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Project: **The Boathouse**
 1191 Barrenjoey Road
 Palm Beach

Report: **Section J Compliance Report**
 NCC 2019-Volume 1-Amendment 1
 Performance Solution
 Section JV3 Verification using a reference building

Date: Revision 3 – 16/8/2022
 Revision 2 – 9/12/2021
 Revision 1 – 9/12/2021
 Revision 0 – 3/12/2021

Reference: 22622

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SECTION 1 - BASIS OF ASSESSMENT

1.1 THE PROJECT

The proposed development at 1191 Barrenjoey Road, Palm Beach includes a new two level café and office building, and an ancillary building.

- The Climate Zone is Climate Zone 5.
- This assessment is based on drawings 14-027 WD-000-2, WD-003-2, WD-004-1, WD-005-2, WD-006-3, WD-007-3, WD-008-2, WD-010-3, WD-015-3, WD-018-1, WD-055-2, WD-056-3, WD-057-3, WD-110-1, WD-120-2, WD-500-2, WD-501-3, WD-502-3, WD-610-3, WD-611-3, WD-620-3, WD-621-3, WD-622-3, WD-623-3, WD-700-2, WD-720-1, WD-910-2, WD-920-2, WD-950-2, WD-951-3, WD-970-2.
- This Report addresses ONLY matters relevant to Section 'J' of Volume 1-Amendment 1 of NCC 2019.
- The project is assessed in accordance with the Performance Based Design Brief, dated 30/8/2021 and Clause A2.2 – NCC – Volume 1 – Amendment 1 – JV3 verification method using a reference building, and using approved energy modeling software namely Design Builder version 6.1.5.004 with Energy Plus version 8.9

1.2 AUTHOR QUALIFICATION

Michael May is a qualified Electrical Engineer (SAIT – 1980), Certified Energy Manager (CEM)(#92319), Sydney University Training in NCC - Section 'J' (2007), Member Australian Institute of Energy.

1.3 COMPLIANCE

This assessment demonstrates that the project, as specified in the plans and in the recommendations in Section 2 of this report, complies with the Performance Requirements JP1 – JV3 Verification using a reference building of Section J of the NCC 2019 – volume 1 – Amendment 1.



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SECTION 2 - SUMMARY OF PROVISIONS TO COMPLY

Compliance with Section J of the NCC 2019-volume 1 – Amendment 1 for new Café/Office Building is achieved using the performance based JV3 Verification method using a reference building. The annual energy consumption of the proposed building (using the proposed building fabric and proposed services) is less than the annual energy consumption for the reference building (using Deemed to Satisfy (DTS) provision for the building fabric and DTS services) (refer sections 3, 4 and 5 for details).

Compliance with Section J of the NCC 2019-volume 1 – Amendment 1 for the new Ancillary Building is achieved using the deemed-to-satisfy (DTS) method. The Ancillary Building is a non-conditioned space and is exempt from the requirements of parts J1 and J3, and part J5 is not applicable.

2.1 PART J1 – BUILDING FABRIC - Café/Office Building

Compliance can be met by:

New metal roof

- *Installing 110mm R2.5 reflective insulating blanket or equivalent in the ceiling cavity, giving a **total 'R-value' of R3.88(downwards)**, which exceeds the required minimum of R3.70.*
- *Installing a light coloured roof with a solar absorptance of 0.45 or less.*

New external cladding walls

- *adding R1.50 wall batts in timber frame to the light weight cladding wall system, giving a **total 'R-value' of R1.57.***

New External Glazing:

- *Installing the all the windows and glazed doors with a characteristic equal to or less than a **U-value of 7.0 and a SHGC-value of 0.72**, which can be achieved with clear single glazing.*

New bridge plywood floor

- *Installing the floor as specified (75mm bridge ply, 60mm sand/cement, floor tiles) without any additional insulation and achieving a **total R-value of R1.0***

2.2 PART J3 - BUILDING SEALING - Café/Office Building

Compliance can be met by the following:

- *The new entry doors to the café seating area must be self-closing or interlocked to ensure any new air-conditioning system for the café area is inactive when these doors are open.*
- *Any new exhaust fans to have self-closing dampers, including “miscellaneous exhaust fans”.*

2.3 PART J5 - A/C & VENTILATION SYSTEMS - Café/Office Building

Compliance can be met by:

- *Certification by a mechanical engineer if any new air-conditioner is greater than 65kW_r.*
- *Ensure any new A/C System has the ability to be inactive when the area is not occupied.*
- *Ensure any new A/C System greater than 2kW_r has a 7 day time switch installed.*

- *Ensure any new Mechanical Ventilation system has the ability to be inactive when the area is not occupied.*
- *Ensure any new Mechanical Ventilation system greater than 1000L/s is controlled by a time switch.*

2.4 PART J6 - ARTIFICIAL LIGHTING & POWER

Compliance can be met by:

- *Not exceeding the “Max. Lighting Wattage” for any new lighting in each of the areas in the lighting calculations table in **Appendix 2**.*
- *The maximum internal lighting wattage for the Café/Office building must not exceed **3,143 watts**.*
- *The maximum internal lighting wattage for the Ancillary building must not exceed **277 watts**.*
- *Time switch(s) or motion detector(s) or security card reader(s) must be installed to control at least **95%** of the lighting in the building.*
- *Decorative or display lighting must be controlled separately from general lighting manually and by a time switch in accordance with specification J6 if the lighting exceeds 1kW*
- *External perimeter lighting must be controlled by either a daylight sensor or a time switch in accordance with specification J6, and have a light source efficiency of not less than 60 lumens/watt if the lighting exceeds 100watts.*

SECTION 3 - PROPOSED BUILDING PERFORMANCE SOLUTION

3.1 INTRODUCTION

This section specifies, in accordance with clause A2.2, clause JV3, specification JVa, specification JVb, and the Performance Base Design Brief assessment method and acceptance criteria, how the Proposed Café/Office Building is modelled differently to the Reference Café/Office Building and supersedes the DTS requirements of J1.5 glazing and J1.6 Floor construction.

3.2 RELEVANT NCC/BCA CLAUSE

- Clause J1.5 - Glazing, and
- Clause J1.6 - Floor construction

3.4 DEEMED TO SATISFY NON-COMPLIANCE

- Clause J1.5 requires that the glazing has a U-value of 5.8 or less, while the proposal building has a U-value of 7.0 or less, and
- Clause J 1.6 requires that the floors above open space must achieve a minimum of R2.0., and the proposed floor has a total R-value of R1.0.

3.5 RELEVANT PERFORMANCE REQUIREMENTS

Clause JP1 – Energy Use

3.6 ASSESSMENT METHOD

NCC 2019, Volume 1, Amendment 1, Clause A2.2(2)(b)(i) - Section JV3 Verification using a reference building.

3.7 ACCEPTANCE CRITERIA

Compliance with JP1 is verified when:

- it is determined that the annual greenhouse gas emissions of the proposed building are not more than the annual greenhouse gas emissions of a reference building when the proposed building is modelled with the proposed service and with the same services as the reference building; and
- The proposed building has a thermal comfort level of between a Predicted Mean Vote of -1 to +1 for at least 95% of the floor area of all occupied zones and at least 98% of the annual hours of operations; and
- The building complies with the additional requirements in Specification JVa

Annual greenhouse gas emissions of the proposed building may be offset by renewable energy generated and used on site or another process used on site.

The calculation method used must comply with Specification JVb

3.8 PROPOSED BUILDING ASSESSMENT USING JV3 - VERIFICATION METHOD

The annual energy consumption of the proposed buildings, using the proposed building fabric and proposed services is **27.39 MWh** (25.24 tonnes of CO₂-e) The annual energy consumption for the reference buildings, using DTS building fabric and DTS services is **27.66 MWh** (25.49 tonnes of CO₂-e). Refer appendix 7, 8, 9 & 10 for annual energy consumption analysis)

The air conditioning achieves the specified temperature ranges for each transitory and non-transitory occupancy zones for at least 98% of the annual operating hours as shown in appendix 11.

The PMV thermal comfort level between -1 and +1 is achieved for each non-transitory zone for 98% of the annual operating hours as shown in appendix 12.

Therefore, the building as proposed is compliant with Section JV3 as the estimated annual energy consumption of the proposed building is less than that of the reference building. It is assumed that in the proposed building the services will achieve minimum DTS requirements.

The proposed building uses the same services as the reference building.

The proposed Café/Office building a glazing for clear single glazing or better for all windows and glazed doors

Compliance for the proposed buildings can be met by:

- *Installing the all the windows and glazed doors with a characteristic equal to or less than a **U-value of 7.0** and a **SHGC-value of 0.72**, which can be achieved with clear single glazing.*

The proposed Café/Office building has a ground floor with a total R-value of R1.0

Compliance for the proposed buildings can be met by:

- *Installing the floor as specified (75mm bridge ply, 60mm sand/cement, floor tiles) without any additional insulation and achieving a **total R-value of R1.0***

3.9 CONCLUSION

The building as proposed has achieved compliance with Performance Requirement JP1, as verified against the acceptance criteria.

SECTION 4 - JV3 - REFERENCE BUILDING REQUIREMENTS

This section specifies the methodology used to model both the reference and proposed buildings.

