Australian National University

ANU Sustainability Specifications

Version 2.1 December 2012

Contents

Glossary

ACH	Air Changes per Hour
AFARDI	Australasian Furnishings Research and Development Institute
AFFL	Above Finished Floor Level
ARI	Average Rainfall Interval
BCA	Building Code of Australia
BMS	Building management System
COP	Coefficient Of Performance
DF	Daylight Factor
DHW	Domestic Hot Water
EMP	Environmental Management Plan
ESD	Ecologically Sensitive Design
FSC	Forest Stewardship Council
GECA	Good Environmental Choice Australia
GFA	Gross Floor Area
GHG	Greenhouse Gas
HDPE	High Density Poly Ethylene
HVAC	Heating Ventilation and Air Conditioning
ICA	Independent Commissioning Agent
IEQ	Indoor Environment Quality
LSZH	Low Smoke Zero Halogen
MANV	Mechanically Assisted Naturally Ventilated
MD	Motion Detector
NLA	Nett Lettable Area
ODP	Ozone Depleting Potential
PFC	Power Factor Correction
POE	Post Occupation Evaluation
PVC	Poly Vinyl Chloride
SHGC	Solar Heat Gain Coefficient
TAUL	Typical Urban Annual Loads
UFA	Usable Floor Area
VOC	Volatile Organic Compounds
WMP	Waste Management Plan

Introduction

ANU faces a series of challenges in regard to developing and operating its building stock, primarily, operational cost, emissions intensity and the resulting implications of maintaining their reputation as a world leading institution.

Ecologically Sustainable Design (ESD) initiatives are often 'value managed' out of the design and construction process as being too costly when the design and construction process is managed as a conventional property development. ANU however is not a conventional property developer since it will typically own a building from design, through refurbishment and or extension to demolition. Consequently ANU directly benefits from whole of life efficiencies that are not realised to a typical property developer. In addition, ANU is subject to aggressive emission reduction targets whilst growing its operations and has committed, via an Environmental Management Plan, to achieving world leading environmental performance as an organisation. Membership of the 'Group of 8' provides significant external pressure to demonstrate effectiveness of their policies.

Consequently ANU requires a building standard that requires building stock to improve environmental performance significantly faster than the Building Code of Australia requires. This is complicated by the cost associated with achieving certification with more stringent standards such as Green Star. If the ESD initiatives are implemented throughout the design and construction process the direct cost of achieving a Green Star rating has no environmental benefit. In addition, many projects ANU undertakes such as extensions, minor works and small structures are not eligible, or financially feasible to obtain a Green Star rating. The tendency is therefore that the projects that do not target a Green Star rating do not follow as rigorous an ESD framework. Therefore ANU has chosen to develop a 'Sustainability Standard' which requires, that ESD considerations are taken into account on all projects.

The goal is that the Sustainability Standard will facilitate implementation of ESD initiatives through:

- Improved internal ESD knowledge and expertise;
- Understanding amongst external service providers (design teams, builders & contractors) of the ANU ESD requirements
- Capture of ESD improvement strategies when they arise during repair, refurbishment and new construction;
- Reduced cost in achieving ESD goals, enabling increased spending on ESD initiatives;
- Improving performance of existing building stock; and
- Affecting a culture change from 'deemed to satisfy' to 'world's best practise'

The development of the Sustainability Standard has drawn upon the knowledge and experience of ANU staff that are responsible for the maintenance and refurbishment of existing facilities as well as the delivery of new facilities. This information has been combined with current ESD practices being adopted across a range of industry sectors in both Australia and Overseas. It also draws heavily from the Green Star suite of tools as ANU already has experience in the application of the Green Star standards and it embodies a significant body of work in incorporating ESD initiatives in the design and construction process.

Whenever ANU undertakes a building project that is intended to demonstrate world's best practise, and improve the knowledge and expertise of ANU Facilities and Services, a formal Green Star rating may also be undertaken. The alignment of the Sustainability Standard with the Green Star tools will enable ANU to make this commitment, when appropriate, from a well-informed position.

It should be noted that the Sustainability Standard requirements are the base level of ESD performance ANU will require of all projects. All projects will be encouraged to go beyond these requirements and to achieve higher levels of ESD performance.

The Sustainability Standard requirements have been developed in a number of categories that reflect the different ESD aspects being addressed. These categories include:

- Management
- IEQ - Health and Wellbeing
- Building Envelope

- Energy Systems
- Water
- Transport
- Materials
- Landscape
- Community

Under each of these categories are listed the specific sustainability requirements. Whether they are applicable to Major Works, Minor Works or Maintenance is noted for each.

Required Initiatives for Different Scale of Works

Initiative	Applicable works		
	Major	Minor	Maintenance
1.1 Modelling Requirements	✓		
1.2 Metering & Monitoring	✓		
1.3 Sustainability Information Display	✓		
1.4 Building Commissioning & Tuning	✓	✓	
1.5 Pre and Post Occupancy Evaluation	✓	✓	
1.6 Building Occupant Guide and Education	✓	✓	
1.7 Maintainability	✓	✓	
1.8 Environmental and Waste Management	✓	✓	✓
2.1 Ventilation	✓	✓	
2.2 CO2 Monitoring	✓	✓	
2.3 Daylight	✓		
2.4 Shading	✓	✓	
2.5 External Views	✓		
2.6 Hazardous Materials	✓	✓	✓
2.7 Volatile Organic Compounds	✓	✓	✓
2.8 Floor Coverings	✓	✓	✓
2.9 Formaldehyde Minimisation	✓	✓	✓
2.10 Indoor Plants	✓	✓	
3.1 Minimum Insulation Values	✓	✓	
3.2 Glazing Performance	✓	✓	
3.3 Building Sealing	✓	✓	
4.1 Power Factor	✓		✓
4.2 Electrical Sub-metering	✓		
4.3 Internal Lighting	✓	✓	✓
4.4 External Lighting	✓	✓	✓
4.5 Passive & Low Energy Heating, Ventilation & Cooling	✓	✓	
4.6 HVAC	✓	✓	✓
4.7 Domestic Hot Water	✓	✓	✓
4.8 Appliances	✓	✓	✓
5.1 Fittings and Fixtures	✓	✓	✓
5.2 Rainwater	✓		
5.3 Greywater	✓		
5.4 Water Sub-metering	✓	✓	
5.5 Heat Rejection Water	✓	✓	
5.6 Landscaping Water Use	✓	✓	
5.7 Fire System Water	✓	✓	
6.1 Provision for Electric Vehicles	✓		
6.2 Cyclist Facilities	✓	✓	
6.3 Telecommuting and Videoconferencing	✓	✓	
7.1 Recycling Waste Storage	✓	✓	

7.2 Concrete and Masonry	✓	✓	✓
7.3 Structural Steel	✓	✓	✓
7.4 Furniture Standards	✓	✓	
7.5 Duct Material	✓	✓	✓
7.6 Sustainable Timber	✓	✓	✓
7.7 PVC Avoidance	✓	✓	✓
7.8 Joinery	✓	✓	✓
7.9 Insulant ODP	✓	✓	✓
7.10 Refrigerant Selection	✓	✓	✓
7.11 Local Sourcing	✓	✓	✓
8.1 Trees	✓	✓	✓
8.2 Topsoil	✓	✓	✓
8.3 Habitat	✓	✓	
8.4 Edible landscapes	✓	✓	
8.4 Stormwater	✓	✓	✓
9.1 External teaching spaces	✓	✓	
9.2 Recreation areas	✓	✓	

Sustainability Standard Application

The Sustainability Standards are intended to be used for maintenance, minor works and new construction activities at ANU. Whilst the standards are a comprehensive coverage of ESD issues, the scope of application will be defined by the nature of the work being undertaken. Separate operational processes will be developed and documented for the different types of work yet are summarised below.

