REPORT

Sustainable Design

University of Sydney Ross Street - Sustainability Services
University of Sydney

CONFIDENTIAL

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NDY
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1 INTRODUCTION

This Sustainable Design report has been prepared by NDY, A Tetra Tech Company, on behalf of the University of Sydney (the applicant) in support of a State Significant Development Application (SSDA) submitted to the Minister of Planning under Part 4 as defined in section 193 of the EP&A Regulation of the Environmental Planning and Assessment Act 1979 (EP&A Act).

The SSDA seeks development consent for the detailed design and construction of a new building, referred to as the A01 Ross Street Teaching and Learning Hub, on the south-eastern corner of Ross Street and Parramatta Road, Camperdown (the site – refer Figure 1**Error! Reference source not found.**).

The site is legally described as Lot 1 in Deposited Plan 1171804 and currently contains demountable buildings.

The project has been declared as a State Significant Development (SSD) pursuant to Section 4.36(2) of the EP&A Act. In accordance with Schedule 1, Clause 15 of the State Environmental Planning Policy (Planning Systems) 2021 (Planning Systems SEPP), the project is declared SSD as it is development for the purpose of a tertiary institution with a capital investment value (CIV) of more than $50 million.

The project falls within the University's Campus Improvement Program (referred to as the "CIP"). The CIP forms a Concept Approval determined by the Minister for Planning on 16 February 2015 (SSD-6123). The CIP is the University's concept development implementation program for future campus precincts with accompanying building envelopes. The Ross Street Teaching and Learning Hub development is fully compliant with the approved concept plan.

The project is designed to maximise the accommodation of large flat floor teaching spaces and provide a learning hub for students in more flexible, collaborative, and larger scale spaces. Key features of the project include:

- Removal of existing demountable buildings via SSD 6123 Development Consent
- New 5 storey building comprising approximately 6,913m² GFA
- General Learning Spaces (GLS) comprising 60, 90 and 120 person flat floor 'formal' teaching spaces as well as 'informal' learning spaces
- 5-star Green Star Building v1
- Significantly enhanced public domain, including outdoor seating areas, new landscaping and increased tree canopy
- The wider project comprises of traffic improvements, including changes on Western Avenue within the University to improve traffic flow and enhanced pedestrian amenity and connectivity
- The realignment of Science Road, being done as part of the University campus upgrade works, has been shown indicatively
- Food and beverage offering directly fronting the new public domain.

This Sustainable Design report addresses the specific project requirements provided in the Secretary's Environmental Assessment Requirements (SEARs) issued by the Department of Planning and Environment (DPE) on 1 May 2023 (DPE reference: SSD- 57838709). Where relevant, this reports also addresses relevant conditions of consent contained in the CIP Concept Approval (SSD-6123).

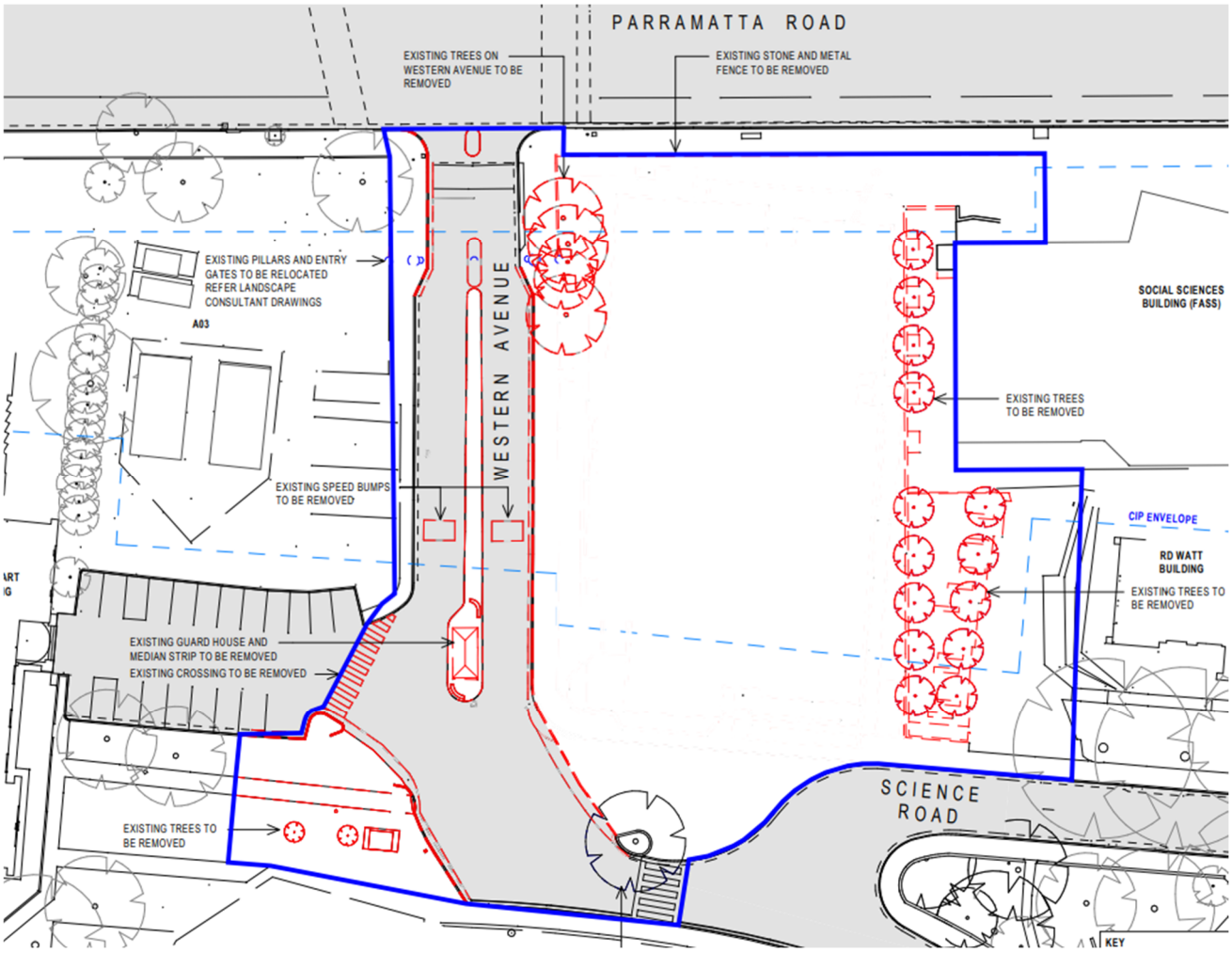

FIGURE 1 SITE AND ITS CONTEXT (SOURCE: BVN)

2 BACKGROUND

2.1 PURPOSE OF THIS REPORT

NDY, A Tetra Tech Company has been engaged by the University of Sydney for the provision of sustainability consulting services for the proposed new A01 Ross Street Teaching and Learning Hub development.

This report provides an overarching framework for the project's sustainability strategy, and includes the following:

- Addressing the minimum requirements set out in the following:
  - Development Consent SSD 6123 dated 16/02/2015
  - Industry Specific SEARs – Tertiary Institutions (SSD-57838709) dated 01/05/2023
- Describing the governance tools in place to assure both that initiatives are implemented, and that sustainability ambitions are achieved; and
- High-level description of sustainability initiatives and ambitions.

2.2 INFORMATION SOURCES

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

- State Environmental Planning Policy (Sustainable Buildings) 2022
- SEARs reports
  - Development Consent SSD 6123 dated 16/02/2015
  - Industry Specific SEARs – Tertiary Institutions (SSD-57838709) dated 01/05/2023
- National Construction Code (NCC) 2022
- Green Star Buildings v1 Rev B Submission Guidelines
- Architectural drawings prepared by BVN
- Workshops and discussions with the project design team

3 PLANNING COMPLIANCE SUMMARY

Table 1 provides a summary of how the proposed project addresses the project-specific sustainability planning requirements.

TABLE 1 PLANNING COMPLIANCE SUMMARY

SEARS REQUIREMENT	PROJECT RESPONSE
Development Consent SSD 6123 - Part B Item B26 Future development applications for new built form shall demonstrate how the principles of ESD have been incorporated into the design, construction and on-going operation of future developments.	Refer to Section 5 of this report.
Industry Specific SEARs – Tertiary Institutions – Section 9. Ecologically Sustainable Development (ESD) Identify how ESD principles (as defined in section 193 of the EP&A Regulation) are incorporated in the design and ongoing operation of the development.	**The precautionary principle** As the site is previously developed, any relevant threats of serious or irreversible environmental damage posed by the project are indirect environmental impacts. High ambitions for: • Reduction of operational energy and water consumption, as well as waste generation; • Responsible procurement of materials and labour; • Fossil fuel free; • Net zero in operation; • Reduced embodied carbon; Along with further strategies described in detail in the sections below, form the overarching strategy to reduce the project's impact on the environment. **Inter-generational equity** The project has implemented a robust sustainability framework, including a climate risk assessment. The latter weighted potential consequences from risks and is planning the implementation of precautionary design and operational measurements for a resilient and safe building. The aim of this is to ensure the health, wellbeing and productivity of future generations is preserved and enhanced during the lifespan of the project. In addition, this project will provide teaching space to the future generations throughout the life of the building. This provides positive intergenerational equity as there is a cost on the current generation to benefit the future generations. **Conservation of biological diversity and ecological integrity** Since the site was previously developed, there is limited local impact on biodiversity and ecological integrity; however, the project aims to engage with First Nations people and ecologists. The proposed design has considered design strategies to enhance the biodiversity of the existing site, such as the use of endemic native vegetation and extensive landscaping. In addition, the project has considered design strategies to minimise the urban heat island effect, such as the use of light-coloured external finishes and landscaping. Finally, access to views have been considered to increase student engagement with the natural environment. **Improved valuation, pricing and incentive mechanisms** The University of Sydney is already incorporating responsible procurement policies such as the purchasing 100% renewable electricity throughout its campuses. This extends to the project.