4.1 PART JV3 VERIFICATION METHOD USING A REFERENCE BUILDING

- (a) For a Class 5,6 & 8 building, compliance is verified when it is determined that the annual energy consumption of the proposed building with its services is not more than the annual energy consumption of a reference building when
- a. The proposed building is modelled with the proposed services and
 - b. The proposed building is modelled with the same services as the reference building.
- (c) The annual energy consumption has been calculated using a method that complies with the ABCB protocol for Building Energy Efficiency, namely Design Builder version 4.7.0.027 with Energy Plus version 8.3
- (d) (i) The annual energy consumption for the reference building has been calculated using:
- The Deemed-To-Satisfy (DTS) Provisions as per Part J1 to J7.
 - Solar absorptance of 0.6 for the external walls and 0.45 for the roofs,
 - The maximum illumination power density without any increase for adjustment factors
 - Air-conditioning with the conditioned space temperature, for 98% of the plant operation time, within the range of 18^o CDB to 25^o CDB for transitory spaces and 21^o CDB to 24^o CDB in all others spaces
 - The profiles for occupancy, air-conditioning, lighting, internal heat gains from people, appliances and equipment and hot water systems as per Specification JV,
 - Infiltration values of 0.7 air changes per hour when there is no mechanically supplied outside air and 0.35 air changes per hour at all other times.
- (ii) The annual energy consumption for the reference building and the proposed building has been calculated using the same:
- Annual energy consumption method,
 - Location
 - Adjacent structures and features
 - Orientation
 - Building form
 - Testing standards
 - Thermal resistance of air films
 - Dimensions of all walls
 - Quality of insulation
 - Assumptions and calculations relating to A/C zone boundaries
 - Floor coverings
 - Shading devices
 - Range and type of services
 - Internal artificial lighting
 - Internal heat gains
 - A/C system configuration
 - Daily and annual occupancy and service profiles
 - Hot water system
 - Infiltration values

SECTION 5 - REFERENCE BUILDING ASSESSMENT

This section specifies how the Reference Building has been modelled using the DTS requirements of Section J and is superseded by Section 3 where ever conflicts arise.

5.1 PART J1 - BUILDING FABRIC – Café/Office Building

J1.1 Application - All new parts of the new café/office building envelope need to comply. The Ancillary building is a non-conditioned space and is exempt from this part.

Building Envelope

The building envelope for the purpose of Section J is bound by the new external walls, floor and roof of the proposed café/office building. As shown in Appendix 5

J1.2 Thermal Construction General - Builder is to ensure compliance, during construction.

- Insulation must comply with AS/NZS 4859.1.
- Insulation must abut or overlap adjoining insulation other than at supporting members such as studs, noggings, joists, furring channels where the insulation must be against the member.
- Insulation must form a continuous barrier with ceilings, walls, bulkheads, floors or the like that contribute to the thermal barrier.
- Insulation must not affect the safe or effective operation of a service or fitting.
- Reflective insulation must be installed with the necessary airspace between the reflective side of the insulation and the lining or cladding.
- Reflective insulation must be installed closely against any penetration, door or window opening.
- Each adjoining sheet of roll membrane being overlapped not less than 50mm or taped together.
- Bulk insulation must be installed so that it maintains its position and thickness, other than when it is compressed between cladding and supporting members, water pipes, electrical cabling or the like.
- When selecting insulation caution should be taken to clearly identify the total R-value of the installed roofing and ceiling system or wall system.

J1.3 Roof & Ceiling Construction

(a) In this Climate Zone, the minimum total R-value is R3.70 (downward direction of heat flow).

The roof & ceiling system is a metal roof with plasterboard ceiling which requires additional insulation to achieve a minimum total R-value of R3.7(downwards).

Roof & Ceiling Element	R- Value Unventilated- Down
Outside air film	0.04
Metal roof	0.00
Additional insulation	2.32 minimum
Reflective Airspace	1.12
Plasterboard	0.06
Internal air film	0.16
Total R-value	3.70 minimum

Compliance can be met by:

- Installing 110mm R2.5 reflective insulating blanket or equivalent in the ceiling cavity, giving a **total 'R-value' of R3.88(downwards)**, which exceeds the required minimum of R3.70.

- (b) In this Climate zone the solar absorptance of the upper surface of a roof must be no more than 0.45 (light coloured roof)

Compliance can be met by:

- Installing a light coloured roof with a solar absorptance of 0.45 or less.

The following table is provided by “Colorbond” to describe their range of roof colours according to the Section J requires. It is reproduced here as a guide.

Colour	Solar Absorptance
Classic Cream™	0.32
Surfmist®	0.32
Paperbark®	0.42
Evening Haze®	0.43
Shale Grey™	0.43
Sandbank®	0.46
Dune®	0.47
Windspray®	0.58
Pale Eucalypt®	0.60
Bushland®	0.62
Headland®	0.63
Wilderness®	0.65
Jasper®	0.68

J1.4 Roof lights – not applicable

J1.5 Walls-glazing construction

- The total system U-value for the Wall-glazing construction must not be greater than U-value 2.0
- The total system U-value for display glazing must not be greater than U-value 5.8.
- The total system U-value for wall-glazing construction must be calculated in accordance with Specification J1.5a.
- Wall components must achieve a minimum total R-value of R1.0 where the wall area is less than 80% of the total wall-glazing area, and in accordance with Table J1.5a where the wall area is 80% or more of the total wall-glazing area.
- The solar admittance of externally facing wall-glazing construction must not be greater than that specified in Table J1.5b, namely 0.13 for this climate zone.
- The solar admittance of a wall-glazing construction must be calculated in accordance with Specification J1.5a.
- The total system SHGC of Display glazing must not be greater than 0.81 divided by the shading multiplier specified in Specification J1.5a.

In this project the new walls have to achieve a minimum R-value of R1.4

Cladding walls with timber frames and internal plasterboard.

Wall Element	R- Value
Outside air film	0.04
Cladding (any light weight cladding)	0.03
R1.5 Wall batts with timber frame	1.32
Plasterboard	0.06
Internal air film	0.12
Total R-value	1.57

Compliance can be met by:

- adding R1.50 wall batts in timber frame to the light weight cladding wall system, giving a **total 'R-value' of R1.57.**

Glazing – Method 2 – Refer appendix 1.

Compliance can be met by:

This requirement is superseded by Section 3

- Installing the new double glazed windows with a characteristic equal to or less than a **U-value of 4.00 and a SHGC-value of 0.72**, which can be achieved with tinted single glazing.
- Installing the remaining windows and glazed doors with a characteristic equal to or less than a **U-value of 5.8 and a SHGC-value of 0.72**, which can be achieved with clear single glazing.

J1.6 Floors

(a) A floor must achieve a Total R-Value of R2.0

The bridge plywood floor requires additional insulation where it is above open space to achieve a minimum total R-value of R2.0.

Floor Element	R- Value
Indoor air film	0.16
Tile floor	0.01
60mm sand & cement	0.21
75mm plywood	0.58
Additional insulation	1.00 minimum
Outdoor air film	0.04
Total R-value	2.0 minimum

Compliance can therefore be met by the following:

This requirement is superseded by Section 3

- Adding a 25mm R1.05 PIR board type insulation to the bridge plywood floor, giving a **total 'R-value' of R2.05**, which exceeds the required minimum of R2.0.

5.2 PART J2 - Is not included in the current NCC

5.3 PART J3 - BUILDING SEALING– Café/Office Building

J3.1 Application - All new parts of the new café/office building envelope need to comply. The Ancillary building is a non-conditioned space and is exempt from this part.

J3.2 Chimneys and Flues – not applicable

J3.3 Roof Lights – not applicable

J3.4 Windows and doors

All external doors and windows must either have seals to restrict air infiltration or the windows must comply with AS 2047. (fire and smoke doors, roller shutter door or grills are exempt)

A seal for the bottom edge of a swing door must be a draft protection device and for other edges of an external door and openable windows may be a foam or rubber compression strip fibrous seal or the like.

An entrance to a building must have an airlock, self-closing door, revolving door or the like, where the conditioned space has a floor area greater than 50m².

Compliance can be met by the following:

- *The new entry doors to the café seating area must be self-closing or interlocked to ensure any new air-conditioning system for the café area is inactive when these doors are open.*

J3.5 Exhaust fans

All exhaust fans fitted in a conditioned space must have a sealing device such as a self-closing damper or the like.

Compliance can be met by:

- *Any new exhaust fans to have self-closing dampers, including “miscellaneous exhaust fans”.*

J3.6 Construction of roofs, walls and floors

Roofs, walls and floors and any opening such as a window or door must be constructed to minimise air leakage by:

- Enclosed or internal lining systems that are close fitting at ceiling, wall and floor *junctions* or
- Sealed by caulking, skirting, architraves, cornices or the like.

