Sustainability Report

Victoria University Clinical Health Teaching Facility

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atelier ten

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Atelier Ten acknowledges the Traditional Owners of country throughout Australia and recognises their continuing connection to land, waters, and community. We pay our respect to them and their cultures, and to Elders past, present, and emerging.

Contents

Acknowledgement of Country

Atelier Ten acknowledges that the Wurundjeri Woi Wurrung and Bunurong peoples as the Traditional Owners of Country. We recognise their continuing connections to land, water, skies, and communities. We are inspired by and learn from their knowledge and stories of Country. Atelier Ten pays respect to Traditional Owners, their cultures, and to Elders past, present and future.

Executive summary

This Sustainability Report details the sustainability vision and strategy for Victoria University's (VU's) Clinical Health Teaching Facility (CHTF), in alignment with VU's Net Zero target by 2025 and broader campus sustainability objectives.

1. Sustainability Context

The first chapter covers the current sustainability context relevant to CHTF, providing an evidence-base for decision making. Key elements include:

- Project Introduction and Brief: Synthesis of relevant project information including the project brief
- Site Analysis: Contextual analysis of physical and environmental conditions surrounding the building.
- Planning and Policy Framework: Review of VU's sustainability frameworks and precinct and city-wide ambition frameworks and policies, including the Maribyrnong City Council's Sustainable Design Assessment in the Planning Process (SDAPP)
- Key Priority Areas: Distillation of essential findings to guide the development of the Sustainability Vision

2. Sustainability Vision and Strategy

The second chapter covers the sustainability vision and strategy. The vision is underpinned by Green Star Buildings as an assurance framework (see Chapter 4) that will support successful delivery. The sustainability vision comprises 8 Sustainability Pillars:

- Connecting to Country
- Place of Health and Well-being
- Energy and Carbon leadership
- Smart and Innovative
- Integrated Water Cycle
- Enhances Nature and Biodiversity
- Resilient
- More Circular (Materials + Resources)

Each pillar expands on the following:

- Ambition: What will the pillar do for sustainability in the project
- Goals: Fundamental outcomes which represent positive achievement for the particular theme.
- Challenges: Potential risks and limitations identified during the concept design stage
- Opportunities: Potential actions to deliver sustainability across the development life cycle
- Key Performance Indicators: Crucial indicators to achieve the credits identified in the assurance framework (Green Star) which reinforce the pillar.

3. Upfront Carbon Emissions Reduction

The third chapter covers strategies for reducing upfront carbon emissions resulting in several key recommendations which will be explored for feasibility and applicability over the design phases:

- It is necessary to demonstrate a 20% reduction in upfront carbon emissions within the climate positive pathway through the following approaches:
  - Reusing existing building elements or site infrastructure
  - Improvements through iterative design processes
  - Building material choices and quantities: select materials according to the hierarchy: avoid, reuse, use circular, and minimise embodied carbon
  - Lower Transport emissions
  - Lower Construction emissions
- During the subsequent design phases, establish an efficient method for tracking and collecting data on material quantities.
- Design the building and structure with consideration for efficient use of materials and space.
- Reduce the need for substructure in underground levels.
- Prioritise specifying materials that are locally sourced, contain recycled content, and/or boast high environmental credentials and low carbon emissions, with Environmental Product Declarations.
- Reduce concrete use in building design.
- Substitute cement with alternative binders where feasible.
- Utilise hollow core products and consider technologies.
- Target glass-wool or mineral wool insulation products with recycled content.
- Reuse or up-cycle bricks sourced from the demolition buildings on site.
- Choose timber products from responsibly managed forests certified by organizations.

4. Assurance Methods

Chapter four covers Green Star Buildings v1, recommending that CHTF building pursue certification under this sustainability assessment tool, since Green Star has a holistic approach to sustainability with a focus on the health and well-being of building users. Certification under Green Star Buildings ensures the closest alignment with the sustainability vision across the eight sustainability pillars. A detailed initial Green Star Buildings v1 pathway is provided in the Appendix A.1.

5. Façade Analysis

Chapter five covers the annual solar analysis of the proposed building massing to understand its orientation on-site and identify potential day light and solar radiation concerns for both direct sunlight (glare) and solar radiation:

- Sun Path: The path of the sun in relation to the building's orientation and identify concerns for direct glare, specifically on the east façade.
- Solar Radiation: The surrounding buildings provide reduction to the radiation incident on the façade. This will be studied in relation to potential building demolition/replacement of surrounding buildings in future.

Key findings include:

The North façades receive high energy loads in summer, therefore appropriate glass selection with optimised window-to-wall ratio is necessary. Glare control through internal blinds is recommended.

The South facade receives small amount of direct radiation; therefore, the building design may benefit from slight increases in glazing size to increase daylight within the building and less need for external shading devices.

The East façade features large glazing panels in front of social spaces, which may result in thermal and visual discomfort during the early hours of the day. Analysis have been carried out to understand the implications for building occupants based on the usage of the space.

Based on the initial analysis carried out and through stakeholder engagement, findings and outcome, the East glazed façade study recommendations include:

- Between equinoxes through summer, the facade receives high levels of direct sunlight until 11:30 am. This is likely to result in visual and thermal discomfort in the summer months.
- For areas with high solar impact, choose high performance glazing:
  - U Value <2.6 (thermally broken DGU, or TGU)
  - SHGC <0.24 (may result in lower VLT than elsewhere in building). This may require windows with tinting or specialist coatings
  - All other areas; U-Value of 4.00, and SHGC of 0.30
- Assessing usage of the space to be more communal with flexible furniture to have better controllability for the occupants.

6. Section J DTS Compliance

Chapter six covers the compliance requirements for the overall building façade to meet the Section J DTS requirements based on NCC 2022 and further elaborates on the proposed building fabric that targets to perform 20% better than the minimum DTS requirements. This enables lower solar gains within the building during operation and helps achieving the minimum 20% energy use target for Green Star Buildings.

1 Sustainability Context

1.1 Project Introduction and Brief

The CHTF will make a significant positive contribution to the quality, amenity, and character of VU's campus and the surrounding urban environment through outstanding architectural, landscape, and urban design.

CHTF purpose is to consolidate VU's health education and research facilities at the Footscray Park Campus. These facilities will be housed in a world-class innovation centre of excellence, focussing on new models of clinical care and preventative health. Additionally, the successful delivery of this building will address Western Health's (VU strategic partner) substantial orthopaedic surgery waiting list.

The Project Brief is as follows:

1. College of Health and Biomedicine (CoHB) - Anatomy, Biology, and Physiology = 1,144 sqm
2. Nursing and Midwifery = 1,983 sqm
3. Medical Sciences = 2,125 sqm
4. Food, Nutrition and Dietetics = 639 sqm
5. Speech Pathology = 763 sqm
6. Physiotherapy = 1,166 sqm
7. Vocational Education and Training (VET) - Nursing = 449 sqm

Total Gross Floor Area (GFA) = 12,546 sqm

The overarching sustainability ambition for the project is to deliver a high quality, sustainable, and architecturally significant development that aligns with the sustainability guidelines for VU. The development will optimise design efficiency to minimise absolute quantities of materials and maximise the use of recycled materials to promote circular economy principles.

Quality assurance for the Project will be ensured through its alignment with best-practice sustainability assurance frameworks, such as Green Star Buildings and WELL. Furthermore, the Project will support the University's ambition to become Net Zero Emissions by 2025.