SEARS REQUIREMENT	PROJECT RESPONSE
	Being an owner-occupier asset, stakeholders have completed feasibility studies that support the responsible pursuit of third-party verification to assure sustainability ambitions are delivered. The University of Sydney will own and occupy the building, and will benefit from ongoing operational cost reductions from the energy and water saving opportunities identified.
Industry Specific SEARs – Tertiary Institutions – Section 9. Ecologically Sustainable Development (ESD) Demonstrate how the development will meet or exceed the relevant industry recognised building sustainability and environmental performance standards.	The project is targeting a 5 Star Green Star Building v1 rating, which is an internationally recognised holistic sustainability rating tool. This level of achievement is classified as Australian Excellence in sustainability, exceeding best practice building performance and industry standards. A Green Star certification independently verifies the environmental and social outcomes of the project. It is developed and regularly updated in consultation with industry and government stakeholders and is therefore the most appropriate mechanism to ensure the project exceeds current benchmarks and standards in an Australian context.
Industry Specific SEARs – Tertiary Institutions – Section 9. Ecologically Sustainable Development (ESD) Demonstrate how the development minimises greenhouse gas emissions (reflecting the Government's goal of net zero emissions by 2050) and consumption of energy, water (including water sensitive urban design) and material resources.	The project will minimise greenhouse gas (GHG) emissions, consumption of energy, water and material resources through a number of design and operational measures. These measures form part of the Green Star strategy and as such, will be independently verified. Design measures include, but are not limited to: • Passive design initiatives such as orientation specific shading and high performance facades; • 100% renewable electricity procurement; • All electric (i.e. zero fossil fuel building); • Selection of refrigerants with a consideration of global warming potential (GWP); • Energy modelling against a reference building to demonstrate a quantifiable reduction in operating GHG emissions; • Energy efficient equipment and lighting; • Life cycle assessment of material use in construction; • Selection of products with accredited sustainability certifications; • Water efficient fixtures and fittings; • WSUD design, rainwater storage and treatment, and water reuse for landscape irrigation, resulting in no net increase in stormwater flows to sewer post-development For further details refer to Section 5 of this report.
Sustainability Buildings SEPP – Item 1. General Sustainability Reporting on general performance, including water conservation, waste minimization and use of renewable energy.	The proposed development aims to go beyond minimum building requirements and provide a progressive sustainability outcome for the University and community at large. The sustainability initiatives of the proposed development will be verified through a Green Star Buildings v1 certification, with the development targeting a 5 Star rating (Australian Excellence in sustainability). Project targets include, but are not limited to: • Reduction in potable water on site through the use of water-efficient fixtures, fittings and landscape irrigation and rainwater harvesting; • Reduction in operational energy through the use of high-performance building fabric and building services (such as lighting and HVAC); • 100% renewable electricity procurement during operation; • Separation of operation waste into multiple waste streams to increase recycling; Refer to Section 5 of this report for more details.

SEARS REQUIREMENT	PROJECT RESPONSE
Sustainability Buildings SEPP – Item 2. Embodied Emissions Reporting Disclose at development application and construction certificate the quantities of materials and associated emissions. Describe how embodied emissions are minimised (by re-used or recycled content and low emissions construction technologies). Use NABERS embodied emissions materials form until NABERS framework is ready.	A completed NABERS *Embodied Emissions Materials Form* will be provided by the project team. It noted that the project is targeting the *Climate Positive Pathway* under the Green Star Building framework. This includes an '*Credit Achievement'* rating under Credit 21 Upfront Carbon, in which the proposed design must achieve at least a 20% reduction in upfront carbon compared to a reference building.
Sustainability Buildings SEPP – Item 3. Net Zero Statement Demonstrate at development application that the development is designed with sufficient space and infrastructure so all energy needs can be sourced from renewables by 2035.	The building is proposed to be all-electric and supplied by 100% renewable electricity. By this means, the project will be entirely sourced from renewables immediately upon construction completion. It noted that the project is targeting the *Climate Positive Pathway* under the Green Star Building framework, which represents the GBCA's pathway towards zero emissions. This includes an '*Exceptional Performance'* rating under Credit 23 Energy *Source*, in which 100% of the building's energy comes from renewables.

4 SUSTAINABILITY FRAMEWORKS & LEGISLATION

This section details the relevant sustainability frameworks and legislation applicable to the proposed development.

4.1 NATIONAL CONSTRUCTION CODE 2022 – SECTION J

National Construction Code (NCC) 2022 Building Code of Australia Volume 1 Section J (hereafter referred to as NCC 2022 Section J) is produced and maintained by the Australian Building Codes Board (ABCB) on behalf of the Australian Government with the aim of achieving nationally consistent, minimum necessary standards of relevant health and safety, amenity and sustainability objectives efficiently. The NCC contains mandatory technical provisions for the design and construction of buildings and other structures, and plumbing and drainage systems through Australia.

Volume 1, Section J of the NCC 2022 outlines energy efficiency provisions required for NCC Class 2 – 9 buildings. There are 6 Deemed-to-Satisfy subsections, focusing on different aspects of energy efficiency as follows:

- J1 – Energy efficiency performance requirements
- J2 – Energy efficiency
- J3 – Elemental provisions for a sole-occupancy unit of a Class 2 building or a Class 4 part of a building
- J4 – Building fabric
- J5 – Building sealing
- J6 – Air-conditioning and ventilation
- J7 – Artificial lighting and power
- J8 – Heated water supply and swimming pool and spa pool plant
- J9 – Energy monitoring and on-site distributed energy resources

This project is committed to achieving compliance with all the NCC 2022 Section J requirements, via either a deemed-to-satisfy or Performance Solution approach as required.

NDY have undertaken a preliminary NCC Section J4 Building Fabric assessment, provided in Appendix A.

4.2 SUSTAINABLE BUILDINGS SEPP 2022

The Sustainable Buildings SEPP applies to all types of buildings in NSW, and is aimed at encouraging the design and construction of more sustainable buildings across NSW. The table below summarises the requirements for all non-residential developments, and the applicability to the proposed A01 Ross Street Teaching and Learning Hub.

TABLE 2 SEPP 2022 CRITERIA APPLICATION MATRIX

MEASURE	DESCRIPTION	APPLICABILITY CRITERIA	APPLICABILITY TO THE A01 ROSS STREET TEACHING AND LEARNING HUB
1. **General Sustainability**	Reporting on general performance, including water conservation, waste minimization and use of renewable energy.	All non-residential developments	Yes
2. **Embodied Emissions Reporting**	Disclose at development application and construction certificate the quantities of materials and associated emissions. Describe how embodied emissions are minimised (by re-used or recycled content and low emissions construction technologies). Use NABERS embodied emissions materials form until NABERS framework is ready.	All non-residential developments	Yes

MEASURE	DESCRIPTION	APPLICABILITY CRITERIA	APPLICABILITY TO THE A01 ROSS STREET TEACHING AND LEARNING HUB
3. Net Zero Statement	Demonstrate at development application that the development is designed with sufficient space and infrastructure so all energy needs can be sourced from renewables by 2035.	Applicable to 'Large Commercial' developments and certain state significant developments. For hotel projects, this is defined as hotels with more than 100 rooms.	Yes
4. Energy Performance & Offsets	Independently verify that the development has met the energy performance required by the NCC, through NABERS post occupancy assurance. Purchase offsets for onsite fossil fuel use and to rectify any performance gap for energy efficiency.	Applicable to 'Large Commercial' developments only.	No
5. Water Performance	Independently verify that the development has met a minimum 3-star NABERS water rating.	Applicable to 'Large Commercial' developments only.	No

4.3 GREEN STAR BUILDINGS

Green Star Buildings is a voluntary sustainability rating tool for buildings in Australia, administered by the Green Building Council of Australia (GBCA), to lead the sustainable transformation of the built environment.

Green Star is a holistic rating system, covering a wide range of sustainability themes and initiatives. The key categories included under the Green Star Buildings framework are as follows:

RESPONSIBLE: Recognises activities that ensure the building is designed, procured, built, and handed over in a responsible manner.

HEALTHY: Promotes actions and solutions that improve the physical and mental health of occupants.