Major Works

Major Works covers all work that is delivered by the Facilities and Services Division and typically involves major refurbishments and new extensions or stand-alone buildings.

At project commencement a suitably qualified professional will be appointed by ANU to act as the Sustainability Advocate for the project to ensure Sustainability Standard requirements are addressed at the appropriate project phase. This person will be independent to the design team and will report directly back to the ESD Subject Matter Manager(s).

The role of the Sustainability Advocate is to:

- Engagement of the Design Team
    - Brief the design team on the requirements of the Sustainability Standard prior to formal engagement and project commencement
- Design Meetings
    - Attend the majority of design meetings and alert the design team to opportunities to improve environmental performance and risks to Sustainability standard compliance.
- Preliminary Sketch Plan Design Review (PSP)
    - Undertake a review of the PSP documentation to ensure that Sustainability Standard objectives are met. All modelling reports must be reviewed and the outcomes for design incorporated in the next phase of the design process.
    - A written report noting compliance with Sustainability Standard requirements will be drafted (Sustainability Compliance Report).
- Final Sketch Plan Design Review (FSP)
    - Undertake a review of the FSP documentation to ensure that Sustainability objectives are met.
    - Ensure modelling of the final design meets the ESD performance requirements, in: Façade Performance; Thermal performance; Energy intensity; Daylight penetration; and HVAC performance before approving for construction.
    - The Sustainability Compliance Report will be updated at this stage.
- Construction Documentation Review
    - Review tender documents and contracts to ensure Sustainability Standard requirements are appropriately specified.
    - The Sustainability Compliance Report will be updated at this stage.
- Construction Management Assistance
    - Provide subcontractor induction to ensure the relevant Sustainability Standard requirements are clearly understood by sub-contractors.
    - Periodic auditing of the construction site to determine appropriate product use and collection of sub-contractor supporting documentation to demonstrate their compliance.

Minor Works

Minor works typically involve small refurbishments or building upgrades in existing facilities to improve amenity or to adapt a space to a new mode of usage. Whilst they are termed ‘minor’ they can still have a significant cost and potential for environment impact.

At the start of the project a meeting will be held with the Project Manager and the Sustainability Advocate to discuss the project and identify where Sustainability applies. To avoid the cost and time involved in having the Sustainability Advocate involved throughout each project a standard template report will be produced to be completed by the ANU Project Manager and submitted for approval.

Maintenance

Maintenance works are carried out in an ongoing manner at ANU, either in response to failure or damage and requiring repair, or through a preventative maintenance program. The individual projects are typically small scale and numerous.

To ensure that all maintenance activities are complying with the Sustainability Standard a training program will be developed for maintenance staff that provides information on the specific requirements that apply to typical maintenance activities. Regular meetings will also be held with maintenance coordinators to discuss forward programs and potential Sustainability requirements.

A simple (1 page) report will be developed that is to be completed for each job and notes where sustainability requirements apply and how they were complied with. These reports will be reviewed on a quarterly basis to confirm compliance.

1 Management

Items in the Management category relate to how a project is delivered and subsequently how the facility is operated.

1.1 Modelling Requirements

Applicable Works: Major, Minor

Modelling is required to inform the design process and fundamentally important to designing a high performance building. It is applicable to all new buildings and also to large extensions/refurbishment projects that have in impact on the thermal envelope. Consequently modelling is required to be undertaken early in the design process (at PSP stage) and then updated to reflect the final design (FSP).

The following modelling is minimally required:

- Thermal Performance of building envelope and subsequent thermal comfort conditions
- Daylight Modelling
- Shading analysis

The above models should be completed in accordance with the most recent version of the Green Star Education rating tool.

1.2 Metering & Monitoring

Applicable Works: Major.

To enable the monitoring of building performance suitable meters must be installed and either connected to the ANU campus-wide BMS or a stand-alone BMS. The installed system must also be able to export data to the ANU Sustainability Monitoring and Reporting System.

To meet this requirement the following must be implemented:

- A meter is to be installed within the facility to measure the consumption of all services entering the facility, including:
    - Electricity
    - Water (Potable, Grey, Black and Rain)
    - Gas
- Each meter must have the capacity to perform data logging at intervals appropriate to the application[1].
- All energy meters and sub meters (see 6.2 Energy Sub-Meters) must be connected to the ANU campus-wide BMS or to a stand-alone building BMS.
- Water meters must be connected to the ANU campus-wide BMS or to a stand-alone building BMS, however sub meters (see 7.4 Water Sub-Meters) are not required to be directly connected to the BMS.
- The BMS must:
    - provide alarms that facilities manager will be alerted via email, SMS or other communication method if an alarm is triggered;
    - be programmed such that significant changes in base load, peak load and diurnal variation for all services trigger alarms;
    - log and store all data available to the BMS;
    - Enable downloading of stored data to central facilities management for subsequent analysis;
    - Enable real time interaction with display systems.

[1] Energy data is required in 15 minute intervals. Water data is required hourly.

1.3 Sustainability Information Display

Applicable Works: Major; Minor.
An environmental information display must be located at the main entrance of the building in a clearly visible and accessible location and display information that clearly communicates building and site attributes that serve as an environmental learning resource to all building users and visitors. The building's environmental attributes are to be displayed in a manner that can be readily understood by building users, and meet the following criteria:

- A minimum of five (5) environmental features of the building must be displayed using a combination of text and graphics;
- Performance targets for energy and water consumption as well as greenhouse gas emissions must be provided.
- A facility for displaying actual performance data must be provided. This can either be an electronic display that is regularly updated from the BMS or a space where performance data can be manually posted (e.g. cork/black/whiteboard space).

1.4 Building Commissioning & Tuning

Applicable Works: Major; Minor.
All building services (BMS, mechanical, electrical, fire and hydraulic) are contractually required to perform comprehensive pre-commissioning, commissioning, and quality monitoring. Commissioning works outlined above are to be completed and reported in accordance with CIBSE Commissioning Codes.