Figure 1.1 Site context (not to scale) | Source: Atelier Ten

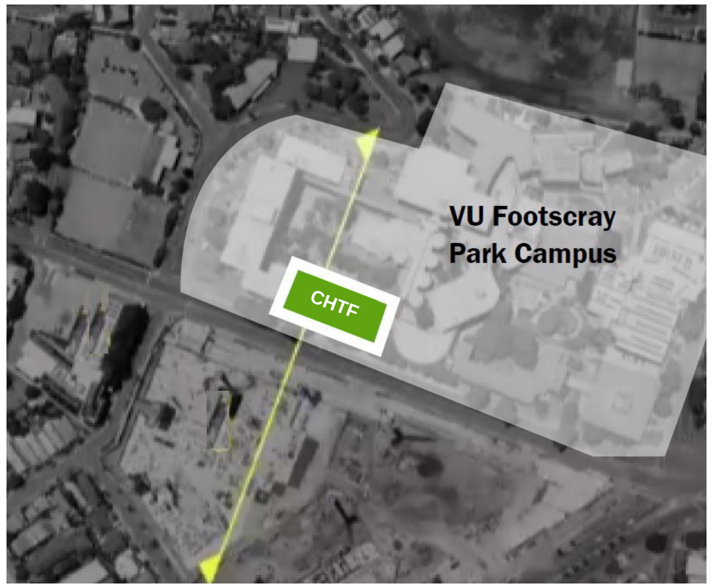

Figure 1.2 Location of site section (not to scale) | Source: DCM

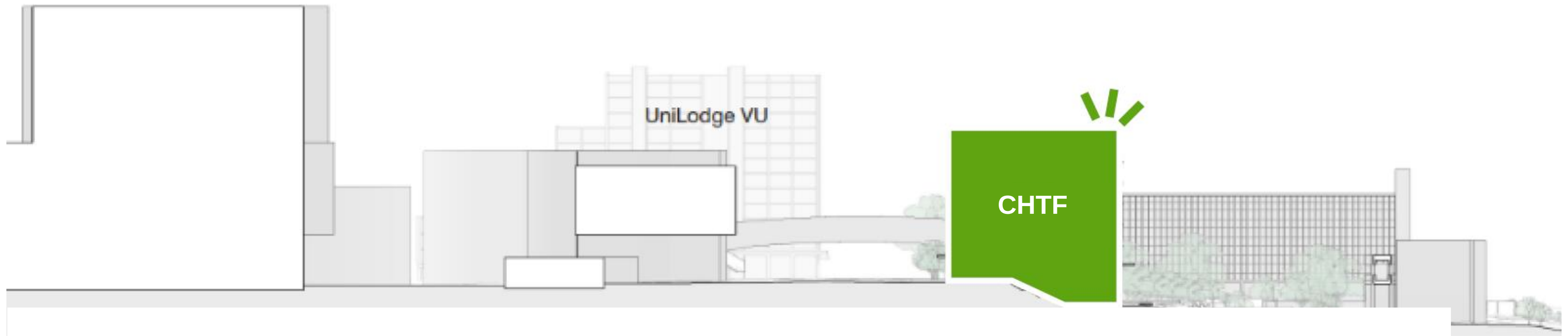

Figure 1.3 Footscray Park Campus site section (not to scale) | Source: DCM

1.2 Site Analysis

The CHTF building can take advantage of ambient daylight conditions to the south whilst the north and east facade will benefit from the reduction of window-wall ratio to reduce overall thermal impact. Additionally, whilst the building is located on an elevation above the Maribyrnong River, the surrounding areas may be subject to flooding.

The site is located at VU's Footscray Park Campus at 70/104 Ballarat Road, Footscray 3011 Victoria, and is orientated slightly off the east-west access the greatest portion of the building facing north/south. The site is located approximately 490 m from the Maribyrnong River which is located down a slope to the north-east.

1.2.1 Local Climate

Current Conditions: The site is located in the Greater Melbourne region. The current conditions for this region are (Source: DELWP):

- Mild to warm summers with an average maximum temperature of around 22 to 24 degrees Celsius
- Cold winters with average maximum temperatures of around 12 to 14 degrees Celsius

Future Conditions: Climate change will affect the Greater Melbourne region in the following ways (Source: DELWP):

- The region will become warmer and drier with more hot days and warm spells
- Less rainfall in winter and spring with more frequent and more intense downpours occurring year round
- Increased frequency and height of extreme sea level events, including rising sea levels
- More frequent and more intense downpours leading to flash flooding risks
- Harsher fire weather and longer fire seasons

1.2.2 Wind

Wind rose studies from the Bureau of Meteorology reveal strong summer breezes from the north and south-west in the morning and from the south in the evening (Figure 1.6). Additionally, strong breezes from the north can be expected during winter mornings and afternoons (Figure 1.7).

1.2.3 Solar Studies

Given the site's orientation, the building can take advantage of horizontal shading (on the north) and potential ambient daylight conditions to the south. The building should be designed to consider potential contextual changes, since the campus master plan considers the demolition of some on site buildings. Currently, the surrounding campus buildings significantly limit the direct solar radiation.

Facade studies revealed several opportunities for increasing amenity and comfort for occupants, as well as early guidance for energy efficiency:

- The eastern facade (see Figure 1.4) has potential concerns relating to direct sunlight and glare in the morning all year around, which will require specific strategies to mitigate these issues such as shading or reduction of window-wall ratio.
- The southern facade has an opportunity to increase the glazing extent by 10-20%, which will allow for an improvement to daylight with only minimal negative impact to energy consumption.
- The northern façade will require window-to-wall ration to be optimised, and include internal blinds to provide a good balance between daylight (visual amenity) and energy consumption.

1.2.4 Flooding

Flooding occurs locally adjacent the Maribyrnong River at depths greater than 60cm for a 1% Annual Exceedance Probability (AEP) or 1 in 100-year flooding event (see Figure 1.5). Whilst no flooding occurs within the site boundary itself, there is an indirect risk of flooding to the Footscray Park Campus.

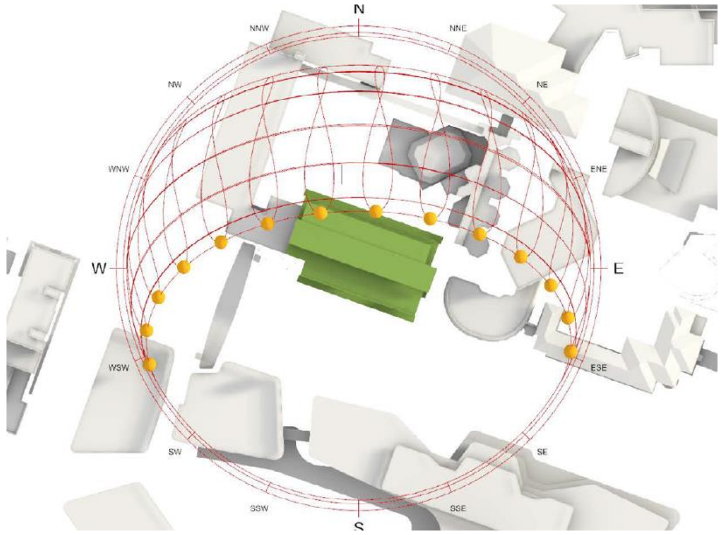

Figure 1.4 Facade Solar Study | Source: Atelier Ten

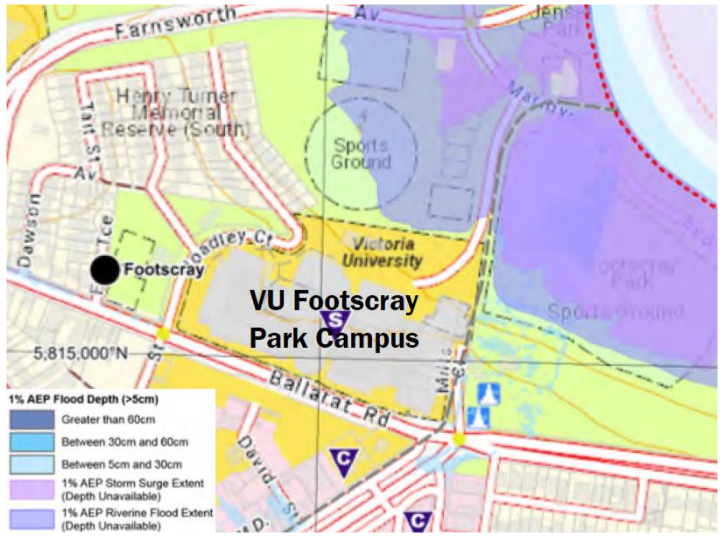

Figure 1.5 1% AEP flooding extents | Source: SES

Climate change

Overhang for solar shading

Flood risk

Climate change

Community

Figure 1.6 Summer Wind Study | Source: BoM

Figure 1.7 Winter Wind Study | Source: BoM

1.3 Local Policy and Framework

Several policy and planning documents were reviewed to identify best practice and project-specific sustainability ambitions.

These policy and planning documents are organised in a hierarchy based on their relevance to the Project. This hierarchy is illustrated opposite and is summarised below:

- State: State-wide goals and aspirations for sustainability, sustainable development, and climate resilience
- Regional: Region-specific objectives and pathways for achieving sustainability ambitions
- Local I guiding sustainability strategies specific to the local Maribyrnong Government
- Project: Sustainability actions for delivering a sustainable project that are specific to VU.

Figure 1.8 Policy and Planning Frameworks hierarchal diagram | Source: Atelier Ten

1.4 Key Priority Areas

The policy and planning documents review highlighted three key priority areas that were used to inform the Vision.

- The first priority area reflects setting clear targets and actionable steps to achieve emissions reductions ambitions.
- The second priority area focuses on reducing consumption and waste through resource recovery strategies and adopting circular economy principles.
- The third priority area encompasses decisive action on key strategies to address the climate emergency

Key Emissions Reductions priorities

- **City of Melbourne:** 30% emissions reduction by 2025 and 50% reductions by 2030. Net Zero by 2045 included delivering zero carbon buildings.
- **Maribyrnong City Council:** Transition to renewable energy and integration of efficient buildings which use less energy and adopt sustainable design standards while integrating innovative solutions.
- **Victoria University:** Net zero by 2025 and Net positive by 2028. Electrifying buildings, meeting energy reduction targets and showing leadership.

Key Circular Economy and Waste priorities

- **City of Melbourne:** Stimulate circular economy, prioritise separation of organic waste minimization and waste recycling strategies.
- **Maribyrnong City Council:** Prioritise waste avoidance and reduce consumption while supporting a local circular economy.
- **Victoria University:** Net Zero waste options and revolutionising material use while embedding circular design principles.

