Sustainable Design Statement

Bankstown City Campus Development

Western Sydney University

Report No	M.WSU-0101 20191021
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engineering sustainable environments

REPORT AUTHORISATION

PROJECT: **SUSTAINABLE DESIGN STATEMENT**
BANKSTOWN CITY CAMPUS DEVELOPMENT

REPORT NO: **M.WSU-0101 20191021**

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Melbourne Office
Umow Lai Pty Ltd
L4, 10 Yarra Street
South Yarra VIC 3141
Australia
Tel: +61 3 9249 0288
Fax: + 61 3 9249 0299
Email: ulmelb@umowlai.com.au
Web: www.umowlai.com.au
ABN: 27 748 212 498

Sydney Office
Umow Lai Enginuity Pty Ltd
657 Pacific Highway
St Leonards NSW 2065
Australia
Tel: +61 2 9431 9431
Fax: +61 2 9437 3120
Email: ulsyd@umowlai.com.au
Web: www.umowlai.com.au
ABN: 99 150 174 782

Brisbane Office
Umow Lai Pty Ltd
123 Charlotte Street
Brisbane QLD 4000
Australia
Tel: +61 7 3210 1800
Fax: +61 7 3210 1799
Email: ulbris@umowlai.com.au
Web: www.umowlai.com.au
ABN: 27 748 212 498

EXECUTIVE SUMMARY

This report provides an overview of the proposed Bankstown City Campus development at the Western Sydney University Bankstown City Campus. It examines the potential for sustainability measures to be incorporated in to the project to achieve the planning scheme objectives.

As a result of the ESD initiatives discussed within this report, the Bankstown City Campus development is expected to achieve a level of environmental sustainability consistent with the criteria required by the Secretary's Environmental Assessment Requirements (SEARSs) for State Significant Development (SSD).

The sustainability measures implemented in the design aim to ensure that the development has enhanced energy efficiency, therefore minimising the associated greenhouse gas emissions. The design targets a reduction in potable water use and investigates the use of alternative water sources. The minimisation of waste going to landfill, and an increase in the rate of material reuse and recycling is also incorporated.

As detailed in this report, the building has demonstrated its ability to achieve the sustainability objectives regarding energy, water and waste efficiency to meet the SEARs requirements. The SEARs requirements for the project with respect to this report are detailed as follows:

- Detail how ESD principles (as defined in clause 7(4) of Schedule 2 of the Environmental Planning and Assessment Regulation 2000) will be incorporated in the design and ongoing operation phases of the development.
- Demonstrate that the development has been assessed against a suitably accredited rating scheme to meet industry best practice.
- Include a description of the measures that would be implemented to minimise consumption of resources, water (including water sensitive urban design) and energy.

Compliance with the second point above is demonstrated through the achievement of a 5 Star Green Star Design and As Built version 1.2 certified rating. This report details the sustainability measures proposed to be implemented into the Bankstown City Campus and which satisfy all SEARs requirements.

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CONTENTS

1 INTRODUCTION

This report has been prepared to provide an overview of the proposed Ecologically Sustainable Development (ESD) design features incorporated into the design of the proposed Bankstown City Campus at the Western Sydney University. The report identifies how ESD principles (as defined in clause 7(4) of Schedule 2 of the Environmental Planning and Assessment Regulation 2000) are incorporated into the project and to demonstrate compliance with the SEARs requirements.

The sustainability measures implemented in the design aim to ensure that the development has enhanced energy efficiency, a resultant reduction in greenhouse gas emissions, reduced potable water use as well as waste going to landfill, and an increase in the rate of material reuse and recycling.

incorporated in the design and ongoing operation phases of the development. As detailed in this report, the building has the preliminary design potential to achieve the sustainability objectives regarding energy, water and waste efficiency as set out in the SEARs requirements.

The report includes discussion on the passive design features, energy efficiency, indoor environment quality, water conservation, sustainable materials, transport, waste management and appropriate WSUD initiatives which are proposed to be incorporated into the development.

The various ESD design measures noted in this document will be further explored as the project design and construction progress.

1.1 THE DEVELOPMENT

The development site for the Bankstown City Campus is located at 74 Rickard Road Bankstown. The site is bordered by the Bankstown City Council Offices to the East, the and Library to the West, Rickard Rd to the North and Paul Keating Park to the South.

The image below shows the existing site and environs:

Figure 1: **Bankstown City Campus** (image from Google Maps)

The development site lies within the jurisdiction of the City of Canterbury Bankstown. The teaching spaces are deemed to be Class 9b under the National Construction Code (NCC) 2016, staff office spaces are Class 5, with the car park area falling under Class 7a.

1.2 ECOLOGICALLY SUSTAINABLE DESIGN

The Intergovernmental Panel on Climate Change quotes that buildings are responsible for consuming 32% of the world's resources, including 12% of its fresh water and up to 40% of its energy, whilst generating 40% of the waste going to landfill and 40% of air emissions. Such figures confirm that buildings are the biggest source of emissions and energy consumption around the globe, and current design and construction practices in the built environment fuel the global slide towards irreversible climate change.

The property industry in Australia is well positioned to deliver significant long-term environmental and social improvements using a broad range of measures. This is realised with a focus on sustainability from an early stage of the design process.