At Practical Completion the design team and/or contractor must provide a Commissioning Report compliant with the code chosen from above, witnessed by an Independent Commissioning Agent.

Tuning of all building services is contractually required to continue for a minimum of 12 months after the latter of practical completion or occupation. The tuning period must include:

- Verification that systems are performing to their design potential during all variations in climate and occupancy over 12 months;
- Optimisation of time schedules to best match occupant needs and system performance; and
- Quarterly monitoring of utility data (electricity, gas and water) and comfort conditions (include user feedback) is undertaken and the outcomes are reported to ANU Facilities and Services;
- An Independent Commissioning Agent and the services design consultants are involved quarterly in building tuning operations and provide a report 12 months after practical completion. Failure to meet building performance targets is quantified and investigated to determine the cause of underperformance;
- All information gained regarding building performance, the seasonal optimisation of building systems and As Built building service operation is to be communicated to ANU Facilities and Services via a final Building Tuning Report.

1.5 Pre and Post Occupancy Evaluation

Applicable Works: Major; Minor.
A Pre Occupancy survey is required to be undertaken to assess current occupant satisfaction/comfort levels and to identify specific issues that can be addressed in the design of the new works.

A Post Occupation Evaluation survey is required within 12 to 18 months after practical completion of the works. The POE survey must cover occupant perception of Indoor Environment Quality (IEQ) factors and their interaction with building systems.

The Building Use Studies (BUS) survey is the ANU standard for a Pre Occupancy Survey. For a Post Occupancy Evaluation survey the BUS survey or a NABERS Indoor Environment rating is suitable.

1.6 Building Occupant Guide and Education

Applicable Works: Major; Minor.

The design and construction team must provide a Building Occupant Guide, which describes features of the building that the occupants interact with. The Building Occupant Guide must be able to be easily and clearly understood by the occupants include the following information:

- Building Services
    - Description of basic function and operation of the following, with simplified systems diagrams and an explanation of energy saving features:
        - Ventilation (including operable windows/louvers);
        - Heating system;
        - Cooling system;
        - Electrical systems;
        - Lighting; and
        - Domestic Hot Water (DHW)
- Transport Facilities
    - Car parking requirements and provision of cyclist facilities, conditions of access, and appropriate use. Also provide, where applicable, local public transport information, maps and timetables, and details or links on alternative methods of transport to the workplace, such as carpooling.
- Materials and Waste Policy
    - Include instructions on proper use for less common practices, such as composting, as well as information on recycling including:
        - What can be recycled;
        - Where the recycling storage areas are; and
        - Schedules for waste and recycling removal.

In addition, a 1-2 page document is to be prepared for the building, or for various distinct spaces in the building as appropriate, that lists the key information required for the staff/users in order to operate the building and/or different spaces in accordance with the design intent. The document should include simple, clear instruction on operating any features of the building requiring user intervention, such as operable windows, light switches, etc. This document should be prepared with consideration of the various education tools that ANU might use, such as:

- Information sheets to be located in the building, for example on doors and noticeboards;
- Key building use information being included on College intranets;
- Inclusion of key building use information and Building Users Guide in the induction of new staff to the building, both for the first intake of building users and for future users over the life of the building.

1.7 Maintainability

Applicable Works: Major; Minor.

The design and construction team must undertake a review of maintainability during the design process and provide a Building Maintenance Guide that describes the maintenance procedures required to maintain the correct operation of the building systems as the building progresses through its life cycle. The Building Maintenance Guide (BMG) must include detailed and easy to read guidance on access and maintenance for each of the following, where applicable:

- Internal and external building fabric (materials and surfaces):
    - Configuration/access for cleaning and painting purposes, particularly in spaces requiring regular cleaning (both internal and external building attributes);
    - Resistance to soiling of external and internal surfaces;
    - Properties of internal and external surfaces which affect the ability to clean;
    - Chemical use requirements including availability of products for maintenance of surfaces;
    - Renewing/reapplying surface finishes (e.g. painting);

    - Reduction of specialised products; and
    - Properties which affect the ability to apply surface finishes.
- Building Services (mechanical, electrical, lighting, hydraulic);:
    - Physical access to building services (e.g. duct work, air handling units, fan-coil units, controllers/sensors and the dimensions of openings and working spaces);
    - Ability to remove/install plant and equipment where necessary with minimal disruption to the building structure or fabric;
    - Provision of fault detection and isolation points for building services;
    - Ability of BMS to incorporate additional controls and be re-programmed;
    - Storage facility/space for maintenance and cleaning supplies, tools and equipment; and
    - Adequacy lighting for maintenance tasks.
- Modularity and repairability of key building components:
    - Reparability of elements (in preference to replacement);
    - Modularity of elements (to facilitate removal and replacement);
    - Standardisation and availability of replacement parts;
    - Labelling of components to facilitate repair and maintenance.

1.8 Environmental and Waste Management

Applicable Works: Major; Minor; Maintenance.
An Environmental Management Plan (EMP) must be in place for the entire construction process. The EMP must be Comprehensive, project-specific, and clearly demonstrate compliance with the requirements of Section 4 of the NSW Environmental Management System Guidelines 1998. The EMP must also explicitly address landscape conservation issues, such that the grounds of ANU are minimally impacted by the construction process by adverse effects of construction traffic and waste storage.

For Major Works the Head Contractor must have valid ISO 14001 Environmental Management System (EMS) accreditation prior to and throughout the project.

Before commencement the contractor must provide the relevant documentation for approval. For Minor and Maintenance works a simple template will be provided by ANU.

The EMP must also include a Waste Management Plan (WMP), and the contractor must retain waste records and submit quarterly reports to ANU Facilities and Services. At least 80%, by mass, of all demolition and construction waste must be re-used or recycled.

Waste must be separated on site into the various classes, with individual weigh bridge receipts provided to ANU Facilities & Services for the following waste streams:

- Concrete, brick and asphalt;
- Timber;
- Metal;
- Cardboard & Paper;
- Comingled
- Fill
- Landfill.

Separation and recycling of other waste streams is also encouraged.

2 IEQ - Health and Wellbeing

Indoor Environment Quality (IEQ) has a significant impact on health and wellbeing of building occupants are fundamental to the success of ANU since it is an academic institution which earns through the ability to develop and communicate intellectual information. Improved health and wellbeing of ANU staff and students consequently has a direct long term benefit to institutional earning potential.

2.1 Ventilation

Applicable Works: Major; Minor.

Buildings should be either naturally ventilated or for mechanically ventilated spaces, provide increased levels of outside air. To meet these requirements projects must:

- For naturally ventilated buildings 95% of the occupied spaces must be naturally ventilated in accordance with AS1668.2-2002. All areas nominated as naturally ventilated cannot be provided with other HVAC services.