RESILIENT: Encourages solutions that address the capacity of the building to bounce back from short-term shocks and long-term stresses

POSITIVE: Encourages a positive contribution to key environmental issues of carbon, water, and the impact of materials.

PLACES: Supports the creation of safe, enjoyable, integrated, and comfortable places.

PEOPLE: Encourages solutions that address the social health of the community.

NATURE: Encourages active connections between people and nature and rewards creating biodiverse green spaces in cities.

LEADERSHIP: Recognises projects that set a strategic direction, build a vision for industry, or enhance the industry's capacity to innovate.

4.4 STAKEHOLDER DESIGN GUIDES

4.4.1 SUSTAINABILITY STANDARDS

The University of Sydney University Infrastructure (UI) Sustainability Standard aims to grow opportunities to contribute to a positive, vibrant and sustainable long-term future for urban, rural and regional Australia. Figure 2 outlines the sustainability strategy at a glance and Figure 3 outlines the University's strategic vision and pillars.

FIGURE 2 UNIVERSITY OF SYDNEY SUSTAINABILITY STRATEGY AT A GLANCE

Pillar 1

Enriching lives through research and education

The University will be a place that drives social and environmental change and where sustainability is integrated into our campus life by implementing world-leading research and education in our everyday lives on campus.

Pillar 2

Enabling resilient places and a responsible footprint

We acknowledge our significant impact on the Country where our campuses reside, and accept the moral and social obligation to leave a responsible footprint where we tread.

Pillar 3

Empowering good governance and coordination

Lessons from our peers show that institutional support for sustainability is crucial. An enduring commitment to incorporating sustainability through our research, education and operations to enact change will be critical to its success.

Foundation: Caring for Country

Caring for Country underpins this strategy, framing our intent and actions. Our work to become a more sustainable university must observe multiple knowledge systems – including those of our First Nations communities – that will continue to build long-term sustainability.

FIGURE 3 STRATEGIC VISION AND PILLARS

5 SUSTAINABILITY STRATEGY

The proposed development aims to go beyond minimum building requirements and provide a progressive sustainability outcome for the University and community at large.

The sustainability initiatives of the proposed development will be verified through a Green Star Buildings v1 certification, with the development targeting a 5 Star rating. Green Star Buildings is an internationally recognised holistic sustainability rating tool. The 5-star level of achievement is classified as Australian Excellence in sustainability, exceeding best practice building performance.

A Green Star certification independently verifies the environmental and social outcomes of the project. It is developed and regularly updated in consultation with industry and government stakeholders and is therefore the most appropriate mechanism to ensure the project exceeds current benchmarks and standards in an Australian context.

The following section outlines the preliminary sustainability strategy for the project, with proposed initiatives provided against each Green Star Buildings category described above. Figure 4 shows the breakdown of credits that are targeted within the project. The targeted credit mix amounts to over 35 points, which support the project's ambition to achieve Australian Excellence – 5 Star Green Star certification.

The Green Star pathway and associated relevant design details will be incorporated into project contract documentation. The head contractor will ultimately be responsible for ensuring the Green Star 5 Star outcome is achieved.

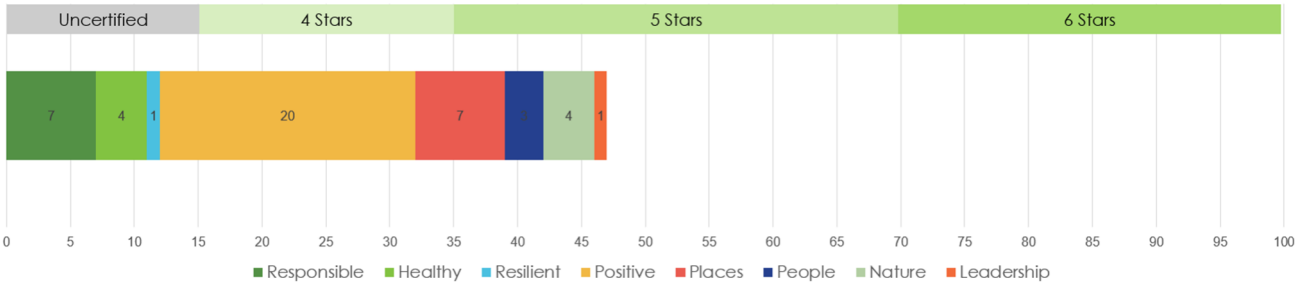

FIGURE 4 GREEN STAR PATHWAY BREAKDOWN

5.1 RESPONSIBLE

GENERAL PRINCIPLES

This category recognises activities that ensure the building is designed, procured, built, and handed over in a responsible manner. The category aims to help builders, owners, and the supply chain on the sustainability journey. Key concepts include:

- Guidance from sustainability professionals
- Responsible construction practices
- Commitments to performance (e.g. reducing building and operational waste).
- Pre-commissioning, commissioning and tuning
- Air tightness testing for building performance verification
- Building information to facilitate operator and user understanding
- Metering and monitoring
- Training of construction personnel for sustainable construction practices

INITIATIVES

The following initiatives are included in the preliminary sustainability strategy:

- Green Star accredited professional has been contractually engaged to provide advice, support and information from schematic design phase through to post-occupancy evaluation.
- Reporting of financial information to the GBCA and marketing of sustainability achievements to encourage industry transformation through collaboration and data sharing.
- Responsible construction practices in place, including development of project-specific best-practice environmental management plan (EMP) and high-quality staff support services. Implementation of a formalized approach to planning, implementing and auditing during construction to ensure conformance with the EMP.

- Waste management plans for demolition, construction and operation of the site. Minimum of 90% of construction and demolition waste to be diverted from landfill.
- Best-practice energy and water metering and monitoring.
- Environmental targets for the development and a system in place to measure results, for reduction of energy and water consumption.
- Provision of best-practise building information to facilitate operator and user understanding of all building systems, and their specific operation and maintenance requirements and/or environmental targets
- Pre-commissioning, commissioning, and tuning of building systems to ensure systems are operating as intended.
- Engagement of an independent commissioning agent.
- Implementation of a soft landings approach that involves the future facilities management team.
- Operational waste management plan (OWMP) to be developed and recommendations to be incorporated into the design, including separation of waste streams to facilitate reuse, recycling, composting, and overall waste reduction.
- Selection of responsible structural and finishes materials that follows best practice environmental and social principles.

5.2 HEALTHY

GENERAL PRINCIPLES

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

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

INITIATIVES

The following initiatives are included in the preliminary sustainability strategy:

- Indoor and outdoor pollutants are minimised through best-practise ventilation strategies
- High-levels of outdoor air provided, exceeding the minimum statutory requirements of AS1668.2
- Best-practice lighting will be provided to improve lighting comfort via flicker-free, high-quality lighting that accurately addresses the perception of colour within the space.
- Acoustic design to support the building's function as training, teaching and multi-purpose spaces
- Internal air pollutants have been reduced via selection of materials with low or no volatile organic compound (VOC) levels and low formaldehyde concentrations, including on-site testing.

5.3 RESILIENT

GENERAL PRINCIPLES

This category addresses the interdependence of assets and services in our community, both of which can be adversely effected by climate variables, health pandemics, terrorism and infrastructure failure. Through smart design and future planning buildings can be developed to be more resilient. Key concepts include:

- The building is designed for potential climate risks both direct and indirect.
- Potential shocks to the building and its operations are considered and mitigated.
- The building considers the local needs and improves the resilience of the community.
- The heat island effect is reduced.
- The building has a reduced dependency on the power grid.

INITIATIVES

The following initiatives are included in the preliminary sustainability strategy:

- Assessment of how the proposed design is responsive to future climate impacts by undertaking a climate change risk assessment, and development of a Climate Adaptation Plan developed for the building to address specific climate risks of the design.

- Strategies to minimise the urban heat island effect including light-coloured roofing and external finishes, as well as maximising the extent of landscaping elements.

5.4 POSITIVE

GENERAL PRINCIPLES

This category acknowledges the value in understanding the full life cycle impacts of the building, and aims to reduce all scopes of emissions of the built environment and support the transition to the renewable energy economy. Key concepts include:

- Understand and reduce the life cycle impacts of the building
- Low carbon design and selection of materials
- Operational energy efficiency to lessen the building's dependency on the grid
- Support the transition of the electricity grid by procuring renewable energy
- Support use of low GWP refrigerants
- Operational water efficiency

INITIATIVES

The following initiatives are included in the preliminary sustainability strategy:

- Building upfront carbon emissions reduced by 20% in comparison to a reference building, through reduced material use, reused materials, low carbon civil, architectural and structural materials.
- Building operational energy reduced by 30% compared to a minimum code-compliance reference building demonstrated through advanced energy simulation modelling, through:
  - High performance building fabric, including high-performance glazing and effective shading devices, exceeding the minimum deemed-to-satisfy (DtS) requirements of NCC 2022 Section J4.
  - High efficiency building services, including efficient fit-for-purpose HVAC systems, domestic hot water and lighting (typically LED).
  - Automatic controls strategies to maximise operational efficiency
  - New roof mounted solar photovoltaic (PV) system
- Building is all-electric, with 100% of electricity supplied from renewables.
- Carbon offsets procured to offset GHG emissions associated with refrigerants.
- All fixtures and water-using appliances installed within the project's scope meet best-practise WELS ratings.
- Rainwater collection and reuse.