Ecologically sustainable design of buildings seeks to minimise the ongoing operational consumption of scarce resources such as energy and water and to use resources in such a way as to minimise the impact on the environment. Within the building consideration is given to the amenity and comfort of the building occupants by appropriate selection of materials, fabric and energy systems.

2 REGULATORY COMPLIANCE

The following section details regulatory compliance requirements identified for the development related to sustainability.

2.1 SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS - SEARS

The SEARs requirements for the project with respect to this report are detailed as follows:

- Detail how ESD principles (as defined in clause 7(4) of Schedule 2 of the Environmental Planning and Assessment Regulation 2000) will be incorporated in the design and ongoing operation phases of the development.
- Demonstrate that the development has been assessed against a suitably accredited rating scheme to meet industry best practice.
- Include a description of the measures that would be implemented to minimise consumption of resources, water (including water sensitive urban design) and energy.

2.2 NCC SECTION J ENERGY EFFICIENCY

Section J of the National Construction Code (NCC) stipulates the minimum energy efficiency requirements for residential (Class 1, 2, 3 & 4) and non-residential buildings (Class 5 to 9) within all states and territories of Australia where Section J has been mandated. The project is currently targeting compliance under the NCC2016 Part J requirements as confirmed by the relevant Building Surveyor for the project.

Section J is comprised of eight parts, each specifically outlining minimum deemed-to-satisfy criteria. Those sections that are applicable within New South Wales cover the performance of the building fabric, glazing, building sealing, HVAC systems, artificial lighting and power and access for maintenance.

Compliance with these requirements is ensured by the design team, and must be demonstrated before being approved for a building permit.

For Class 9b and Class 5 areas, compliance is demonstrated via the Deemed-to-Satisfy requirements of Part J1 to J3 (where applicable) or performance verification (JV3 modelling).

The Bankstown City Campus project is proposing to significantly exceed the minimum NCC2016 Part J energy requirements.

3 GREEN STAR

The Green Star environmental rating system for buildings was created for the property industry in order to:

- Establish a common language.
- Set a standard of measurement for green buildings.
- Promote integrated, whole-building design.
- Recognise environmental leadership.
- Identify building life-cycle impacts.
- Raise awareness of green building benefits.

The GBCA has historically managed a suite of Green Star rating tools for different building types (e.g. Office, Education, Healthcare etc.). These tools have had significant penetration into the property and construction sector, becoming the default “yard-stick” for environmental performance of property development.

The use of the Green Star Education tool has also been popular within the tertiary education sector with numerous projects of significance defining Green Star objectives.

With a recent overhaul and change of strategic direction, these sector specific rating tools are now referred to as “legacy” rating tools. Since late 2014, the GBCA has released a Design and As Built tool to replace all previous legacy rating tools.

3.1 GREEN STAR DESIGN & AS-BUILT (GREEN STAR DAB)

The Green Star DAB is a single rating tool which can be applied to any eligible building type. Therefore educational developments such as the Bankstown city campus development, a single tool can be used for the whole project. The fitout component is not currently proposed to be rated (Green Star Interiors) but would need to align with any Design and As Built requirements for integrated fitout elements.

Previously with legacy rating tools, each different space type would need to use the specific tool for that space type (i.e. Green Star Office v3 and Green Star Education v1):

Umow Lai notes the significant changes within the Green Star DAB rating tool compared to legacy tools:

- The number of credits have been rationalised with the number of points available limited to approximately 100, plus an additional 10 innovation points.
- The rating system no longer uses “weighting factors” to allocate different emphasis on environmental issues.
- The rating achieved is an As-Built rating only, although an option exists to have the GBCA undertake a ‘Design Review’ rating achieved as the design develops.
- Significant changes and improvements have been made to credit criteria.
- A significant emphasis is placed on Life Cycle Assessment within the materials category.
- The Innovation category has been completely revised with the integration of Innovation Challenges.

Green Star DAB has undergone 2 major reviews since its release with the current version of the tool being version 1.2

3.2 Targeted Green Star Points

The project requires 60 points out of 100 available to achieve the target 5 Star 'Australian Excellence' rating. Currently the project is sitting at 65.5 points, which includes a point 'buffer'.

The project is targeting 10 out of 10 available innovation points.

Table 1 *Green Star Status*

Category	*Available Points*	*Targeted Points*	*'Potential/Alternative' Points*
Management	14	13	1
Indoor Environment Quality	17	12	4
Energy	22	9.5	2
Transport	10	6	1
Water	12	5	1
Materials	14	5	8.5
Ecology	6	2	1
Emissions	5	3	0
Innovation	10	10	0
TOTAL	**100**	**65.5**	**12.5**

The proposed 5 Star pathway has been reviewed and commented on by the design team to ensure targeted credits are incorporated into the design and cost plan.

A detailed summary of Green Star Design and As Built version 1.2 credits targeted by BCCD is contained in the appendix.

4 ESD PRINCIPLES

The Environmental Planning and Assessment Regulation 2000 (clause 7(4) of Schedule 2) defines the Principles of Ecologically Sustainable Development as follows:

a) The **precautionary principle**, namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by:
   i. careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and
   ii. an assessment of the risk-weighted consequences of various options,

b) **inter-generational equity**, namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations,

c) **conservation of biological diversity and ecological integrity**, namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration,

d) **improved valuation, pricing and incentive mechanisms**, namely, that environmental factors should be included in the valuation of assets and services, such as:
   i. polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,
   ii. the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,
   iii. environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.