OR

- For mechanically air-conditioned spaces projects the design ventilation rates (based on actual occupancy) represent a 100% increase on AS1668.2-1991.

For hybrid buildings both previous requirements are required to be satisfied.

2.2 CO_2 Monitoring

Applicable Works: Major; Minor.

Monitoring of CO_2 levels inside buildings enables the supply of outside air to be modulated based on occupancy levels. To meet this requirement:

- The HVAC return air system must be equipped with CO_2 sensors, connected to the BMS, such that the outside air flow rates can be adjusted for individually enclosed spaces. CO_2 sensors are to be continuously monitored by the BMS so that outside air flow can be modulated based on occupancy.

OR

- For a naturally ventilated building a CO_2 sensor must be installed in each separate space that provides a visual or audible alarm when CO2 levels rise above a set limit (suggest 900ppm).

2.3 Daylight

Applicable Works: Major.

Natural daylight has been demonstrated through numerous studies to provide substantial productivity and wellbeing benefits to building occupants. To ensure the comfort and wellbeing of staff and students in ANU buildings a minimum of 70% of the floor area of all offices, laboratories, teaching spaces (non-lecture theatre) and informal gathering spaces (e.g. tea rooms) must achieve a Daylight Factor >2.0%, achieved at desk-height level (720mm AFFL).

Spaces which have a specific use that preclude the provision of daylight (e.g. Laboratories that utilise Class 3a, 3b or 4 lasers) need not comply with this initiative.

2.4 Shading

Applicable Works: Major; Minor.

To avoid discomfort from direct glare and unwanted heat gain building facades must be designed such that for 80% of the working day (8am to 6pm) there is no direct sun entry.

2.5 External Views

Applicable Works: Major.
External views have demonstrated to play a significant role in occupant wellbeing by reducing eye strain and also providing psychological benefits. To meet this requirement:
Greater than 60% of work spaces* must have a compliant external view. Compliant external views are defined as:

- A direct line of sight to vision glazing less than or equal to 8m to the outdoors, or into an adequately sized and day-lit atrium.
- Line of sight must be greater than 45^{o} angle of incidence on vision glazing.
- No object greater than 1.5m in height that will obscure the view.
- For an atrium to be considered as providing an external view the atrium must be naturally lit, and every dimension of the atrium must exceed 8m.

*Work spaces are defined as spaces where staff or students typically spend 4hrs or more on any one day. Work spaces in which the work to be performed precludes external views (e.g. Laboratory which utilises Class 3a, 3b or 4 Lasers)

2.6 Hazardous Materials

Applicable Works: Major; Minor; Maintenance.
No projects are permitted to install materials that include hazardous materials, such as Asbestos, Lead or PCBs.

For projects that utilise some or all of existing building stock, or a brownfield site, a comprehensive hazardous materials survey must be carried out on the project site, as defined by the relevant Environmental and Occupational Health and Safety (OH&S) legislation.

Whenever asbestos, lead or polychlorinated biphenyls (PCBs) are found, they will be removed in accordance with the following standards:

Asbestos	Occupational Health and Safety (OH&S) legislation and relevant environmental legislation.
Lead	AS4361 'Guide to Lead Paint Management'.
Polychlorinated Biphenyls (PCBs)	ANZECC Polychlorinated Biphenyls Management Plan.

2.7 Volatile Organic Compounds

Applicable Works: Major; Minor; Maintenance.
Volatile Organic Compounds (VOCs) are found in many building products and are linked to headaches, cancer, liver and kidney disease and a major contributor to sick building syndrome. Use of Low VOC products impacts F&S staff directly, as they are exposed to the products during the most toxic curing phase.

All contractors and subcontractors are required to restrict paint, sealant and adhesive products to those that comply with the limits specified in this section. All subcontractors are required to provide the site manager with a product specific data sheet or MSDS which states the Total VOC (TVOC) content and test method used to determine the stated TVOC value. In addition, all subcontractors are to provide project specific supply documentation to demonstrate the products used on the project.

2.7.1 Paints

Paints are defined as any liquid applied finishes. Any paint applied on-site, must meet the TVOC Content Limits outlined in Table 1.

TVOC values should reflect the final product as mixed and ready to use, inclusive of tints. Numerous paint suppliers do not comply with manufacturer recommendations on tints and consequently tints applied must be clearly documented.

Product Type/Sub Category	Max TVOC content[2]
Walls and ceilings - interior gloss	75
Walls and ceilings - interior semi-gloss	16
Walls and ceilings - interior low sheen	16
Walls and ceilings - interior flat washable	16
Ceilings - interior flat	14
Trim - gloss, semi-gloss, satin, varnishes and wood stains	75
Timber and binding primers	30
Latex primer for galvanized iron and zincalume	60
Interior latex undercoat	65
Interior sealer	65
One and two pack performance coatings for floors	140
Walls and ceilings – exterior gloss	75
Walls and ceilings – exterior semi-gloss	70
Walls and ceilings – exterior low sheen	50
Any solvent-based coatings whose purpose is not covered in table	200

Table 1: TVOC limits allowed for paint products used on Sustainability projects.

2.7.2 Adhesives and Sealants

Any adhesive and sealant product(s) used in an internal application, and applied on-site, must meet the TVOC Content Limits outlined in Table 2. This includes both exposed and concealed applications.

Product Type	Maximum TVOC content[3]
Indoor carpet adhesive	50
Carpet pad adhesive	50
Wood flooring and Laminate adhesive	100
Rubber flooring adhesive	60
Sub-floor adhesive	50
Ceramic tile adhesive	65
Cove base adhesive	50
Dry Wall & Panel adhesive	50
Multipurpose construction adhesive	70
Structural glazing adhesive	100
Architectural sealants	250

Table 2: TVOC limits allowed for adhesive and sealant products used on Sustainability projects

[2] TVOC g/l of ready-to-use product
[3] TVOC g/l of ready-to-use product

2.8 Floor Coverings

Applicable Works: Major; Minor; Maintenance.

2.8.1 Carpet

The manufacturer environmental performance and life cycle costs of carpet are complex and investigated in detail by 3rd party certification organisations. Consequently Sustainability defines and will periodically review the 3rd party accreditation for carpet procurement. The current required certification required is one or more of the following:

- Carpet Institute of Australia Limited, Environmental Certification Scheme (ECS) v1.2
    - ECS Level 4 accreditation required
- GECA 50-2011 v2 - 'Carpets'
- GreenTag GreenRate v3.1[4] Level A

2.8.2 General Floor Coverings

Floor coverings not previously discussed in this section must comply with:

- GECA 25-2011 v2 - 'Floor Coverings'
- GreenTag GreenRate v3.1[5] Level A

2.9 Formaldehyde Minimisation

Applicable Works: Major; Minor; Maintenance.