5.5 PLACES

GENERAL PRINCIPLES

Under this category people are placed at the forefront of the design to ensure the building supports health movement, provides enjoyable places and contributes the local community and cultural heritage of the site. Key concepts include:

- Active transport (walking and cycling) is encouraged, and private vehicle use is reduced
- Communal spaces which support occupant and community engagement are developed
- The local community's cultural heritage embedded in the design

INITIATIVES

The following initiatives are included in the preliminary sustainability strategy:

- Comprehensive site-specific Transport Assessment and Transport Plan have been undertaken by a qualified Professional, and implemented in the design.
- Project designed to provide an enjoyable public space that is inclusive, safe, flexible, and where people want to gather and participate in the community.

5.6 PEOPLE

GENERAL PRINCIPLES

This category recognizes the contributions made by the local workforce which develops the building and aims to ensure sustainable practices support workers during the construction process, for areas including mental health and social inclusion. Key concepts include:

- The builder supports mental health initiatives and promotes diversity
- Celebration of Aboriginal and Torres Strait Islander people
- Disadvantaged groups are supported for workforce inclusion
- Take a more inclusive view of how people access and engage with the building

INITIATIVES

The following initiatives are included in the preliminary sustainability strategy:

- The builder has policies and programs to support construction workers and provides staff support.
- Incorporation of Indigenous design elements into the design, addressing each of the principles from the Australian Indigenous Design Charter (AIDC).

5.7 NATURE

GENERAL PRINCIPLES

Impacts to nature are minimised and the biodiversity of the site is fostered through selection of native plant species, this also supports the wellbeing of building and local groups who can maintain a connection with nature through urban green spaces. Key concepts include:

- Limit impacts on the natural world
- Enhance ecological value and biodiversity of the site
- Support off-site natural spaces to restore the impact to nature from development

INITIATIVES

The following initiatives are included in the preliminary sustainability strategy:

- Appropriate lighting design to reduce light pollution, including ensuring an upward Light output Ratio (ULOR) <5% or use of awnings to block light pollution to neighbours and the night sky
- External landscaping (horizontal or vertical) provided to at least 15% of the site. Landscape include diverse species and prioritise the use of climate-resilient and indigenous plants.

5.8 LEADERSHIP

GENERAL PRINCIPLES

This category aims to recognise the implementation of innovative practices, processes and strategies that promote achievements in the built environment.

INITIATIVES

The following initiatives are included in the preliminary sustainability strategy:

- Climate Positive Pathway, which represents the GBCA's pathway towards zero emissions.

6 APPENDICES

6.1 APPENDIX A – PRELIMINARY NCC SECTION J ASSESSMENT

Refer to the following pages.

NDY
A TETRA TECH COMPANY

CONSULTANT ADVICE NOTICE

PROJECT: **UNIVERSITY OF SYDNEY ROSS STREET** **CAN NO:** **G-011[1.0]**

Date: **18 June 2024** **Project No:** **25186 - 358** **Pages:** **7**

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BUILDING FABRIC ADVICE

This advice note provides preliminary advice on the building fabric performance requirements for the updated design of the University of Sydney, Ross Street development, based on a Deemed-to-Satisfy (DTS) assessment of NCC 2022 Section J Energy Efficiency, Part J4.

The project will demonstrate final NCC compliance through a modelled Performance Solution for Green Star Buildings and compliance, as required. This advice has been prepared to provide indicative performance values for the project team to consider at the early design stage only.

We note that the project has additional sustainability targets beyond minimum code compliance, including 5-star Green Star Buildings certification. We recommend that the project incorporate high performing building fabric exceeding the minimum compliance requirements of the NCC 2022.

As a result, this advice note provides ***Recommended*** performance values, in addition to the minimum compliance requirements. These *Recommended* values are preliminary recommendations for consideration only, subject to change based on energy modelling in later design stages. NDY will continue coordinating with the architect and façade engineer to confirm final building fabric performance.

INFORMATION SOURCES

The assessment is based on the following:

- National Construction Code (NCC) 2022 Volume 1, Section J, Part J4.
- The site being located at Ross Street, Sydney, NSW, categorised as being in NCC Climate Zone 5.
- Architectural drawing set by BVN Architects, Issued for Information, 04/06/2024
- The development being classified as Class 9b.

GENERAL

In addition to the thermal performance requirements outlined herein, all new construction must comply with the thermal construction requirements of Parts J4D3 outlined in Appendix A.

This advice is concerned with Part J4 only. Parts J5 through to J9 are not included in this assessment, compliance with these sections of the code is the responsibility of the architect and relevant services designer(s).

BUILDING FABRIC

Refer to the table below for the minimum building fabric thermal performance requirements for NCC Section J compliance, in addition to the proposed recommended thermal performance. All R-values noted are **total system values inclusive of thermal bridging**, to be calculated in accordance with NCC 2022 Clause J4D3(5).

Refer to the mark-up in Appendix B for the thermal envelope requirements, including the extent of insulation required for compliance.

Table 1 Summary of Building Fabric Performance Requirements

ELEMENT	TOTAL R-VALUE (m^2K/W)	
	NCC 2022 MINIMUM REQUIREMENTS	RECOMMENDED PERFORMANCE
Ceiling/Roof	R3.7 minimum Maximum solar absorptance of upper surface ≤ 0.45	**R5.0 minimum** **Maximum solar absorptance of upper surface ≤ 0.35**
Floor – Ground Contract	No insulation required*	**No insulation required***
Floor – Exposed	R2.0 minimum	**R3.0 minimum**
Walls (including opaque spandrels)	R1.0 minimum	**R1.8 minimum**

*This is based on the entire ground floor being in contact with the ground and that there is no in-slab heating provided. In accordance with NCC Specification J4D7(2), the contribution of the soil in contact with floor has been accounted for.

GLAZING

Refer to the table below for the minimum glazing performance requirements for NCC Section J compliance, based on uniform glazing throughout the building. Refer to Appendix C for wall-glazing calculator used in this assessment.

The recommended performance values will require the use of high-performance double-glazed units. The nominated SHGC will require 'Low E' and/or tinted glazing. NDY will undertake a modelled Performance Solution in later project stages to verify impacts of shading/screening and associated glazing performance requirements and to demonstrate compliance with the relevant credits of the Green Star Buildings pathway.

All glazing values presented are system values (inclusive of both glazed and framing elements). Note that higher performance glazing has U-Values and SHGC values closer to zero. The manufacturer's total glazing system U-value and SHGC value must be equal to or less than the values stated.

Table 2 Summary of Glazing Performance Requirements

NCC 2022 MINIMUM REQUIREMENTS		RECOMMENDED PERFORMANCE	
SYSTEM U-VALUE (W/m²K)	SYSTEM SHGC	SYSTEM U-VALUE (W/m²K)	SYSTEM SHGC
3.8 maximum	0.26 maximum	**2.5 maximum**	**0.25 maximum**

Notes:

- The extent of shading is as per the listed architectural drawings. Changes to shading will require the façade calculation to be updated and may affect thermal performance requirements.
- The shading fins provided to the West Façade have not been included in the Deemed to Satisfy assessment
- Envelope wall requirements are based on the ratio of wall to window areas. As such, any changes in the window area may affect the required performance of both the glazing and the solid walls.
- All glazing values presented are system values (inclusive of both glazed and framing elements).
- Higher performance glazing has U-Values and SHGC values closer to zero. The manufacturer's total glazing system U-value and SHGC value must be equal to or less than the values stated.

ROOF LIGHTS

Roof lights are proposed to the roof of the building serving the void, stairs and informal space on Level 5. Refer to the table below for a summary of the roof light areas.

NCC 2022 Part J4D5(a) provisions specify a maximum roof light area of 5% of the space served. Therefore, **the proposed Level 5 roof light is compliant with the DTS provisions of the NCC 2022**.

Table 3 Summary of Roof Light Areas

LOCATION	SPACE AREA (m²)	TOTAL ROOF LIGHT AREA (m²)	ROOF LIGHT AREA PROPORTION OF SPACE SERVED	NCC 2022 DTS COMPLIANCE	MAX. ROOF LIGHT AREA FOR DTS COMPLIANCE (m²)
Level 5 Void and Informal	365[1]	11.5	3.15%	Compliant	-

Notes:

- [1]Space area served by Level 5 roof light has been estimated as the Level 5 void, stairs, and informal space as per the architectural plans.

Refer to the table below for a summary of the roof light performance requirements for the skylight.

Table 4 Summary of Roof Light Performance Requirements

ROOF LIGHT LOCATION	NCC 2022 MINIMUM REQUIREMENTS		RECOMMENDED PERFORMANCE	
	SYSTEM U-VALUE (W/m²)K)	SYSTEM SHGC	SYSTEM U-VALUE (W/m²K)	SYSTEM SHGC
Level 5	3.9 maximum	0.45 maximum	**3.0 maximum**	**0.3 maximum**

If you have any questions, please don't hesitate to contact the undersigned.