5.4 PART J4 - Is not included in the current NCC

5.5 PART J5 - A/C & VENTILATION SYSTEMS

J5.2 Air-conditioning system control

- (a) An air-conditioning system –
 - i. must be capable of being deactivated when the building or part of a building served by that system is not occupied; and
 - ii. when serving more than one air-conditioning zone or area with different heating or cooling needs, must—
 - (A) thermostatically control the temperature of each zone of area; and
 - (B) not control the temperature by mixing actively heated air and actively cooled air; and
 - (C) limit reheating to not more than—
 - (aa) for a fixed supply air rate, a 7.5 K rise in temperature; and
 - (bb) for a variable supply air rate, a 7.5 K rise in temperature at the nominal supply air rate but increased or decreased at the same rate that the supply air rate is respectively decreased or increased; and
 - iii. which provides the required mechanical ventilation, other than in climate zone 1 or where dehumidification control is needed, must have an outdoor air economy cycle, if the total air flow rate of any airside component of an air-conditioning system capacity is greater than or equal to 3000) l/s; and
 - iv. which contains more than one water heater, chiller or coil, must be capable of stopping the flow of water to those not operating; and
 - v. with an airflow of more than 1000L/s, must have a variable speed fan when its supply air quantity is capable of being varied; and
 - vi. when serving a sole-occupancy unit in a Class 3 building, must not operate when any external door of the sole-occupancy unit that opens to a balcony or the like, is open for more than one minute; and
 - vii. must have the ability to use direct signals from the control components responsible for the delivery of comfort conditions in the building to regulate the operation of central plant; and
 - viii. must have a control dead band of no less than 2°C, except where a smaller range is required for specialised applications; and
 - ix. must be provided with balancing dampers and balancing valves that ensure the maximum design air or fluid flow is achieved but not exceeded by more than 15% above design at each component or group of components
 - x. must ensure that each independently operating space of more than 1000m² and every separate floor of the building has provision to terminate airflow independently of the remainder of the system sufficient to allow for different operating times; and
 - xi. when deactivated, must close any motorised outdoor air or return air damper that is not otherwise being actively controlled.
- (b) When two or more air-conditioning systems serve the same space they must use control sequences that prevent the systems from operating in opposing heating and cooling modes.
- (c) Time switches –
 - (i) A time switch must be provided to control –
 - (A) an air-conditioning system of more than 2 kW_r; and
 - (B) a heater of more than 1 kW_{heating} used for air-conditioning.
 - (ii) The time switch must be capable of switching electric power on and off at variable pre-programmed times and on variable pre-programmed days

- (iii) The requirements of (i) and (ii) do not apply to –
 - (A) an air-conditioning system that serves—
 - (aa) only one sole-occupancy unit in a Class 2 or 3 building; or
 - (bb) a Class 4 part of a building; or
 - (cc) only one sole-occupancy unit in a Class 9c building; or
 - (B) a building where air-conditioning is needed for 24 hour occupancy.

Compliance can be met by:

- *Ensure any new A/C System has the ability to be inactive when the area is not occupied.*
- *Ensure any new A/C System greater than 2kW_r has a 7 day time switch installed.*

J5.3 Mechanical ventilation systems control

- (a) A mechanical ventilation system, including one that is part of an air-conditioning system, except where the mechanical system serves only one sole-occupancy unit in a Class 2 building or serves only a Class 4 part of a building, must—
 - (i) be capable of being deactivated when the building or part of the building served by that system is not occupied; and
 - (ii) when serving a conditioned space
 - (A) where in the outdoor air flow is greater than 500 L/s, have
 - (aa) an energy reclaiming system that preconditions outdoor air at a minimum sensible heat transfer effectiveness of 60%; or
 - (bb) demand control ventilation in accordance with AS 1668.2 if appropriate to the application; and
 - (B) not exceed the minimum outdoor air quantity required by Part F4 by more than 20%, except where –
 - (aa) additional unconditioned outdoor air is supplied for free cooling; or
 - (bb) additional mechanical ventilation is needed to balance the required exhaust; or
 - (cc) an energy reclaiming system preconditions all the outside air.
 - (iii) For an airflow of more than 1000L/s, have a variable speed fan unless the downstream airflow is required by Part F4 to be constant.
- (b) Exhaust Systems – An exhaust system with an air flow rate of more than 1000L/s must be capable of stopping the motor when the system is not needed, except for an exhaust system in a sole-occupancy unit in a Class 2,3 or 9c building.
- (c) Carpark exhaust systems – Carpark exhaust systems must have a control system in accordance with 4.11.2 or 4.11.3 of AS 1668.2
- (d) Time switches –
 - (i) A time switch must be provided to a mechanical ventilation system with an air flow rate of more than 1000 L/s
 - (ii) The time switch must be capable of switching electric power on and off at variable pre-programmed times and on variable pre-programmed days
 - (iii) The requirements of (i) and (ii) do not apply to –
 - (C) A mechanical ventilation system that serves—
 - (aa) only one sole-occupancy unit in a Class 2, 3 or 9c building; or
 - (bb) a Class 4 part of a building; or
 - (D) a building where air-conditioning is needed for 24 hour occupancy.

Compliance can be met by:

- *Ensure any new Mechanical Ventilation system has the ability to be inactive when the area is not occupied.*
- *Ensure any new Mechanical Ventilation system greater than 1000L/s is controlled by a time switch.*

J5.4 Fan systems

- (a) Fans, ductwork and duct components that form part of an air-conditioning system or mechanical ventilation system must separately comply with (b), (c), (d) and (e) or achieve a lower fan motor input power per flowrate than when combining (b), (c), (d) and (e).

Clauses J5.4 (b), (c), (d) and (e) are included in appendix 6

J5.5 Ductwork insulation

- (i) Ductwork and fitting in an air-conditioning system must be provided with insulation.
- i. Complying with AS/NZS 4859.a, and
 - ii. Have an insulation R-value greater than or equal to
 - R1.0 flexible ductwork
 - The same as connecting duct work for cushion boxes
 - R1.20 within a conditioned space
 - R3.0 where exposed to direct sunlight
 - R2.0 all other locations
- (ii) Insulation must
- i. Be protected against the effects of weather and sunlight, and
 - ii. Be installed so that it abuts joining insulation to form a continuous barrier and maintains its position and thickness
 - iii. When conveying cooled air be protected by a vapour barrier on the outside of the insulation.
- (iii) These requirements do not apply to:
- Ductwork or fittings located in the last room served, or
 - Return air ductwork passing in a conditioned space, or
 - Ductwork for outside or exhaust air, or
 - The floor of an in-situ air-handling unit, or
 - Packaged air-conditioning equipment complying with MEPS, or
 - Flexible fan connectors

J5.6 Ductwork sealing

Ductwork in an air-conditioning system with a capacity of 3000 L/s or greater, not located within the only or last room served by the system, must be sealed against air loss in accordance with the duct sealing requirements of AS 4254.1 and AS 4254.2 for the static pressure of the system

J5.7 Pump systems

- (a) Pumps and pipe work that form part of an air-conditioning system must separately comply with (b), (c) and (d) or achieve a lower pump motor input power per flowrate than when combining (b), (c) and (d).

Clauses J5.7 (b), (c) and (d) are included in appendix 6

J5.8 Pipework insulation

- (a) Piping, vessels, heat exchangers and tanks containing heating or cooling fluid, where the fluid is held at a heated or cooled temperature, that are part of an air-conditioning system, other than in appliances covered by MEPS, must be provided with insulation.
- (i) Complying with AS/NZS 4859.1, and

(ii) Have an insulation in accordance with Table J5.8a and J5.8b below

Table J5.8a - Piping

Fluid temp range	Min R-value Nom Pipe <40mm	Min R-value Nom Pipe 40-80 mm	Min R-value Nom Pipe 80-150mm	Min R-value Nom Pipe >150mm
Low Temp Chilled <2°C	1.3	1.7	2.0	2.7
Chilled 2°C - 20°C	1.0	1.5	2.0	2.0
Heated 30°C - 85°C	1.7	1.7	1.7	1.7
High Temp heated >85°C	2.7	2.7	2.7	2.7

The minimum R-value may be halved for piping penetrating a structural member

Table J5.8b – Vessels, heat exchangers and tanks

Fluid temp range	Min R-value Nom Pipe <40mm
Low Temp Chilled <2°C	2.7
Chilled 2°C - 20°C	1.8
Heated 30°C - 85°C	3.0
High Temp heated >85°C	3.0

(b) Insulation must-

- (i) Be protected against the effects of weather and sunlight, and
- (ii) Be able to withstand the temperatures within the piping, vessel, heat exchanger or tank.

(c) These requirements do not apply to piping, vessels or heat exchangers

- located in the last room served and downstream of the control device for the regulation of heating or cooling service to that room, or
- encased within a concrete slab or panel which is part of the heating or cooling system, or
- supplied as an integral part of a chiller, boiler or unitary air-conditioner, or
- inside an air- handling unit, fan-coil unit, or the like.

J5.9 Space Heating

(d) A Heater used for air-conditioning or as part of an air-conditioning system must be-

- (i) A solar heater; or
 - (ii) A gas heater; or
 - (iii) A heat pump heater; or
 - (iv) A heater using reclaimed heats from another process such as reject heat from a refrigeration plant; or
 - (v) An electric heater if_
 - (A) The heater capacity is not more than-
 - (aa) 10 W/m² of the floor area of the conditioned space in climate zone 1; or
 - (bb) 40 W/m² of the floor area of the conditioned space in climate zone 2; or
 - (cc) In this climate zone <500m² – 65W/m² or >500m² – 55W/m²; or
 - (B) The annual energy consumption of the heating is not more than 15 kWh/m² of the floor area of the conditioned space in climate zones 1,2,3,4 and 5; or
 - (C) The in-duct heater complies with J5.2(a)(ii)(C); or
 - (vi) Any combination of (i) to (v).
- (e) An electric heater may be used for heating a bathroom in a class 2,3,9a or 9c building if the heating capacity is not more than 1.2 kW and the heater has a timer.
- (f) A fixed heating or cooling appliance that moderates the temperature of an outdoor space must be configured to automatically shut down when-
- (i) There are no occupants in the space served; or
 - (ii) A period of one hour has elapsed since the last activation of the heater; or

- (iii) The space served has reached a design temperature.
- (g) A gas water heater, that is used as part of an air-conditioning system, must-
 - (i) If rated to consume 500MJ/hour of gas or less, achieve a minimum gross thermal efficiency of 86%; or
 - (ii) If rated to consume more than 500MJ/hour of gas or less, achieve a minimum gross thermal efficiency of 90.

