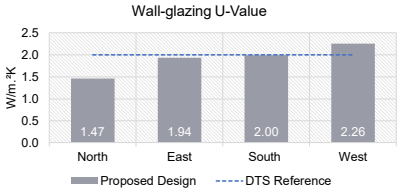
Tool Version
1.1 (April 2020)

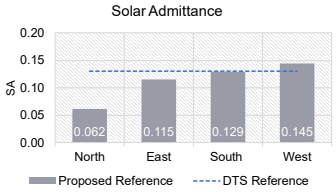
The summary below provides an overview of where compliance has been achieved for Specification J1.5a - Calculation of U-Value and solar admittance - Method 1 (Single Aspect) and Method 2 (Multiple Apects).

Compliant Solution =
Non-Compliant Solution =

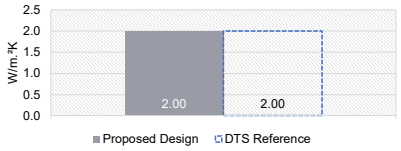
	Method 1				Method 2
	North	East	South	West	All
Wall-glazing U-Value (W/m².K)	1.47	1.94	2.00	2.26	2.00
Solar Admittance	0.06	0.12	0.13	0.14	
AC Energy Value					221

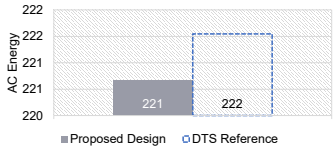
Method 1





Method 2





Project Details

	North	East	South	West
Glazing Area (m²)	21.2	126.786	127.676	157.92
Glazing to Façade Ratio	15%	31%	33%	41%
Glazing References	GlzType-01	GlzType-01 GlzType-02 GlzType-03 GlzType-04	GlzType-01 GlzType-02 GlzType-03 GlzType-04	GlzType-01 GlzType-02 GlzType-03 GlzType-04 GlzType-05
Glazing System Types	0	0	0	0
Glass Types	0	0	0	0
Frame Types	0	0	0	0
Average Glazing U-Value (W/m².K)	4.06	4.06	4.06	4.06
Average Glazing SHGC	0.41	0.41	0.41	0.41
Shading Systems	Horizontal	Horizontal	Horizontal	Horizontal
Wall Area (m²)	118.1	287.3	263.4	226.7
Wall Types	Wall	Wall	Wall	Wall
Methodology	Wall			
Wall Construction	NCC19_Min_R1.0	NCC19_Min_R1.0	NCC19_Min_R1.0	NCC19_Min_R1.0
Wall Thickness	0	0	0	0
Average Wall R-value (m².K/W)	1.00	1.00	1.00	1.00
Solar Absorptance				

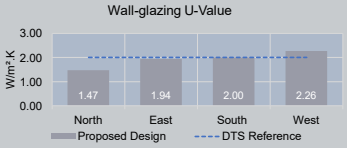
Façade

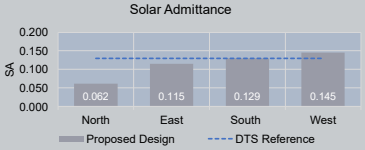
Wall Glazing Areas + Results

User Input | Active Row - All Inputs Required | User Dropdown | Calculator

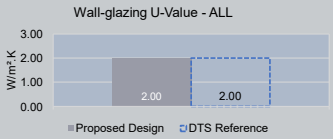
Results | **Class 9b - schools** | **Climate Zone 6 - Mild temperate**

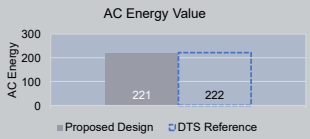
Method 1





Method 2





Wall Glazing Area

Compliant Solution =
Non-Compliant Solution =

North	Glazing Reference	Height (m)	Width (m)	Glazing Area (m²)	Shading Reference	Wall Reference	Wall Area (m²)	Total Area (m²)
1	GlzType-01			21.2		NCC2019_MinR1.0	118.1	139
2								0
3								0
4								0
5								0
6								0

	Result	Target				
Wall-glazing U-Value (W/m².K)	1.47	2.00	Glazing Area (m²)	21.2	Average Glazing U-Value (W/m².K)	4.07
Solar Admittance	0.062	0.130	Wall Area (m²)	118.1	Average Glazing SHGC	0.41
			Glazing to Façade Ratio	15%	Average Wall R-Value (m².K/W)	1.00

East	Glazing Reference	Height (m)	Width (m)	Glazing Area (m²)	Shading Reference	Wall Reference	Wall Area (m²)	Total Area (m²)
1	GlzType-01	1.4	3.84	5.376	SH-E1	NCC2019_MinR1.0	287.3	293
2	GlzType-02	1.4	4.15	5.81	SH-E2			6
3	GlzType-03			23.9	SH-E3			24
4	GlzType-04			91.7				92
5								0
6								0

	Result	Target				
Wall-glazing U-Value (W/m².K)	1.94	2.00	Glazing Area (m²)	126.786	Average Glazing U-Value (W/m².K)	4.07
Solar Admittance	0.115	0.130	Wall Area (m²)	287.3	Average Glazing SHGC	0.41
			Glazing to Façade Ratio	31%	Average Wall R-Value (m².K/W)	1.00

South	Glazing Reference	Height (m)	Width (m)	Glazing Area (m²)	Shading Reference	Wall Reference	Wall Area (m²)	Total Area (m²)
1	GlzType-01	1.4	14.7	20.58	SH-S1	NCC2019_MinR1.0	263.4	284
2	GlzType-02	2.4	1.99	4.776	SH-S2			5
3	GlzType-03	1.4	9.8	13.72	SH-S3			14
4	GlzType-04			88.6				89
5								0
6								0