NDY, A Tetra Tech Company

Jessica Pegg | Associate | Sustainability
J.Pegg@ndy.com

APPENDIX A – GENERAL REQUIREMENTS FOR THERMAL CONSTRUCTION

J1.2 THERMAL CONSTRUCTION — GENERAL

a) Where required, insulation must comply with AS/NZS 4859.1 and be installed so that it—
   i. abuts or overlaps adjoining insulation other than at supporting members such as studs, noggings, joists, furring channels and the like where the insulation must be against the member; and
   ii. forms a continuous barrier with ceilings, walls, bulkheads, floors or the like that inherently contribute to the
   iii. thermal barrier; and
   iv. does not affect the safe or effective operation of a service or fitting.

b) Where required, reflective insulation must be installed with—
   i. the necessary airspace to achieve the required R-Value between a reflective side of the reflective insulation and a building lining or cladding; and
   ii. the reflective insulation closely fitted against any penetration, door or window opening; and
   iii. the reflective insulation adequately supported by framing members; and
   iv. each adjoining sheet of roll membrane being—
      a) overlapped not less than 50 mm; or
      b) taped together.

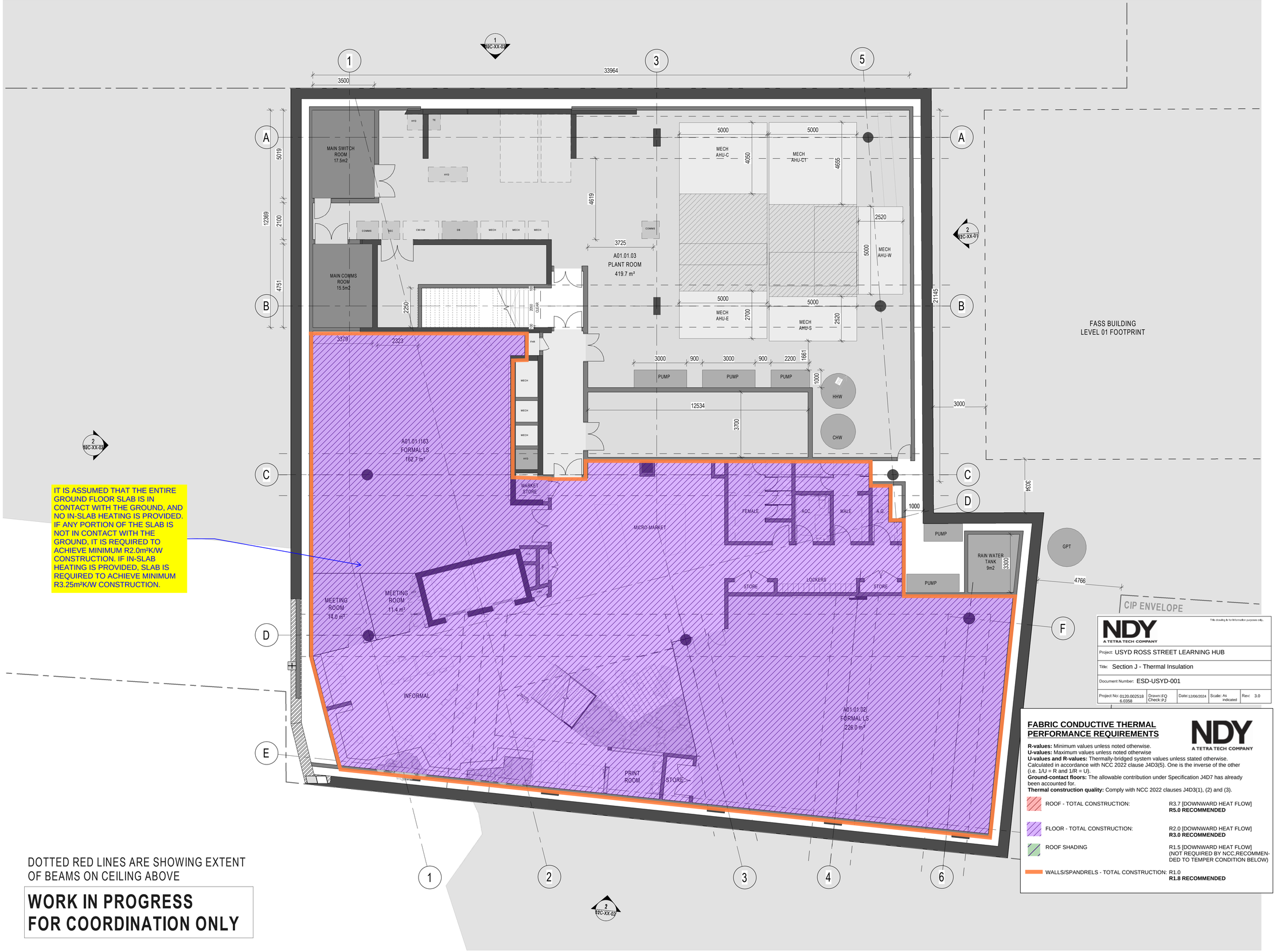
c) Where required, bulk insulation must be installed so that—
   i. it maintains its position and thickness, other than where it is compressed between cladding and supporting members, water pipes, electrical cabling or the like; and
   ii. in a ceiling, where there is no bulk insulation or reflective insulation in the wall beneath, it overlaps the wall by not less than 50 mm.

d) Roof, ceiling, wall and floor materials, and associated surfaces are deemed to have the thermal properties listed in Specification J1.2.

e) The required Total R-Value and Total System U-Value, including allowance for thermal bridging, must be—
   i. calculated in accordance with AS/NZS 4859.2 for a roof or floor; or
   ii. determined in accordance with Specification J1.5a for wall-glazing construction; or
   iii. determined in accordance with Specification J1.6 or Section 3.5 of CIBSE Guide A for soil or sub-floor spaces.

APPENDIX B – THERMAL ENVELOPE MARK-UP

Refer to the following pages.



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Project: USYD ROSS STREET LEARNING HUB

Title: Section J - Thermal Insulation

Document Number: ESD-USYD-001

Project No: 0120.002518 6.0358	Drawn: FQ Check: PJ	Date: 12/06/2024	Scale: As indicated	Rev: 3.0

FABRIC CONDUCTIVE THERMAL PERFORMANCE REQUIREMENTS

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Ground-contact floors: The allowable contribution under Specification J4D7 has already been accounted for.
Thermal construction quality: Comply with NCC 2022 clauses J4D3(1), (2) and (3).

ROOF - TOTAL CONSTRUCTION:	R3.7 [DOWNWARD HEAT FLOW] **R5.0 RECOMMENDED**
FLOOR - TOTAL CONSTRUCTION:	R2.0 [DOWNWARD HEAT FLOW] **R3.0 RECOMMENDED**
ROOF SHADING	R1.5 [DOWNWARD HEAT FLOW] (NOT REQUIRED BY NCC,RECOMMENDED TO TEMPER CONDITION BELOW)
WALLS/SPANDRELS - TOTAL CONSTRUCTION:	R1.0 **R1.8 RECOMMENDED**

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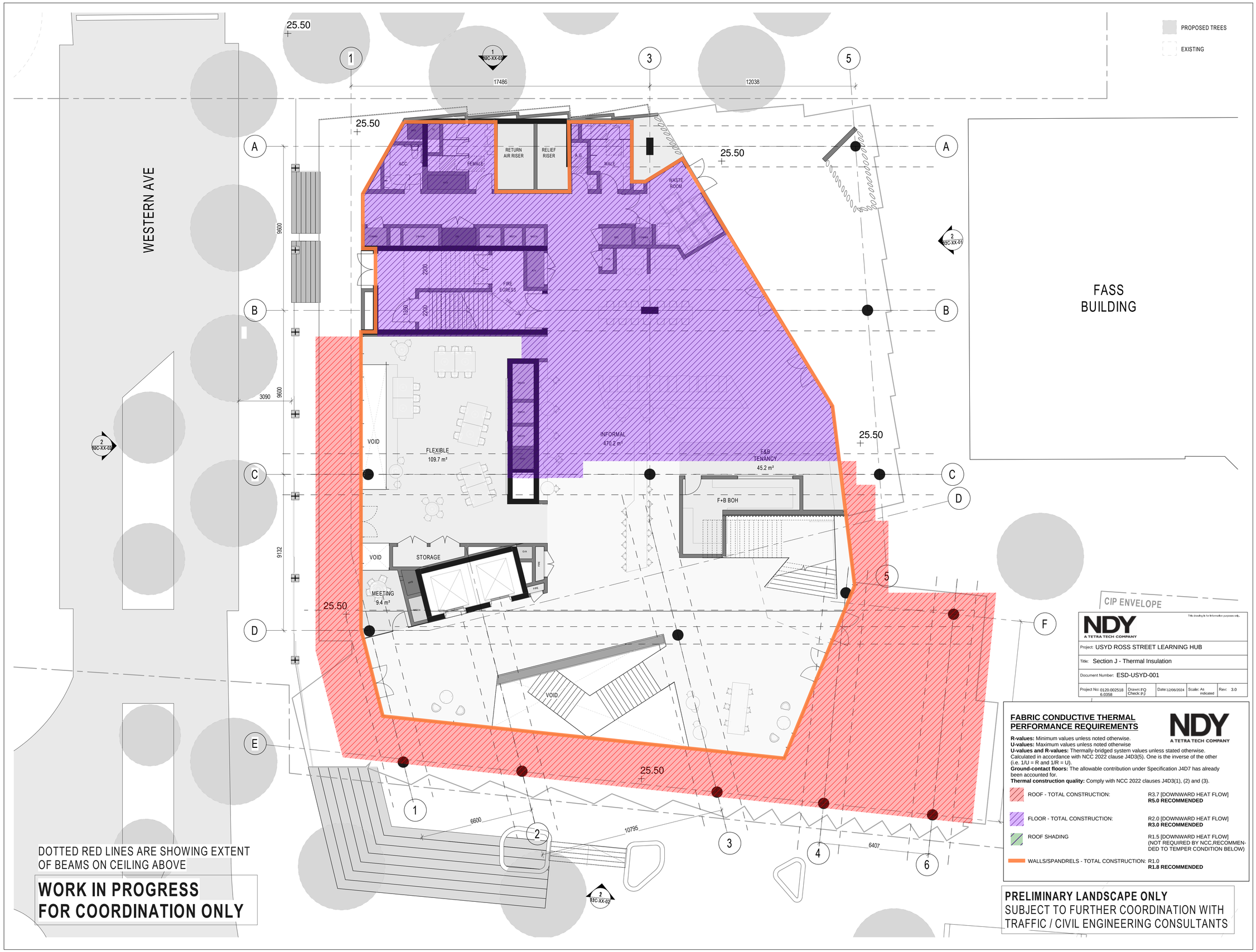