J5.10 Refrigerant chillers

Refer appendix 6.

J5.11 Unitary air-conditioning equipment

Any new air-conditioning system greater than 65kW_r require certification by a Mechanical Engineer.

Any new air-conditioning system 65kW_r or less must comply with MEPS

Compliance can be met by:

- *Certification by a mechanical engineer if any new air-conditioner is greater than 65kW_r.*

J5.12 Heat rejection equipment

Refer appendix 6.

5.6 PART J6 - ARTIFICIAL LIGHTING & POWER

J6.1 Application

Parts J6.2, J6.3 and J6.5 (a)(ii) do not apply to a Class 8 electricity network substation.

J6.2 Interior artificial lighting

- (b) All artificial lighting for the whole building must not exceed the aggregated maximum Illumination Power Density (IPD) specified in Table J6.2a.(refer Appendix 3).

Compliance can be met by:

- *Not exceeding the “Max. Lighting Wattage” for any new lighting in each of the areas in the lighting calculations table in Appendix 2.*
 - *The maximum internal lighting wattage for the Café/Office building must not exceed **3,143 watts**.*
 - *The maximum internal lighting wattage for the Ancillary building must not exceed **277 watts**.*
- (c) The lighting limits do not apply to the following:
 - Emergency Lighting
 - Signage and display lighting
 - A heater where it emits light
 - Lighting for a specialised process nature
 - Lighting for performances such as theatrical or sporting
 - Lighting of permanent displays in museums or galleries
 - Lighting installed solely to provide Photosynthetically active radiation for plant growth

J6.3 Interior artificial lighting and power control

- (a) Artificial lighting of a room or space must be individually operated by a switch or other control device.
- (c) An artificial lighting switch must:
 - (i) Be located in a visible position in the room being switched or in an adjacent room or space from where 90% of the lighting being switched is visible,
 - (ii) for other than a single function space such as an auditorium, theatre or sporting stadium, not operate lighting for an area greater than 250m² if in a Class 5 or Class 8 building, or,
 - (ii) not operate lighting for an area greater than 250m² for a space up to 2000m² or up to 1000m² for a space greater than 2000m²
- (d) 95% of artificial lighting in a building or storey of a building, other than a Class 2 or 3 building or a Class 4 part, of more than 250m² must be controlled by:
 - (i) A time switch in accordance with Specification J6; or
 - (ii) An occupant sensing device such as a security key card reader or a motion detector in accordance with Specification J6.

Compliance can be met by:

- *Time switch(s) or motion detector(s) or security card reader(s) must be installed to control at least 95% of the lighting in the building.*
- (i) These lighting requirements do not apply to Emergency lighting requirements or where lighting is required for 24 hours occupancy situations.
- (j) The requirements of (d) do not apply to the following:
 - (i) Artificial lighting in a space where the sudden loss of artificial lighting would cause an unsafe situation such as in a patient care area in a Class 9a building or in a Class 9c aged care building.
 - (ii) A heater where the heater also emits light, such as in bathrooms.

J6.4 Interior decorative and display lighting

- (a) Interior decorative and display lighting, such as for a foyer mural or art display, must be controlled:
 - (i) Separately from other artificial lighting; and
 - (ii) By a manual switch for each area other than when the operating times of the displays are the same in a number of areas such as in a museum, art gallery or the like, in which case they may be combined; and
 - (iii) By a time switch in accordance with Specification J6 where display lighting exceeds 1 kW.
- (b) Window display lighting must be controlled separately from other display lighting.

Compliance can be met by:

- *Decorative or display lighting must be controlled separately from general lighting manually and by a time switch in accordance with specification J6 if the lighting exceeds 1kW*

J6.5 External artificial lighting

- (a) External artificial lighting attached to or directed at the façade of a building, must:
- (i) Be controlled by either a daylight sensor or a time switch that is capable of switching on and off electric power to the system at variable pre-programmed times and on variable pre-programmed days; and
 - (ii) When the total perimeter lighting load exceeds 100W, use LED luminaires for 90% of the total lighting load, or be controlled by a motion detector in accordance with Specification J6, or when used for decorative purposes, such as façade lighting or signage lighting, have a separate time switch in accordance with Specification J6.
- (b) The requirements of (a)(ii) do not apply to the following:
- (i) Emergency lighting in accordance with Part E4.
 - (ii) Lighting around a detention centre.

Compliance can be met by:

- *External perimeter lighting must be controlled by either a daylight sensor or a time switch in accordance with specification J6, and have a light source efficiency of not less than 60 lumens/watt if the lighting exceeds 100 watts.*

NOTE:

- That for smaller rooms a greater Illumination Power Density can be achieved by using a Motion Detector.
- All areas have had the Room Aspect Ratio applied.
- For stairwells and corridors the provisions of Part E4 override this Section.

J6.6 Boiling water & chilled water storage units

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

J6.7 Lifts – not applicable

J6.8 Escalators and moving walkways – not applicable

Specification J6

This section contains the requirements for lighting control devices should they be used in the building.

Spec J6.3 Time switch

- (a) A time switch must be capable of switching on and off electric power at variable pre-programmed times and on variable pre-programmed days
- (b) A time switch for internal lighting must be capable of being overridden by
- a means of turning the lights on
 - by a manual switch or occupant sensing device for a period of 2 hours after which the time switch must resume control or
 - an occupant sensing device that overrides the time switch upon a person's entry and returns control to the time switch on the person's exit (eg security card reader), and
 - a manual "off" switch

- (c) A time switch for external lighting must be capable of
 - Limiting the period the system is switched on to between 30 minutes before sunset and 30 minutes after sunrise is determined or detected including any pre-programming period between these times, and
 - Being overridden by a manual switch or a security access system for a period of up to 30 minutes, after which the time switch must resume control.
- (d) A time switch for boiling water and chilled water storage units must be capable of being overridden by a manual switch or a security access system that senses a person's presence, overrides for a period of up to 2 hours, after which if there is no further presence detected, the time switch must resume control.

Spec J6.4 Motion Detectors

- (b) In a Class 5, 6, 7, 8, 9a or 9b building, a motion detector must:
 - (i) Be capable of sensing movement such as by infra-red, ultrasonic or microwave detection or by a combination of these means; and
 - (ii) Be capable of detecting a person before they have entered 1 m into the space, and movement of 500mm within the useable part of the space; and
 - (iii) Not control more than, in other than a car park, an area of 500m² with a single sensor or group of parallel sensors and 75% of the lights in spaces using high intensity discharge; and
 - (iv) Be capable of maintaining the artificial lighting when activated for a maximum of 30 minutes unless it is reset, and without interruption if the motion detector is reset by movement; and
 - (v) Not be overridden by a manual switch to permanently leave the lights on.
- (c) When outside a building, a motion detector must:
 - (i) Be capable of sensing movement such as by infra-red, ultrasonic or microwave detection or by a combination of these means; and
 - (ii) Be capable of detecting a person within a distance of twice the mounting height or 80% of the ground area covered by the lights beam, and
 - (iii) Not control more than 5 lights and
 - (iv) Be operated in series with a photoelectric cell or astronomical time switch so that the lights will not operate in daylight hours, and
 - (v) Be capable of maintaining the artificial lighting when the switch is turned on for a maximum of 10 minutes unless it is reset, and
 - (vi) Have a manual override switch which is reset after a maximum period of 4 hours.

Spec J6.5 Daylight sensor and dynamic lighting control device

- (a) A daylight sensor and dynamic lighting control device for artificial lighting must:

For switching on and off, be capable of having the switching level set point adjusted between 50 and 10000 lux; and have a delay of more than 2 minutes or a differential of more than 50 lux, and

For dimming or stepped switching, be capable of reducing the power consumed by the controlled lighting in proportion to the incident daylight on the working plane either continuously down or in no less than 4 steps down to a power consumption that is less than 50% of full power.

- (b) Where a daylight sensor and dynamic control device has a manual override switch, the manual override switch must not be able to switch the lights permanently on or bypass the lighting controls.

5.7 PART J7 – HEATED WATER SUPPLY, SWIMMING POOL, SPA POOL

J7.2 Heated Water Supply

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

J7.3 Swimming Pool Heating and Pumping - Not Applicable

J7.4 Spa Pool Heating and Pumping - Not Applicable

5.8 PART J8 - FACILITIES FOR ENERGY MONITORING – Not Applicable

J8.1 Application

The provisions of this part apply to all buildings except:

- the sole-occupancy of a Class 2 building,
- a Class 4 part of a building or
- a Class 8 electricity network substation.

J8.2 Not included in current NCC

J8.3 Facilities for Energy Monitoring – not applicable

- (a) A building with a floor area greater than 500m² must have an energy meter to record time-of-use consumption of gas and electricity.

The space is less than 500m².