Formaldehyde is a common VOC found in most engineered wood products (e.g. MDF and chipboard). To reduce the off-gassing of formaldehyde within buildings all engineered wood products must be low formaldehyde class E0 or better. This is required for all joinery, storage, doors and any other product that contains engineered wood products.

2.10 Indoor Plants

Applicable Works: Major; Minor.

Indoor plants improve the available oxygen, break down VOCs and other indoor pollutants and trap dust. In addition there is a positive psychological benefit. Consequently the increase in maintenance should be able to be recouped through improved staff performance.

For new buildings and major refurbishments of office areas the interior design should allow for:

- One ‘small’ plant (~200mm diameter pot) per occupant, and;
- At least two ‘large’ plants (pot diameter >300mm) in each common area, such as: tea rooms; lounges; reading areas; and foyers.

Plants must be evenly distributed throughout the space, in particular if there are individual offices/rooms. Plant species installed must have been tested for their suitability to be used indoor. Plants should be serviced on a weekly basis, or as determined by suitably qualified personnel. Plant servicing is to include disease prevention and detection, fertilisation and watering. Replacement of diseased plants or periodic rotation of plants to an outdoor environment may be required to maintain the benefits of the indoor plants.

[4] Or more subsequent version of standard. Note that version 3.2 already available for comment.

[5] Or more subsequent version of standard. Note that version 3.2 already available for comment.

3 Building Envelope

The thermal performance of a building envelope has a significant and ongoing impact on energy use and user comfort. Investment in improving the building envelope beyond minimum compliance will provide long term benefits.

3.1 Minimum Insulation Values

Applicable Works: Major; Minor.

The Building Code of Australia Section J lists minimum insulation values for the building envelope based on climate zones. The ACT is classed as climate zone 7 (out of 8 zones, with 8 being 'alpine areas').
To improve beyond minimum requirements all projects in the ACT region are required to comply with Climate zone 8 insulation requirements of BCA Section J as shown in the table below.

	Section J, 2011 Zone 7	Section J, 2011 Zone 8
Floor (slab on ground)[2]	1.0	2.0
Floor (elevated, open)	2.0	3.5
Roof and Ceiling[3]	3.7	4.8
Wall (external)	2.8	3.8

1. R values are a 'system' value that includes bulk insulation and construction materials.
2. This assumes no in-slab heating system. Where in-slab heating is installed Section J requirements are 1.25(2.25).
3. Assumes 99.5% of the roof is insulated. Where uninsulated areas exceed 0.5% of total area, insulation R values are increased (see BCA Section J 2011, Table J1.3b).

By way of context, the European 'Passivhaus' standard requires floor insulation levels of R 7.0 to 8.8, roof insulation levels of R 10.5 to 14.0 and wall insulation levels of R 8.8 to 10.6.

3.2 Glazing Performance

Applicable Works: Major; Minor.

Stipulation of glazing performance is a complex mix of orientation, size, shading, U value and Solar Heat Gain Coefficient. The BCA Section J Glazing Calculator takes all of these factors into account when assessing compliance.

As with the insulation values noted above, projects will be required to comply with the BCA Section J 2011 zone 8 glazing requirements.

3.3 Building Sealing

Applicable Works: Major

The majority of energy leaving a building envelope is via conditioned air leaking through the building fabric. Sealing the building consequently provides a significant increase in performance and therefore must be a high priority for design. Vapour should still be allowed to diffuse in and out of the structure to minimise condensation risks.

To ensure that appropriate building sealing is undertaken all major projects are required to undergo pressure testing during the building commissioning phase.

4 Energy Systems

4.1 Power Factor

Applicable Works: Major; Maintenance.
All buildings should achieve a Power Factor exceeding 0.95 under all operating conditions. This can be achieved via local Power Factor Correction equipment or precinct based systems.

Power Factor correction equipment must have an ongoing maintenance regime and be contractually established to ensure continuation of service.

4.2 Electrical Sub-metering

Applicable Works: Major.
Sub-metering of electricity within buildings facilitates better energy management as it provides information on the amount and consumption profile of different electricity end uses.

For all new building projects sub-metering of General Power, Lighting and Mechanical Services will be required. In addition, all substantive loads >100kVA must be individually metered.

All meters must be connected to the BMS to enable centralised data acquisition.

4.3 Internal Lighting

Applicable Works: Major; Minor; Maintenance.
Lighting energy use can constitute 30% or more of total energy use within a university building. Efficiency lighting systems with good control systems can substantially reduce this.

Lighting designs must conform to the following requirements:

- Lighting power density < 2W/m^2/100 lumens;
- All lighting linked to the ANU campus-wide BMS or a local lighting control system;
- Light switching zones no more than 100m^2;
- Lighting designs must achieve a maintained illuminance of not greater than 25% above the minimum maintained illuminance levels in Table E1 of AS1680.2.3 for 95% of all spaces.
- Where Daylight Factor in a room is >2% for more than 30% of the area or for >100m2 (whichever is the smaller) a daylight sensor and dimmable lights must be installed.
- Motion Detector (MD) controls for all areas that have irregular occupation[6].

4.4 External Lighting

Applicable Works: Major; Minor; Maintenance.
External lighting must have the following performance:

- All external lighting must have a light source efficacy of at least 50 lumens/watt;
- 95% of outdoor spaces meet or exceed the minimum requirements of AS1158 for illuminance levels; and
- 95% of all external lights are connected to daylight sensors (daylight sensors can be combined with a time switch).
- Downlighting is to be installed in preference to uplighting. Where uplighting is installed no direct light beam, generated from within the building or outside of the building boundary, is directed at any point in the sky;

[6] Spaces are considered to be irregularly occupied if not continuously occupied for more than 80% of a standard 9am – 5pm working day.

- The path of any direct light's angle of incidence directed to the sky must be obstructed by a non-transparent surface;
- The lighting design complies with AS4282 'Control of the Obtrusive Effects of Outdoor Lighting'; and
- Opportunities for the use of LED lighting should be addressed for each installation with a cost-benefit analysis undertaken that includes full lifecycle costs of purchase, maintenance, replacement and energy use.

4.5 Passive & Low Energy Heating, Ventilation & Cooling

Applicable Works: Major; Minor.
All projects are to assess opportunities for passive or low-energy heating, cooling and ventilation systems prior to the assessment of traditional HVAC systems. The assessment must review, at a minimum, the options of:

- External shading or internal blinds
- Building Envelope thermal upgrade (walls, windows, floor and roof)
- Gap sealing
- Operable windows/louvers to provide natural ventilation and night purge
- Ceiling fans
- Evaporative air conditioning

The review must assess:

- The potential for a PMV (Predicted Mean Vote) of +/-1.0 to be achieved for 95% of occupied hours (8am to 6pm).
- Lifecycle costing to include capital, maintenance and operational costs.