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Document Number: ESD-USYD-001

Project No: 0120.002518.0358	Drawn: FQ Check: PJ	Date: 12/06/2024	Scale: As indicated	Rev: 3.0

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WALLS/SPANDRELS - TOTAL CONSTRUCTION:	R1.0 **R1.8 RECOMMENDED**

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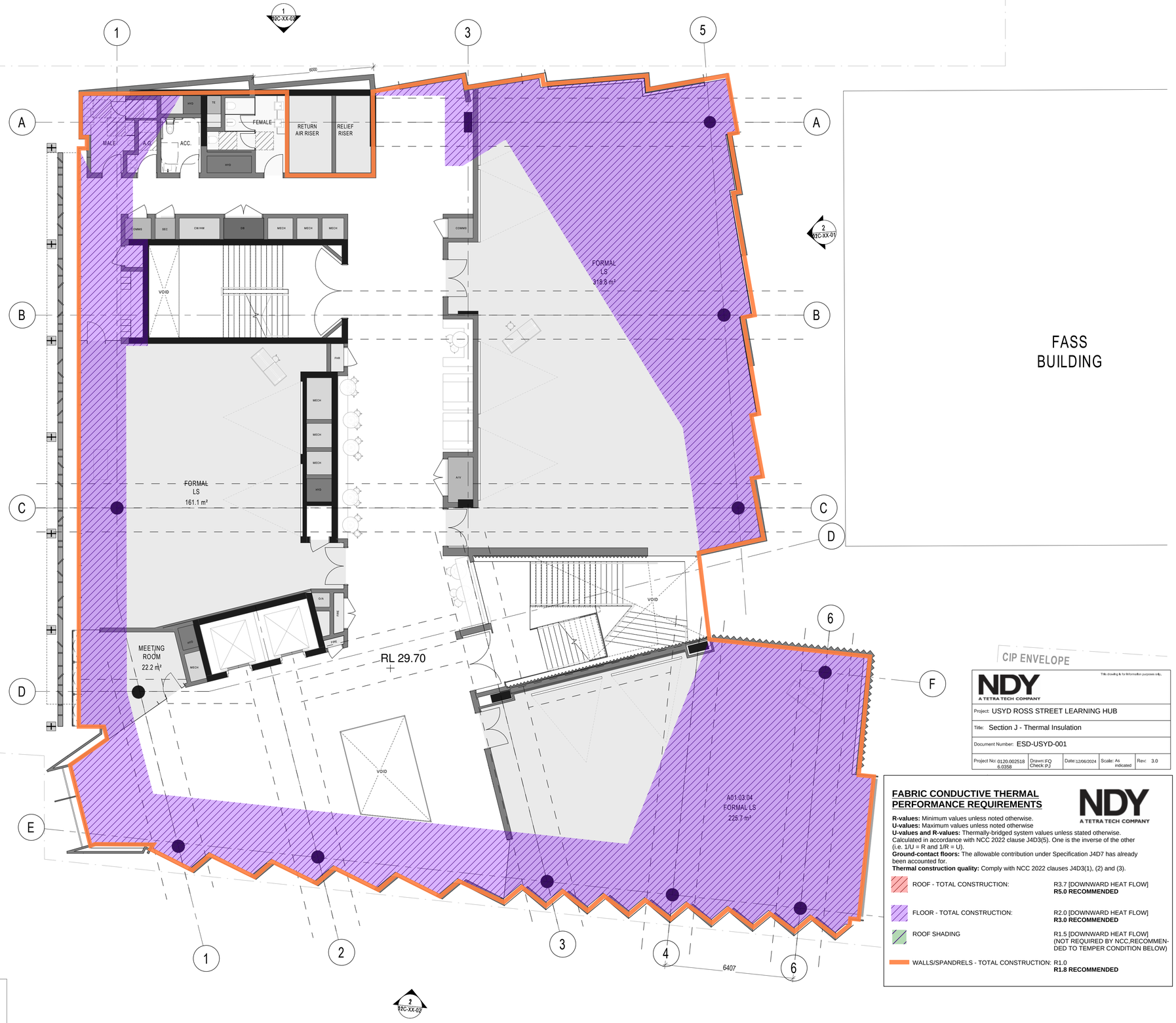

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WALLS/SPANDRELS - TOTAL CONSTRUCTION:	R1.0 **R1.8 RECOMMENDED**

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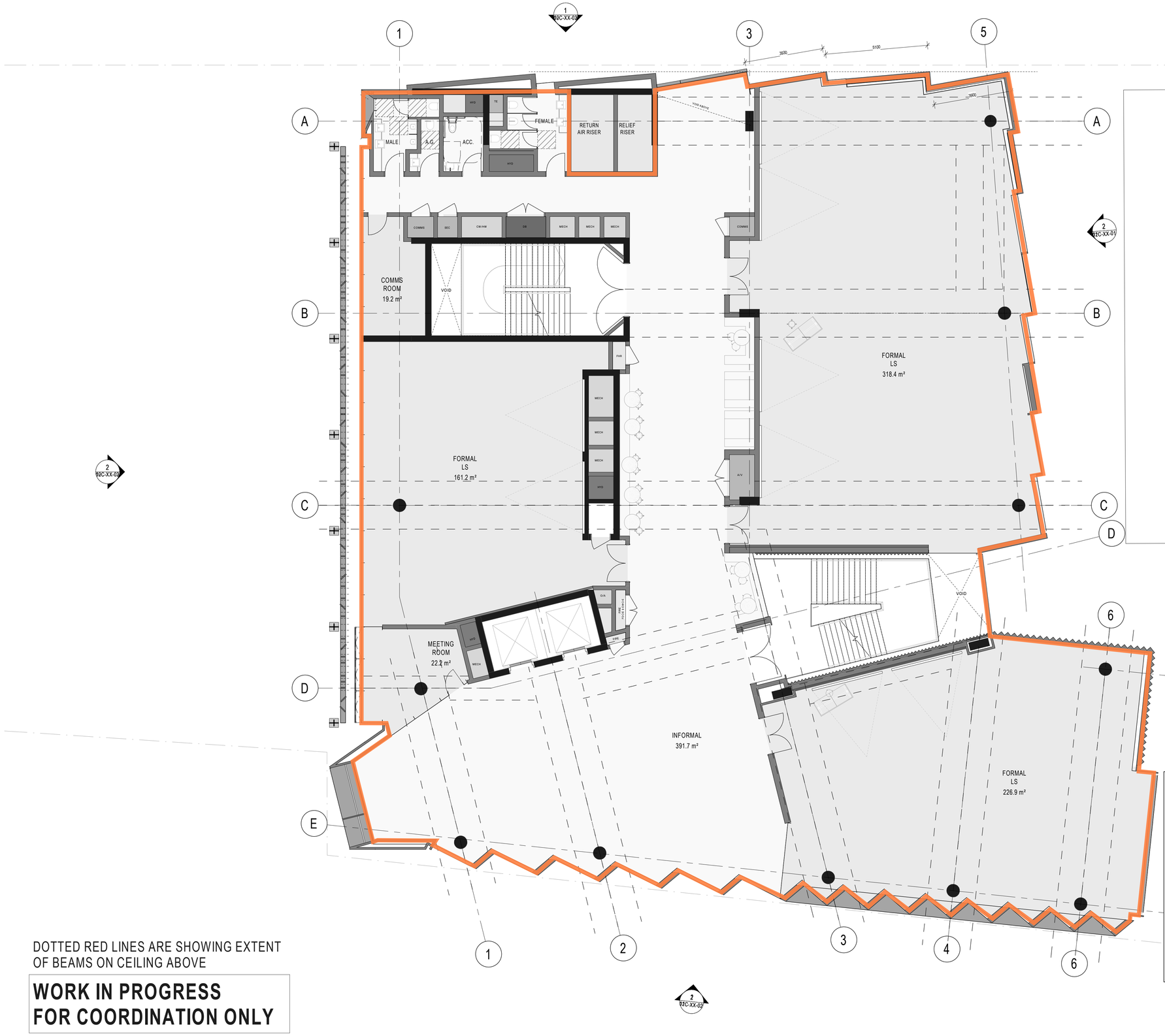