Key Climate change and adaptation priorities

- **City of Melbourne:** Greening the environment, flood and drainage management and reducing impacts of extreme weather conditions.
- **Maribyrnong City Council:** Greening the environment, restore, protect and enhance ecology.
- **Victoria University:** Protecting Country, increase biodiversity, regenerating the landscape and water conservation efforts.

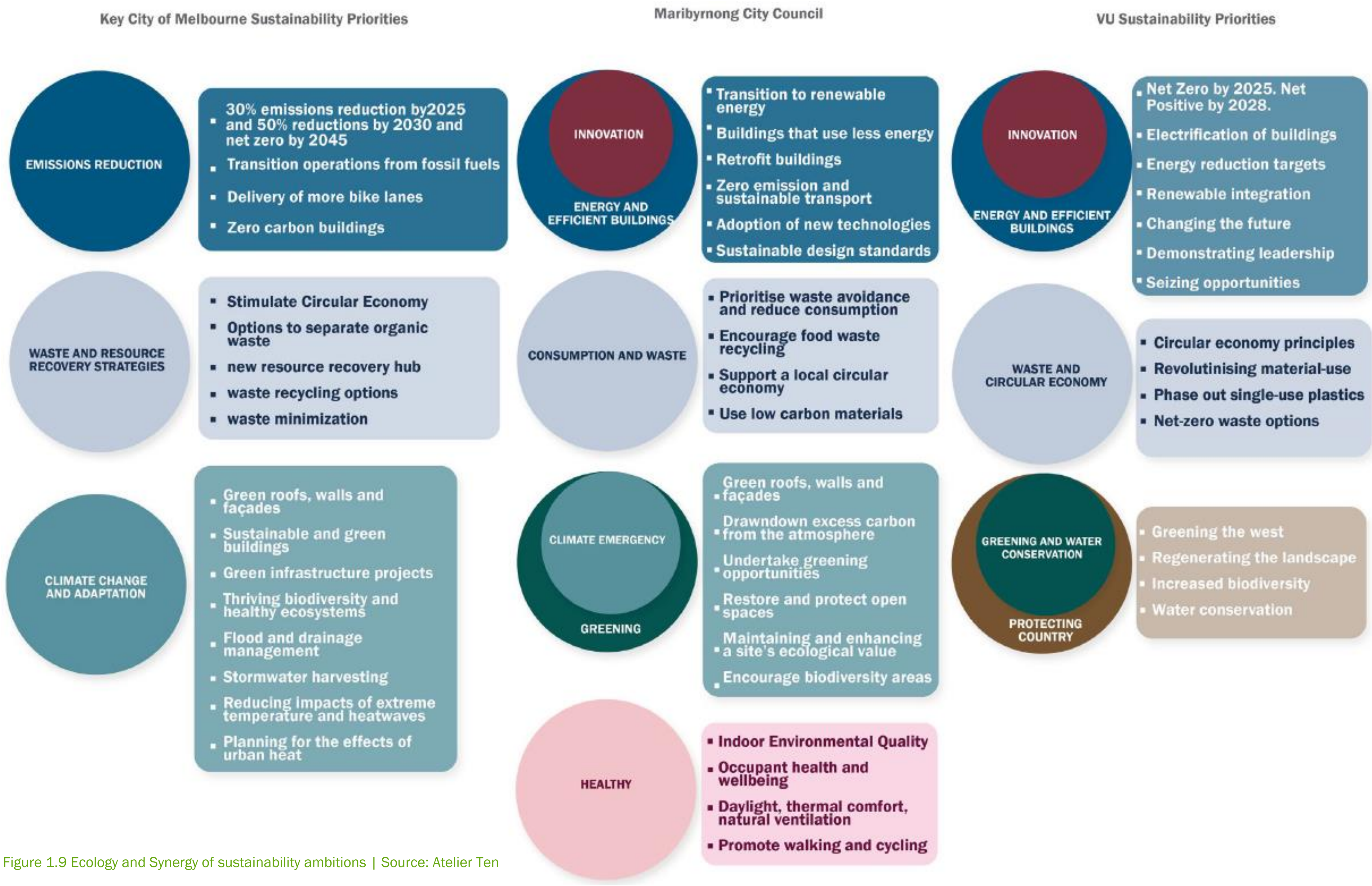

Figure 1.9 Ecology and Synergy of sustainability ambitions | Source: Atelier Ten

2 Sustainability Vision and Strategy

2.1 Sustainability Vision

The CHTF building will stand as a beacon at the heart of the west. Strategically positioned to engage with Footscray Park Campus and the new hospital, the building will serve as a gateway to the West. It will cultivate vibrant collaborative spaces where sustainability takes centre stage, offering abundant daylight, inviting social zones, and lush green settings to inspire and uplift all who work and learn within.

The Vision comprises eight Sustainability Pillars (the Pillars) which provide direction on specific targets and design initiatives. The Pillars are:

1. Connecting to Country
2. Place of Health and Wellbeing
3. Energy + Carbon Leadership
4. Smart + Innovative
5. Integrated Water Cycle
6. Enhances Nature + Biodiversity
7. Resilient
8. Materials + Resources

The overall ambition for each Pillar is stated opposite and a detailed overview of each Pillar's goals, challenges, opportunities, and key performance indicators is provided on the subsequent pages. The applicability and feasibility of integrating these opportunities will be evaluated in detail over the future design phases.

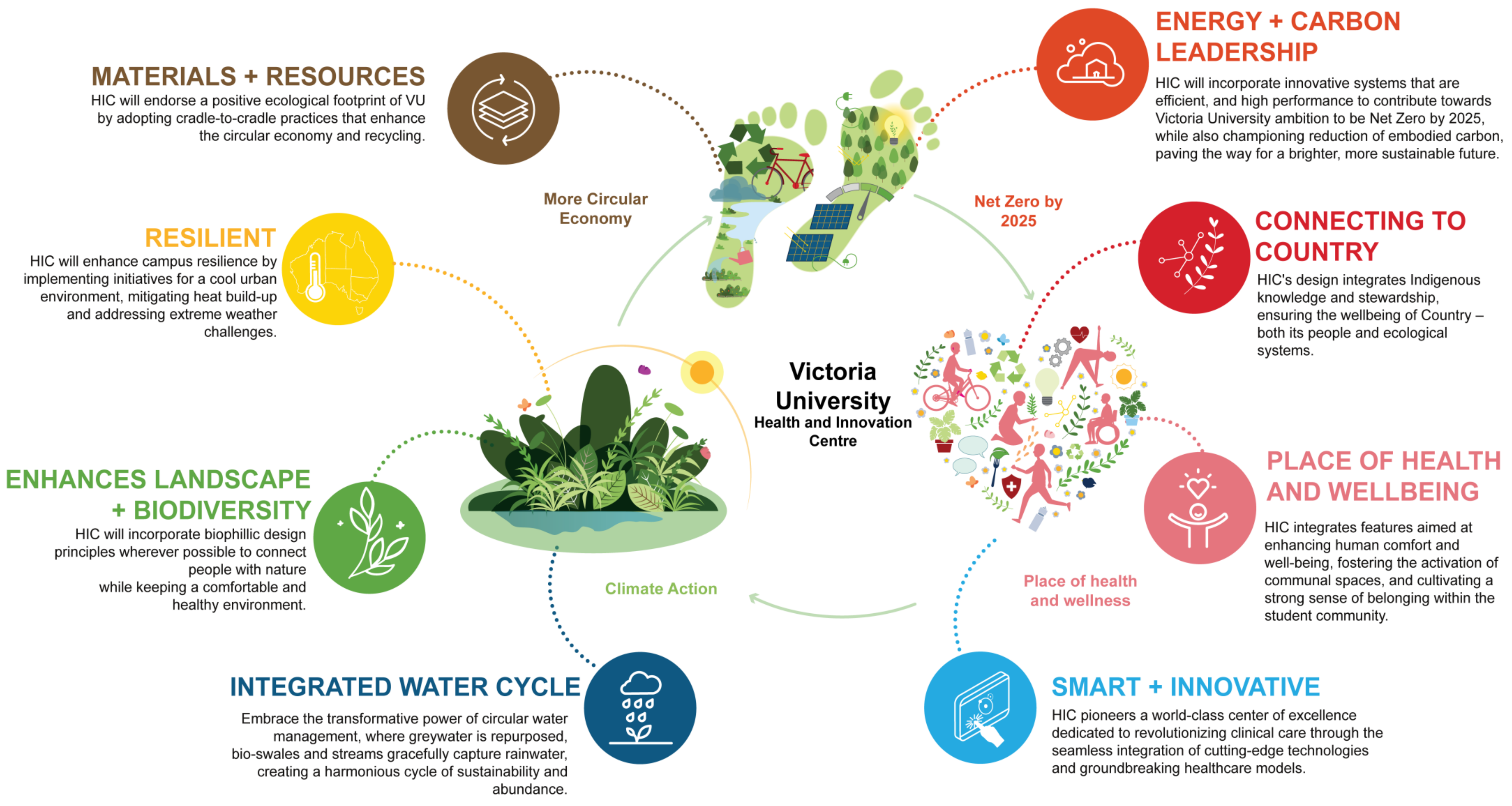

Figure 2.1 VU CHTF Sustainability Vision | Source: Atelier Ten

2.2 Sustainability Strategy

Connecting to Country

CHTF's design will envision Indigenous knowledge and stewardship, ensuring the wellbeing of Country - both its people and ecological systems.