The following sections detail how the proposed design specifically responds to each of these principals.

4.1 PRECAUTIONARY PRINCIPLE

The design for the Bankstown City Campus development follows the precautionary principal by applying best practice environmental sustainable design throughout the project. Much of this design has been undertaken to prevent irreversible damage to the environment. For example the large solar photovoltaics array covering all available areas of the roof of the building will ensure that a significant proportion of electricity comes from renewable sources. This reduces the harm to the environment that occurs through fossil fuel based power generation.

A risk weighted assessment basis is also followed to assess the merits of various sustainable design options. A primary example of this is the Climate Adaptation Plan that is being developed to allow the project team to identify key risks associated with climate change over the expected lifetime of the project. The Plan includes a risk assessment to analyse varying degrees of climate change severity over future time scales based on scientific research. The risk assessment process identifies design initiatives that can be implemented to ensure that risks are lowered to an acceptable level. The significant planting of vegetation across the building is driven by a desire to improve the local thermal environment while adding to local ecology.

4.2 INTER-GENERATIONAL EQUITY

The project sustainable design initiatives are intended to maintain or enhance the health, diversity and productivity of the environment for the benefit of future generations. Key among these issues is climate change, which represents the single greatest threat to the health, diversity and productivity of the environment for the benefit of future generations. The project combats climate change through the design of the building being very energy efficient and also through the use of renewable electricity sources for part of the power consumed by the building.

Other areas of intergenerational equity are also addressed in the sourcing and supply of raw materials used for the construction of the building. Key materials for use in the building such as timber, steel and PVC are responsibly sourced to limit their impact on future generations. The project is also in close consultation with members of local indigenous communities to ensure that the wishes of the traditional custodians of the land are respected.

4.3 CONSERVATION OF BIOLOGICAL DIVERSITY AND ECOLOGICAL INTEGRITY

Conservation of biological diversity and ecological integrity is a fundamental consideration for the project sustainable design. The Bankstown City Campus development occupies a relatively minor area of limited ecological value (a former car park) and so therefore has minimal existing biological diversity and ecological integrity. The project is seeking to significantly improve its ecological integrity through the planting of various forms of vegetation. This includes large areas of planting including trees on the terraces that step up[the building and also green wall elements.

The project will also benefit biological diversity and ecological integrity through the sourcing of materials and resources required for the construction and operation of the facility. Construction materials such as timber will be supplied using sustainable forest certification schemes that ensure that biological diversity and ecological integrity is protected and maintained. Similarly various other materials used in the project will be sourced with Environmental Product Declarations that are designed to protect biological diversity and ecological integrity.

The conservation of water resources is also a fundamental consideration in the design. Low water consuming fittings are to be specified throughout the project. In addition the roof area is used to capture a substantial volume of rainwater that reduces potable water consumption and therefore reduces pressure on ecological systems caused by water scarcity.

4.4 IMPROVED VALUATION, PRICING AND INCENTIVE MECHANISMS

The University of Western Sydney is developing the Bankstown City Campus development for its own use and will be the long term occupant and operator of the facility. The University is also responsible for the provision of all resources needed for the building and the management of all waste produced. This closed cycle from production to disposal ensures that the University bears the cost of containment, avoidance or abatement of any pollution associated with the development.

Sustainability is fully integrated through the design and construction of the Bankstown City Campus development to ensure that the strong environmental goals set for the facility are achieved in the most cost effective way. Detailed energy, water and environmental impact modelling is used throughout the design process to optimise the performance and effectiveness of the project.

5 SUSTAINABILITY INITIATIVES

The subsequent sections set out the important ESD design features of the new development, that contribute to it meeting the SEARs requirements.

5.1 ESD DESIGN APPROACH

The ESD design approach for the project seeks to deliver a very low energy and highly sustainable building without complicating the design and ongoing operation. The ESD and Green Star solutions proposed have been targeted towards a commercially acceptable outcome on the expectation that a developer-led delivery approach may be undertaken.

The use of complex technology will be avoided in favour of holistic design approaches and sound engineering principles. The ESD design will seek to deliver an integrated design approach where all members of the project team work together to achieve market leading sustainable performance.

Key design aspects are discussed in the following sections.

5.2 BUILDING FABRIC AND MASSING

The fundamental approach to be taken in designing a sustainable building is to design the orientation and massing of the building to limit unwanted solar exposure while providing good indoor environment quality. The orientation and massing of Bankstown City Campus development is largely defined by the site footprint and orientation, and the requirement to minimise overshadowing of the Paul Keating Park. The core of the building is located to the east of the floor plate.

The project has an extensive external shading system provided on all façade excepts the terrace areas, ground floor retail facades and to a lesser extent the south facade. Based on collaborative design evaluation between Umow Lai, Inhabit and Lyons, the shading system has been optimised so that solar loads are minimised across the façade. The external shading scheme consists of horizontal banded shading blades across the north façade, vertical shades blades to the east and diagonal sloped shading fins to the west. The south facing façade features minimal shading protrusion due to limited direct solar gains on this façade. Glazing will be high performance low-E double glazing with excellent solar control and daylight transmission properties.

Massing of the building has been designed to daylight access deep into the floor plate with terraces providing important occupant amenity access.