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Title: Section J - Thermal Insulation

Document Number: ESD-USYD-001

Project No: 0120.002518 6.0358	Drawn: FQ Check: PJ	Date: 12/06/2024	Scale: As indicated	Rev: 3.0

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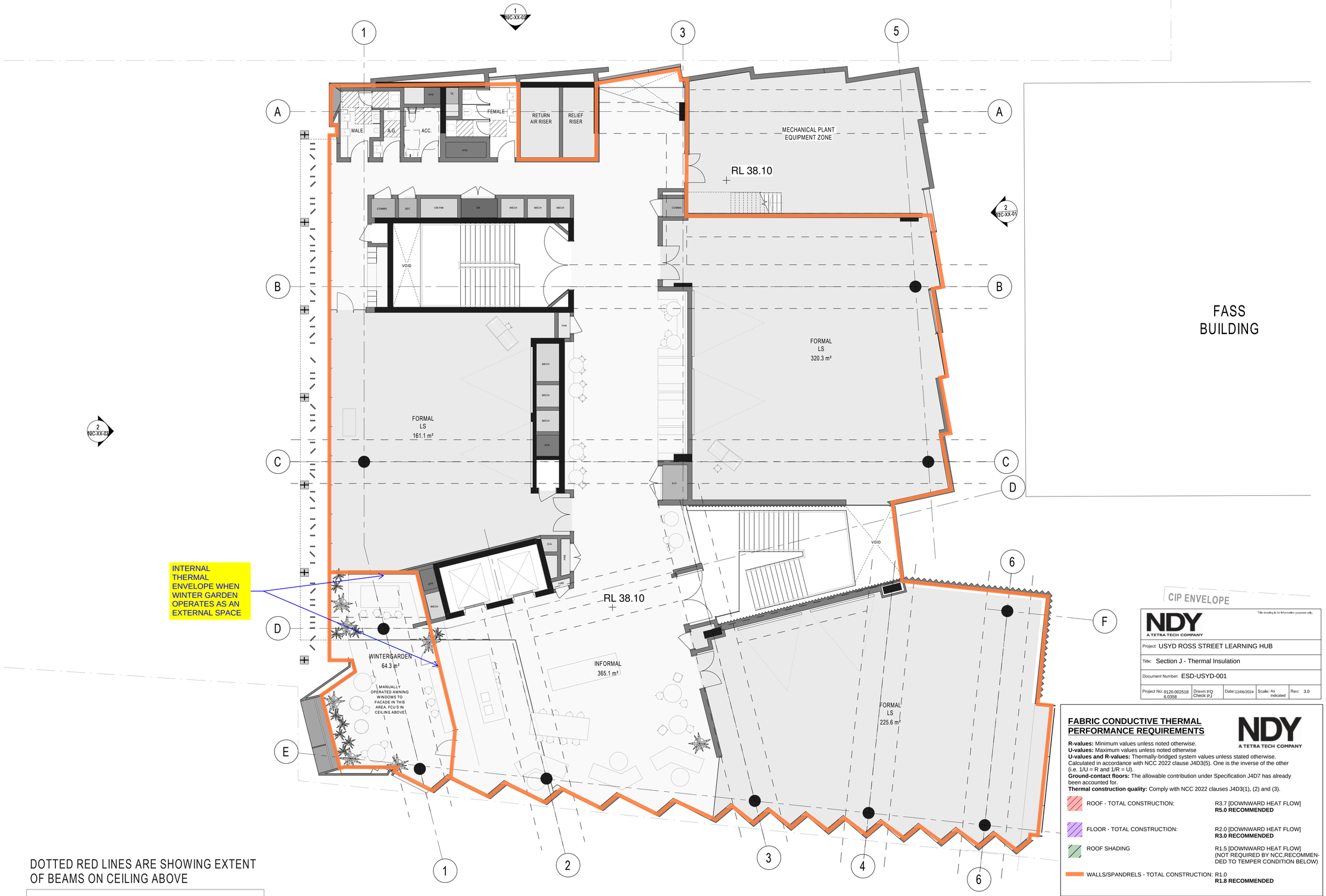

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Project No: 0120.002518 6.0358	Drawn: FQ Check: PJ · Date: 12/06/2024 · Scale: As indicated · Rev: 3.0

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2	08/11/2023	FOR INFORMATION	
3	24/11/2023	FOR INFORMATION	
4	07/12/2023	FOR INFORMATION	
5	21/12/2023	FOR INFORMATION	
6	12/04/2024	FOR INFORMATION	
7	03/05/2024	FOR INFORMATION	
8	29/05/2024	FOR INFORMATION	

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A01 ROSS ST TEACHING & LEARNING HUB
BVN PROJECT NUMBER
2306010
DRAWING KEY

TRUE NORTH · PROJECT NORTH
GRAPHIC SCALE
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SCALE
1 : 100@A1
STATUS
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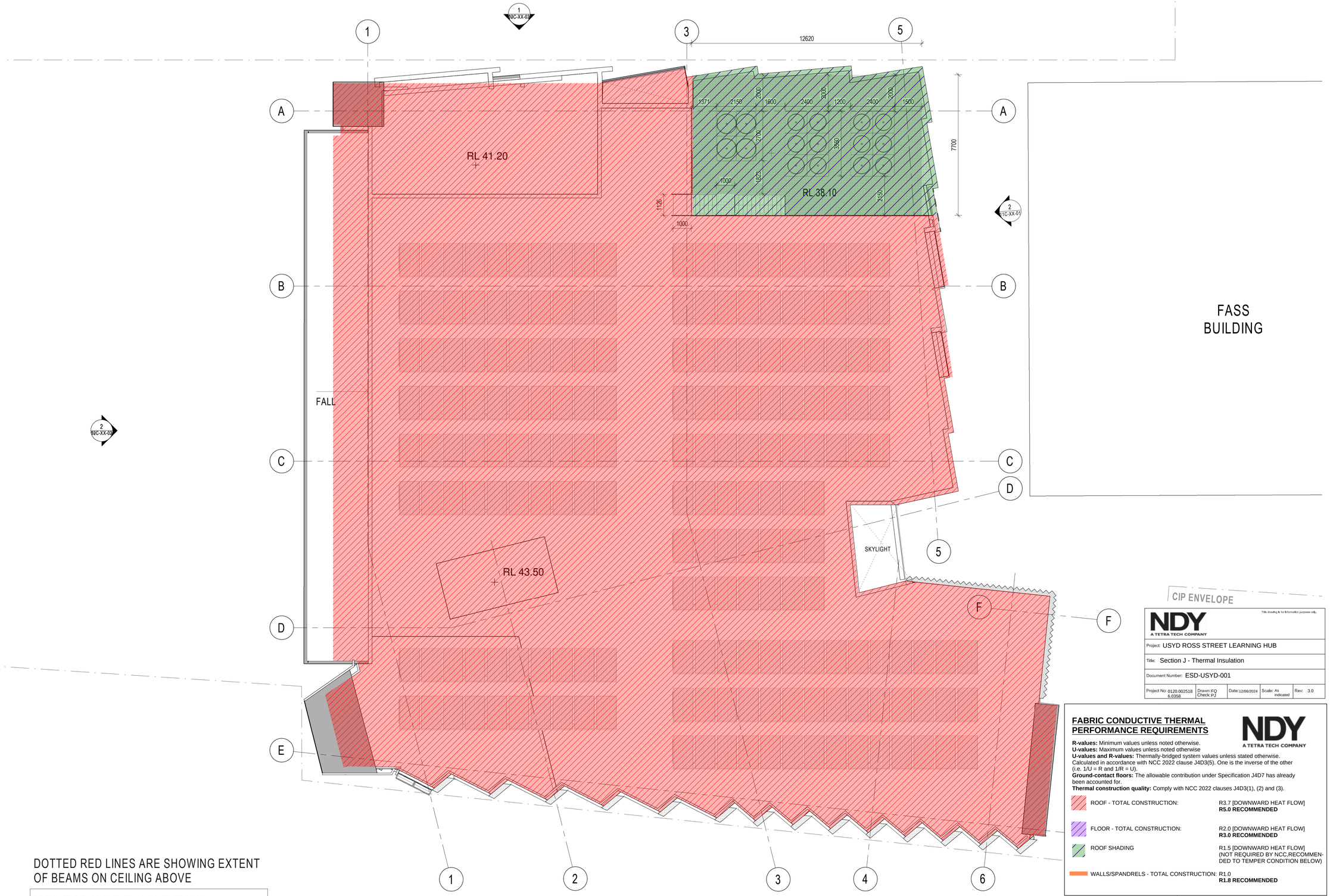
GENERAL ARRANGEMENT PLAN - LEVEL 05

AR-11B-05-01 · ISSUE 8



DOTTED RED LINES ARE SHOWING EXTENT OF BEAMS ON CEILING ABOVE

WORK IN PROGRESS FOR COORDINATION ONLY

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Title drawing is for information purposes only.