	Result	Target				
Wall-glazing U-Value (W/m².K)	2.00	2.00	Glazing Area (m²)	127.676	Average Glazing U-Value (W/m².K)	4.07
Solar Admittance	0.129	0.130	Wall Area (m²)	263.4	Average Glazing SHGC	0.41
			Glazing to Façade Ratio	33%	Average Wall R-Value (m².K/W)	1.00

West	Glazing Reference	Height (m)	Width (m)	Glazing Area (m²)	Shading Reference	Wall Reference	Wall Area (m²)	Total Area (m²)
1	GlzType-01			10.8	SH-W1	NCC2019_MinR1.0	226.7	238
2	GlzType-02			42.4	SH-W2			42
3	GlzType-03			26.3	SH-W3			26
4	GlzType-04			74				74
5	GlzType-05			4.42	SH-W4			4
6								0

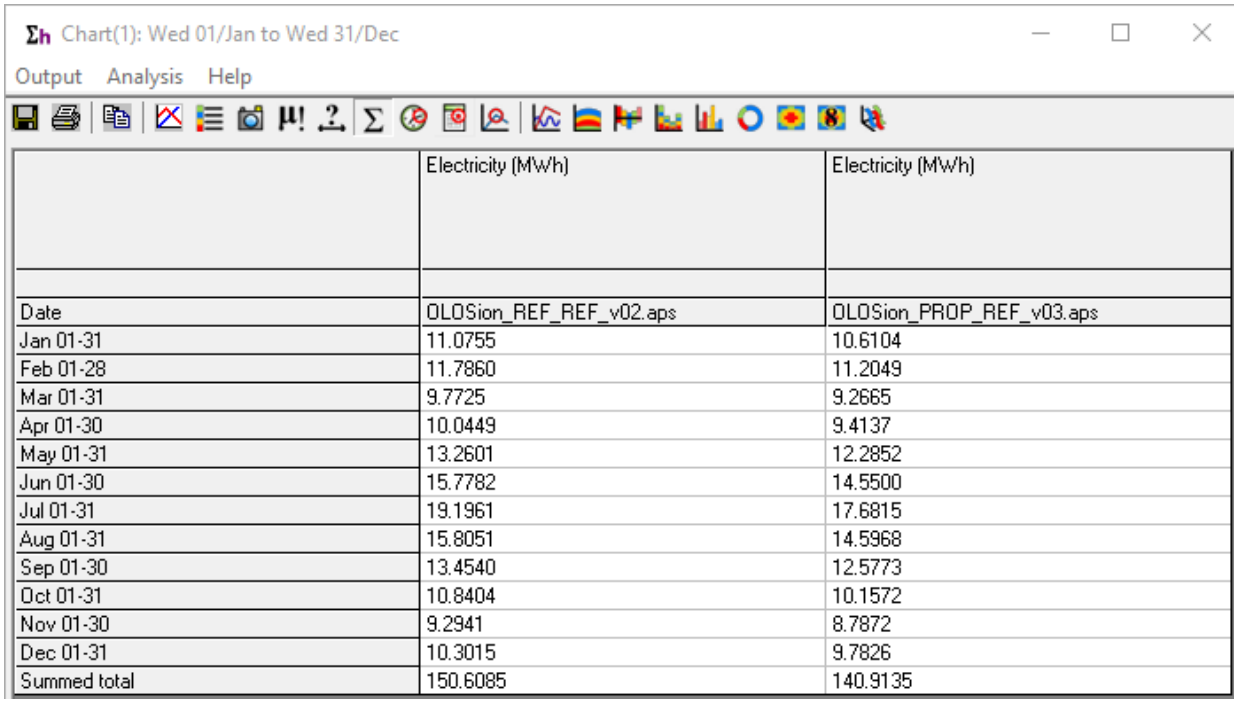
	Result	Target				
Wall-glazing U-Value (W/m².K)	2.26	2.00	Glazing Area (m²)	157.92	Average Glazing U-Value (W/m².K)	4.07
Solar Admittance	0.145	0.130	Wall Area (m²)	226.7	Average Glazing SHGC	0.41
			Glazing to Façade Ratio	41%	Average Wall R-Value (m².K/W)	1.00

Reference Building

Include shading? As Proposed

	Glazing to Façade Ratio	Method 1 Wall U-Value (W/m².K)	Method 1 Glazing U-Value (W/m².K)	Shading Multiplier	Method 1 SHGC	Method 2 Wall U-Value (W/m².K)	Method 2 Glazing U-Value (W/m².K)	Method 2 SHGC
North	15%	0.71	5.80	1.000	0.81	0.96	4.14	0.41
East	31%	1.00	4.27	0.928	0.46			
South	33%	1.00	4.06	0.978	0.41			
West	41%	1.00	3.44	0.870	0.36			

8. Appendix C – IES outputs



	Electricity (MWh)	Electricity (MWh)
Date	OLOSion_REF_REF_v02.aps	OLOSion_PROP_REF_v03.aps
Jan 01-31	11.0755	10.6104
Feb 01-28	11.7860	11.2049
Mar 01-31	9.7725	9.2665
Apr 01-30	10.0449	9.4137
May 01-31	13.2601	12.2852
Jun 01-30	15.7782	14.5500
Jul 01-31	19.1961	17.6815
Aug 01-31	15.8051	14.5968
Sep 01-30	13.4540	12.5773
Oct 01-31	10.8404	10.1572
Nov 01-30	9.2941	8.7872
Dec 01-31	10.3015	9.7826
Summed total	150.6085	140.9135