SECTION 4 - APPENDICES

APPENDIX 1 – WALL-GLAZING CONSTRUCTION

This requirement is superseded by Section 3

NCC 2019 Facade calculator								
Project Name:	The Boathouse - Palm Beach							
Building Class	5	Class 2,3,5,6,7,8,9a						
Climate Zone	5	Storey ground						
Wall+glazing U-value max limit	2.0							
	N	E	S	W				
Solar Admittance max limit	0.13	0.13	0.13	0.13				
Proposed wall R-value	1.57	1.57	1.57	1.57				
	Method 1				Method 2			
	N	E	S	W	Combined			
Wall+glazing area	72.5	92.8	72.5	92.8	330.5			
Glazing area	13.7	18.5	22.2	36.2	90.6			
percentage	19%	20%	31%	39%	27%			
Proposed Wall U-value	0.64	0.64	0.64	0.64	0.6			
Proposed Wall+Glazing U-value	1.61	1.67	1.93	2.65		1.99		
Proposed Wall+Glazing Solar Admit	0.103	0.096	0.160	0.116				
	Reference combined SHGC Energy Value					30.53		
	Proposed combined SHGC Energy Value					30.46		
Element	Facing	Height	Width	Area	U-value	SHGC	P (device or int)	H
W01	E	1.20	1.20	1.4	5.80	0.72		
W02	E	1.20	1.20	1.4	5.80	0.72		
W03	E	1.20	2.40	2.9	5.80	0.72	1.6	1.2
ENTRY	E	2.10	2.56	5.4	5.80	0.72	1.6	2.1
W05	S	2.25	3.74	8.4	4.00	0.72	1.3	2.65
W06	S	1.35	2.40	3.2	4.00	0.72	1.3	1.75
W07	W	1.35	2.40	3.2	5.80	0.72	device	
D03,04	W	2.25	4.80	10.8	5.80	0.72	4.2	2.65
W08	W	1.35	1.80	2.4	5.80	0.72	device	
W09,10,11	N	1.20	7.20	8.6	5.80	0.72		
W12	E	1.20	2.40	2.9	5.80	0.72	0.5	1.4
W13,14,15,16	E	0.45	3.60	1.6	5.80	0.72	0.5	0.65
W17	E	1.20	2.40	2.9	5.80	0.72	0.5	1.4
W18	S	1.20	2.40	2.9	5.80	0.72	1.3	1.2
W19,20	S	1.20	4.80	5.8	5.80	0.72	1.3	1.2
D05	S	2.10	0.90	1.9	5.80	0.72	1.3	2.1
D06,07	W	2.10	9.40	19.7	5.80	0.72	4.2	2.3
Boat Office	n	2.10	2.40	5.0	5.80	0.72	device	

APPENDIX 2 - LIGHTING CALCULATIONS TABLE(S)

AREA DESCRIPTION	FLOOR DIMENSIONS		AREA (m2)	LIGHT ALLOW (W/m ²)	MAX. LIGHTING WATTAGE (W)
	L	B			
Ground floor					
Cool room	4.2	3.3	13.9	1.5	34
Store	3.4	3.3	11.2	1.5	28
Boat hire store	1.2	2.0	2.4	1.5	7
Boat hire office	5.4	2.8	15.1	4.5	111
WC	2	2.1	4.2	3	22
Cool room	3.3	1.8	5.9	1.5	16
Prep & washing	6.6	3.6	23.8	4	148
Kitchen	2.7	11.7	31.7	4	200
Seating	9.1	9.8	89.0	14	1575
Take-away	3.6	3.4	12.4	9	183
WC	2.3	2.3	5.4	3	28
First Floor					
Store	4.4	2.9	12.8	1.5	31
Staff change	4.4	2.0	8.6	4	59
Shower	2.9	1.0	3.0	4	22
WC	2.9	1.4	4.2	3	22
Seaplane office	2.9	3.3	9.7	4.5	73
WC	2.9	1.4	4.2	3	22
Restaurant office	11.9	7.9	94.5	4.5	562
Total Sum					3143

AREA DESCRIPTION	FLOOR DIMENSIONS		AREA (m2)	LIGHT ALLOW (W/m ²)	MAX. LIGHTING WATTAGE (W)
	L	B			
Ancillary building					
Female	3.2	5.3	17.0	3	82
Male	2.1	5.3	11.1	3	56
Boat hire store	2.3	5.3	12.2	1.5	31
Bin room	3.2	5.3	17.0	4	109
Total Sum					277

APPENDIX 3 - TABLE OF MAXIMUM ILLUMINATION POWER DENSITY

Space	Maximum illumination power density (W/m ²)
Auditorium, church and public hall	8
Board room and conference room	5
Car park - general	2
Car park - entry zone (first 20 m of travel)	11.5
Common rooms spaces and corridors	4.5
Control room, switch room, and the like	3
Corridors	5
Courtroom	4.5
Entry lobby	9
Health-care - Children's ward	4
Health-care - examination room	4.5
Health-care - patient ward	2.5
Health-care - all patient care	2.5
Kitchen and food preparation area	4
Laboratory	6
Library - stack and shelving	2.5
Library - reading room	4.5
Museum and gallery - circulation, cleaning and service lighting	2.5
Office - artificially lit to an ambient level of 200 lux or more	4.5
Office - artificially lit to an ambient level of less than 200 lux	2.5
Plant room	4
Restaurant, café, bar, hotel lounge and a space for the serving and consumption of food or drinks	14
Retail space including a museum and gallery whose purpose is the sale of objects	14
School - general purpose learning area	4.5
Storage with shelving no higher than 75% of the height of the aisle lighting	1.5
Service area, locker room, staff room, cleaner's room, rest room and the like	1.5
Toilet, locker room, staff room, rest room and the like	3
Wholesale storage and display area	4

Notes:

1. In areas not listed above, the maximum *illumination power density* is:
 - a) For an illuminance of less than 80 Lux, 2 W/m²
 - b) For an illuminance of less than 80 to 160 Lux, 2.5 W/m²
 - c) For an illuminance of less than 160 to 240 Lux, 3 W/m²
 - d) For an illuminance of less than 240 to 320 Lux, 4.5 W/m²
 - e) For an illuminance of less than 320 to 400 Lux, 6 W/m²
 - f) For an illuminance of less than 400 to 600 Lux, 10 W/m²
 - g) For an illuminance of less than 600 to 800 Lux, 11.5 W/m²

APPENDIX 4 - EVIDENCE OF COMPLIANCE CHECKLIST

The purpose of this checklist is to itemise the evidence that should be collected during the construction phase of the project that will demonstrate how the final building complies with the Energy Efficiency requirements of Section J of the NCC that were identified during the design phase. Generally, evidence should take the form of delivery receipts, photographs, or signed and dated statements from installers. This following check list is a generic list and some elements may not be applicable to a particular project.

PART J1 - BUILDING FABRIC

Element	Applicable (Y or N)	Evidence
Roof & ceiling insulation		Delivery receipts for roof/ceiling insulation type and rating and/or pictures of insulation installation and the R rating of the insulation.
Wall insulation		Delivery receipts for wall insulation type and rating and/or pictures of insulation installation and the R rating of the insulation.

Or a signed and dated statement from the builder/contractor that the Building Fabric insulation was installed as per the authorised plans and the Energy Efficiency Report.

PART J3 - BUILDING SEALING

Element	Applicable (Y or N)	Evidence
Infiltration prevention		Delivery receipts for the number of self closing doors installed.
Exhaust fans		Delivery receipts for the self closing dampers on exhaust fans or pictures showing their installation.

Or a signed and dated statement from the builder/contractor that the self closing doors and/or A/C outlet next to the open shop front was installed as per the authorised plans, specifications and the Energy Efficiency Report.

PART J5 - A/C & VENTILATION SYSTEMS

A signed and dated statement from the A/C installer that the A/C system complies with MEPS and complies with all the requirements of Section J of the NCC 2019.