Project: USYD ROSS STREET LEARNING HUB

Title: Section J - Thermal Insulation

Document Number: ESD-USYD-001

Project No: 0120.002518 6.0358	Drawn: FQ Check: PJ	Date: 12/06/2024	Scale: As indicated	Rev: 3.0

FABRIC CONDUCTIVE THERMAL PERFORMANCE REQUIREMENTS

NDY A TETRA TECH COMPANY

R-values: Minimum values unless noted otherwise.
U-values: Maximum values unless noted otherwise
U-values and R-values: Thermally-bridged system values unless stated otherwise.
Calculated in accordance with NCC 2022 clause J4D3(5). One is the inverse of the other (i.e. 1/U = R and 1/R = U).
Ground-contact floors: The allowable contribution under Specification J4D7 has already been accounted for.
Thermal construction quality: Comply with NCC 2022 clauses J4D3(1), (2) and (3).

	ROOF - TOTAL CONSTRUCTION:	R3.7 [DOWNWARD HEAT FLOW] **R5.0 RECOMMENDED**
	FLOOR - TOTAL CONSTRUCTION:	R2.0 [DOWNWARD HEAT FLOW] **R3.0 RECOMMENDED**
	ROOF SHADING	R1.5 [DOWNWARD HEAT FLOW] (NOT REQUIRED BY NCC,RECOMMENDED TO TEMPER CONDITION BELOW)
	WALLS/SPANDRELS - TOTAL CONSTRUCTION:	R1.0 **R1.8 RECOMMENDED**

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GENERAL ARRANGEMENT PLAN - ROOF

AR-11B-06-01

ISSUE 08

APPENDIX C – WALL-GLAZING CALCULATOR

Refer to the following pages.

PART J4D6 WALL-GLAZING CALCULATION

		Check Figures		Method 1				Method 2				Other Checks	
	Orientation	Area (m²)	WWR	System U value	Allowance used	Solar admittance	Allowance used	System U value	Allowance used	Air-conditioning energy	Allowance used	Display window U value/SHGC	Residential SHGC
Class 9b	North	502	12%	1.33	67%	0.031	24%	1.97	99%	468.85	99%	NA	NA
	East	974	42%	2.17	109%	0.109	84%						
	South	739	37%	2.03	101%	0.095	73%						
	West	710	67%	2.88	144%	0.174	134%						
	Internal	561	0%	1.00	50%	NA	NA			NA	NA	NA	NA

Wall	Orientation	Area (m²)	R value (m².K/W)	Class	Exposure	WWR	Minimum R value (m².K/W)	Wall R value [2]	Total U value [1]	Glazing solar [1]	Display windows
L1 East	East	58.0	1.0	9b	External	0%	1.0				
L1 South	South	156.2	1.0	9b	External	0%	1.0				
L1 West	West	105.0	1.0	9b	External	0%	1.0				
L1 Internal	Internal	259.4	1.0	9b	Internal	0%	1.0				
L2 North	North	57.3	1.0	9b	External	0%	1.0				
L2 East	East	176.3	1.0	9b	External	67%	1.0				
L2 South	South	102.8	1.0	9b	External	78%	1.0				
L2 West	West	149.4	1.0	9b	External	60%	1.0				
L2 Internal	Internal	53.3	1.0	9b	Internal	0%	1.0				
L3 North	North	166.4	1.0	9b	External	8%	1.0				
L3 East	East	260.0	1.0	9b	External	44%	1.0				
L3 South	South	161.6	1.0	9b	External	22%	1.0				
L3 West	West	153.6	1.0	9b	External	83%	1.0				
L3 Internal	Internal	53.3	1.0	9b	Internal	0%	1.0				
L4 North	North	166.4	1.0	9b	External	15%	1.0				
L4 East	East	260.0	1.0	9b	External	41%	1.0				
L4 South	South	161.6	1.0	9b	External	49%	1.0				
L4 West	West	150.8	1.0	9b	External	85%	1.0				
L4 Internal	Internal	53.3	1.0	9b	Internal	0%	1.0				
L5 North	North	111.8	1.0	9b	External	19%	1.0				
L5 East	East	219.5	1.0	9b	External	31%	1.0				
L5 South	South	157.0	1.0	9b	External	48%	1.0				
L5 West	West	150.8	1.0	9b	External	85%	1.0				
L5 Internal	Internal	141.9	1.0	9b	Internal	0%	1.0				

Window	Wall	Width	Height	Area	System U value	System SHGC	Display window?	P	H	Max U value	Limiting SHGC
W1	L2 East	1.8	3.4	6.0	3.8	0.26		3.3	3.4		
W2	L2 East	11.8	3.4	40.3	3.8	0.26		6.9	3.4		
W3	L2 East	6.2	3.4	20.9	3.8	0.26		3.7	3.4		
W4a	L2 East	4.2	3.4	14.1	3.8	0.26					
W4b	L2 East	10.9	3.4	37.2	3.8	0.26		10.6	3.4		
W5	L2 South	23.6	3.4	80.3	3.8	0.26		3.9	3.4		
W6	L2 West	5.3	3.4	17.9	3.8	0.26		4.9	3.4		
W7	L2 West	17.1	3.4	58.3	3.8	0.26		2.5	3.4		
W8	L2 West	2.4	3.4	8.2	3.8	0.26		3.2	3.4		
W9	L2 West	1.8	3.4	6.1	3.8	0.26		2.5	3.4		
W10	L3 North	1.2	3.9	4.7	3.8	0.26					
W11	L3 North	1.2	3.9	4.7	3.8	0.26					
W12	L3 North	1.2	3.9	4.7	3.8	0.26					
W13	L3 East	2.7	3.9	10.5	3.8	0.26					
W14	L3 East	3.0	3.9	11.7	3.8	0.26					
W15	L3 East	2.4	3.9	9.4	3.8	0.26					
W16	L3 East	3.0	3.9	11.7	3.8	0.26					
W17	L3 East	4.1	4.2	17.2	3.8	0.26					
W18	L3 East	7.3	3.9	28.3	3.8	0.26					
W19	L3 East	0.7	3.0	2.0	3.8	0.26					
W20-26	L3 East	7.0	3.0	21.0	3.8	0.26					
W27	L3 East	1.1	3.0	3.3	3.8	0.26					
W28-32	L3 South	10.5	3.0	31.5	3.8	0.26					
W33	L3 West	4.0	3.9	15.8	3.8	0.26					
W34	L3 South	1.1	3.9	4.1	3.8	0.26					
W35	L3 West	28.8	3.9	112.3	3.8	0.26					
W36	L4 North	0.9	3.9	3.5	3.8	0.26					
W37a	L4 North	4.6	3.9	17.9	3.8	0.26					
W37b	L4 East	0.8	3.9	3.1	3.8	0.26					
W38	L4 North	0.9	3.9	3.5	3.8	0.26					
W39	L4 East	6.1	3.9	23.7	3.8	0.26					
W40	L4 East	2.5	3.9	9.8	3.8	0.26					
W41	L4 East	3.2	3.9	12.3	3.8	0.26					
W42	L4 East	3.0	3.9	11.7	3.8	0.26					
W43	L4 East	4.1	4.2	17.2	3.8	0.26					
W44	L4 East	7.3	3.9	28.3	3.8	0.26					
W45-52	L4 South	9.6	3.4	32.6	3.8	0.26					
W53-58	L4 South	12.6	3.4	42.8	3.8	0.26					
W59	L4 West	4.1	3.9	16.1	3.8	0.26					
W60	L4 South	1.1	3.9	4.1	3.8	0.26					
W61	L4 West	28.8	3.9	112.3	3.8	0.26					
W62	L5 North	0.9	3.9	3.5	3.8	0.26					
W63a	L5 North	4.6	3.8	17.4	3.8	0.26					
W63b	L5 East	0.8	3.8	3.0	3.8	0.26					
W64	L5 East	4.2	3.9	16.2	3.8	0.26					
W65	L5 East	2.5	3.9	9.8	3.8	0.26					
W66	L5 East	4.1	3.4	13.9	3.8	0.26					
W67	L5 East	7.3	3.4	24.7	3.8	0.26					

W68-75	L5 South	9.6	3.4	32.6	3.8	0.26					
W76-81	L5 South	12.6	3.4	42.8	3.8	0.26					
W82	L5 West	4.0	3.0	12.1	3.8	0.26					
W83	L5 West	1.1	3.9	4.1	3.8	0.26					
W84	L5 West	28.8	3.9	112.3	3.8	0.26					

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