The overall arrangement provides the building with low façade loads allowing highly efficient energy systems to be used to maintain occupant comfort.

5.2.1 Building Fabric

In order to reduce the energy consumption associated with active heating and cooling systems, the development will incorporate sufficient levels of insulation to provide a high performing building fabric.

A high performing building fabric is relevant for a University development in Sydney’s climate. Space conditioning will occur for extended hours through the day (to varying extent throughout the building). A building fabric which meets and/or exceeds minimum NCC requirements can significantly decrease the heating and cooling energy consumption associated with the facility.

The levels of insulation to be incorporated within the building fabric should be selected to meet or exceed the requirements of the NCC Section J. Typically, these are recommended to be as follows:

Table 2 *Building Fabric Insulation Performance*

Building Fabric Component	*Recommended Insulation Level (Total System R-value)*
Exposed Ceilings/Roof	R4.2
Exposed Exterior Walls	R2.8
Exposed Suspended Floors	R2.0
Walls between conditioned and unconditioned spaces	R1.8
Floors between conditioned and unconditioned spaces	R1.0

5.2.2 Preliminary Glazing Performance

The current architectural proposal includes large areas of vision glazing, which will require high performance façade systems to meet the overall project requirements.

In order to optimize the building façade performance Umow Lai have proposed different options with different glazing configurations, external shade design options and electrochromic glazing. The results of all such options were presented in the separate Façade ESD Options Report.

The preliminary minimum glazing performance properties proposed are as follows:

Table 3 *Proposed Glazing Performance*

Parameter	*Retail Facades*	*Main Tower Facade*
Total System U-value	4.6 W/m^{2}K	3.0 W/m^{2}K (shading) 3.5 W/m^{2}K (no shading)
Total System SHGC	0.62	0.23
Glass Only U-value	3.5 W/m^{2}K	1.6 W/m^{2}K
Visual Light Transmission	42%	42%

5.2.3 Air-tightness

Air-tightness of the building envelope contributes significantly towards overall energy efficiency. The building will be pressure tested during construction as part of the Green Star DAB v1.2 building commissioning requirement (see Section 5.3.1).

Umow Lai have set a target air leakage rate of 5m3/hr.@50Pa, which is considered 'normal' practice for an air conditioned office type building in the UK (refer ATTMA TSL2 Issue 1). The required methodology for whole of building air pressure testing and this performance requirement be written into the construction contract.

5.3 Management Strategies

It is expected that the majority of the Green Star Management credits will be targeted by the project. Significant emphasis will be placed on commissioning activities, building tuning and the management of the site during construction. Comprehensive metering will be investigated to provide facility management with sufficient information to operate BCCD efficiently.

5.3.1 Commissioning

Comprehensive building pre-commissioning, commissioning and quality monitoring will be required by the appropriate contractors and trades on site.

Note that it is now a requirement of Green Star Design and As Built v1.2 that whole building air pressure testing must be conducted as part of the commissioning process. This will require the engagement of a specialist air pressure testing contractor to advise the head contractor on air leakage minimisation during construction and to conduct the final air pressure testing. Architectural detailing will also need to take account of the requirement for the building to deliver a high degree of air tightness.

Transfer of all documentation regarding design intent, as-installed details, commissioning report and training of building management staff to the Building Owner/Manager.

To ensure the optimum energy performance of the building, an Independent Commissioning Agent (ICA) should be engaged to provide advice to the client and to the design team to monitor and verify the commissioning of the HVAC and building control systems. Umow Lai have provided an ICA scope to assist with engagement.

The installing Contractors will be committed to a 12 month building tuning period after handover, including minimum quarterly reviews and final recommissioning after 12 months. This will require the installation of a comprehensive energy monitoring system in the BMS.

In addition to the requirements of the Green Star manual we would propose that the Contractor undertakes an intense initial fine tuning commissioning phase during the first quarter with formal monthly reporting of energy performance across the defects liability period.

5.3.2 Building Users Guide

To enable the building users to achieve the environmental performance envisaged by the design team, a comprehensive Building Users Guide will be prepared for use by the tenants and building management.

5.3.3 Construction Management

In order to minimise environmental impact during construction, the Contractor will be required to provide and implement a comprehensive, site-specific Environmental Management Plan (EMP) during the construction works.

In addition, the Contractor will be required to have ISO14001 Environmental Management System accreditation applicable to the construction of the building.

5.3.4 Metering

Metering and sub-metering shall be provided in accordance with Green Star and tenancy requirements, where applicable. Should a future NABERS Energy rating be required for part of the building, then additional electrical and thermal metering would be required to differentiate those areas covered by the rating.

A comprehensive energy monitoring system will be required to fulfil the requirements for Green Star commissioning and building tuning credits.

5.4 INDOOR ENVIRONMENT QUALITY

The design response will provide for high levels of indoor environment quality through the provision of daylight and views, well-designed artificial lighting systems and consideration of thermal comfort.

Emissions of pollutants from internal finishes and furniture will be reduced through the broad application of low VOC and low formaldehyde products.

5.4.1 Indoor Air Quality

The indoor air quality (IAQ) in BCCD will be continuously monitored by a carbon dioxide (CO_2) monitoring system which will be used to adjust the outside air ventilation rates being provided to the space to ensure a high level of IAQ.

A fan coil system with high induction air diffusion will be designed to achieve a high air change effectiveness for improved IAQ.