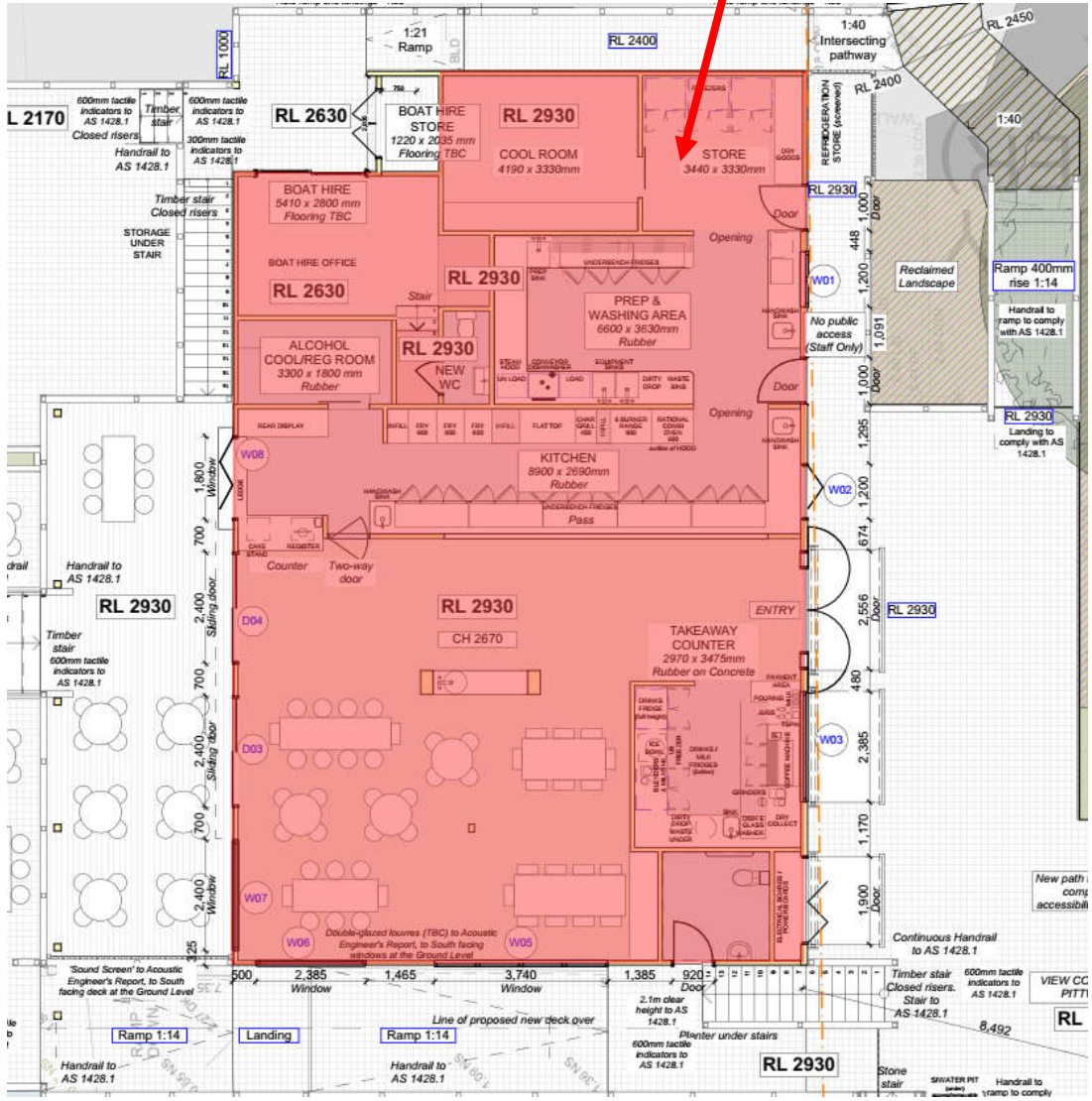
PART J6 - ARTIFICIAL LIGHTING AND POWER

Element	Applicable (Y or N)	Evidence
Internal Lighting		Delivery receipts for the number and wattage of all the internal lights installed.
External lighting		Delivery receipts for the number and wattage of all the external lights installed.

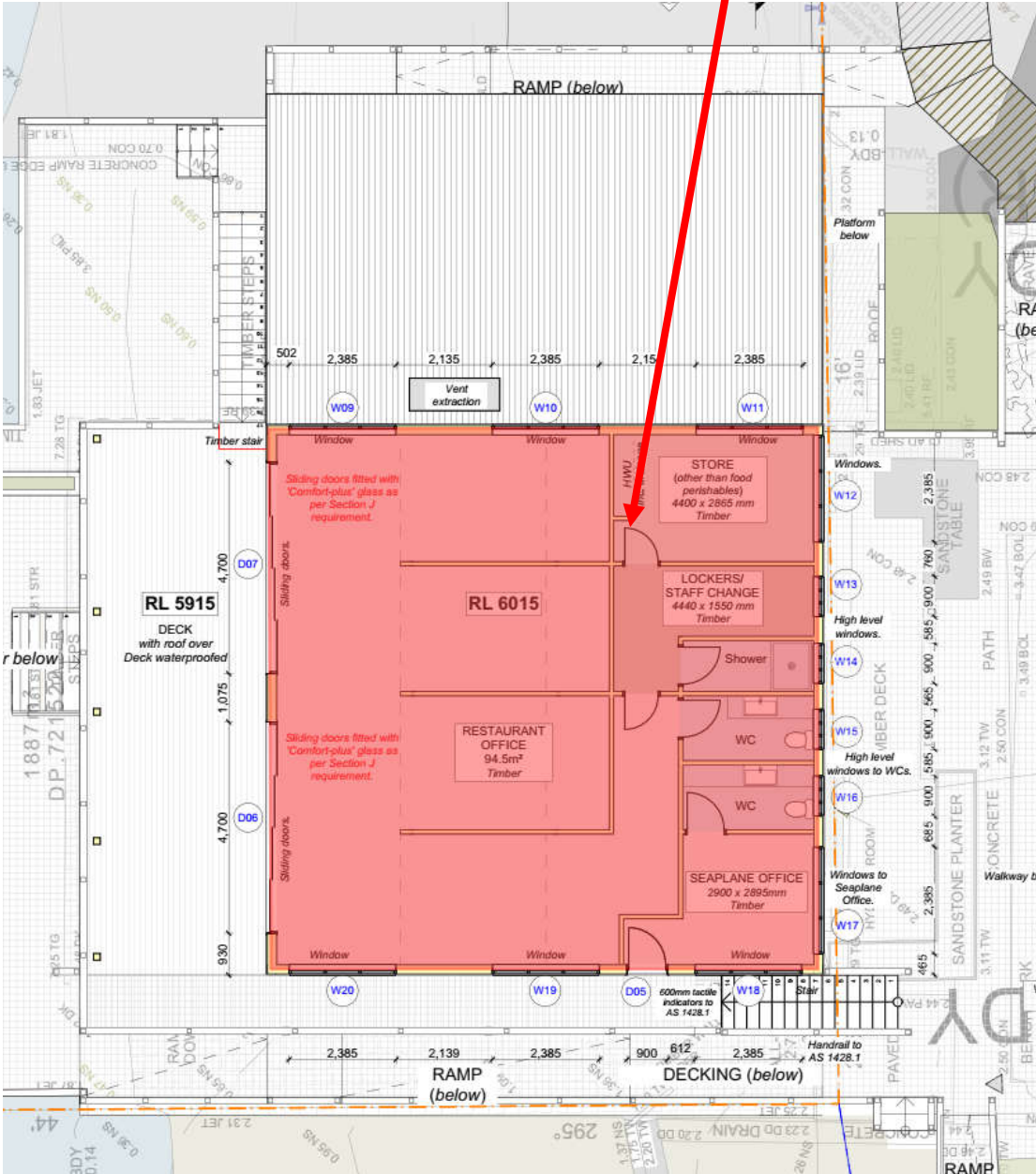
Or a signed and dated statement from the lighting installer that the lighting was installed as per the authorised plans, specifications and the Energy Efficiency Report.

APPENDIX 5 – BUILDING ENVELOPE

The Building Envelope surrounds this area



The Building Envelope surrounds this area



APPENDIX 6 – NCC 2019 ADDITIONAL CLAUSES

J5.4 Fan systems

- (a) Fans, ductwork and duct components that form part of an *air-conditioning* system or mechanical ventilation system must—
 - (i) separately comply with (b), (c), (d) and (e); or
 - (ii) achieve a fan motor input power per unit of flowrate lower than the fan motor input power per unit of flowrate achieved when applying (b), (c), (d) and (e) together.
- (b) **Fans—**
 - (i) Fans in systems that have a static pressure of not more than 200 Pa must have an efficiency at the full load operating point not less than the efficiency calculated with the following formula:

$$\eta_{min} = 13 \times \ln(p) - 30$$
 where—
 - η_{min} = the minimum *required* system static efficiency for installation type A or C or the minimum *required* system total efficiency for installation type B or D; and
 - p = the static pressure of the system (Pa).
 - (ii) Fans in systems that have a static pressure above 200 Pa must have an efficiency at the full load operating point not less than the efficiency calculated with the following formula:

$$\eta_{min} = 0.85 \times (a \times \ln(P) - b + N) / 100$$
 where—
 - η_{min} = the minimum *required* system static efficiency for installation type A or C or the minimum *required* system total efficiency for installation type B or D; and
 - P = the motor input power of the fan (kW); and
 - N = the minimum performance grade obtained from Table J5.4a; and
 - a = regression coefficient a, obtained from Table J5.4b; and
 - b = regression coefficient b, obtained from Table J5.4c; and
 - ln = natural logarithm.
 - (iii) The requirements of (i) and (ii) do not apply to fans that need to be explosion proof.

Table J5.4a Minimum fan performance grade

Fan type	Installation type A or C	Installation type B or D
Axial — as a component of an air handling unit or fan coil unit	46.0	51.5
Axial — other	42.0	61.0
Mixed flow — as a component of an air handling unit or fan coil unit	46.0	51.5
Mixed flow – other	52.5	65.0
Centrifugal forward-curved	46.0	51.5
Centrifugal radial bladed	46.0	51.5
Centrifugal backward-curved	64.0	64.0

Notes to Table J5.4a:

1. **Installation type A** means an arrangement where the fan is installed with free inlet and outlet conditions.
2. **Installation type B** means an arrangement where the fan is installed with a free inlet and a duct at its outlet.
3. **Installation type C** means an arrangement where the fan is installed with a duct fitted to its inlet and with free outlet conditions.
4. **Installation type D** means an arrangement where the fan is installed with a duct fitted to its inlet and outlet.