Goals
- Deep listening to increase understanding of sustainability from the perspectives of Traditional Owners and embed learnings.
- The building's design will incorporate design elements using the Indigenous design and planning strategies and principles.
- Building strong relationships

Challenges
- Aligning time frames: engagement process with the local Aboriginal representatives, and communities of origin may conflict project timelines.
- Respect that the engagement process is not linear.

Opportunities
- Work with the Australian Indigenous Design Charter guiding principles.
- The project to acknowledge, recognise, and incorporate the Indigenous culture of the site.

Key Performance Indicators (Green Star)
- Indigenous-led design response
- Alignment with four Australian Indigenous Design Charter principles
- Indigenous Engagement Strategy

Place of Health and Wellbeing

CHTF's design will assess the features aimed at enhancing human comfort and well-being, fostering the activation of communal spaces, and cultivating a strong sense of belonging within the student community.

Goals
- Achieve high indoor environment quality (IEQ) that promotes thermal and visual comfort.
- Create zones of respite for students and staff.
- Prioritise active movement in the building.
- Design and construct the building to be inclusive to a diverse range of people with different needs.

Challenges
- Limitations associated with incorporating biophilic design principles in medical laboratories.
- Ensuring adequate and appropriate spaces for privacy and respite of building users.

Opportunities
- Embed biophilic design principles.
- Create spaces that incorporate amenity and comfort throughout seasonal changes.
- Integrate active design (walking, biking, nature etc.)

Key Performance Indicators (Green Star)
- Ensure materials and finishes meet TVOC limits.
- Acoustic Comfort Strategy
- Fresh air and minimisation of pollutants
- Lighting comfort, glare addressed, daylight access
- EOT Facilities/bike parking/sustainable transport

Energy + Carbon Leadership

CHTF's design will visualise the innovative systems that are efficient, and high performance to contribute towards Victoria University's ambition to be Net Zero by 2025, while also championing reduction of embodied carbon, paving the way for a brighter, more sustainable future.

Goals
- Embed upfront carbon reduction targets
- Adaptive thermal comfort – relaxing set points for season-informed indoor environments
- Responsiveness to orientation and consideration of space use.

Challenges
- Achieving on-site energy generation for energy resilience may be difficult.
- Designing with whole of life considerations.

Opportunities
- Priorities passive design and high-performance facade to minimize operational energy use.
- Efficient systems and smart building controls to minimise waste of energy and resources.

Key Performance Indicators (Green Star)
- Climate Positive Pathway
- 20% upfront carbon emissions and energy use reduction
- Offsetting demolition works requirement
- 100% of building's energy from renewables
- Scope 1 eliminated or offset (refrigerants and fossil fuels)

Smart + Innovative

CHTF's design will envision a world-class centre of excellence dedicated to revolutionising clinical care through the seamless integration of cutting-edge technologies and groundbreaking healthcare models.

Goals
- Incorporate intelligent building technologies to trial patient feedback.
- Partner with businesses to test technology in the form of a Living Laboratory.

Challenges
- Restrictions around data privacy, user privacy, and susceptibility to hacking need to be considered and monitored for changing regulations over time.
- Reliance on smart building technologies means that the building is less resilient during power outages.
- Fast-paced development of technology might mean that these technologies become quickly outdated.

Opportunities
- Integrate IOT devices, smart energy management systems, and smart HVAC systems into the building design, with the data collected to be accessible to students for learning purposes.

Key Performance Indicators (Green Star)
- Climate Positive Pathway - 20% energy use reduction
- Responsible structure, and systems

Integrated Water Cycle

CHTF's design will envision ways to embrace the transformative power of circular water management, where grey water is re purposed, bio-swales and streams gracefully capture rainwater, creating a harmonious cycle of sustainability and abundance.

Goals

- Balance water consumption with water recycling and replenishment by significantly reducing potable water consumption.
- Storm-water management systems capture and control rainwater runoff from the building.
- On-site retention and integration into landscape design.

Challenges

- Treating water on-site before it is returned to wider ecosystem.

Opportunities

- Potential to integrated First Nations relationships with water strategies in the landscape.
- Use landscaping features such as berms, swales, and retention ponds to redirect and absorb excess rainwater, reducing the risk of flooding on-site.
- Rooftop and landscape to collect and re-use water

Key Performance Indicators (Green Star)

- Reduction in average annual storm-water discharge of 40% across whole site
- 45% less potable water, recycled water facilities

Enhances Nature + Biodiversity

CHTF's design will assess the feasibility of biophilic design principles wherever possible to connect people with nature while keeping a comfortable and healthy environment.

Goals

- Increase tree canopy on site and soft grounds.
- The project will prioritise nature-based solutions.
- Achieve no net loss of biodiversity & prepare for an increase of biodiversity.
- Incorporate biophilic principles

Challenges

- Creation of natural corridors across the site to support biodiversity may be inhibited and/or restricted by urban pockets surrounding the site.

Opportunities

- Creating accessible outdoor spaces such as courtyards, terraces, or rooftop gardens that provide opportunities for relaxation, social interaction, and connection with nature.
- Design and co-create Indigenous-led trails, narratives of the biodiversity in open space
- Increase tree canopy in landscaped areas

Key Performance Indicators (Green Star)

- Landscaping 15% of site area or ratio of 1:500 GFA
- Species diversity, use of climate resilient and indigenous plants
- Outdoor lighting complies with AS/NZS4282:2019
- Indigenous-led design response

Resilient

CHTF's design will explore opportunities for campus resilience by implementing initiatives for a cool urban environment, mitigating heat build-up and addressing extreme weather changes.

Goals

- Mitigate urban heat island effects and ensure flooding resilience on campus.
- Making the site resilient to flooding
- Integrate community facilities that can serve as gathering places during emergency situations, e.g. localised infrastructure and services disruptions.
- Integrate of broader climate adaptation and community resilience plan in campus

Challenges

- Restrictions associated with incorporating the appropriate infrastructure to deliver appropriate demand response strategies that align with climate action priority areas.

Opportunities

- Identify climate change risks and develop project-specific mitigation measures in the project.
- Mitigate heat island effect on site.

Key Performance Indicators (Green Star)

- Undertake a climate change risk and adaptation assessment and address the risks identified though design and operational intervention strategies.
- Implement heat island effect reduction strategies in at least 75% of the whole site area.

More Circular (Materials & Resources)

CHTF's design will gauge possibilities for a positive ecological footprint of Victoria University by adopting cradle-to-cradle practices that enhance the circular economy and recycling.

Goals

- Leverage existing research clusters on campus to pioneer the use of experimental building materials.
- Maximise reuse of appropriate demolition materials.
- Target a zero waste to landfill approach.
- Specify low-carbon and recycling content materials (structural, facade and finishes).

Challenges

- Challenges associated with adapting reused materials considering laws and testing processes.

Opportunities

- Optimise design efficiency to minimise absolute quantities of material use.
- Establish a comprehensive recycling strategy for on-site waste management.
- Reuse demolition materials in new building
- Specify products with high EPDs that are considered low carbon options

Key Performance Indicators (Green Star)

- Separation of waste streams (at least three).
- 20% upfront carbon reductions over a typical building.

3 Upfront Carbon Emissions and Reduction

3.1 Carbon Reduction Methodology

The design and selection of materials used in the CHTF building will significantly impact upfront carbon emissions targets, spanning from structural elements to building envelope and interior finishes.

Three key areas will be assessed in detail for feasibility over the next phases to optimise upfront carbon in the new development and there by achieve the 20% target reduction aligned with Climate Positive Pathway within Green Star Buildings.

3.1.1 Reuse existing materials

1. **Reuse of Existing Materials from demolished buildings and excavation materials:**
   - Salvaging bricks for reuse in the new build, will help reducing the demand for new materials.
   - Assess feasibility to Re-purpose excavation material such as stone gravel which can be used for retaining walls, garden borders, or decorative features. see Figure 3.1

3.1.2 Efficiency vs. Sufficiency of materials

Reducing the mass of materials is key to reducing carbon. Additionally, it is important to optimise material use to achieve desired performance and longevity without overbuilding or over consuming. The following strategies will be explored for feasibility over the design development phase

1. **De-materialise:** Avoid any unnecessary materials

2. **Material Efficiency:** Selecting materials that offer the required strength, durability, and performance while minimising embodied carbon content. This may involve using alternative materials, such as recycled or low-carbon alternatives, or optimising designs to reduce material quantities.

3. **Design Optimization:** Designing the building and structure with consideration for efficient use of materials and space. This includes minimising material waste, optimising layouts to reduce material consumption. Reduce the need for substructure for underground levels.

3.1.3 Use of circular and low carbon materials

The design team will assess feasibility to select materials according to the hierarchy: Avoid, reuse, use circular and avoid embodied carbon

1. **Recycled Materials:** Specify reused materials, either from on-site demolition or from local sources.