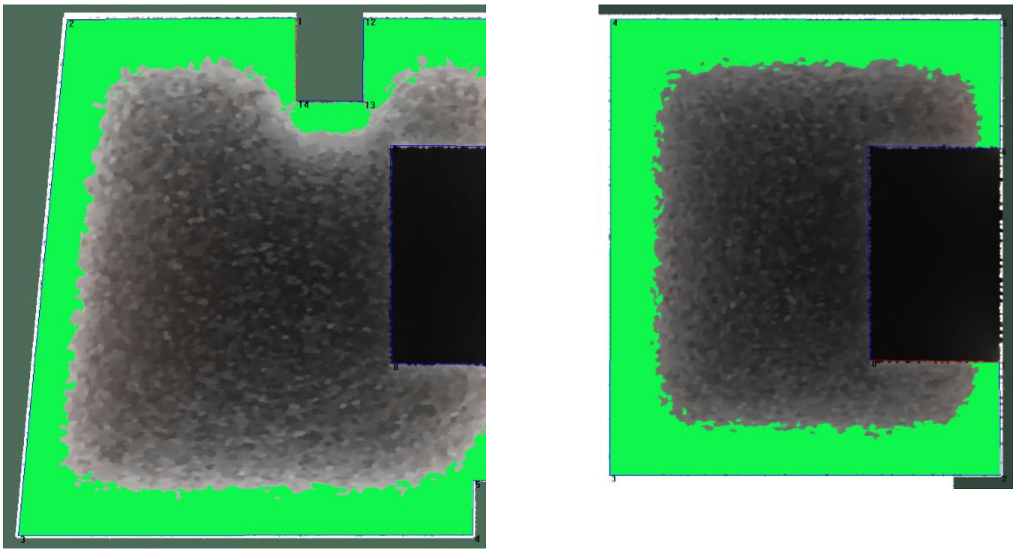
High efficiency air filtration shall be provided to all air handling units to further enhance IAQ

5.4.2 Daylight

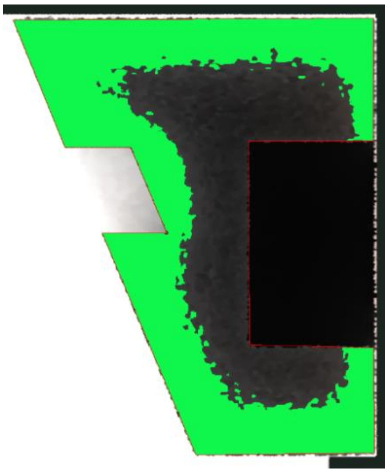
The external glazed façade has been designed to provide excellent daylight levels across the floor plate while also providing good energy efficiency. Advanced glazing technology with spectrally selective coatings allows reasonably high levels of visible daylight to transmit through the windows while rejecting a high proportion of solar radiation. This combined with external shading provides an excellent balance between daylight, views, glare control and energy efficiency.

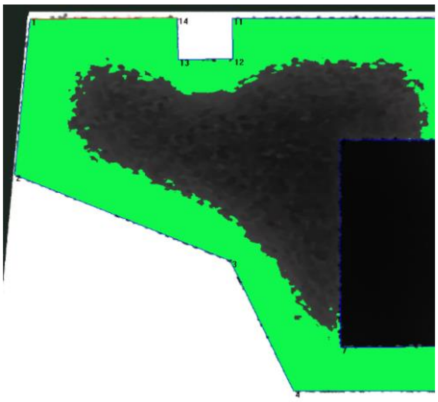
The following image shows preliminary daylight modelling conducted for ‘typical’ levels 2, 5, 7, and 14. The areas shown in green are where the Daylight Factor is equal or greater than 2%

Figure 1 *Typical Floors Daylight Factor ≥2%*



Level 2 *Level 5*





Level 7 *Level 14*

Table 1 *Sample Floor Daylight Modelling Results*

Level	*L2*	*L5*	*L7*	*L14*
Floor Area (m^2)	2685.6	1932.6	1215.6	1243.1
Area DF>2.0% (m^2)	866.7	769.9	703.8	671.8
% Compliant	32.3%	39.8%	57.9%	54.0%
Floor Area (m^2	2685.6	1932.6	1215.6	1243.1

When area-weighted across the whole building, these results show that approximately 45% of the total floor area receives a Daylight Factor equal or greater than 2%, which achieves 1 point for the relevant Green Star credit.

5.4.3 Lighting

The building interior lighting will be carefully designed to optimise occupant comfort. High quality LED light fixtures will specified for their energy efficiency, high colour rendering index (CRI) and long life span when compared to alternative technologies.

The use of indirect/direct lighting for the office areas will be considered, with the base building office lighting designed for a maintained illuminance level of no more than an average of 320 lux as measured at the working plane.

Perimeter daylight dimming and occupancy sensor control will assist in maintain lighting levels efficiently.

5.4.4 Thermal Comfort

The high performance façade system in conjunction with the air conditioning systems will be designed to ensure high thermal comfort conditions leading to greater occupant satisfaction and improved productivity.

Predicted Mean Vote calculations will be carried out to ensure radiant and convective climate effects are properly considered for all occupants over the entire floor plate to ensure perimeter and core zone comfort is maintained through correct shading and air conditioning zoning.

During the next design phase, thermal modelling of the building will be undertaken to calculate the comfort performance of the building in accordance with ISO7730.