Table J5.4b Fan regression coefficient a

Fan type	Fan motor input power < 10 kW	Fan motor input power ≥ 10 kW
Axial	2.74	0.78
Mixed flow	4.56	1.1
Centrifugal forward-curved	2.74	0.78
Centrifugal radial bladed	2.74	0.78
Centrifugal backward-curved	4.56	1.1

Table J5.4c Fan regression coefficient b

Fan type	Fan motor input power < 10 kW	Fan motor input power ≥ 10 kW
Axial	6.33	1.88
Mixed flow	10.5	2.6
Centrifugal forward-curved	6.33	1.88
Centrifugal radial bladed	6.33	1.88
Centrifugal backward-curved	10.5	2.6

(c) Ductwork—

- (i) The pressure drop in the index run across all straight sections of rigid ductwork and all sections of flexible ductwork must not exceed 1 Pa/m when averaged over the entire length of straight rigid duct and flexible duct. The pressure drop of flexible ductwork sections may be calculated as if the flexible ductwork is laid straight.
- (ii) Flexible ductwork must not account for more than 6 m in length in any duct run.
- (iii) The upstream connection to ductwork bends, elbows and tees in the index run must have an equivalent diameter to the connected duct.
- (iv) Turning vanes must be included in all rigid ductwork elbows of 90° or more acute than 90° in the index run except where—
 - (A) the inclusion of turning vanes presents a fouling risk; or
 - (B) a long radius bend in accordance with AS 4254.2 is used.

(d) Ductwork components in the index run—

- (i) The pressure drop across a coil must not exceed the value specified in [Table J5.4d](#).

Table J5.4d Maximum coil pressure drop

Number of rows	Maximum pressure drop (Pa)
1	30
2	50
4	90
6	130
8	175
10	220

- (ii) A high efficiency particulate arrestance (HEPA) air filter must not exceed the higher of—
 - (A) a pressure drop of 200 Pa when clean; or
 - (B) the filter design pressure drop when clean at an air velocity of 1.5 m/s.
- (iii) Any other air filter must not exceed—
 - (A) the pressure drop specified in [Table J5.4e](#) when clean; or
 - (B) the filter design pressure drop when clean at an air velocity of 2.5 m/s.

Table J5.4e Maximum clean filter pressure drop

Filter minimum efficiency reporting value	Maximum pressure drop (Pa)
9	55
11	65
13	95
14	110

- (iv) The pressure drop across intake louvres must not exceed the higher of—
 - (A) for single stage louvres, 30 Pa; and
 - (B) for two stage louvres, 60 Pa; and
 - (C) for acoustic louvres, 50 Pa; and
 - (D) for other non-weatherproof louvres, 30 Pa.
- (v) The pressure drop across a variable air volume box, with the damper in the fully open position, must not exceed—
 - (A) for units with electric reheat, 100 Pa; and
 - (B) for other units, 25 Pa not including coil pressure losses.
- (vi) Rooftop cowls must not exceed a pressure drop of 30 Pa.
- (vii) Attenuators must not exceed a pressure drop of 40 Pa.
- (viii) Fire dampers must not exceed a pressure drop of 15 Pa when open.
- (ix) Balancing and control dampers in the index run must not exceed a pressure drop of 25 Pa when in the fully open position.
- (x) Supply air diffusers and grilles must not exceed a pressure drop of 40 Pa.
- (xi) Exhaust grilles must not exceed a pressure drop of 30 Pa.
- (xii) Transfer ducts must not exceed a pressure drop of 12 Pa.
- (xiii) Door grilles must not exceed a pressure drop of 12 Pa.
- (xiv) Active chilled beams must not exceed a pressure drop of 150 Pa.
- (e) The requirements of (a), (b), (c) and (d) do not apply to—
 - (i) fans in unducted *air-conditioning* systems with a supply air capacity of less than 1000 L/s; and
 - (ii) smoke spill fans, except where also used for *air-conditioning* or ventilation; and
 - (iii) the power for process-related components; and
 - (iv) kitchen exhaust systems.

J5.7 Pump systems

- (a) **General** — Pumps and pipework that form part of an *air-conditioning* system must either—
- (i) separately comply with (b), (c) and (d); or
 - (ii) achieve a pump motor power per unit of flowrate lower than the pump motor power per unit of flowrate achieved when applying (b), (c) and (d) together.
- (b) **Circulator pumps** — A glandless impeller pump, with a rated hydraulic power output of less than 2.5 kW and that is used in closed loop systems must have an energy efficiency index (EEI) not more than 0.27 calculated in accordance with European Union Commission Regulation No. 622/2012.
- (c) **Other pumps** — Pumps that are in accordance with Articles 1 and 2 of European Union Commission Regulation No. 547/2012 must have a minimum efficiency index (MEI) of 0.4 or more when calculated in accordance with European Union Commission Regulation No. 547/2012.
- (d) **Pipework** — Straight segments of pipework along the index run, forming part of an *air-conditioning* system—
- (i) in pipework systems that do not have branches and have the same flow rate throughout the entire pipe network, must achieve an average pressure drop of not more than—
 - (A) for constant speed systems, the values nominated in Table J5.7a; or
 - (B) for variable speed systems, the values nominated in Table J5.7b; or
 - (ii) in any other pipework system, must achieve an average pressure drop of not more than—
 - (A) for constant speed systems, the values nominated in Table J5.7c; or
 - (B) for variable speed systems, the values nominated in Table J5.7d.
- (e) the requirements of (d) do not apply—
- (i) to valves and fittings; or
 - (ii) where the smallest pipe size compliant with (d) results in a velocity of 0.7 m/s or less at design flow.

Table J5.7a Maximum pipework pressure drop - Non-distributive constant speed systems

Nominal pipe diameter (mm)	Maximum pressure drop in systems operating 5000 hours/annum or less (Pa/m)	Maximum pressure drop in systems operating more than 5000 hours/annum (Pa/m)
Not more than 20	400	400
25	400	400
32	400	400
40	400	400
50	400	350
65	400	350
80	400	350
100	400	200
125	400	200
150 or more	400	200

Table J5.7b Maximum pipework pressure drop - Non-distributive variable speed systems

Nominal pipe diameter (mm)	Maximum pressure drop in systems operating 5000 hours/annum or less (Pa/m)	Maximum pressure drop in systems operating more than 5000 hours/annum (Pa/m)
Not more than 20	400	400
25	400	400
32	400	400
40	400	400
50	400	400
65	400	400
80	400	400
100	400	300
125	400	300
150 or more	400	300

Table J5.7c Maximum pipework pressure drop - Distributive constant speed systems

Nominal pipe diameter (mm)	Maximum pressure drop in systems operating 2000 hours/annum or less (Pa/m)	Maximum pressure drop in systems operating between 2000 hours/annum and 5000 hours/annum (Pa/m)	Maximum pressure drop in systems operating more than 5000 hours/annum (Pa/m)
Not more than 20	400	300	150
25	400	220	100
32	400	220	100
40	400	220	100
50	400	220	100
65	400	400	170
80	400	400	170
100	400	400	170
125	400	400	170
150 or more	400	400	170

Table J5.7d Maximum pipework pressure drop - Distributive variable speed systems

Nominal pipe diameter (mm)	Maximum pressure drop in systems operating 5000 hours/annum or less (Pa/m)	Maximum pressure drop in systems operating more than 5000 hours/annum (Pa/m)
Not more than 20	400	250
25	400	180
32	400	180
40	400	180
50	400	180
65	400	300
80	400	300
100	400	300
125	400	300
150 or more	400	300

J5.10 Refrigerant chillers

An *air-conditioning* system refrigerant chiller must comply with *MEPS* and the full load operation energy efficiency ratio and integrated part load energy efficiency ratio in [Table J5.10a](#) or [Table J5.10b](#) when determined in accordance with AHRI 551/591.

Table J5.10a Minimum energy efficiency ratio for refrigerant chillers — Option 1

Chiller type	Full load operation ($W_r / W_{input\ power}$)	Integrated part load ($W_r / W_{input\ power}$)
Air-cooled chiller with a capacity ≤ 528 kW _r	2.985	4.048
Air-cooled chiller with a capacity > 528 kW _r	2.985	4.137
Water-cooled positive displacement chiller with a capacity ≤ 264 kW _r	4.694	5.867
Water-cooled positive displacement chiller with a capacity > 264 kW _r but ≤ 528 kW _r	4.889	6.286
Water-cooled positive displacement chiller with a capacity > 528 kW _r but ≤ 1055 kW _r	5.334	6.519
Water-cooled positive displacement chiller with a capacity > 1055 kW _r but ≤ 2110 kW _r	5.800	6.770
Water-cooled positive displacement chiller with a capacity > 2110 kW _r	6.286	7.041
Water-cooled centrifugal chiller with a capacity ≤ 528 kW _r	5.771	6.401
Water-cooled centrifugal chiller with a capacity > 528 kW _r but ≤ 1055 kW _r	5.771	6.519
Water-cooled centrifugal chiller with a capacity > 1055 kW _r but ≤ 1407 kW _r	6.286	6.770
Water-cooled centrifugal chiller with a capacity > 1407 kW _r	6.286	7.041

Table J5.10b Minimum energy efficiency ratio for refrigerant chillers — Option 2

Chiller type	Full load operation ($W_r / W_{input\ power}$)	Integrated part load ($W_r / W_{input\ power}$)
Air-cooled chiller with a capacity ≤ 528 kW _r	2.866	4.669
Air-cooled chiller with a capacity > 528 kW _r	2.866	4.758
Water-cooled positive displacement chiller with a capacity ≤ 264 kW _r	4.513	7.041
Water-cooled positive displacement chiller with a capacity > 264 kW _r but ≤ 528 kW _r	4.694	7.184
Water-cooled positive displacement chiller with a capacity > 528 kW _r but ≤ 1055 kW _r	5.177	8.001
Water-cooled positive displacement chiller with a capacity > 1055 kW _r but ≤ 2110 kW _r	5.633	8.586
Water-cooled positive displacement chiller with a capacity > 2110 kW _r	6.018	9.264
Water-cooled centrifugal chiller with a capacity ≤ 528 kW _r	5.065	8.001
Water-cooled centrifugal chiller with a capacity > 528 kW _r but ≤ 1055 kW _r	5.544	8.001
Water-cooled centrifugal chiller with a capacity > 1055 kW _r but ≤ 1407 kW _r	5.917	9.027
Water-cooled centrifugal chiller with a capacity > 1407 kW _r	6.018	9.264

J5.11 Unitary air-conditioning equipment

Unitary *air-conditioning* equipment including packaged air-conditioners, split systems, and variable refrigerant flow systems must comply with *MEPS* and for a capacity greater than or equal to 65 kW_r—

- (a) where water cooled, have a minimum energy efficiency ratio of $4.0 W_r / W_{input\ power}$ for cooling when tested in accordance with AS/NZS 3823.1.2 at test condition T1, where input power includes both compressor and fan input power; or
- (b) where air cooled, have a minimum energy efficiency ratio of $2.9 W_r / W_{input\ power}$ for cooling when tested in accordance with AS/NZS 3823.1.2 at test condition T1, where input power includes both compressor and fan input power.