2. **Circular Materials**: If there is no reused option, specify materials with recycled content. Aim for local materials which are sourced as close to the site as possible.

3. **New Materials:** Last resort is to use virgin materials, favour low embodied carbon and carbon sequestering materials and long-lasting materials that need very little maintenance.

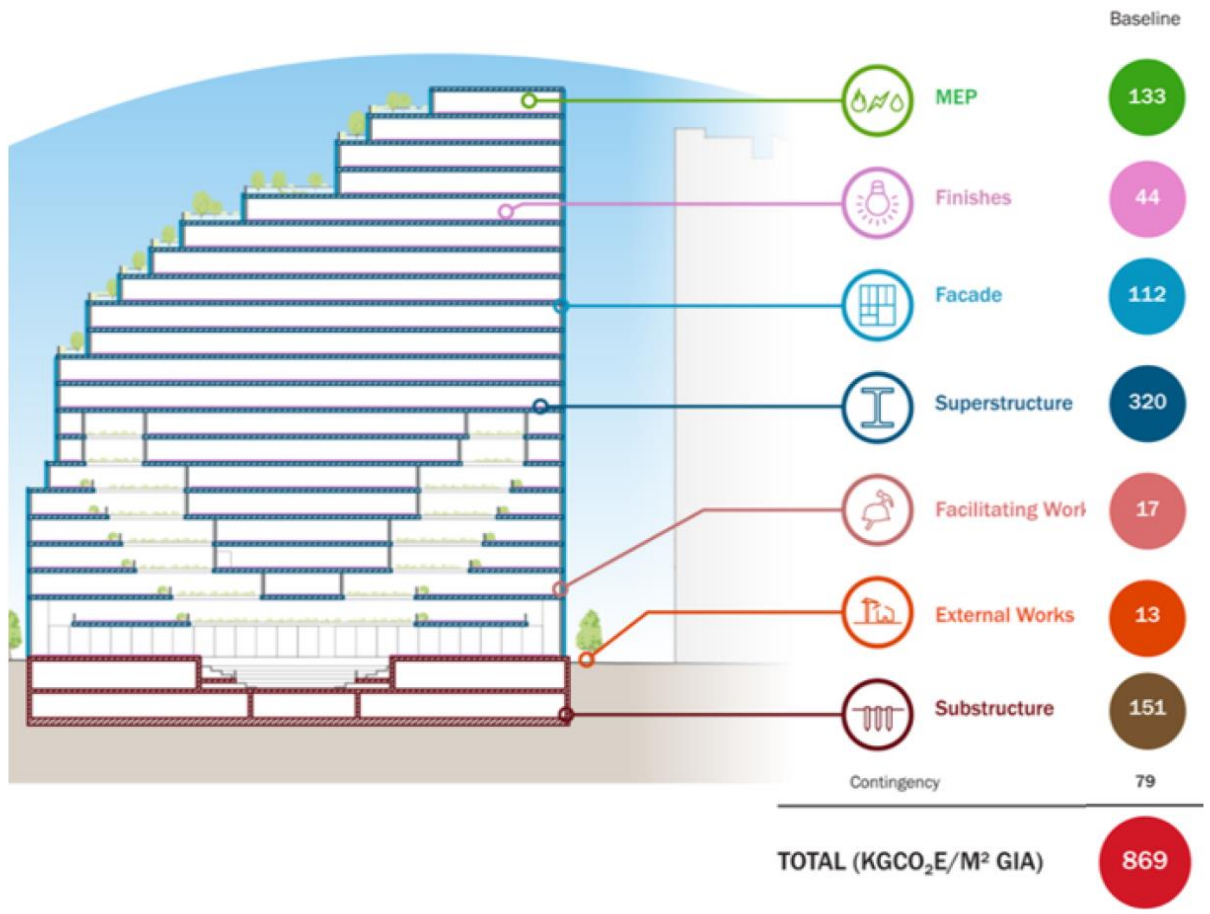

Figure 3.1 Typical Embodied Carbon hot spots in a building | Source: Atelier Ten

4 Sustainability Quality Assurance - Benchmarking

4.1 Sustainability Assessment Tool

It is imperative that sustainability objectives for the project are backed up by an approach to assurance that gives absolute confidence that the claimed outcomes will be achieved.

Green Star Buildings v1 was assessed for its relevance to the Project, specifically, its alignment with the Sustainability Vision. The Green Star tools operate at the building level, scrutinising aspects of sustainability such as energy efficiency, materials usage, and indoor environmental quality. The use of this tool will help to ensure that the project aligns with relevant sustainability goals and planning requirements.

The tool is highly applicable in the Australian context and is closely aligned with the Vision. It encompasses a holistic assessment of sustainability, is aligned with a zero-carbon pathway, has a focus on the health and wellbeing of users, and promotes the adoption circular design principles, all of which are central components to the Vision. Therefore, it is recommended that the Project pursues Green Star Buildings v1 to ensure the closest alignment with the Vision across the eight Sustainability Pillars.

4.1.1 Appraisal Summary

To determine the level of points to be pursued for Green Star Buildings v1, a detailed appraisal of the tool was performed (see Appendix). In summary, it is recommended that Green Star Buildings v1 be pursued with a target of **42 points**. This will equate to a Green Star Buildings v1 5 Star Rating. The summary of points and alignment with the Vision for Green Star Buildings v1 is summarised in Figure 4.1 and Figure 4.2. The credits have been categorised into low medium and high based on a cost complexity evaluation carried out during DS1 phase. The detail pathway for Green Star has been included as a part of Appendix.

It should be noted that the initial appraisal pathway has been subject to change over and may continue to change across the life of the project; hence, the final appraisal pathway may differ slightly. This is to ensure the sustainability assessment tool remains flexible in meeting the Project's sustainability ambitions as the project progresses.

Sustainability Assessment Tool	Sustainability Pillar: Connecting to Country	Place of Health and Wellbeing	Energy + Carbon Leadership	Smart + Innovative	Integrated Water Cycles	Enhances Nature + Biodiversity	Resilient	Materials + Resources
Green Star Buildings v1	✓	✓	✓	✓	✓	✓	✓	✓

Figure 4.1 Sustainability Assessment Tool alignment with CHTF Sustainability Vision | Source: Atelier Ten