5.4.5 Noise

Detailed design will be performed to ensure that the building services achieves ambient internal noise levels in accordance with AS/NZS 2107:2000, to ensure comfort of the building occupants. Compliance with the Green Star acoustic credits will require acoustic testing by registered professionals. This acoustic testing will be undertaken by a specialist sub-contractor to be appointed by the Contractor.

5.4.6 Minimisation of Internal Air Pollutants

The materials used in the construction of the building will be specifically selected to minimise off-gassing of Volatile Organic Compounds (VOC) and Formaldehyde, which can negatively impact IAQ.

- All paints used in the construction will be zero-VOC paints
- Carpets will be specially selected to be low-VOC
- It is proposed that only low formaldehyde composite wood products will be utilised
- A dedicated tenants' exhaust riser will be installed as part of the base building in accordance with AS1668 Part 2. Reticulation form this riser to tenants photocopying/printing areas will be undertaken as part of the fitout for extraction of contaminants from the building. Note that this exhaust extraction will not be required where complying low emissions photocopying/printing equipment is installed in the tenancy.

5.5 Energy Efficiency

Energy efficiency design approach begins with a high performance façade to reduce the overall energy requirements of the building. This allows simpler services systems to be used utilising well understood systems and design approaches.

The demands minimised through a high-performance façade will be met with mechanical services designed for energy efficient performance. Conventional and well understood air delivery systems will be applied, with highly efficient fans and equipment (e.g. chillers & boilers).

Energy consumption associated with artificial lighting systems will be minimised through high performance (e.g. LED) fittings and effective lighting controls including daylight dimming and localised presence detection.

Improvement in energy efficiency will form a primary strategy to assist in achieving the 5-Star Green Star DAB Energy performance.

5.5.1 Building Fabric

The building façade has been designed for energy efficiency as described in Section 5.2 of this report.

5.5.2 Energy Efficient Air Conditioning Design

The initial concept design included a low temperature variable air volume (VAV) system. In order to reduce plant space throughout the building, this has been changed to an in-ceiling fan coil solution.

Traditionally VAV systems are more energy efficient than in-ceiling fan coils due to their ability to reduce fan speed when peak air supply is not required (the majority of the time).

Umow Lai have recommended a number of efficiency measure to be included into the fan coil system design:

- Variable speed EC fans controlled by space load demand and occupancy.
- Demand control ventilation controlled by carbon dioxide (CO_2) monitoring system.

These items have been accepted and incorporated by the mechanical engineer.

In addition, the air conditioning system will include the following features:

- Electric motors will be high efficiency.
- High efficiency water-cooled chillers will be selected.
- High efficiency condensing gas boilers will be selected.
- High efficiency variable speed pumping systems for the chilled water and heating hot water systems.
- Plant energy use will be monitored and optimised using the Building Management System.

5.5.3 Electrical Design Initiatives

LED lighting will be specified for energy efficiency performance. Dimmable control will also be provided to light fittings with daylight sensors along perimeter areas to allow for daylight compensation control. Initial daylight simulations indicate that these daylight areas will extend well into the floor plate – see Section 5.4.2.

All substantive energy uses within the building will be sub-metered and in addition, sub metering will be provided for each floor and tenancy. This will be linked through an energy monitoring system to allow trending of energy uses daily, weekly and annually. The data collected will be provided in the correct format for the NABERS Energy rating.

The base building lighting system design will be configured with controls to minimise the extent of lighting of unoccupied areas. Design measures include:

- All individual or enclosed spaces to have individual switches and motion sensors.
- The size of individually switched lighting zones will not exceed $100m^2$ for 95% of NLA.
- Switching will be clearly labelled and easily accessible by building occupants.
- Car parks, toilets and escape stairs to allow the provision of high sensitivity ultrasonic occupancy sensors to ensure that switching off of lights can be employed.

5.5.4 Renewable Energy – Solar PV

The cost of renewable energy systems such as Solar PV have fallen dramatically in recent years while the costs for grid electricity has risen significantly. While trends such as off-site renewable energy Power Purchase Agreements (PPA's) become popular in tertiary education, this does not avoid the cost of network charges or renewable firming capacity. Therefore on-site renewable energy remains a very attractive proposition and is also strongly rewarded within the Green Star rating. (Green Star benefits of PPAs are lower than those for site-installed PV).

The use of on-site Solar PV arrays to generate energy is an effective and cost competitive solution to hedge institutions against long term energy costs and fluctuations. It is therefore proposed that most of the roof area will contain Solar Photovoltaic panels to provide renewable energy supply into the building.

Preliminary analysis has been undertaken to determine the maximum solar coverage that can be achieved on the available roof area. This will be reduced due to the requirement for some roof mounted mechanical plant an associated access, and the precise system capacity is still under development by the design team.

At this stage of the design we anticipate that an array size of up to 99 kW will be achievable, with an annual energy yield of approximately 133,000 kWh.

5.5.5 Preliminary Energy Modelling

Preliminary energy modelling has been undertaken incorporating the energy efficiency measures of the building envelope, building systems, and solar PV as described in this report.