4.6 HVAC

Applicable Works: Major; Minor; Maintenance.
If passive or low-energy heating, cooling and ventilation is deemed unsuitable (see 6.5 above) then HVAC systems must meet the following requirements.

To reduce energy use in HVAC systems the following requirements apply:

- All HVAC to utilise Heat Recovery Units
    - If HRU not used a detailed argument must be provided to demonstrate why HRU cannot be applied.
- Sufficient internal, external temperature sensors and automated control mechanisms to implement and ensure correct operation of night purge and economy cycle modes of operation.
- A 20% reduction in the maximum fan power allowed under BCA Section J 2011 Table J5.2.
- A 20% reduction in the maximum pump power allowed under BCA Section J 2011 Table J5.4a
- The minimum thermal efficiency of Water heaters (for space heating) is 90%.
- A 20% increase on the minimum energy efficiency ratio (COP) of packaged air-conditioning equipment allowed under BCA Section J 2011 Table J5.4d.
- A 20% increase on the minimum energy efficiency ratio (COP) of refrigerant chillers allowed under BCA Section J 2011 Table J5.4e.
- All miscellaneous exhaust systems with an air flow rate of more than 500 l/s that is associated with equipment having a variable demand must have a variable speed control and the ability to stop when the system is not needed.
- All infrequently occupied spaces (laboratory, classroom, lecture theatre, office) are designed to automatically either set back or shut down when not in use.

4.7 Domestic Hot Water

Domestic scale hot water units are typically installed in most buildings to supply hot water to bathrooms and kitchens. They can range from small under-bench units, through to large (>300 L) storage tanks or high volume instantaneous heaters. To ensure that the most energy (and greenhouse) efficient systems are installed the following will apply:

- Permitted hot water systems include:
    - Cogeneration or Tri generation;
    - Solar hot water systems;
    - Heat pump systems; and
    - If none of the above are applicable, gas fired instantaneous hot water.
- Electric resistive heaters are not permitted;
- If a central cogeneration or tri-generation plant providing district services is available this resource should be used;
- In the absence of cogeneration or tri-generation, the available solar resource and low grade thermal energy (typically waste heat from either electrical or mechanical systems) will determine the most applicable technology;
- All pool and spa heating to be provided by solar hot water heaters or co/tri generation;
- If solar and heat pump systems are deemed unsuitable by the project team, and the hot water source will only be used infrequently, gas fired instantaneous hot water systems may be used upon provision of a clearly stated argument including, but not limited to:
    - Reason(s) why solar hot water cannot service the DHW requirements;
    - Proposed gas fired domestic hot water unit;
    - Annual operating cost;
    - Installation cost including provision and connection of gas;
    - Lifetime of hot water unit;
    - Evidence that the selected hot water unit exceeds 4.5 star energy rating.

4.8 Appliances

Applicable Works: Major; Minor; Maintenance.

Many electrical appliances can be rated under the Energy Star rating system and include:

- Air-conditioners;
- Clothes dryers;
- Clothes washers;
- Dishwashers;
- Refrigerators/Freezers;
- Televisions.

Where such appliances are purchased they must achieve the within ½ a star the highest rating possible in their class (e.g. if the highest rating possible for a dishwasher was 4 stars all dishwashers purchased must be 3.5 stars and above).

5 Water

5.1 Fittings and Fixtures

Applicable Works: Major; Minor; Maintenance.
All sanitary fittings and fixtures to be the following minimum WELS ratings:

- toilets dual Flush WELS 4 star (4.5/3 L flush);
- urinals low flush (6 star WELS) or waterless urinals;
- taps 6 star WELS (3.5 to 4.5 L/s); and
- showers maximum resultant flow of 9L per minute.

All toilet flushing should be supplied via a header tank such that recycled water can be supplied to the header tank (avoiding issues of cross contamination).

5.2 Rainwater

Applicable Works: Major.
Rainwater collection is to be installed on all major projects and used within and around the building to replace use of potable water. Rainwater collection tanks to be appropriately sized such that a minimum of 2 months of average annual rainfall on the building can be captured and stored.

Captured rainwater is to be provided, in order of preference to:

1. Toilet flushing;
2. Process cooling or heat rejection systems;
3. Irrigation.

5.3 Greywater

Applicable Works: Major.
A minimum of 50% of grey water produced shall be captured and suitably processed, according to the requirements of local regulator, and made available for reuse.

5.4 Water Sub-metering

Applicable Works: Major; Minor.
All major uses of water must be individually metered. Major uses are minimally:

- Bathrooms;
- Evaporative heat rejection systems;
- Irrigation Systems;
- Rainwater Supply;
- Hot Water;
- Laboratories; and
- Recycled grey water.

All meters must have a data logging capacity and ability to store 1 year worth of meter data.

5.5 Heat Rejection Water

Applicable Works: Major; Minor.
Where possible, evaporative heat rejection systems are to be avoided. If evaporative heat rejection systems are installed, or pre-existing, non-potable water should be used where possible. Non-potable water must be processed such that the local statutory authority approves the use in evaporative systems.

Heat rejection or process cooling systems that are single pass or 'once through' cooling systems (e.g. for cooling laboratory equipment) should use:

- non-potable water (processed grey water, processed black water or rainwater) or,
- be connected to a process cooling system.

Potable water can be supplied as a backup if and only if the system is designed such that potable water will only be used if there is an interruption in supply of non-potable water (for example, an extended period of no rain resulting in rainwater being unavailable).

5.6 Landscaping Water Use

Applicable Works: Major; Minor.

No permanent non-potable irrigation systems to be installed in landscaping.

Landscaping must be designed to retain water such that healthy, robust soil ecology is maintained.

- Water infiltration to ground water is maximised
- Water movement is slowed and takes the longest practical path toward waterways, providing the greatest ecological benefit.
- Avoid excessive water-logging that will result in prolonged anaerobic soil conditions

5.7 Fire System Water

Applicable Works: Major; Minor.

All Fire Systems will be designed to minimise the potable water used to test the system. All systems must provide:

- Sufficient temporary storage for a minimum of 80% of the routine fire protection system test water and maintenance drain-downs, for re-use on-site; AND
- Each floor fitted with a sprinkler system has isolation valves or shut-off points for floor-by-floor testing; OR
- The fire protection system does not expel water for testing.

6 Transport

Whilst transport infrastructure is typically delivered as a campus-wide service there are several features that can be integrated into individual buildings that assist in the adoption of alternative transport options.

6.1 Provision for Electric Vehicles

Applicable Works: Major.
In order to facilitate the uptake of electric vehicles it is important to incorporate the requirements in current planning. This has two distinct components: Provision of suitable electrical infrastructure to car parks to enable future creation of charge points; and Provision of car parking spaces with charge points.