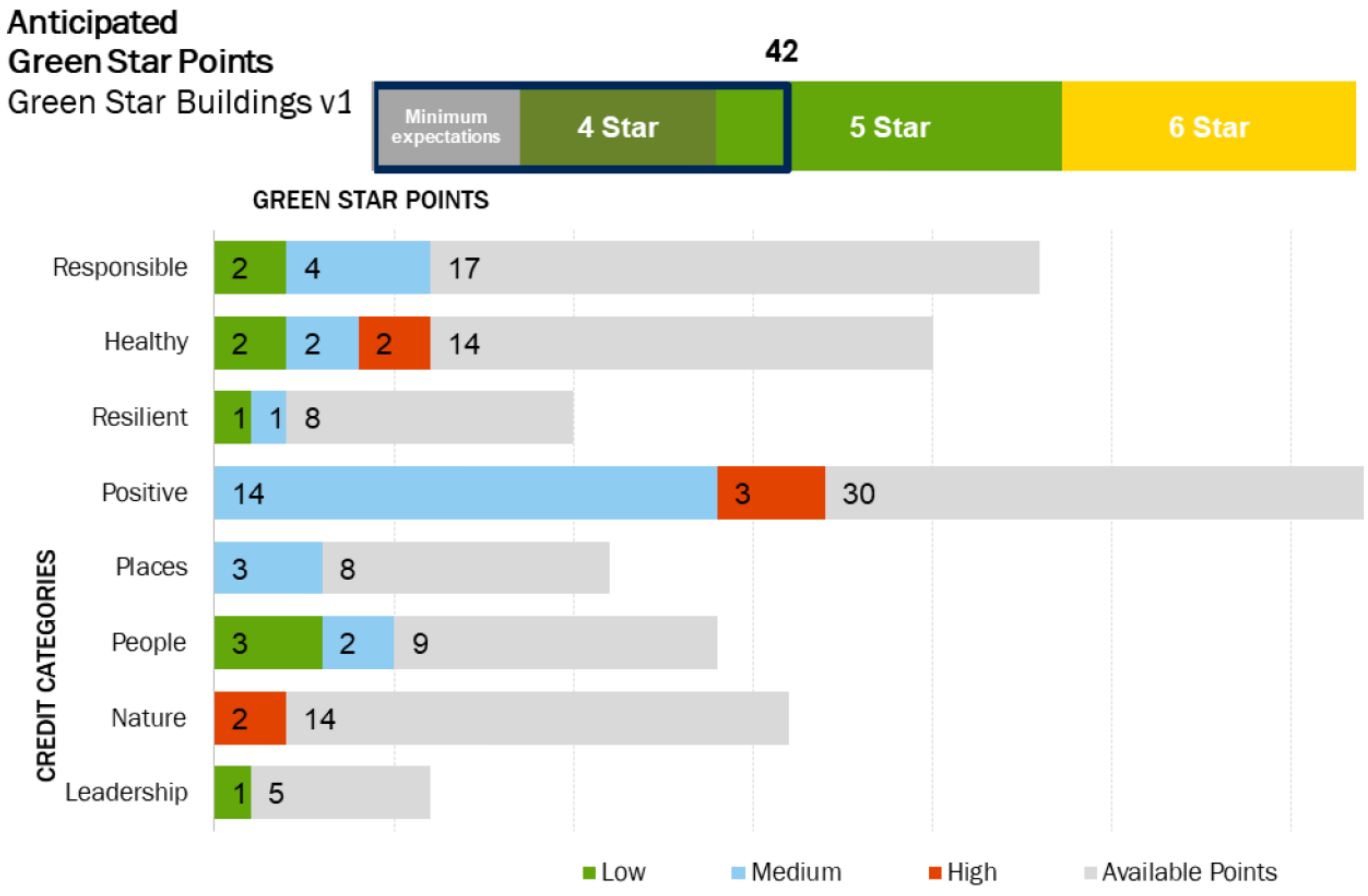

Figure 4.2 Anticipated targeted Green Star Points | Source: Atelier Ten

5 Façade Analysis

Optimising the façade is imperative as it helps guide the project team's decision-making and aiding specific credits that are being targeted such as Credit 22: Energy Use, and Credit 11: Light Quality.

Figure 5.1 Typical room in the North Facade | Source: DCM

To determine the feasibility of achieving these credits, the façade was assessed for the following:

1. Solar Radiation Analysis
2. Thermal Performance
3. Daylight Performance

From the initial assessment, Atelier Ten has provided recommendations to ensure that the building fabric has been optimised to the best of its capabilities, while also ensuring that the overall aesthetic vision is being met in the façade design.

5.1 Solar Radiation Analysis

Solar radiation analysis was conducted to better understand the orientation and identify direct sunlight (glare) and solar radiation concerns.

Two studies were completed:
1. A sun path study (Figure 5.1.); and
2. A solar radiation study (Figure 5.1.)

The following key findings were identified for this assessment:
- Mitigate direct sunlight (glare) on the eastern facade through the adoption of appropriate shading strategies and window-wall ratio.
- Surrounding campus buildings inhibit the radiation incident (amount of radiation received) on the building. Therefore, assume an unshaded/worst case scenario for radiation in all further studies
- North and east façades receive high energy loads in summer. Therefore, appropriate glass selection and optimised glare control strategies.

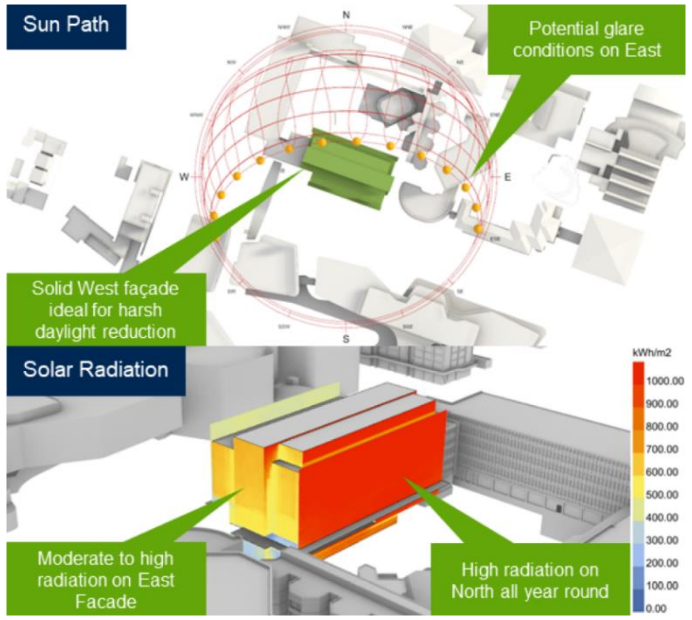

Figure 5.2 Solar Analysis | Source: Atelier Ten

5.1.1 South and West Façade

The western façade predominantly consists of building services, core and other functional spaces, and thus does not influence visual or thermal comfort for the building occupants.

With the South Façade, there may be opportunities to increase its glazing size to improve visual amenity since the façade do not receive direct solar radiation.

5.1.2 North and East Façade

These facades receive high direct solar radiation during summer, which translate to requirement on appropriate thermal performance targets to be met. They contain highly active spaces, including long-term workspaces, breakout spaces and transient corridors. As such, retention of visual amenity and thermal comfort is important.

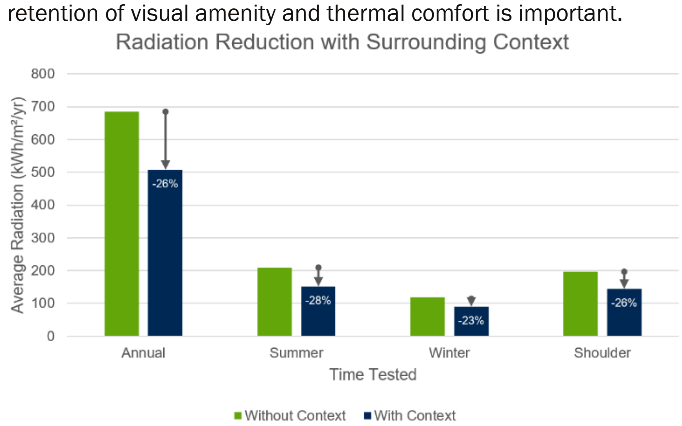

Figure 5.3 Radiation Reduction with Surrounding Context | Source: Atelier Ten

5.2 Thermal Performance

In conjunction with the solar radiation analysis, the thermal performance of the building was conducted to determine peak loads at each orientation. Assessing the thermal performance of the building will help guide the project team in reducing energy consumption, by means of improving the building fabric, and help aid the HVAC system sizing.

As discussed, the North and East façade contain majority of the regularly occupied areas within the building, a typical room representative of the lab spaces within the development oriented along the North and East façade have been assessed for thermal performance (Figure 5.4).

Figure 5.4 Typical room in the East & North Facade | Source: DCM

5.2.1 West Façade

As mentioned previously the western façade primarily contains building services, and other functional space, as such no analysis was carried to further optimise the West façade.

5.2.2 South Façade

Along the southern façade are regularly occupied spaces. Since the southern façade does not receive direct solar radiation, this orientation was assessed by increasing the window height, and various SHGC option, while keeping the U-Value consistent to U3.0.

Results demonstrated that the cooling loads are low, and opportunities exists to increasing the glazing size to allow more daylight without it resulting in higher energy loads.

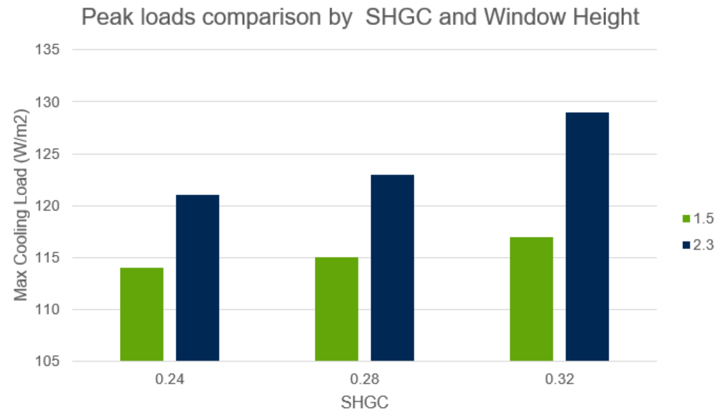

Figure 5.5 Peak Load results for South Facade - Window height and SHGC optioneering

South Façade Recommendations:
1. The addition of an external vertical shade to the South had minimal impact both energy and daylight.
2. Daylight levels remain high when the glazing VLT can be kept at >45%
3. Increasing the Window size by a 10-15% over its current size would improve daylight.

5.2.3 North Façade

The North façade received the highest direct solar radiation, especially during the occupied hours, as such the glazing properties will have a huge impact on the peak load energy performance.

As show in Figure 5.6, increasing the U-Value resulted in marginal improvements. Keeping the U-Value to U3.0 is likely to be necessary for Section J and other energy performance requirements.

The results also demonstrated that the SHGC with external shading, resulted in improvements to the peak load energy performance as seen in Figure 5.7.