Figure 2 *Whole Building Energy Model*

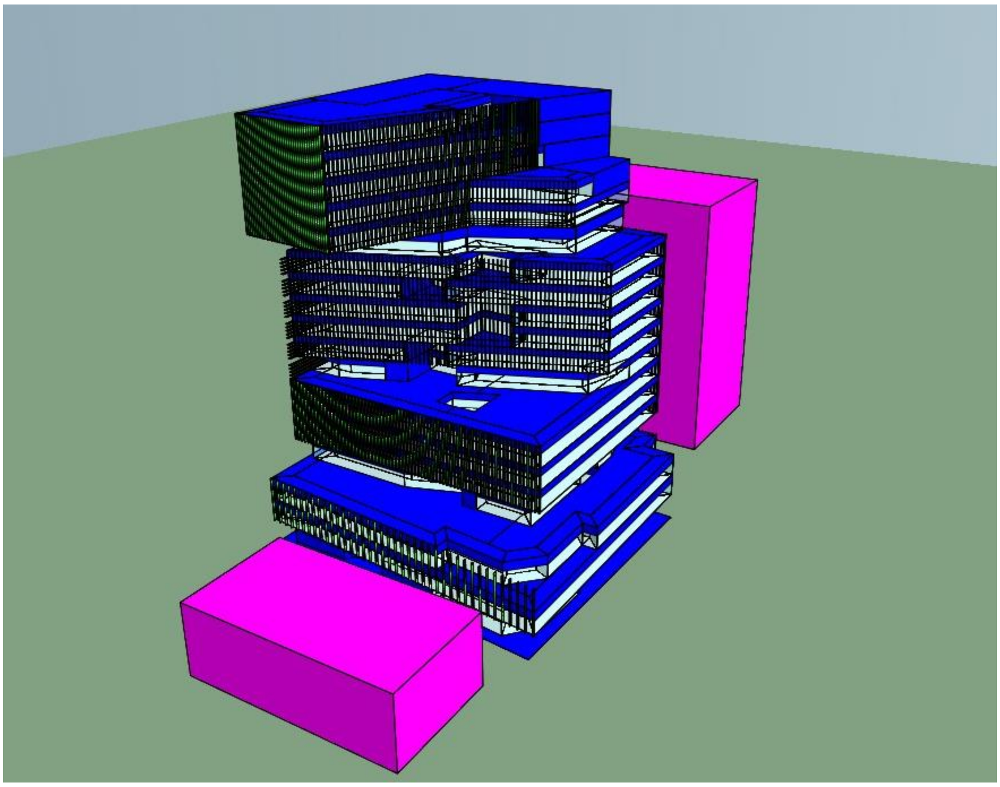


Table 2 *Green Star Energy Modelling Assumptions*

Parameter	Preliminary Assumption
Building Envelope	As per section 3.2 High performance glazing and air-tight
Heating, Ventilation, Air-conditioning	Condensing gas boilers (95% eff.) Water-cooled chiller (IPLV 7.5) FCU's including variable speed and CO2 demand control ventilation Ventilation fan energy 90% of Section J 2016 max. Carpark fan energy 70% of Section J 2016 max.
Lighting	Lighting energy 65% of Section J 2016 max.
Domestic Hot Water	Proposed usage 60% of reference case
Vertical Transport	8 kWh/m2
Solar PV	99kW = 134,000kWh/year

This results in the following preliminary and target Green Star Energy points scores that will be further refined as the project progresses.

Table 3 *Preliminary Green Star Energy Results*

Category	Minimum Points	Target Points
Façade Reduction	1.4	1.6
GHG Emission Reduction	4.6	4.9
Renewable Energy	1.0	1.0
Peak Energy Demand	1.9	2.0

5.6 TRANSPORT

The site's location provides significant benefit for public transport access. Cyclist facilities will also need to be provided to meet Green Star and planning requirements, including comprehensive End-of-Trip facilities for staff. The provision of more sustainable forms of transport will reduce the usage rates of car parking on site.

The performance based approach in Green Star is proposed for the Green Star transport category. Detailed analysis of sustainable transport performance will be required to be undertaken by the project Transport Consultant to compare the building to a reference project.

5.6.1 Car Parking

Part (15%) of the car parking should be designed to encourage the use of smaller, more efficient vehicles.

The provision of Electric Vehicle (EV) charging infrastructure and dedicated charging bays (5% Min 3 phase Mode 3 charging) is also strongly encouraged. EV's are anticipated to dramatically transform vehicle fleets over the coming decade and provision should be made in the design of the electrical infrastructure to support a significant quantity of destination charging to occur in the building.

5.6.2 Cyclist Facilities

A substantial cyclist facility will be provided to encourage occupants to cycle to work located for easy access into the building.

Facilities will include secure tenant bicycle storage, showers, secure lockers, changing and drying facilities.

Standard Green Star benchmarks rates for cycle racks and end of trip facilities are as follows:

Table 4 *Green Star Benchmark Cyclist and End of Trip Facilities*

Facilities	Benchmark Requirement
WSU Staff Secure Bike Racks	7.5% of Total Regular Occupants
WSU Students Secure Bike Racks	10% of 75% of Peak Occupants
Visitor Secure Bike Racks	5% of Peak Visitors
Showers for staff only	300-500 Staff = 8 Showers Additional 2 showers per extra 250 staff
Lockers for Staff	1.2 locker/bike rack

As the project is pursuing a performance based approach, it is expected that cyclist facilities for the building less than the above benchmark requirements will be required to meet the Green Star requirements.