Consequently the requirements are:

- A minimum of 10% of car parking spaces are provided with electrical infrastructure to enable the creation of an electric vehicle charge point

6.2 Cyclist Facilities

Applicable Works: Major; Minor; Maintenance.
Secure bicycle storage is to be provided within the building footprint at the rate of:

- 10% of the peak number of students using the building at any one time (75% occupancy); and
- 10% of the building staff.

In addition to the bike storage facilities, suitable change rooms, showers and lockers must be provided as follows:

- Lockers must be provided at the rate of 10% of the building staff and be of adequate size to hang work clothing.
- Showers and associated changing space must be provided at the rate of 2% of the building staff, with the minimum of 1 unisex shower per stand-alone building. This shower must not be used for compliance as a disabled access shower and must also be accessible for use by students.

6.3 Telecommuting and Videoconferencing

Applicable Works: Major; Minor.
To reduce staff and student travel suitable tele/videoconferencing facilities must be provided.

IT infrastructure must be capable of supporting multiple staff members using a single user videoconferencing tool such as Skype, with provision of at least one meeting room per 500m^2 of building area capable of enabling a group of minimum 8 users to engage in videoconferencing.

7 Materials

7.1 Recycling Waste Storage

Applicable Works: Major; Minor.

A dedicated storage area for the separation and collection of recyclable waste is provided and it:

- Meets the access requirements of 'Policy for Waste Minimisation in New Developments' (NSW, 2004): Section A, points A-12 through A-17.
- Is separate from, but adjacent to, general waste facilities;
- Provides a clearly marked, sign-posted, convenient, level and guaranteed access route;
- Be sufficiently sized to accommodate the storage equipment for the following recyclables (where produced), as a minimum:
    - Cardboard;
    - Paper;
    - Comingled;
    - Polystyrene;
    - Metals;
    - Pallets;
    - Used cooking oil; and
    - Organic (compost) materials.

7.2 Concrete and Masonry

Applicable Works: Major; Minor; Maintenance.

Concrete and masonry are commonly used building product that typically have a high embodied energy and carbon content. The Portland cement in concrete mixes and also masonry (concrete blocks) is responsible for most of the energy/carbon content yet can be replaced with less energy and carbon-intensive waste materials such as blast furnace slag and fly ash.

To reduce the absolute quantity of Portland cement, by substituting it with industrial waste product(s), the following requirements are set

- 30% cement replacement for in situ concrete;
- 20% cement replacement for pre-cast concrete (including concrete block); and
- 15% cement replacement for stressed concrete.

Concrete mixes also include aggregate, which is typically quarried and supplied as a virgin material. Where concrete is used for non-structural purposes (e.g. curbs, gutters and pathways) a minimum of 30% of the aggregate must be a recycled aggregate.

Where clay brick is used, to reduce the embodied energy of the brick, a minimum of 50% of the bricks used in the project must be:

- Post consumer recycled.

OR

- Extruded with at least a 30% reduction in mass

OR

- Produced in a manufacturing process that reduces carbon intensity (e.g. kilns co-fired with landfill gas)

7.3 Structural Steel

Applicable Works: Major; Minor; Maintenance.
All structural steel used is to be produced by a responsible steel maker, which is defined as a company which complies with both of the following initiatives:

- The steel making facilities where the steel for the project is being sourced have a currently valid ISO 14001 Environmental Management System (EMS) in place. Valid ISO 14001 Environmental Management System (EMS) certificates must be provided from the steel making facilities where the structural and/or reinforcing steels in the project were produced; and
- The steel maker supplying the steel is a member of the World Steel Association's (WSA) Climate Action Programme (CAP). A current CAP certificate from the WSA, confirming that the steel maker is a member of the CAP, must be provided. Certificates are valid for a period of two years and must be current at the time that the project purchases the steel.

7.4 Furniture Standards

Applicable Works: Major; Minor.
The manufacturer environmental performance and life cycle costs of furniture are complex and beyond the scope of construction projects. Minimizing the environmental footprint of the product life cycle is investigated in detail by 3rd party certification organisations. In addition the footprint can be practically minimised by reusing furniture that would otherwise be sent to landfill or disassembly and subsequent recycling. Since 3rd party accreditation schemes periodically update their standards and new accreditation schemes are created Sustainability defines will periodically review the 3rd party accreditation for furniture procurement. The current required certification required is one or more of the following:

- Supplier of furniture to confirm >80% by mass of the furniture is reused; OR
- Australasian Furnishings Research and Development Institute (AFARDI) Standard 150, either level A or B;
- Good Environmental Choice Australia (GECA) 28-2011 v2 - 'Furniture and Fittings';
- GreenTag GreenRate v3.1[7] Level A.

7.5 Duct Material

Applicable Works: Major; Minor.
Whilst zincalume is a common material used in duct work it is not resistant to corrosion and can result in replacement early in the building lifecycle. Replacement due to corrosive chemicals used in the ventilated space (typically laboratory) significantly exceeds any cost savings from not using stainless steel ductwork and increases materials churn. Consequently all spaces that are planned to use corrosive chemicals and all spaces that may use corrosive chemicals under a minor reconfiguration (e.g. adjacent laboratories) must use corrosion resistant ductwork.

7.6 Sustainable Timber

Applicable Works: Major; Minor; Maintenance.
All timber products are to be either post-consumer recycled timber or Forest Stewardship Council/Australian Forestry Standard (FSC/AFS) certified. Timber can only qualify as post-consumer recycled timber if it has previously been used as part of a product or structure which has since been disassembled.

7.7 PVC Avoidance

Applicable Works: Major; Minor; Maintenance.
The use of PVC is to be avoided wherever possible. Specifications must state this as a general principle, and specifically wherever possible. Common service which utilise products that contain PVC and their alternatives are:

[7] Or more recent version of standard. Note that version 3.2 already available for comment.

Service	Use	Alternative
Electrical	Cable insulation	Low Smoke Zero Halogen (LSZH) products.
	Conduit	HDPE, metal
Hydraulic	Pipes and connectors	HDPE, copper, XLPE
Mechanical	HVAC accessories (e.g. AC drip trays)	HDPE, metal
Interiors	Carpet, Furniture components	Sustainability furniture standards avoid usage.

Where PVC is to be used, PVC should be selected that complies with the 'Best Practice Guidelines for Lifecycle of PVC Building Products'[8].

7.8 Joinery

Applicable Works: Major; Minor; Maintenance.
All joinery must comply with the Sustainability requirements of *Sustainable Timber* and *Formaldehyde Minimisation*. In addition all joinery must be designed such that it can be easily disassembled for reuse, recycling or re-processing. The disassembly requirement is:

- Joinery must be readily disassembled, using non-specialist tools, into elemental components for re-use, recycling or re-processing (e.g. mechanically fixed, not glued).
- Each joinery item must enable at least 75% (by mass) to be readily disassembled.