J5.12 Heat rejection equipment

- (a) The motor rated power of a fan in a cooling tower, closed circuit cooler or evaporative condenser must not exceed the allowances in [Table J5.12](#).
- (b) The fan in an air-cooled condenser must have a motor rated power of not more than 42 W for each kW of heat rejected from the refrigerant, when determined in accordance with AHRI 460 except for—
 - (i) a refrigerant chiller in an *air-conditioning* system that complies with the energy efficiency ratios in [J5.10](#); or
 - (ii) packaged air-conditioners, split systems, and variable refrigerant flow *air-conditioning* equipment that complies with the energy efficiency ratios in [J5.11](#).

Table J5.12 Maximum fan motor power — Cooling towers, closed circuit coolers and evaporative condensers

Type	Cooling tower maximum fan motor input power (W/kW _{rej})	Closed circuit cooler maximum fan motor input power (W/kW _{rej})	Evaporative condenser maximum fan motor input power (W/kW _{rej})
Induced draft	10.4	16.9	11.0
Forced draft	19.5	Note	11.0

Note to [Table J5.12](#): A closed circuit, forced draft cooling tower must not be used.

APPENDIX 7 - REFERENCE BUILDING - TOTAL ANNUAL ENERGY CONSUMPTION

Fuel Totals - NCC2019 Reference, Building	
EnergyPlus Output	1 Jan - 31 Dec, Run period
	Year
	Licensed
Room Electricity (kWh)	8649.25
Lighting (kWh)	8296.21
System Fans (kWh)	302.99
Electricity (kWh)	27662.51
Heating (Electricity) (kWh)	886.40
Cooling (Electricity) (kWh)	9527.66

APPENDIX 8 - REFERENCE BUILDING - MONTHLY ENERGY CONSUMPTION

Fuel Totals - NCC2019 Reference, Building												
EnergyPlus Output	1 Jan - 31 Dec, Monthly											
	Licensed											
Month												
Room Electricity (kWh)	745.01	663.23	720.00	717.75	745.01	692.74	745.01	745.01	692.74	745.01	717.75	720.00
Lighting (kWh)	714.55	636.16	690.68	688.42	714.55	664.55	714.55	714.55	664.55	714.55	688.42	690.68
System Fans (kWh)	44.30	42.34	37.83	24.99	14.51	8.09	12.03	13.01	11.37	25.27	30.43	38.82
Electricity (kWh)	3007.77	2792.70	2739.60	2278.31	1977.52	1668.88	1919.11	1934.04	1759.19	2342.53	2457.35	2785.51
Heating (Electricity) (kWh)	0.99	0.00	0.25	10.62	70.97	192.93	315.37	191.85	71.60	23.34	4.70	3.78
Cooling (Electricity) (kWh)	1502.92	1450.96	1290.84	836.53	432.49	110.57	132.15	269.62	318.93	834.36	1016.05	1332.23

APPENDIX 9 - PROPOSED BUILDING - TOTAL ANNUAL ENERGY CONSUMPTION

Fuel Totals - NCC2019 Proposed, Building	
EnergyPlus Output	1 Jan - 31 Dec, Run period
	Year
Room Electricity (kWh)	8649.25
Lighting (kWh)	8296.21
System Fans (kWh)	294.24
Electricity (kWh)	27391.40
Heating (Electricity) (kWh)	1006.80
Cooling (Electricity) (kWh)	9144.90

APPENDIX 10 - PROPOSED BUILDING - MONTHLY ENERGY CONSUMPTION

Fuel Totals - NCC2019 Proposed, Building												
EnergyPlus Output	1 Jan - 31 Dec, Monthly											
	Licensed											
Month												
Room Electricity (kWh)	745.01	663.23	720.00	717.75	745.01	692.74	745.01	745.01	692.74	745.01	717.75	720.00
Lighting (kWh)	714.55	636.16	690.68	688.42	714.55	664.55	714.55	714.55	664.55	714.55	688.42	690.68
System Fans (kWh)	44.82	43.21	37.68	23.58	12.41	7.30	11.82	11.79	9.57	24.13	29.58	38.36
Electricity (kWh)	3025.53	2822.58	2735.38	2229.86	1907.06	1646.80	1922.88	1897.95	1698.99	2305.08	2428.63	2770.67
Heating (Electricity) (kWh)	0.98	0.00	0.08	8.09	76.17	221.07	371.88	218.06	76.99	26.14	3.95	3.39
Cooling (Electricity) (kWh)	1520.17	1479.98	1286.93	792.02	358.93	61.14	79.62	208.54	255.14	795.26	988.93	1318.24

APPENDIX 11 - Proposed Building - temperature and PMV range excursions

Section J Temperature Range Check. Target temperature range: 21 - 24 degrees (occupied zones). 18 - 25 degrees (transitory occupancy (TO) zones).
 All zones pass temperature check. **Building : PASS**

Block	Zone	Floor Area (m ²)	Fraction Total Floor Area	Building Class	Operation Hours	Operation Hours T below target	Operation Hours T in target range	Operation Hours T above target	Fraction Operation Hours T in target range	Zone temperature meets Section J target (T in target range ≥ 98 % Operation Hours)
Ground floor	Cafe	92.6	0.25	Class 6 cafe/restaurant	4069	0	4069	0	1.000	PASS
Ground floor	Take away	14.3	0.04	Class 6 cafe/restaurant	4069	0	4069	0	1.000	PASS
Ground floor	Store	2.5	0.01	Class 6 cafe/restaurant	4069	0	4069	0	1.000	PASS
Ground floor	Cool-store	26.9	0.07	Class 6 cafe/restaurant	4069	0	4069	0	1.000	PASS
Ground floor	Office	20.1	0.05	Class 6 cafe/restaurant	4069	0	4069	0	1.000	PASS
Ground floor	Kitchen	60.6	0.16	Class 6 cafe/restaurant	4069	0	4069	0	1.000	PASS
Ground floor	Keg Room	6.0	0.02	Class 6 cafe/restaurant	4069	0	4069	0	1.000	PASS
First floor	Offices	103.3	0.27	Class 6 cafe/restaurant	4069	0	4069	0	1.000	PASS
First floor	Seaplane Office	16.3	0.04	Class 6 cafe/restaurant	4069	0	4069	0	1.000	PASS
First floor	Amenities	33.5	0.09	Class 6 cafe/restaurant	4069	0	4069	0	1.000	PASS

Section J PMV Thermal Comfort Check. Target PMV range: -1.0 to +1.0
 More than 95% (99.3%) of floor area passes PMV check - **Building : PASS**

Block	Zone	Floor Area (m ²)	Fraction Total Floor Area	Building Class	Operation Hours	Operation Hours PMV below -1	Operation Hours PMV between -1 and 1	Operation Hours PMV above 1	Fraction Operation Hours PMV between -1 and 1	Zone PMV meets Section J target (greater than 98 % Operation Hours between -1 and 1)
Ground floor	Cafe	92.6	0.25	Class 6 cafe/restaurant	4069	29	4040	0	0.993	PASS
Ground floor	Take away	14.3	0.04	Class 6 cafe/restaurant	4069	34	4035	0	0.992	PASS
Ground floor	Store	2.5	0.01	Class 6 cafe/restaurant	4069	87	3982	0	0.979	FAIL
Ground floor	Cool-store	26.9	0.07	Class 6 cafe/restaurant	4069	39	4030	0	0.990	PASS
Ground floor	Office	20.1	0.05	Class 6 cafe/restaurant	4069	40	4029	0	0.990	PASS
Ground floor	Kitchen	60.6	0.16	Class 6 cafe/restaurant	4069	26	4043	0	0.994	PASS
Ground floor	Keg Room	6.0	0.02	Class 6 cafe/restaurant	4069	49	4020	0	0.988	PASS
First floor	Offices	103.3	0.27	Class 6 cafe/restaurant	4069	10	4059	0	0.998	PASS
First floor	Seaplane Office	16.3	0.04	Class 6 cafe/restaurant	4069	23	4046	0	0.994	PASS
First floor	Amenities	33.5	0.09	Class 6 cafe/restaurant	4069	3	4066	0	0.999	PASS