5.7 Water Efficiency

Water efficiency will be given a high-priority given the significant demands likely of a large building of this nature.

Water efficiency will be assisted through the use of rainwater harvesting to the extent available from the building footprint. This non-potable water resource is a potential source to be used for toilet flushing, irrigation and to potentially supplement heat rejection demands. However given the ratio of building footprint to area, rainwater may be limited in its impact.

Measures employed include:

- The use of water efficient (generally 5 Star rated where possible) fittings for basin, pans, sinks, urinals and showers.
- 45kL rainwater collection tank with harvested water used for toilet flushing throughout the building, irrigation and potentially heat rejection (cooling towers).
- Any landscaping will be designed to be water sensitive.
- Water meters will be installed for all major water uses. These will be linked to the Building Management System to provide a leak detection system.
- Collection or recirculation of all fire protection system test water and maintenance drain-downs for reuse on-site.

5.8 MATERIALS

Responsibly sourced materials including steel, timber and PVC, will be applied extensively. Life Cycle Analysis can be applied to assist in materials selection but is not proposed at this stage. Some areas of sustainable materials use such as Portland cement replacement in concrete are not recommended at this stage due to the potential impact on project cost and program.

5.8.1 Recycling Waste Storage

A dedicated storage area will be provided for the separation, collection, and recycling of consumables with access for all building occupants and for collection by recycling companies. The storage area shall be adequately sized to allow for recycling of, as a minimum, paper, glass, plastics, metals, and organic (compost) materials. The current size of the recycling facility has been determined by a waste consultant engaged as part of the consultant team.

5.8.2 Waste Reduction

In order to reduce waste, consideration will be given to selecting materials to be used in the building construction and refurbishment to have a significant recycled content and that utilise Environmental Management Systems in the manufacture.

5.8.3 Steel

The responsible sourcing of steel for use in reinforcement is proposed in accordance with Green Star requirements.

5.9 LAND USE ECOLOGY AND EMISSIONS

5.9.1 Sustainable Sites

Roof treatments (other than PV) will be carefully considered to minimise impacts of the heat island effect. Roofing materials with high albedo will be investigated.

Stormwater runoff will be mitigated in terms of run-off volumes and quality of the water discharged to the municipal stormwater system.

5.9.2 Stormwater Management

The quality and quantity of stormwater released from this site post development is a significant factor for consideration both within the town planning and sustainability contexts.

The following performance objectives should be demonstrated within the new development:

- Reduction in the impact of stormwater run-off.
- Improvement in water quality of stormwater run-off.
- Achievement of best practice stormwater quality outcomes.
- Incorporating water sensitive urban design principles where possible.

▪ The project design will include measures to mitigate the impact of litter, sediments and pollution entering stormwater systems and downstream waterways. Detailed information on proposed maintenance and site management plans will need to be provided as the design progresses.

5.10 Emissions

5.10.1 Refrigerants

The design will include the use of refrigerants in HVAC systems which have an Ozone Depletion Potential (ODP) of zero.

5.10.2 Light Pollution

The design will endeavour to minimise light pollution in that no direct beam light will be directed beyond the site boundaries or upwards to the night sky.

5.10.3 Watercourse Pollution and Reduced Flow to Sewer

Rainwater harvesting systems will be designed to provide on-site detention and filtration of stormwater leaving site, and the potable water conservation strategies will also have a secondary benefit of reducing waste water produced by the building.

5.10.4 Insulant ODP

The design will specify thermal insulation which avoids the use of ozone depleting substances in either manufacture or composition.

5.11 Innovation

The expansion of the Innovation category within the Green Star DAB tool will be exploited to achieve a the maximum number of innovation points. Innovation initiatives will be further investigated, such as exceeding Green Star benchmarks, local procurement, financial transparency, market transformation, contractor education and the undertaking of a pre and post occupancy survey.

6 CONCLUSION

This report has demonstrates meets the Bankstown City Campus development meets the SSDA submission SEARS requirements. These are in addition to the minimum compliance requirements of the NCC (i.e. Section J).

As a result of the ESD initiatives discussed within this report, the Bankstown City Campus development is expected to achieve a level of environmental sustainability consistent with the SEARs requirements.

The sustainability measures implemented in the design aim to ensure that the development has enhanced energy efficiency, thus minimising the associated greenhouse gas emissions. Potable water use will be minimised through water conservation measures, including Water Sensitive Urban Design initiatives. The project also includes measures to minimises waste going to landfill through the construction and operational stages, while increasing the rate of material reuse and recycling.

As detailed in this ESD Statement, the Bankstown City Campus development has demonstrated the design potential to achieve the SSDA submission SEARS requirements.

APPENDIX A - PRELIMINARY GREEN STAR ANALYSIS

The tables across the following pages shows the preliminary Green Star Office Design and As Built Version 1.2 assessment for the Bankstown City Campus Development Project. The individual credits shown are indicative and may change in the final design, however the overall rating target of 5 stars would still be achieved.

The preliminary credit scores are provided in the two far right columns the first being the current points targeted and the second being potential additional points possible with the project design.

This analysis shows that the proposed design would comfortably be able to achieve the

required 5 Star Green Star ratings (minimum 60 points required) with numerous additional points also available.

The Green Star Design and As Built Version 1.2 rating is a combined design and as built rating with formal certification only being awarded at the conclusion of the as-built stage.