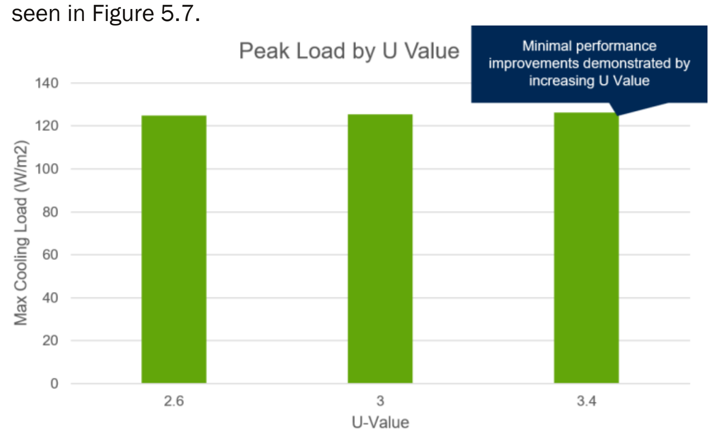

Figure 5.6 North facade peak load performance by U-Value | Source: Atelier Ten

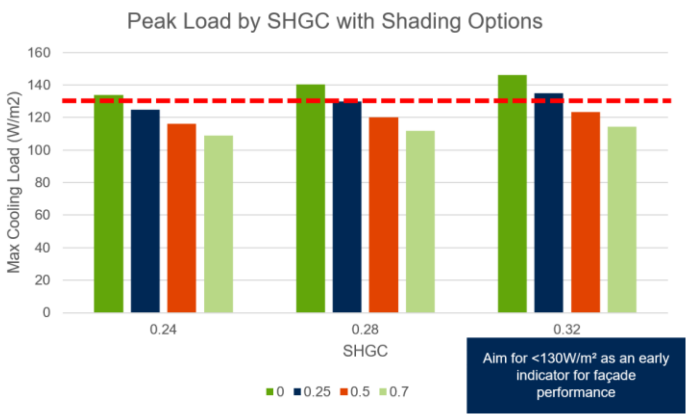

Figure 5.7 North Facade Peak Load Performance by SHGC and shading options | Source: Atelier Ten

North Façade Recommendations:

1. Increasing the size of the shading beyond 500 mm began to negatively impact daylighting while providing marginal gains for the cooling load
2. Daylight levels remain high when the glazing VLT can be kept at >45%
3. Peak Loads are relatively low when shades are provisioned.

5.2.4 East Façade

East façade features large glazing panels, which may result in thermal and visual discomfort for building occupants. As seen in Figure 5.8 the thermal loads are significantly higher compared to the other orientation due to the large size of the glazing especially along the east spine.

It is recommended that it is imperative to use high performance glass, such a thermally broken double glazing (<U2.6) with a triple siler low-e coating or tint (SHGC <0.24) to lower energy use.

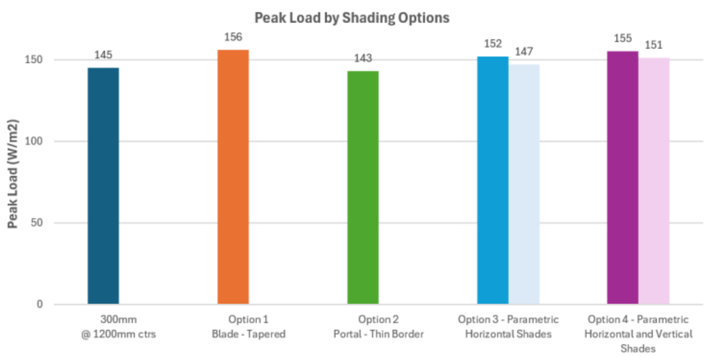

Figure 5.8 East Facade Peak Load Performance by shading option | Source: Atelier Ten

Through stakeholder engagement, the most preferred option for the East Façade was the exclusion of shading components to capture the project team's vision. Option 1 in Figure 5.8 describes the peak load scenario for the preferred option - no shading components applied to the East façade.

East Façade Recommendations:

1. High performance glazing with optimised VLT.
2. U Value <2.6 (thermally broken DGU, or TGU)
3. SHGC <0.24 (may result in lower VLT than elsewhere in building)

5.3 Daylight Studies

Preliminary daylight studies were completed to assess the East façade daylight performance, primarily along the "spine" area (Figure 5.9 - Marked in red dotted line). This space was assessed for visual comfort in addition to the solar radiation analysis.

A representative floor along the East façade spine was assessed at desk height (i.e. 700mm above floor level), as shown in Figure 5.9. It is important to note that this has not been assessed for vertical contrast glare.

Figure 5.9 Typical common area | Source: DCM

5.3.1 Daylight Assessment Metrics

Performance benchmarks for this study includes Spatial Daylight Autonomy (sDA) and Useful Daylight Index (UDI). These benchmarks help inform the minimum requirements specified in Green Star Buildings v1, Credit 11 - Light Quality.

Table 5.1 Performance Benchmarks

Metric	Specification	Target Compliance	Reference
sDA	160 lux for 80% occupied hours	40%	Credit 11 - Light Quality
UDI	300-3000lux for 50% occupied hours.	50%	Informs Credit 11 - Glare Reduction

5.3.2 Results

Annual Daylight Analysis - 8am to 5pm

The assessment was analysed for working hours, typically 8am to 5pm, where occupants will be within the facility.

Table 5.2 Results

	40% VLT	50% VLT
sDA Compliance	97.3%	97.7%
UDI Levels	76.2%	66.5%

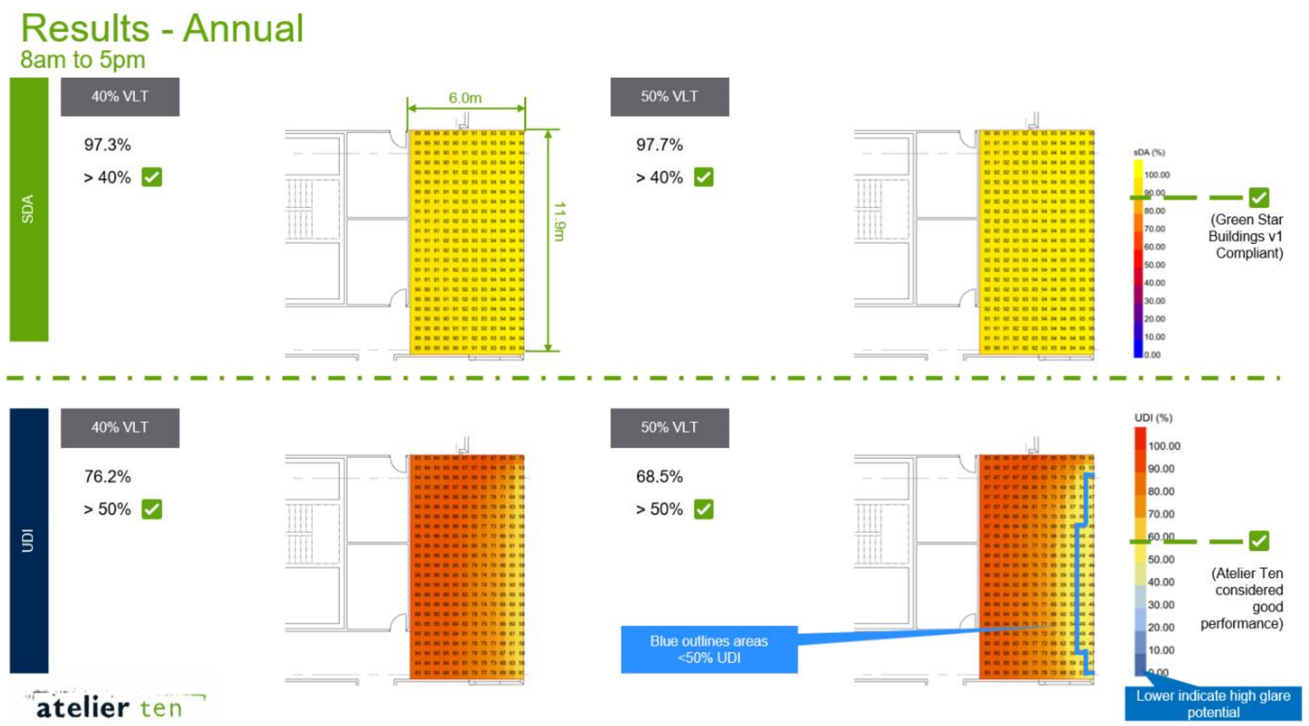

Figure 5.10 Daylight Results | Source: Atelier Ten

From the analysis carried out, the following can be ascertained for the Eastern Façade only:

2. With VLT of 50% the space would experience discomfort glare in the first 1-2m from the façade perimeter.
3. Glare mitigation strategies to be considered if deemed necessary but is not mandatory as per Green Star requirements in non-regularly occupied spaces (Transient Spaces).
4. A VLT of 40% or lower would be recommended as a higher VLT would result in lowering the useful daylight within the space.
5. Low VLT glass may appear slightly darker than the glass used on the other facades.
6. Low VLT glass will mitigate but not eliminate the risk of glare, so movable furniture is recommended so occupants can move around the space to find a visually comfortable location.

6 NCC 2022 Section J deemed-to-satisfy (DTS) Compliance

Section J assessment was completed to ascertain the proposed building fabric compliance with NCC 2022 Section J requirements, using the Deemed-to-Satisfy (DTS) Provisions.

6.1.1 Project Description

Section J requirements for Part J4 help determine the minimum building fabric requirements for VU's CHTF building, optimising the overall thermal performance. Table 6.1 demonstrates the project description based on its climate zone and building classification.

Table 6.1 Project Description

	Classification
Climate Zone	6
NCC 2022 Building Classification	Class 9b

The site is located in Victoria and is under Climate Zone 6, which is as described as a mild temperate climate zone.