7.9 Insulant ODP

Applicable Works: Major; Minor; Maintenance.
All insulation must be zero ODP in manufacture and composition.

7.10 Refrigerant Selection

Applicable Works: Major; Minor; Maintenance.
All refrigerants must have a 100 year Global Warming Potential less than 1300 (GWP_{100}<1300) and an Ozone Depletion Potential less than 0.035 (ODP<0.035).

7.11 Local Sourcing

Applicable Works: Major; Minor; Maintenance.
To support local industries and to also minimise carbon emissions from transport all projects are to source materials from local sources where available and fit for purpose. Imported goods are only allowed if they provide a functional benefit to the building that cannot be sourced locally.

The maximum distances materials can be sourced from are provided in the table below.

Material Type	Example	Maximum Distance
Heavy weight and high density	Cement, sand, aggregate, steel, masonry, stone, tiles	500 km
Medium weight and medium density	Glass, timber, aluminum, carpet, plasterboard, furniture, electronic goods	1000 km
Light weight and low density	Plastics, insulation, ceiling tiles, fabrics	2000 km

Approximate distances in kilometres (by surface transport) to major Australian cities are as follows – Wollongong 250, Sydney 290, Albury/Wodonga 340, Newcastle 440, Melbourne 660, , Brisbane 1200, Adelaide 1200, , Hobart 1400, Perth 3700, Darwin 4000.

[8] www.gbca.or.au/uploads/156/2716/Literature%Review.pdf

8 Landscape

8.1 Trees

Applicable Works: Major; Minor.
Established trees of appropriate species and sound structure are beneficial components of the built environment and a potential asset to any development site. Measures to protect trees need to comply with AS 4970—2009: Protection of trees on development sites.

A preliminary tree assessment should be carried out at the beginning of the project of all trees on-site, when tree protection is most effective. All trees should be assessed by the project arborist as the basis for deciding which trees are suitable for retention. This preliminary tree assessment will guide the development layout in that trees selected for retention are provided with enough protection and space from construction activities.

An arboricultural impact assessment will be prepared once the final layout is complete. It will include the following main elements:

- The report will identify trees to be removed, retained or transplanted.
- The report will identify possible impacts on trees to be retained.
- The report will determine a Tree Protection Zone (TPZ) for trees to be retained. The TPZ is a combination of the crown zone and root zone to be protected. TPZs isolate the tree from construction impact with clearly marked fencing, and act as the principal means of protecting trees on development sites. Refer to AS 4970-2009 for determining the TPZ.
- The report will include a tree protection plan (drawing) showing the TPZs for trees being retained. The tree protection plan should be included in subsequent construction documentation.
- The report will recommend measures necessary to protect the trees throughout all construction stages.

A list of tree protection measures are listed in AS 4970-2009. These measures are identified in the arboricultural impact assessment and tree protection plan. A process for monitoring should be identified in all stages of development works.

8.2 Topsoil

Applicable Works: Major; Minor; Maintenance.
All topsoil removed during the construction process is utilised such that it remains productive. This requires:

- All topsoil impacted by the construction works is separated and protected from degradation, erosion or mixing with fill or waste; and
- 95% of all topsoil (by volume) retains its productivity, i.e. it is returned to the top 10cm of a natural soil substrate as quickly as is feasible.
- Topsoil is to remain on, and is to be reused on ANU grounds.

8.3 Habitat

Applicable Works: Major; Minor; Maintenance.
The ANU has developed a Biodiversity Management Plan which should be consulted where any work has a potential habitat impact. Habitat is to be conserved or improved over the course of a project and any impact on the landscape properly rehabilitated.

Habitat improvement can be achieved by many initiatives:

- Selecting appropriate plant species and creating habitat structures (e.g. rock and logs) in the landscape.

- Implementing a green roof, utilising plants that are useful to local bird species, such that the roof creates a functional habitat;
- Creating an appropriate niche ecology as part of the landscaping of the site;
- Improving the site hydrology through integrating an in-built stormwater/greywater collecting system, with the intent of reusing the water in on-site landscaping, to improve resilience of the local landscape
- Integrating plants with the façade creating a living wall e.g. vine shading western wall that provides habitat for local bird and or marsupial population.

8.4 Edible Landscapes

Applicable Works: Major; Minor; Maintenance.

Edible landscapes invite people to interact with the landscape, and consequently increase the perceived value of the landscape to the individual. Wherever appropriate, perennial edible species should be included in the landscape. Ideally, edible species should be visible from common egress areas such that many people are given the opportunity to interact with the plant.

8.5 Stormwater

Applicable Works: Major; Minor.

Implement biological pollution treatment system to process all storm water emanating from hard surfaces (i.e.: Buildings, Carparks, Roads) such that before entering a waterway or sewer it complies with the following pollution reduction targets:

Pollutant	Reduction Target (% of TAUL[9]).
Total Suspended Solids (TSS)[10]	90%
Gross Pollutants	95%
Total Nitrogen (tN)	60%
Total Phosphorus (tP)[11]	70%
Total Petroleum Hydrocarbons	90%
Free Oils	98%

[9] Typical Urban Annual Loads (TAUL) can be estimated using continuous simulation modelling such as MUSIC. Where available, relevant guidelines values for pollutant concentrations for the catchment land use and surface type should be used. In areas where there are no specific guidelines reference can be made to sources such as Australian Runoff Quality (ARQ, 2006).

[10] Load based on the following particulate size distribution (by mass): 20% <20 µm; 20% 20-60 µm;20% 60-150 µm; 20% 150-400 µm; 20% 400-2000 µm

[11] Load includes particulate and dissolved fraction.

9 Community

Provision of common areas for social interaction is an important component of social sustainability. In the context of an academic institution, it also serves as an opportunity for cross pollination of ideas from both related and disparate disciplines.

9.1 External teaching space

Applicable Works: Major; Minor.

Teaching outside of conventional classrooms can be an effective method to alter students' learning patterns and perception of subject matter, irrespective of whether the environs are directly related to the subject matter being conveyed. Effective external teaching spaces require careful consideration of landscape topology, vegetation, egress patterns, noise sources and sound barriers (both architectural and vegetative) in the locality. The use of natural ventilation, and therefore the likelihood of noise from the external teaching space coupling back into the building must also be considered. Consequently it will not always be possible to include this initiative in all works.

9.2 Recreation Areas

Applicable Works: Major; Minor.

Building social capital is important for organisation cohesion and optimal interaction between individuals. Consequently areas in which this occurs are an important component of the utility of a building to an organisation. Areas such as tea rooms, common rooms, barbeque areas and external seating areas are critical to enabling staff to relax, host functions and build relationships with personnel that are not directly related to their daily duties. If considered late in the design process the recreational areas are typically poorly utilised due to inappropriate placement (e.g. BBQ facility on the south side of the building). The placement of these areas should be considered early in the design process to optimally integrate with building usage patterns.