6.1.2 Model Geometry

The building has been modelled as a basic surface model using Rhino3D v.6 - a 3D modelling software tool. The model was simplified to reduce any complexities when analysing the DTS requirements for Section J - Part J4.

A simple script was created using Grasshopper - a Rhino3D plugin, for the purpose of translating the calculations required to identify the minimum glazing properties (i.e., U-Value and SHGC) and the wall R values.

6.1.3 Section J DTS Requirement: Part J4 Breakdown

The building envelope, for the purposes of Section J, is defined as the parts of the building's fabric that separates a conditioned space (or habitable room) from:

- the exterior of the building; or
- a non-conditioned space including:
  - the floor of a rooftop plant room, lift-machine room, or the like; and
  - the floor above a carpark or warehouse; and
  - the common wall with a carpark, warehouse, or the like; or
- parts of the building's fabric that separates artificially heated or cooled spaces from:
  - the exterior of the building; or
  - other spaces that are not artificially heated or cooled.

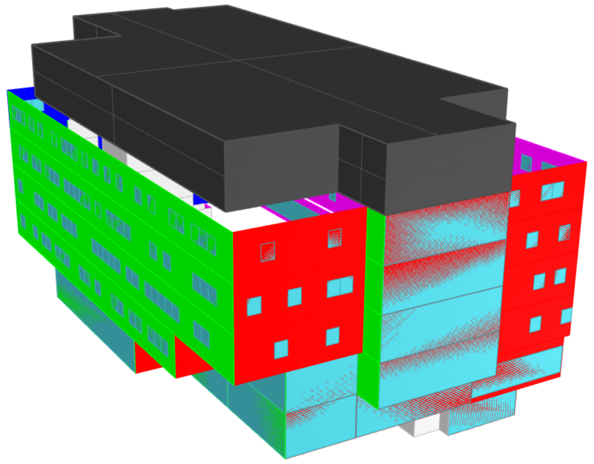

Figure 6.1 Building Surface Model for Section J Assessment

6.1.4 Façade Section J Assessment

The project has an energy use target of achieving 20% improvement through a Reference Pathway under the Green Star Credit 22 - Energy Use.

To assist in achieving this credit, the fabric performance needs to perform better than the minimum DTS requirements.:

- To achieve a DTS scheme under Section J of the NCC 2022, and
- To improve façade performance to align with the Green Star energy improvement targets.

The following table (Table 6.3) demonstrates the improvement from the minimum NCC 2022 Section J minimum requirements, compared against the proposed building fabric by the project team. The proposed building fabric construction properties displays a 23% improvement from the minimum Section J DTS requirement.

Figure 6.2 National Construction Code - Building Code of Australia

Table 6.2 Improvement from Section J minimum DTS requirements

Variable		Minimum DTS Requirements	Proposed Building
Walls/Spandrel R-Value (WoS)		R1.4	R1.4
Glazing U-Value (WoS)	East (Central Spine)	U5.28	U2.60
	Entrance Lobby		U4.50
	All other areas		U4.00
Glazing SHGC (WoS)	East (Central Spine)	0.55	0.25
	Entrance Lobby		0.55
	All other areas		0.30
Roof and Ceiling		R3.2	R3.2
Floors and/or Soffits		R2.0	R2.0
Section J Compliant		Yes	Yes
Improvement on Section J		-	Yes ~23% Improvement

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7.1 Site Analysis

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Appendices

Appendix A Green Star Buildings Appraisal
Green Star Buildings Preliminary Appraisal - 5 Star Rating Target

Appendix A Green Star Buildings Appraisal

Green Star Buildings Preliminary Appraisal - 5 Star Rating Target

Category	#	Credit	Pathway Requirements	Target Level	Available Points	Targeted Points
Responsible	1	Industry Development	1.1 Appoint a Green Star Accredited Professional; and 1.2 Disclose the cost of sustainable building practices to the GBCA; and 1.3 Market the building's sustainability achievements.	Credit Achievement	1	1
	2	Responsible Construction	Contractor undertakes: 0.1 Environmental management system (EMS certified) 0.2 Environmental management plan (EMP) 0.4 Sustainability training provided to 95% of all subcontractors for at least 3 days 1.1 Construction and demolition waste diversion of 90%	Credit Achievement	1	1
	3	Verification and Handover	0.1 Metering and monitoring for energy and water 0.2 Commissioning and tuning from prior to construction to after PC. 0.3 Building Information to be provided to building owner and relevant staff 1.1 Soft landing approach; and 1.2 Independent Commissioning Agent	Credit Achievement	1	1
	4	Operational Waste	0.1 Separation of waste streams at least 3 0.2 Dedicated easy to access waste storage area to account estimated waste and collection 0.3 Signoff by waste specialist and/or contractor	Minimum Expectation	-	-
	6	Responsible Structure	1.1 50% of all structural components (by cost) meet Resp. Products Value score ≥10	Credit Achievement	5	3
Healthy	10	Clean Air	0.1 Ventilation systems attributes: Separation from pollutants-cleaning ductwork 0.2 Provision of outdoor air: 50% > min AS1668 OR maintain CO2 levels <800ppm 0.3 Exhaust or elimination of pollutants	Minimum Expectation	2	-
	11	Light Quality	0.1 Lighting comfort: Flicker-free, required CRI, illuminance, uniformity etc. 0.2 Glare addressed in nominated areas 0.3 Daylight access to building occupants 1.1 Artificial Lighting solution that addresses quality, contrast etc; OR 1.2 Daylight	Credit Achievement	4	2
	12	Acoustic Comfort	1.1 Internal noise levels limits as per standards; and 1.2 Acoustic separation between enclosed spaces; and 1.3 Impact noise transfer through floors; and 1.4 Reverberation control as per limit in standards (non-residential only)	Credit Achievement	2	2
	13	Exposure to Toxins	0.1 Paints, adhesives, sealants, and carpets; 95% (volume) meet TVOC limits 0.2 Engineered wood products; 95% (area) meet formaldehyde limits 0.3 Lead, asbestos and PCBs; hazardous materials survey, best practice removal 1.1 Testing of TVOC and formaldehyde levels	Credit Achievement	2	2
Resilient	16	Climate Change Resilience	0.1 Climate change pre-screening checklist and communication to stakeholders 1.1 Project-specific climate change risk and adaptation assessment.	Credit Achievement	1	1
	19	Heat Resilience	1.1 Heat island effect reduction strategies in at least 75% of the whole site area	Credit Achievement	1	1
Positive	21	Upfront Carbon Emissions	0.1 Upfront carbon emissions are at least 10% less than reference building 1.1 Net Zero Path: Upfront carbon emissions are at least 20% less than reference building	Credit Achievement	6	3
	22	Energy Use	0.1 Energy use is at least 10% less than reference. 1.1 Net Zero Path: Energy use is at least 20% less than a reference building; OR NABERS 5.5 Stars with 25% modelling margin; OR NatHERS target.	Credit Achievement	6	3
	23	Energy Source	2.1 Net Zero Path: 100% of the building's energy comes from renewables	Exceptional Performance	6	6
	24	Other Carbon Emissions	1.1 Net Zero Path: The building owner eliminates/offsets emissions from refrigerants	Credit Achievement	4	2
	25	Water Use	1.1 45% less potable water compared to a reference building	Credit Achievement	6	3
Places	27	Movement and Place	0.1 Showers and changing facilities for building occupants	Minimum Expectation	3	-
	29	Contribution to Place	1.1 Design contributes to the liveability of the wider urban context and enhances the public realm. Demonstrated through Urban Context Report and public realm interface design, OR 1.2 an Independent design review	Credit Achievement	2	2
	30	Culture, Heritage and Identity	1.1Design reflects and celebrates local demographics and identities, the history of the place, and any hidden or minority entities. Demonstrated through local analysis that justifies design responses, OR 1.2 through Independent Design Review	Credit Achievement	1	1
People	31	Inclusive Construction Practices	0.1 Gender inclusive facilities and protective equipment during construction. 0.2 Policies on-site to raise awareness, reduce discrimination, racism & bullying.	Minimum Expectation	1	-
	32	Indigenous Inclusion	1.1 Building's design and construction celebrates Aboriginal and Torres Strait Islander people, culture and heritage by either playing an active role in the organisational RAP; OR, 1.2 Incorporating design elements using the Indigenous Design & Planning principles.	Credit Achievement	2	2
	34	Design for Inclusion	1.1The building is designed and constructed to be inclusive to a diverse range of people with different needs. 2.1 Engagement with target groups has informed the inclusive design	Exceptional Performance	3	3
Nature	35	Impacts to Nature	0.1 Building was not built on, or significantly impacted, a site w/ high ecological value; and manages light pollution impacts and has a wetland management plan	Minimum Expectation	2	-
	39	Waterway Protection	1.1 Annual average flow reduction (ML/yr) of 40% compared to pre-development levels and meets specified pollutants targets.	Credit Achievement	4	2
Leadership	40	Market Transformation	1.1 Climate Positive Pathway	Credit Achievement	0	1
					Total	42